# DRAFT
# REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORK PLAN

## DUWAMISH WATERWAY PARK

Prepared for
City of Seattle Parks and Recreation

Prepared by
Herrera Environmental Consultants, Inc.

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**Note:**
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# REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORK PLAN

## DUWAMISH WATERWAY PARK

Prepared for
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DRAFT
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# ABBREVIATIONS

| | |
|---|---|
| ARAR | Applicable or Relevant and Appropriate Requirements |
| bgs | below ground surface |
| COC | contaminant of concern |
| cPAHs | carcinogenic polycyclic aromatic hydrocarbons |
| CSM | conceptual site model |
| CUL | cleanup level |
| DCA | Disproportionate Cost Analysis |
| DEM | digital elevation model |
| DNR | Department of Natural Resources |
| DWPA | Duwamish Waterway Park Addition |
| Ecology | Washington State Department of Ecology |
| EIM | Environmental Information Management |
| FS | Feasibility Study |
| HAT | highest estimated tide |
| Herrera | Herrera Environmental Consultants, Inc. |
| IB | Industrial buffer |
| IG | Industrial general use |
| LDW | Lower Duwamish Waterway |
| LDWG | Lower Duwamish Waterway Group |
| LiDAR | light detection and ranging |
| mg/kg | milligrams/kilogram |
| MHHW | mean higher high water |
| MLLW | mean lower low water |
| msl | mean sea level |
| MTCA | Model Toxics Control Act |
| NAVD88 | North American Vertical Datum 1988 |
| PAHs | polycyclic aromatic hydrocarbons |
| PCBs | polychlorinated biphenyls |
| PSL | preliminary screening level |
| RAL | Remedial Action Level |
| RI | Remedial Investigation |
| SDOT | Seattle Department of Transportation |
| SPR | Seattle Parks and Recreation |

| | |
|---|---|
| SVOCs | semi-volatile organic compounds |
| TEE | Terrestrial Ecological Evaluation |
| TOC | Total Organic Carbon |
| TPH | total petroleum hydrocarbons |
| USCS | Unified Soil Classification System |
| USGS | United States Geological Survey |
| USS | United Site Services |
| VCP | Voluntary Cleanup Program |
| VOC | volatile organic compound |
| WAC | Washington Administrative Code |

# 1. INTRODUCTION

Past sampling activities conducted at Duwamish Waterway Park (Park) by the City of Seattle Department of Parks and Recreation (SPR) detected elevated concentrations of arsenic, lead and other Contaminants of Concern (COCs) in soils that exceed Model Toxics Control Act (MTCA) Cleanup Levels (CULs) or other more stringent Site Screening Levels (SSLs). Additional Remedial Investigation (RI) activities are planned and described under this Work Plan to further characterize the nature and extent of COCs in soil, sediment, groundwater (including seeps), and surface water. The term *Site* refers to the RI boundary covered under this Work Plan where the investigation activities will take place (see *Site Description* in Section 1.1.3 below).

## 1.1. GENERAL SITE INFORMATION

The Park is located at 7900 10th Avenue South, adjacent to the Duwamish River, in Seattle, Washington (Figure 1 and Figure 2). SPR has managed the Park since 1975 on land previously owned by King County. The Park area currently accessible to the public includes multiple parcels owned by SPR, City of Seattle Department of Transportation (SDOT), and the Port of Seattle; the portion formerly owned by King County was purchased by SPR in May 2019. A portion of the northeast corner of the Park along the Duwamish River is designated as commercial waterway managed by the Port of Seattle but owned by the Washington Department of Natural Resources (DNR).

### 1.1.1. Site Identification and Contact Information

Site investigation and cleanup activities are being reviewed by the Washington State Department of Ecology (Ecology) under the Voluntary Cleanup Program (VCP Site number NW3279). Ecology is tracking the status of site investigation and cleanup activities as follows:

- Facility Site Identification Number: 49919
- Cleanup Site Identification Number: 15139

Site contact information:

City of Seattle Parks and Recreation
300 Elliott Avenue West, Suite 100
Seattle, WA 98119
Jean Lee: jeanh.lee@seattle.gov 206.256.5951
Scott Stevens: scott.stevens@seattle.gov 206.615.0865

Ecology VCP Program Manager:

Anthony Wenke: anwe461@ecy.wa.gov 425.515.5993


Legend

- Study Area
- City Limits
- Waterbody
- Streams (DNR)


**Figure 1.**
**Vicinity Map, Duwamish Waterway Park, Seattle, Washington.**

N

0 750 1,500 3,000 Feet

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Aerial: Maxar, March 2021

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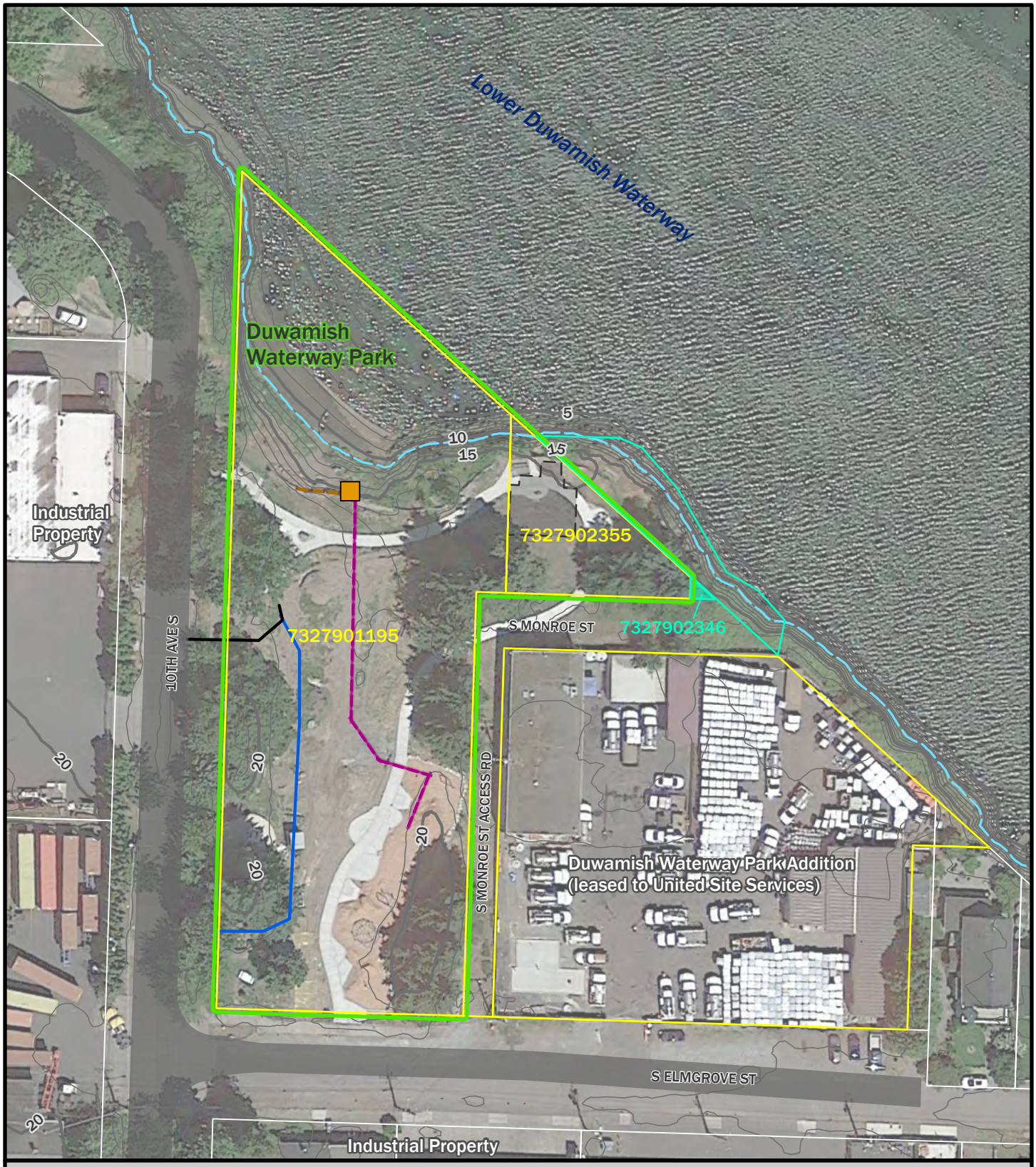


Legend

- Remedial Investigation Site Boundary
- Seattle Parks Parcels
- Port of Seattle Parcel
- Department of Natural Resources (Managed by Port of Seattle)
- King County Tax Parcel Boundaries
- Footprint of Former House
- Catch Basin
- Dispersion Trench
- Stormwater Drainpipe
- Sanitary Side Sewer
- Water Service Line

Elevation Contours (DNR 2016)

- 5 FT Contour
- 1 FT Contour
- Mean Higher High Water (11.1 FT MLLW)

**Figure 2. Site Map of Duwamish Waterway Park, Seattle, Washington.**

N

0 50 100 200 Feet

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Aerial: EagleView Technologies, 2019

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### 1.1.2. Project Stakeholders

Key project stakeholders interested in the RI Site characterization and cleanup activities include:

- City of Seattle Department of Parks and Recreation
- Duwamish River Community Coalition and the South Park Community
- Washington State Department of Ecology
- Lower Duwamish Waterway Group: includes The Boeing Company, City of Seattle, King County, and the Port of Seattle
- Port of Seattle
- City of Seattle Department of Transportation
- City of Seattle Office of Planning and Community Development

### 1.1.3. Site Description

The Site is a 1.26-acre park located in the City of Seattle's South Park neighborhood (Figure 2). The South Park community lies adjacent to the Duwamish River (also referred to as the Lower Duwamish Waterway [LDW]), a man-made channel portion of the historic Duwamish River that drains into Elliott Bay to the north.

The RI boundary covered under this Work Plan encompasses the two parcels owned by SPR that make up the majority of the Park:

- A large main parcel number 7327901195 situated north/south, and
- A smaller triangular shaped parcel number 7327902355 to the east.

For the purpose of describing where previous investigation work has taken place and where planned RI activities will occur under this Work Plan, the Park is divided into three management areas: the Central Meadow (including the Playground), the Northeast Meadow, and the Beach Area (Figure 3).

Figure 3. 2021 Park Improvements, Duwamish Waterway Park, Seattle, Washington.
(Source: Johnson + Southerland Architects 2019; Prepared for Seattle Parks & Recreation)

Legend

- Remedial Investigation Site Boundary
- Mean Higher High Water (11.1 FT MLLW)
- EXISTING TREES (W/ TYPE/SIZE IDENTIFIER) ADJACENT TO WORK TO REMAIN
- CONCRETE PAVING, SEE 4/L5.0
- EXPOSED AGGREGATE PAVING, SEE 5/L5.0
- COBBLE PAVING, SEE 5/L5.0
- CRUSHED ROCK PAVING, TYP, SEE 3/L5.0
- EWF SURFACING, SEE 4/L5.1
- LOG, TYP, SEE 3/L5.1
- BOULDER, TYP, SEE 2/L5.1
- INTERPRETIVE BOULDER, TYP, SEE 2/L5.1
- ROCKERY, TYP, SEE 1/L5.1

0 17.5 35 70 Feet

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Adjacent properties east of the park will have separate field investigations completed (outside of this workplan) in the future. That work combined with the results of the RI work discussed herein will guide future decisions regarding cleanup and expansion of the existing Park. The parcels and land to be investigated separately during a future phase include (Figure 2):

- The small triangular parcel number 7327902346 along the east side of the Park owned by the Port of Seattle,
- A portion of the promontory at the northeast corner of the Park that is managed as a commercial waterway by the Port of Seattle but owned by the Washington Department of Natural Resources,
- The SDOT property along formerly vacated South Monroe Street, and
- Duwamish Waterway Park Addition (owned by SPR and leased to United Site Services)

The Park is situated within the northeast quarter of Section 32, Township 24, Range 04 East of the Willamette Meridian (King County 2022). The Park is centered at latitude 47º 31′ 51″ North and longitude 122º 19′ 11″ West on land that is flat with a surface elevation of approximately 16 feet above mean sea level (msl) (LDWG 2004). Land at the north end of the park includes a rock armored shoreline and beach area that slopes down to the LDW, with the size of the available beach area fluctuating as the tide ebbs and flows.

The neighborhood surrounding the park is zoned as an industrial buffer zone, described in the City of Seattle municipal code as land that provides buffer between industrial areas and adjacent residential zones. Properties adjacent to the west and northwest of the Park are zoned IG (Industrial General Use), and properties adjacent to the southwest, south, and east are zoned IB (Industrial Buffer)(City of Seattle 2019).

### 1.1.4. Adjacent Duwamish Waterway Park Addition

SPR purchased the Duwamish Waterway Park Addition (DWPA) property, located adjacent to the east of the Park (Figure 2) and leased to United Site Services (USS)in 2021. The Office of Planning and Community Development and SPR are working with the local community to develop a plan for future redevelopment of the DWPA property to expand the current Duwamish Waterway Park. Contaminated soils identified on the DWPA property will be addressed as a separate project once the current lease agreement has ended; future work on the DWPA property is not covered under this Work Plan or RI/FS.

# 2. SITE USE

The Site is currently used as a park with features that include a play area, walking trail, beach access, picnic areas with a barbeque, and benches along the river. Mature trees are located along the eastern and western sides of the Park and park users utilize the beach area to access the LDW for water recreation activities. The Park is an important asset to the community who use it each year for the Duwamish River Festival. SPR plans to maintain this location as a park in perpetuity. Park renovations in 2020 and 2021 addedthe play area, more picnic areas, and upgraded and extended the paved walking path.

## 2.1. PHYSICAL SETTING

The Site is located in the Puget Sound Lowland adjacent to the LDW. Until the early part of the 20th century, most of the Duwamish River valley consisted of floodplains, freshwater wetlands, and tidal marshes occupied by shallow, meandering stream channels that eventually discharged to Elliott Bay to the north. Between 1913 and 1920, the main channel of the historical Duwamish River from its mouth at Elliot Bay to about 4.5 miles upstream was straightened and confined by US Army Corps of Engineers dredging operations, to facilitate navigation and industrial development by creating the LDW (Wilbur 2004a).

The original valley floodplain was raised 10 to 15 feet above flood levels, slightly above Mean Higher High Water (MHHW). Old, abandoned channels were filled with hydraulic and other fill material, including a channel between Dallas Avenue South and South Orr Street. The meanders disappeared, except for recesses adjacent to the main channel to accommodate high water flows and the turning of ships.

## 2.2. GEOLOGY AND HYDROGEOLOGY

### 2.2.1. Geologic Setting

Native American tribal communities have inhabited the Duwamish River Valley for over 10,000 years and have fished, hunted and gathered, and farmed in the area; Tribal fishing activities continue to the present day (Wikipedia 2022).

Seattle is located within the southwestern portion of the Puget Sound Lowland physiographic region, a basin located between the Olympic Mountains to the west and the Cascade Range to the east (Troost et al., 2003; Troost and Booth, 2008). At least seven glaciations have impacted the Seattle area within the last 2.4 million years (Troost and Booth, 2008). Near-surface geology in Seattle is dominated by sediments associated with the advance and retreat of Vashon

Glaciation, the most recent icesheet that reshaped our region's topography around 15,000 to 13,500 years ago (Galster and Laprade 1991).

The hydrogeology of the LDW has been influenced by both natural events (e.g., earthquakes and lahars [mudflows down river valleys caused by volcanic activity]) and anthropogenic activities (e.g., channel straightening, dredging, and filling)(AECOM 2012). Lahar events are recorded in the near-surface alluvial deposits of the Duwamish Valley, which extend to depths of roughly 200 feet below ground surface (bgs). In the late 1800s and early 1900s, after Europeans arrived in the area, the river was extensively modified. Tide flats and floodplains were filled to straighten the river channel, resulting in the abandonment of almost 3.7 miles of the original meandering riverbed. Current side slips in the Duwamish Waterway are remnants of these old river meanders, one of which is across the river and to the north of the Park (LDWG 2010).

Based on information derived from upland borings and sediment cores at several locations along the Duwamish River in Seattle and the South Park Neighborhood, three primary soil and sediment units in the Lower Duwamish Waterway (LDW) (from younger to older) are:

- **Fill –** Primarily comprised of dredged material used to fill in the old river channels when the LDW was straightened in the early 1900s (USACE 1919). The fill is similar in hydraulic conductivity to the native younger alluvium, consists of sand and silty sand, and depths typically range from 3 to 20 feet bgs.

- **Younger Alluvium (Qyal) –** Younger alluvium deposits are composed predominantly of sand, silt, gravel, and cobbles deposited by streams and running water (USGS 2005). Younger alluvium has been identified at the bottom of filled Duwamish River channels (USGS 2005).

- **Older Alluvium (Qoal) –** The older alluvium is characterized by estuarine deposits, often including shells at lower depths, and is composed of silts and clays with sandy interbeds (USGS 2005). The older alluvium is commonly identified between 50 and 100 feet bgs in the central Duwamish Valley, increasing in depth toward the mouth of the LDW to a range of 150 to 200 feet bgs.

### 2.2.2. Site Geology

The Park is situated within the Duwamish Valley, a relic estuary of Puget Sound that was carved and deepened by glacial ice and subsequently filled in by estuarine and alluvial deposits. Data from borings within 0.25 mile southeast of the Park indicate that the base of the trough, identified either as bedrock or very dense sediments that has been glacially overridden, lies between 20 feet bgs to the south to about 100 feet bgs near the Duwamish Waterway (Herrera 2009). Soils were not classified using the Unified Soil Classification System (USCS) during the soil boring investigation conducted in 2019. However, field observations indicate gravelly fill material in samples collected in the Northeast Meadow. This fill was not observed in the borings collected in the Central Meadow (ECC 2019).

### 2.2.3. Site Hydrogeology

Principal unconfined aquifers in the Duwamish Valley are found in the river alluvium or in the older unconsolidated deposits beneath the alluvium (Herrera 2009). Groundwater was encountered in soil borings advanced during the January 2019 investigation at 8 to 9 feet bgs (ECC 2019a), and at 9 feet bgs on the adjacent DWPA property during a 2021 Phase II Environmental Site Assessment (ECC 2021b). Localized groundwater flow is assumed to be to the north toward the Duwamish Waterway. Groundwater also expresses itself as seeps along the shoreline at the north end of the Site that are visible during low tide.

### 2.2.4. Surface Water

There are no streams or surface water features at the Site. Most stormwater falling on the Site infiltrates through soils. After park renovation in 2020, a new perforated stormwater drainpipe was installed to collect and convey stormwater from the playground area through the Central Meadow to a catch basin and gravel dispersion trench for infiltration adjacent to the shoreline (Figure 2).

### 2.2.5. Mean Higher High Water

The mean higher high water (MHHW) elevation is used as the boundary between upland soils and river sediments at the Site. The MHHW elevation was determined to be located at 11.10 feet mean lower low water (MLLW), which is equivalent to 8.73 feet North American Vertical Datum of 1988 (NAVD88).

Local datum planes relative to the MLLW datum were documented for the site in an August 2003 bathymetric survey of the Duwamish Waterway completed by David Evans and Associates, Inc. Elevation isolines were digitized in ArcGIS based on drawing sheets prepared by Windward Environmental, LLC dated November 21, 2003 and compared to a 2016 LiDAR-derived digital elevation model (DEM) in the NAVD88 vertical datum. The difference between the 2003 bathymetric survey elevations and 2016 LiDAR-derived elevations was calculated at several points across the site and averaged to estimate the difference between local MLLW and NAVD88 vertical datums. This yielded an estimated relationship between the two datums at the site where 0.00 feet MLLW is equivalent to -2.37 feet NAVD88. Based on this relationship, the 2016 DEM was adjusted by -2.37 feet vertically to coincide with the estimated local MLLW datum. The adjusted 2016 DEM was then used to calculate the approximate position of the local MHHW line at 11.10 feet MLLW.

# 3. PREVIOUS INVESTIGATIONS AND INTERIM ACTION

## 3.1. SITE ENVIRONMENTAL HISTORY – SUMMARY

SPR has operated Duwamish Waterway Park since 1975. The original park property, the largest portion of the park, was owned by King County until May 2019 when SPR purchased the property. In approximately 1989, SPR expanded the original park by acquiring the residential property east of the original park near the water (the Northeast Meadow).

Based on review of Sanborn fire insurance maps from 1917 to 1967 and aerial photographs from 1936 to 2015 included in a 2018 Phase I Environmental Site Assessment (ESA), previous uses of the Site appear to have been primarily residential (ECC 2018). The Site appeared largely undeveloped with one residential structure on the northeast corner of the park property near the Duwamish River; this structure first appears in 1936 and was removed from the site in 1989 (Figure 2). Historical documents located in SPR property files indicate that the house was moved from the site and that Long Painting planned to donate soil fill material for placement on the "new" park property, likely to backfill within and around the footprint of the former house.

Properties adjacent to the Site were agricultural and residential until the 1950s and 1960s, when more industrial properties appear. The Site also may have been impacted by aerial deposition from other nearby industrial properties.

## 3.2. SUMMARY OF PREVIOUS INVESTIGATIONS, DATA, AND INTERIM ACTION

This section summarizes site investigations previously completed from 2014 through 2021 to characterize the nature and extent of COCs in soil, sediment, and groundwater at the Site and at adjacent properties. Also included is a summary of the Interim Action completed in 2020 to remove contaminated soils at the Northeast Meadow at the Site. Data tables summarizing the laboratory analytical results for soil and sediment samples collected during the previous investigations and interim action are presented in Appendix A.

Soil and sediment results from the previous investigations were compared to SSLs established using Ecology's LDW study area screening level tool (LDW tool) (Ecology 2022b). Development of SSLs for soil, sediment, and groundwater are discussed in Section 4.0 and summarized in Appendix A, Tables 1, 2, and 3, respectively. Chemical analytical results for soil and sediment samples collected during previous investigations, during the interim action, and following park

renovation activities are summarized in Appendix A, Tables 4 through 11. Sample locations for soil and sediment collected during previous investigations, during the interim action, and following park renovation activities are depicted on Figures 4 through 12.

## 3.2.1. Previous Investigations

### *3.2.1.1. 2014 Limited Soil Sampling*

In July 2014, Eco Compliance Corporation (ECC) collected three soil samples to characterize surface soils prior to constructing a gravel path in the park (ECC 2014) (see Appendix A, Table 4). Each sample was a composite of three separate samples which were collected from the upper three inches of soil at three locations along the planned path (see Figures 4 and 6). The three samples were analyzed for Resource Conservation and Recovery Act (RCRA) metals including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. A composite of the three individual composites was also analyzed for carcinogenic polynuclear aromatic hydrocarbons (cPAHs) and dioxins/furans. Concentrations of one metal arsenic (61 and 69 mg/kg) exceeded the MTCA Method A CUL of 20 mg/kg. Concentrations of arsenic, barium (70.8 to 104 mg/kg), cadmium (0.9 mg/kg), and lead (89 and 135 mg/kg) also exceeded the respective more conservative SSLs. The concentration of total cPAHs (0.027 mg/kg) exceeded the SSL, but the concentration of dioxins did not.

### *3.2.1.2. 2018 Phase I Environmental Site Assessment and Hazardous Materials Survey*

In May 2018, a Phase I ESA and Hazardous Materials Survey was completed for the Site as part of due diligence for the purchase of the Park property by SPR from King County (ECC 2018). No samples of soil, sediment, or other media were collected during the Phase I ESA. The ESA identified two Recognized Environmental Conditions (RECs) including 1) arsenic contamination in shallow onsite soil possibly related to the Site location within the plume of the former Asarco smelter that operated in Tacoma, and 2) potential for soil, sediment, and/or groundwater contamination to exist at the Site from adjacent offsite sources, including the Duwamish River.

### *3.2.1.3. 2019 Due Diligence Investigation*

In January 2019, ECC collected soil samples from seven borings (three hand augers and four geoprobes) at various depths up to 9 feet bgs throughout the Site as follow-up to the 2018 Phase I assessment (ECC 2019a)(see Figures 5 and 6). The samples were analyzed for total RCRA metals and PAHs (see Appendix A, Table 5). Concentrations of arsenic and lead exceeded the MTCA Method A CULs of 20 mg/kg and 250 mg/kg, respectively, in only a few samples. Concentrations of four metals, arsenic (8.35 to 261 mg/kg), barium (15.8 to 89.9 mg/kg), cadmium (1.63 mg/kg), and lead (52.4 and 284 mg/kg) exceeded the SSLs of 7.3, 8.3, 0.77, and 50 mg/kg, respectively, in several samples. Concentrations of four PAHs, acenaphthene (0.0319 mg/kg), benzo(a)pyrene (0.0085 to 0.0191 mg/kg), dibenzofuran (0.0501 mg/kg), and

naphthalene (0.0095 to 0.0152 mg/kg), as well as total cPAHs (0.0019 to 0.026 mg/kg) also exceeded the respective SSLs.

#### *3.2.1.4. 2019 – 2020 Remedial Investigation Grid Sampling*

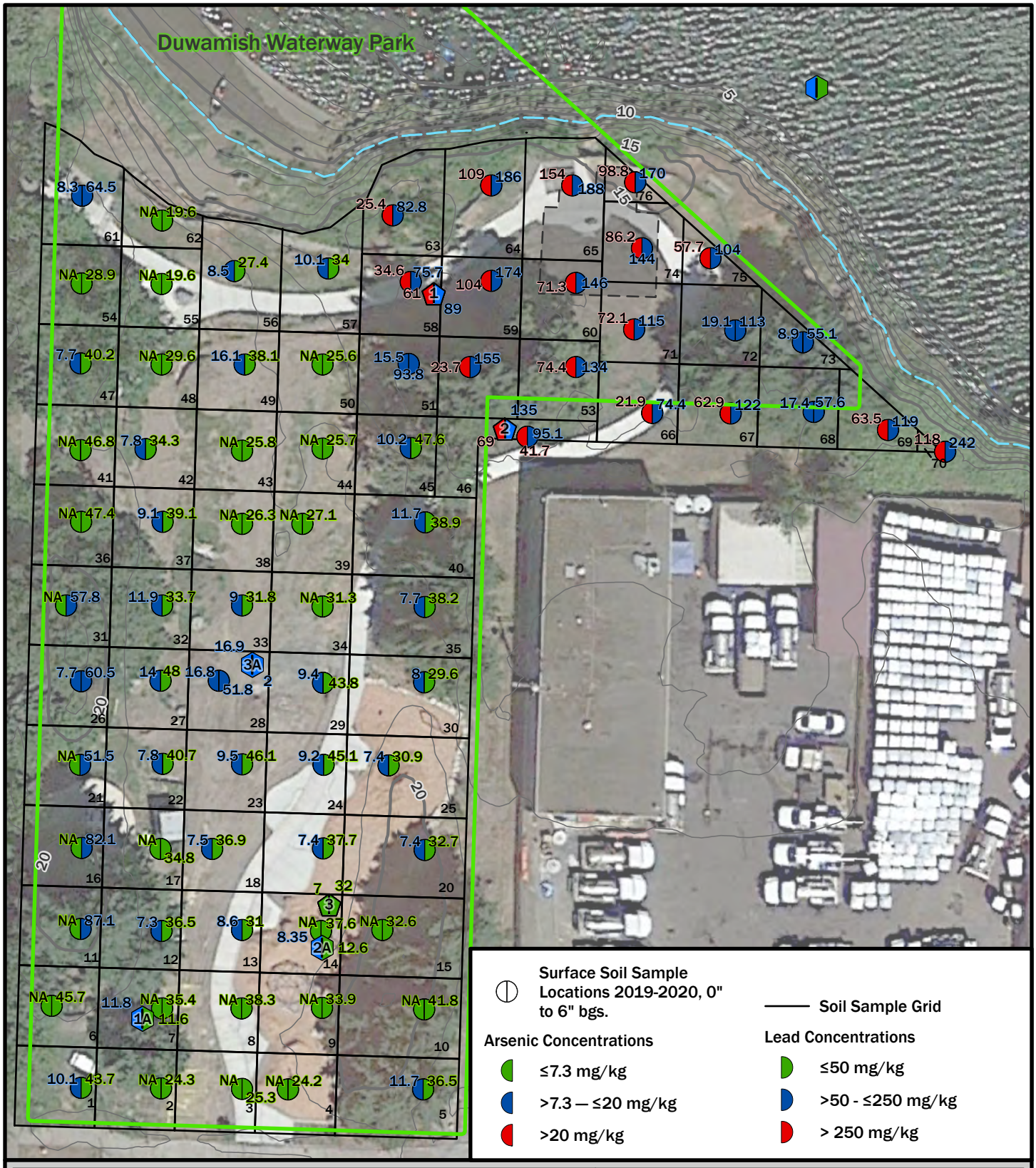
In February 2019, ECC collected surface soil samples from 0-6 inches bgs and subsurface soil samples from 7 to 12 inches bgs at 65 areas established on a grid across the entire Site (ECC 2019b)(see Figures 4 and 5). The samples were collected to further characterize arsenic concentrations in soils and confirm that arsenic concentrations in surface and near-surface soils at the Site were mostly below the MTCA Method A unrestricted land use CUL of 20 mg/kg (see Appendix A, Table 6). Most samples were collected from 0 to 6 inches bgs, and 13 samples were collected from 7 to 12 inches bgs. Each sample was composited from three locations within the grid cell and analyzed for total arsenic and total lead.

Arsenic and lead concentrations were uniformly below the respective MTCA Method A CULs of 20 mg/kg and 250 mg/kg in the Central Meadow but exceeded the CULs in some samples from the Northeast Meadow. Concentrations of arsenic and lead in some samples from the Central Meadow also exceeded the SSLs, and nearly all samples in the Northeast Meadow exceeded the SSLs.

In July 2020, additional surface samples (0-6 inches bgs) and subsurface soil samples (7-12 inches bgs) were collected from grid cells 66 through 76, which were established in the Northeast Meadow to characterize the area not included in the March 2019 investigation (ECC 2021a)(see Figures 4 and 5 and Appendix A, Table 6). One sample was collected from each grid and analyzed for total arsenic and lead. Concentrations of arsenic in a few samples exceeded the MTCA Method A CUL, and arsenic (7.32 to 154 mg/kg) and lead (51.5 to 242 mg/kg) concentrations in several samples exceeded the respective SSLs.

#### 3.2.1.5 2020 Sampling for Additional Contaminants of Concern

On October 2 and 19, 2020, additional samples were collected from three random grids: grid 65 (sample DX-1), grid 71 (sample DX-2), and grid 46 (sample DX-3) to obtain information on other potential COCs in soil (see Figure 6 and Appendix A, Table 7).). Each sample was collected at a depth of approximately 3 feet bgs and analyzed for diesel- and lube oil-range TPH, total metals (barium, cadmium, chromium, mercury, selenium and silver), PAHs, and PCBs. At grid 65, concentrations of PAHs benzo(a)pyrene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, and total cPAHs exceeded the respective SSLs; no PAHs were detected at grids 71 and 46 Various metals were detected in all three samples, but only barium exceeded the SSL. No TPH or PCBs were detected in any of the samples.




Legend

- Remedial Investigation Site Boundary
- Elevation Contours (FT MLLW; DNR 2016)
  - 5 FT Contour
  - 1 FT Contour
  - Mean Higher High Water (11.1 FT MLLW)
- Footprint of Former House
- Soil Boring and Historical Trail Sampling Locations
  - 2014 Composite Sample
  - 2019 Hand Auger Sample

**Figure 4. Surface Soil Arsenic and Lead Results Prior to Interim Action Work, Duwamish Waterway Park, Seattle, Washington.**

0 25 50 100 Feet

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Aerial: EagleView Technologies, 2019

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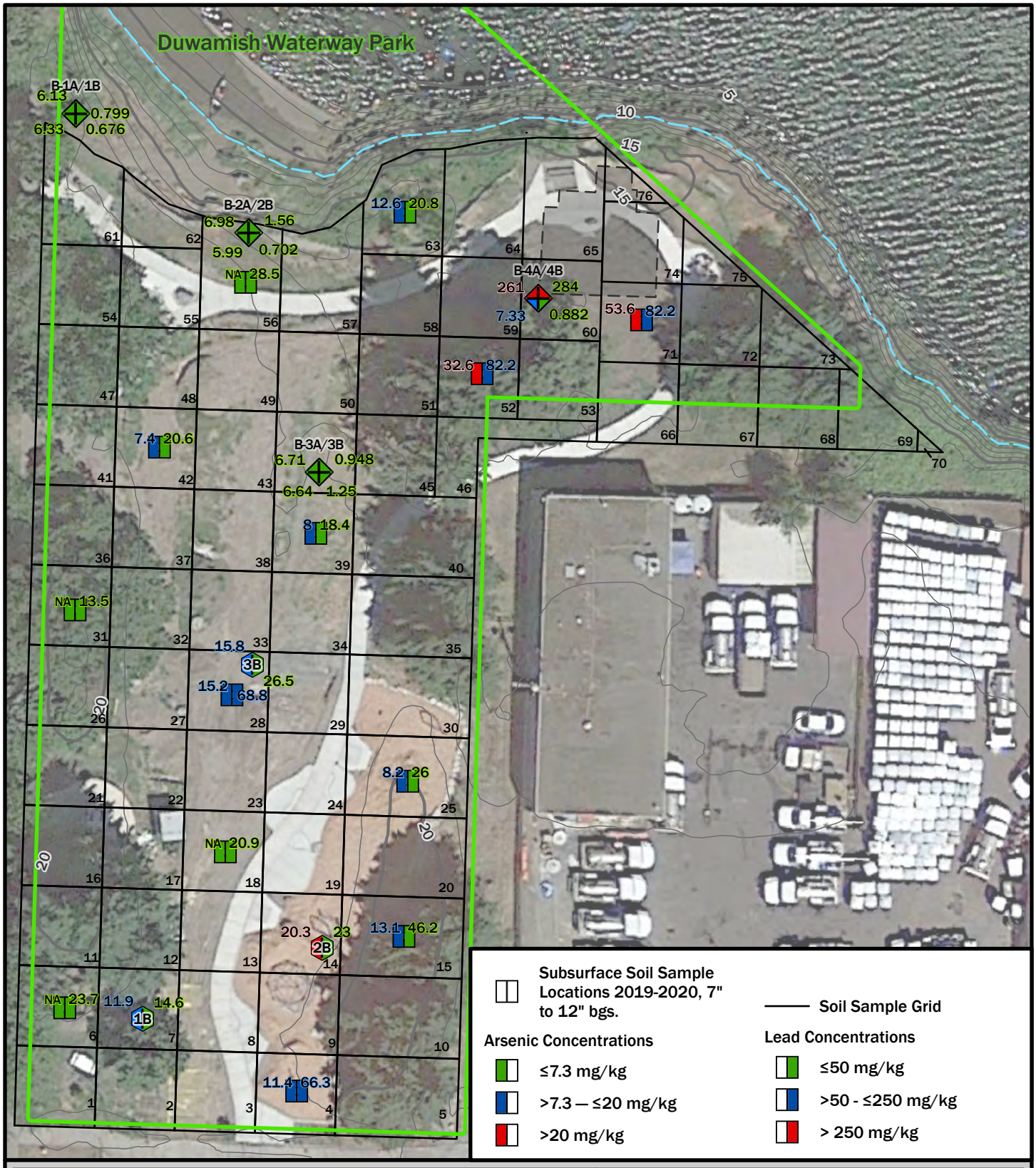


Legend

- Remedial Investigation Site Boundary
- Footprint of Former House

Elevation Contours (FT MLLW; DNR 2016)

- 5 FT Contour
- 1 FT Contour
- Mean Higher High Water (11.1 FT MLLW)

Soil Boring and Historical Trail Sampling Locations

- 2019 Hand Auger Sample
- 2019 Geoprobe Sample*

*samples show both surface and subsurface sample concentrations taken at the same location. Surface results shown on top of diamond, sub-surface results shown below.

**Figure 5. Subsurface Soil Arsenic and Lead Results Prior to Interim Action Work, Duwamish Waterway Park, Seattle, Washington.**

0 25 50 100 Feet

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Aerial: EagleView Technologies, 2019

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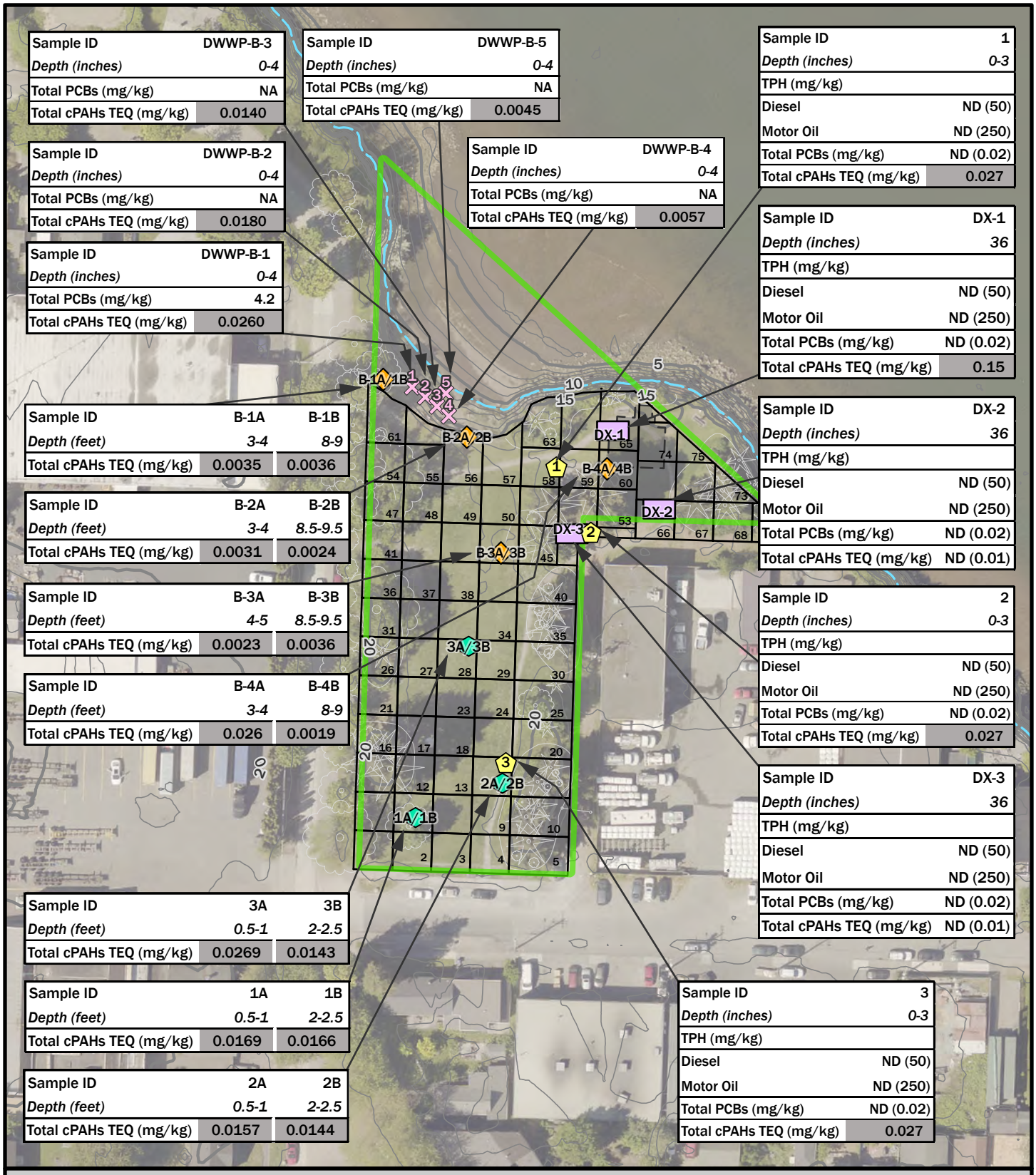



# Figure 6. Surface and Subsurface Soil Results for Organic Contaminants of Concern, Duwamish Waterway Park, Seattle, 2014–2020.

## 3.2.2. Interim Action and Confirmation Sampling

From October 2020 through 2021, soil was excavated as part of an Interim Action at the Site. The Interim Action included several different excavation areas and sampling activities to address contaminated soils primarily in the Northeast Meadow at depths ranging from 12 inches to 7 feet bgs (ECC 2021a) (see Figure 7). As excavation work was completed, confirmation soil samples were collected, a demarcation textile placed in the excavation bottom, and clean soil was imported for backfill. All excavated soils during the Interim Action and later park renovation,were disposed at off-site facilities. )

Soil data tables for the confirmation samples are included in Appendix A, Tables 8 and 9 and the various activities completed during the Interim Action are summarized as follows Excavation for the irrigation lines located in the Northeast Meadow (in contaminated soils) was postponed until May 2021, in coordination with the Park renovations. The remediation contractor and consultant returned to the site to complete this excavation.

### *3.2.2.1. Excavations At Borings B-3 and B-4*

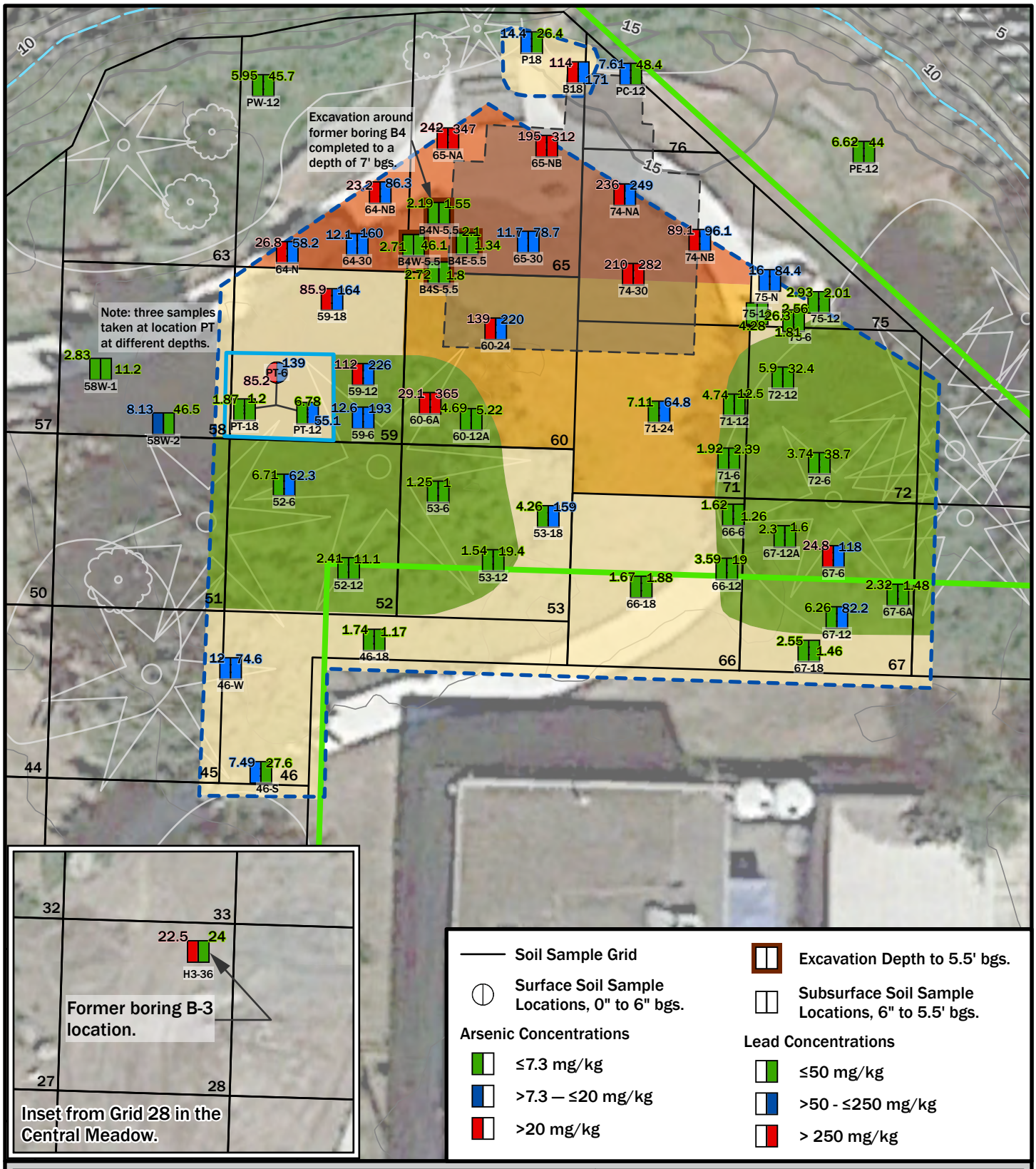
At boring location B-3 in an area approximately 4 feet square by 3 feet bgs was excavated and contaminated soils were removed for offsite disposal (see Figure 7). One confirmation sample (sample H3-36) was collected from the excavation bottom at approximately 36 inches bgs and analyzed for total arsenic and lead; no sidewall samples were collected. Of the two metals, only the concentration of total arsenic (22.5 mg/kg) exceeded the SSL.

At boring location B-4 an area approximately 8 feet square by 7 feet bgs was excavated and contaminated soils were removed for offsite disposal (see Figure 7). Four confirmation soil samples (B4N-5.5, B4S-5.5, B4W-5.5 and B4E-5.5) were collected from the excavation sidewalls and analyzed for total arsenic and lead. No concentrations of total arsenic or lead exceeded the SSLs.

### *3.2.2.2. Excavation in Grids Within Tree Root Zones*

All or portions of grids 52, 53, 59, 60, 66, 67, 71 and 75 are located within the root zones of several trees. To protect the trees during soil excavation activities, a SPR arborist used air sparging (also referred to as an air knife) to loosen and remove contaminated soils from the tree roots for offsite disposal. Approximately 6 to 8 inches of contaminated surface soils were removed in the root zones of the eight grids listed above and in grid 72.

After completing excavation work, confirmation soil samples were collected from at least two locations within each grid and analyzed for total arsenic and lead. Concentrations of total arsenic (12.6 to 139 mg/kg) exceeded the SSL in grids 59, 60, 66, 67, and 75 at depths ranging from 6- to 36-inches bgs (see Figure 7). Concentrations of total lead (62.3 to 365 mg/kg) exceeded the SSL in grids 52, 53, 59, 60, 66, 67, 71 and 75 at depths ranging from 6 to 36 inches bgs.




Legend

- Remedial Investigation Site Boundary
- Footprint of Former House
- Elevation Contours (DNR 2016)
  - 5 FT Contour
  - 1 FT Contour
  - Mean Higher High Water (11.1 FT MLLW)

Excavation depths (October 2020)

- Excavation depth of 12"
- Excavation depth of 18"
- Excavation depth of 24"
- Tree root zone
- Excavation Work Area
- Picnic Table Area

**Figure 7. Approximate Excavation Areas and Samples Within Excavations, Northeast Meadow, Duwamish Waterway Park, Seattle. (Source: City of Seattle, 2021)**

0 10 20 40 Feet

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Aerial: EagleView Technologies, 2019

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#### 3.2.2.3. Excavation in Grids Outside Tree Root Zones

At areas outside tree root zones, soils were excavated for offsite disposal from 0 to 12 inches bgs. At grids 60 and 71, soil was excavated from 0 to 18 inches bgs, and at grids 64, 65, and 74, soil was excavated from 0 to 24 inches bgs (see Figure 7). After completing excavation work, soil samples were collected from the excavation bottom and sidewalls and analyzed for total arsenic and lead. Concentrations of arsenic (11.7 to 242 mg/kg) and lead (58.2 to 347 mg/kg) exceeded the respective SSLs in grids 60, 64, 65, 71, and 74.

#### 3.2.2.4. Excavation Around Bench in Grid 65 and Confirmation Samples in Landscaped Areas

On October 20, 2020, soils around a bench at the north end of grids 65 and 76 in the Northeast Meadow were excavated in an area approximately 15 feet by 20 feet to a depth of 12 inches bgs for offsite disposal. The bench and small concrete pad were not removed. Two confirmation soil samples (B18 and P18) were collected from the excavation and analyzed for total arsenic and lead (see Figure 7). Concentrations of arsenic (114 and 14.4 mg/kg) in the samples exceeded the SSL and lead (171 mg/kg) exceeded the screening level in sample B18.

In addition, three soil samples (PW-12, PC-12 and PE-12) were collected within landscaped areas along the shoreline to confirm that those areas did not require excavation. The samples were collected from approximately 0 to 12 inches bgs and analyzed for total lead and arsenic. Arsenic was detected at a concentration of 7.61 mg/kg in sample PC-12 slightly above the SSL.

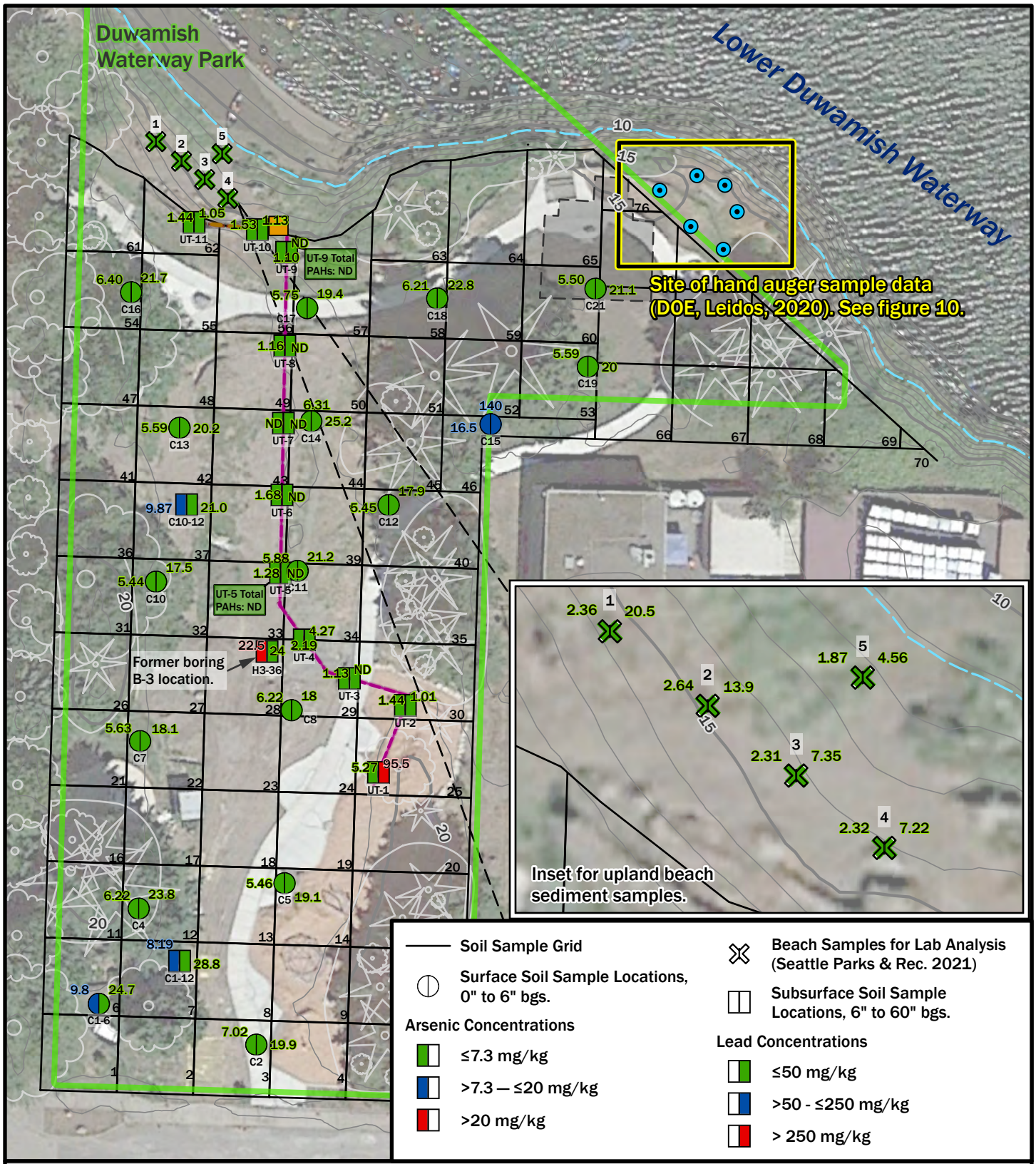
At the picnic table in grid 59, initial concentrations of arsenic and lead exceeded the SSLs in one surface soil sample (PT-6) from 0 to 6-inch bgs, and lead only slightly exceeded the SSL in a second soil sample (PT-12) collected from 6 to 12-inch bgs after the concrete slab and contaminated soils in this area were excavated and disposed offsite. Concentrations of arsenic and lead in a third soil sample (PT-18) collected from 12 to 18-inch bgs were well below the respective SSLs.

### 3.2.3. Park Renovations and Confirmation Sampling

This section describes the completion of the interim action and park renovations and confirmation sampling completed in 2021. The sampling locations are depicted in Figures 8 through 10 and data are summarized in Appendix A, Tables 9 and 10.

#### 3.2.3.1. 2021 Completion of Interim Action and Park Renovations

To complete the interim action, clean soil was imported to fill remedial excavations, and clean topsoil was imported to prepare the lawn areas for seeding in the Central Meadow and Northeast Meadow areas. Hard surfaces such as sidewalks, concrete pads for picnic tables and benches, and the playground itself were also installed as part of the park renovations. In addition, a new water service line and irrigation lines, and a stormwater drainpipe and infiltration trench were installed.




Legend

- Remedial Investigation Site Boundary
- Footprint of Former House
- Elevation Contours (DNR 2016)
- 5 FT Contour
- 1 FT Contour
- Mean Higher High Water (11.1 FT MLLW)
- Dispersion Trench
- Stormwater Drainpipe
- Catch Basin
- 2021 Offsite Hand Auger Sample Location (Leidos)
- Beach Samples for Lab Analysis (Seattle Parks & Rec. 2021)

**Figure 8. Additional Soil Samples Collected During Park Renovations, Duwamish Waterway Park, Seattle. City of Seattle, 2021.**

0 25 50 100 Feet

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HERRERA

Aerial: EagleView Technologies, 2019

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#### 3.2.3.2. Utility Trench Samples

In January 2021, during the Park renovations, 11 soil samples (UT-1 through UT-11) were collected from the bottom of a stormwater utility trench (see Figure 8 and Appendix A, Table 9). The samples were collected at approximate 25-foot intervals at depths ranging from 30 to 54 inches bgs (Figure 7). All samples were analyzed for total arsenic and lead and two samples (UT-5 and UT-9) were also analyzed for PAHs. Arsenic and/or lead were detected below the SSLs in almost every sample; the concentration of lead (95.5 mg/kg) in only one sample (UT-1) exceeded the SSL. PAHs were not detected above the laboratory reporting limits in the two samples analyzed.

#### 3.2.3.3. May 2021 Water Line Excavation Sampling

In May 2021, the remediation contractor returned to remove additional soil for an irrigation trench in the northeast meadow where soils were likely contaminated. On May 10, 2021, two soil samples (58W-1 and 58W-2) were collected from approximately 30-36 inches bgs from an excavation dug to install an irrigation water line in grid 58 (see Figure 8). Arsenic was detected in one sample 58W-2 above the SSL, but lead concentrations in both samples were below the SSL.

#### 3.2.3.4. August 2021 Confirmation Sampling

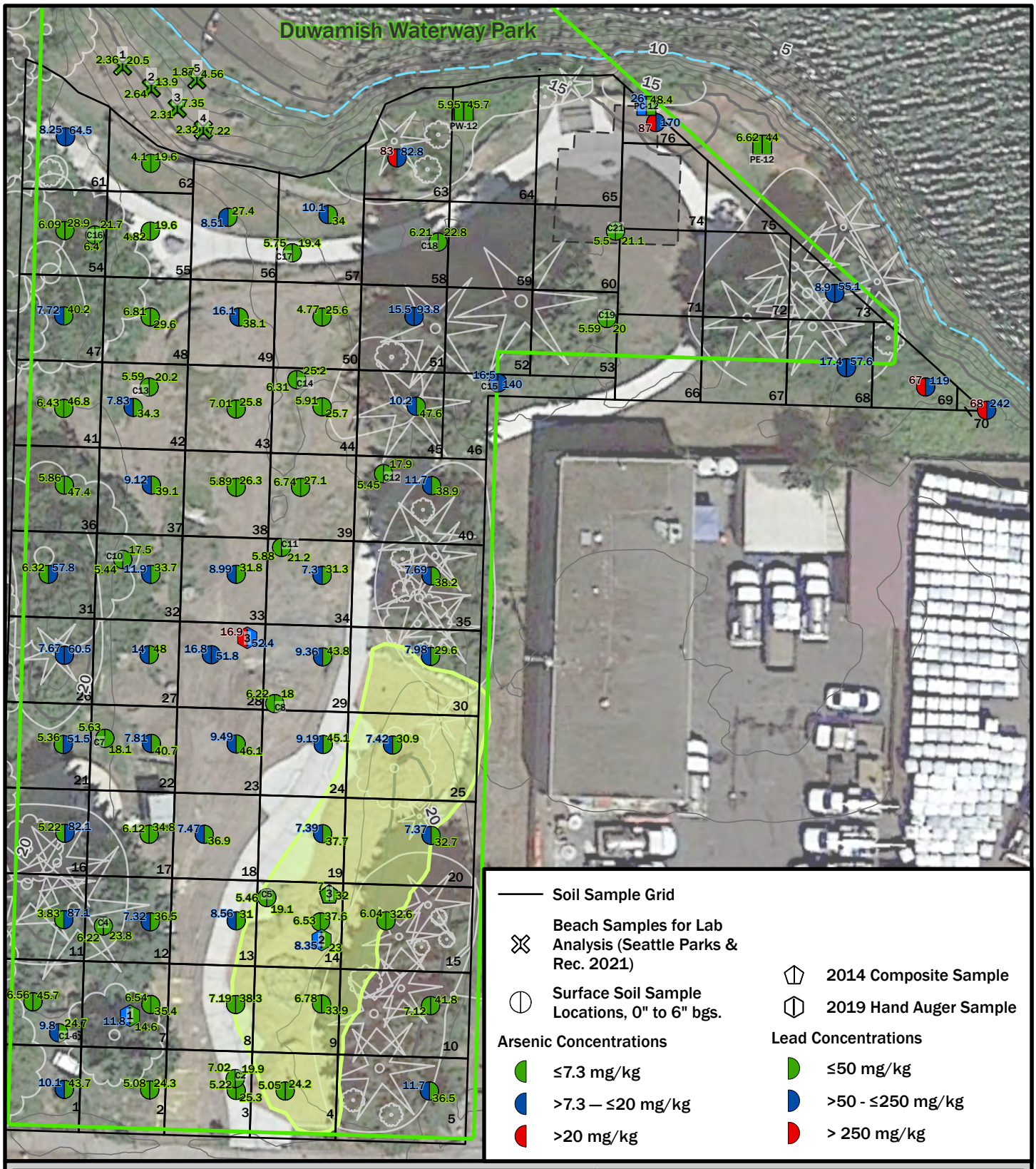
On August 20, 2021, a total of 21 confirmation soil samples (C1 through C21) were collected throughout the Central Meadow and Northeast Meadow on an approximately 50-foot grid. Surface samples were collected from 0-6 inches bgs at each location and two subsurface samples (C1-12 and C10-12) were collected from 6-12 inches bgs. Arsenic was detected above the SSL in two surface samples (C1-6 and C15-6) and both subsurface samples (C1-12 and C10-12), and lead was detected above the SSL in surface sample C15-6 (see Figure 8).

#### 3.2.3.5. October 2021 Upper Beach Sampling

In October 2021, five samples (DWWP-B-1 through DWWP-B-5) were collected along the upper portion of the beach above MHHW elevation; although collected as sediment samples, these samples are considered upland surface soil samples for site characterization purposes (see Figure 8 and Appendix A, Table 10). These samples were analyzed for total metals, organics, phthalates, total PCBs, and PAHs.

#### 3.2.3.6. Arsenic and Lead Concentrations Remaining in Soil After the Interim Action and Park Renovations

Arsenic and lead concentrations remaining in surface soils and subsurface soils after the interim action and park renovations were completed are depicted in Figures 9, 10a and 10b, respectively. Surface soil concentrations exceeded the SSLs in a total of 41 samples for arsenic and 15 samples for lead. The playground area and adjacent sidewalk provide a protective cap preventing exposures to low concentrations of contaminants remaining in soils in those areas.




Legend

- Remedial Investigation Site Boundary
- Footprint of Former House
- Playground area

Elevation Contours (FT MLLW; DNR 2016)

Major

- 5 FT Contour
- 1 FT Contour
- Mean Higher High Water (11.1 FT MLLW)

**Figure 9. Arsenic and Lead Concentrations Remaining in Surface Soils After Interim Action, Duwamish Waterway Park, Seattle, Washington.**

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0 25 50 100 Feet

HERRERA

Aerial: EagleView Technologies, 2019

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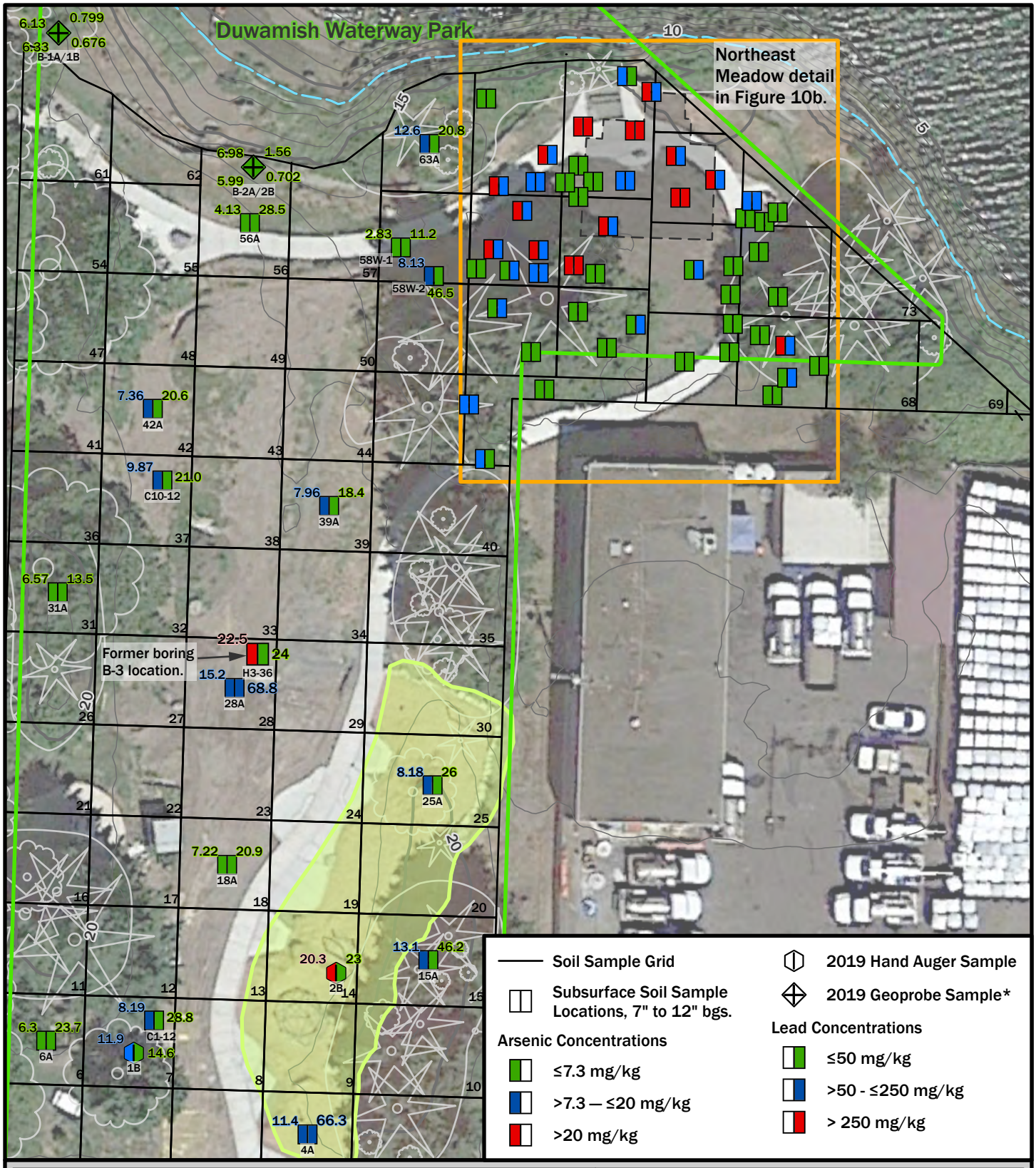


Legend

- Remedial Investigation Site Boundary
- Footprint of Former House
- Playground area

Elevation Contours (FT MLLW; DNR 2016)

Major

- 5 FT Contour
- 1 FT Contour
- Mean Higher High Water (11.1 FT MLLW)

**Figure 10a. Arsenic and Lead Concentrations Remaining in Subsurface Soils in the Central Meadow After Interim Action, Duwamish Waterway Park, Seattle, Washington.**

0 20 40 80 Feet

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Aerial: EagleView Technologies, 2019

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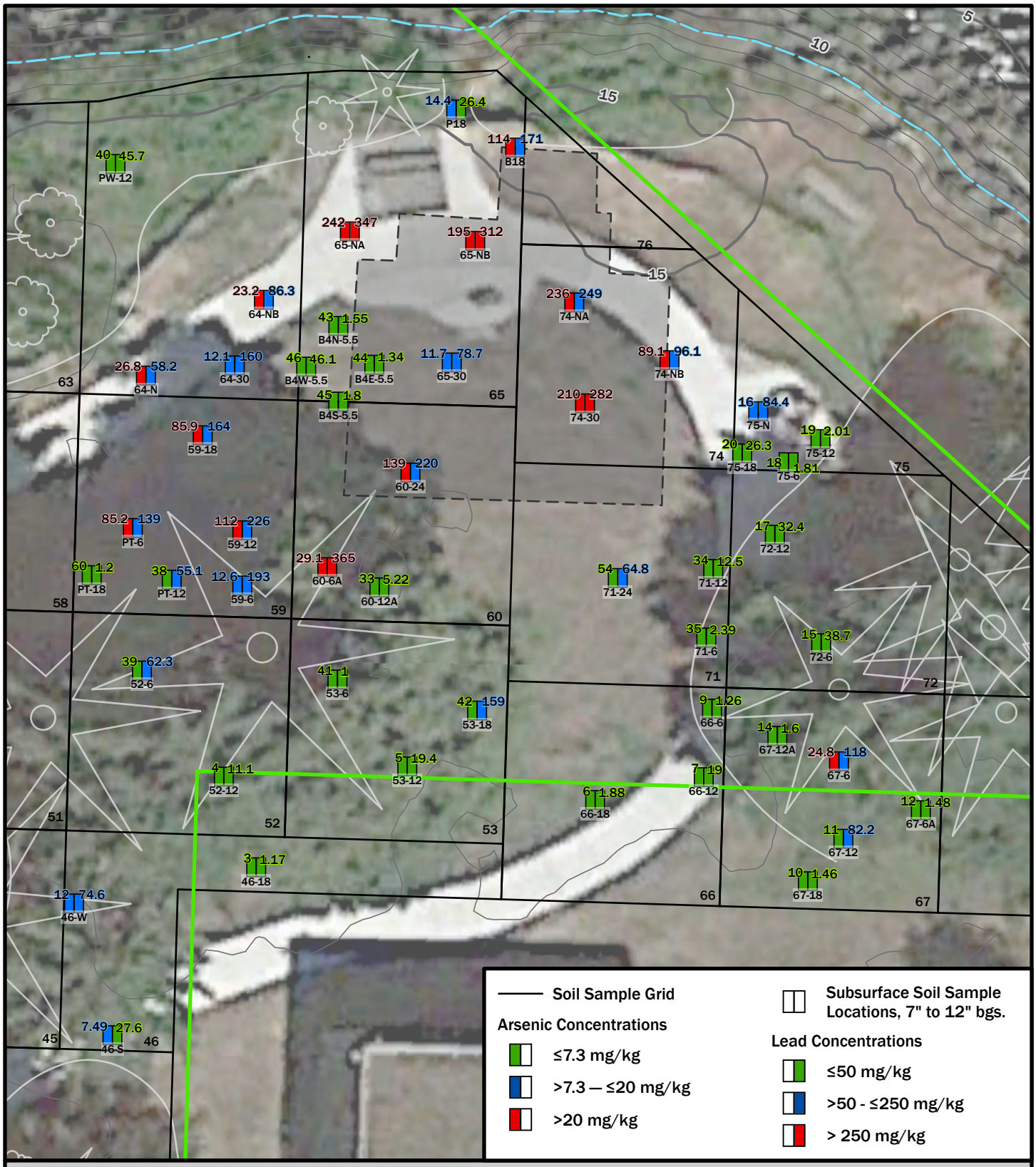


Legend

Remedial Investigation Site Boundary

Footprint of Former House

Playground area

Elevation Contours (FT MLLW; DNR 2016)

Major

5 FT Contour

1 FT Contour

Mean Higher High Water (11.1 FT MLLW)

**Figure 10b. Arsenic and Lead Concentrations Remaining in Subsurface Soils in the Northeast Meadow after Interim Action, Duwamish Waterway Park, Seattle, Washington.**

0 7.5 15 30 Feet

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Aerial: EagleView Technologies, 2019

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The average concentrations of arsenic and lead in all remaining surface soils across the site are 11.0 mg/kg and 41.7 mg/kg, respectively, only slightly above the SSLs of 7.3 for arsenic and 50 for lead. The average concentrations of arsenic and lead remaining in surface soils for areas outside the play area and adjacent sidewalk are only slightly higher at 11.2 mg/kg and 42.7 mg/kg, respectively. Subsurface soil concentrations exceeded the SSLs in a total of 35 samples for arsenic and 27 samples for lead and the average concentrations for all subsurface soil samples are 24.8 mg/kg for arsenic and 65.3 mg/kg for lead.

#### 3.2.3.7. Sediment

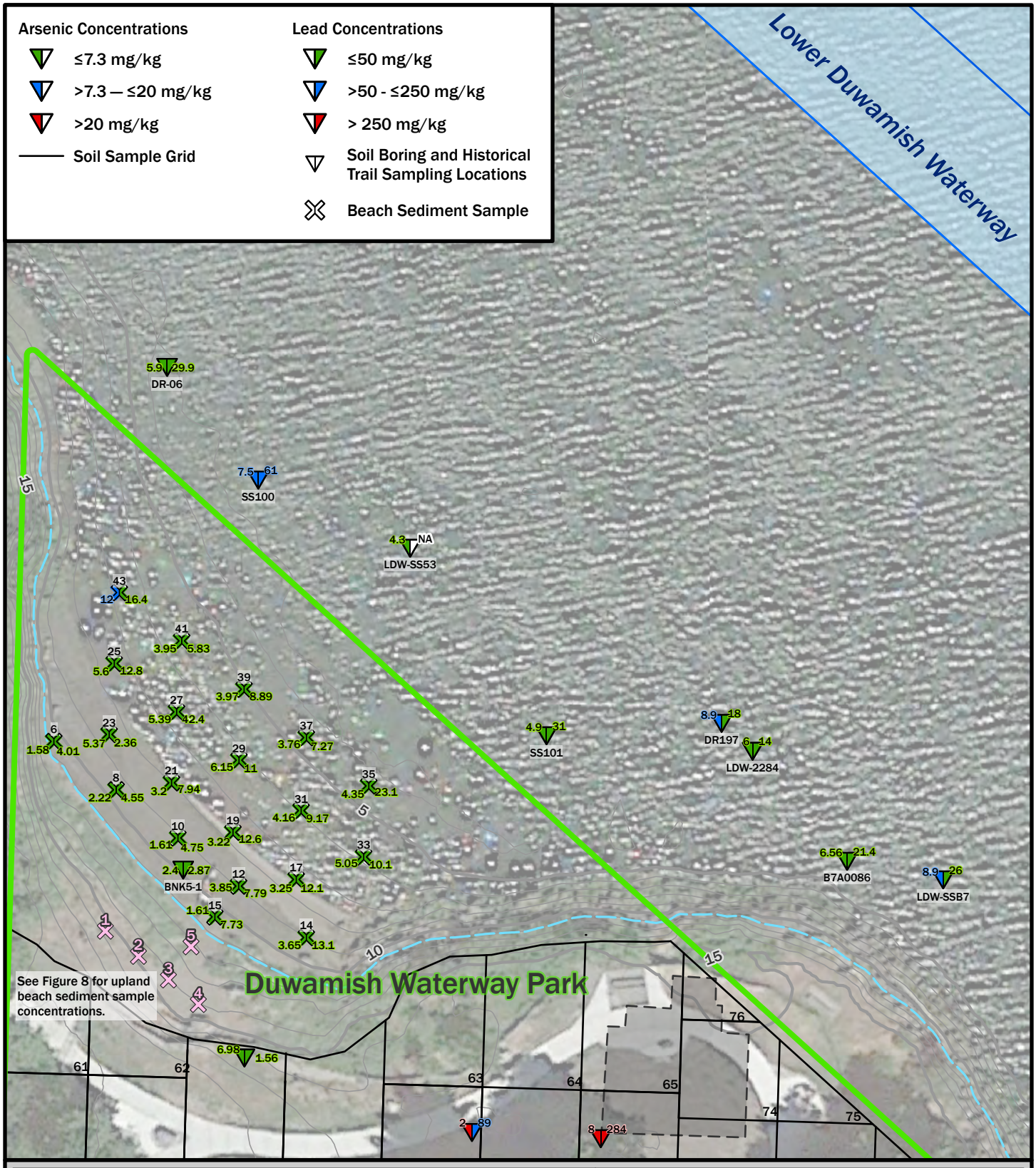
In October 2021, a total of 43 surface sediment samples were collected at low tide from the Beach Area at the north end of the Park (Figure 11). A beach sediment sampling memo included in Appendix B provides a summary of the sampling locations, sample location, analysis, and data validation. Sample locations were established on a grid approximately 10 feet apart and collected from 0 to 10 centimeters (cm) bgs. Five samples (DWWP-B-1 through DWWP-B-5) were collected along the upper portion of the beach above the MHHW elevation, and are therefore considered upland soil samples for purposes of data analysis. The remainder of the samples were collected below the MHHW throughout the beach area.

A total of 25 of the samples were submitted for laboratory analysis while the others were archived for potential follow-up analysis: this includes the 20 samples analyzed as sediment and 5 samples designated upland soils. The surface sediment samples were analyzed for total metals; semi-volatile organic compounds (SVOCs); PCBs; and total organic carbon (TOC) (see Appendix A, Table 11). The draft sample results show that the beach has generally good surface sediment quality. No remedial action levels (RALs) established by the LDW Record of Decision (EPA 2014, Table 28) were exceeded for detected metals, PAHs, or PCBs. No concentrations of total PCBs, arsenic or total cPAHs exceeded the LDW human health based (RALs), which are based on Site average values (Table 1). There were only one benthic RAL exceedance for a detected concentration of hexachlorobenzene in one sample for station B-37 based on the dry weight result. No other benthic RALs were exceeded. Concentrations of three metals arsenic, copper, and lead exceeded the Site screening level in one sample each. The reporting limits (RLs) for two phthalate COCs, bis(2-ethylhexyl) phthalate and butylbenzyl phthalate, exceeded the Site screening levels in four samples.

**Table 1. Duwamish Waterway Park Sediment Results Compared to Human Health Based RALs.**

| Analyte | Unit | LDW RAL[a] (Category 3) | Average Site Value |
|---|---|---|---|
| Total PCBs | mg/kg OC | 12 | 1.42 |
| | µg/kg dw | 230 | 12.2 |
| Arsenic | mg/kg dw | 57 | 4.2 |
| Total cPAHs (TEQ) | µg/kg dw | 1,000 | 14.4 |

[a] Project site is located in Lower Duwamish Waterway Recovery Category 3. The remedial action level (RAL) applies to intertidal sediment in the top 10-centimeter depth interval. Values taken from the LDW Record of Decision (EPA 2014, Table 28).




Legend

- Remedial Investigation Site Boundary
- Footprint of Former House
- Elevation Contours (DNR 2016)
  - 5 FT Contour
  - 1 FT Contour
  - Mean Higher High Water (11.1 FT MLLW)
  - Navigation Channel Boundary

Beach Sampling Locations Submitted for Laboratory Analysis (Seattle Parks & Rec. 2021)

- Upland Sediment Sample

See Figure 8 for Upland Sediment Sample 1-5 detail.

**Figure 11. Sediment Sampling Locations, Duwamish Waterway Park, Seattle, Washington.**

0 20 40 80 Feet

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Aerial: EagleView Technologies, 2019

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### 3.2.4. Groundwater and Seeps

No characterization of groundwater or seeps has been performed at the Site.

### 3.2.5. Surface Water

No characterization of surface water (e.g., stormwater) has been performed at the Site.

## 3.3. Adjacent Investigations and Data

### 3.3.1. Lower Duwamish Waterway

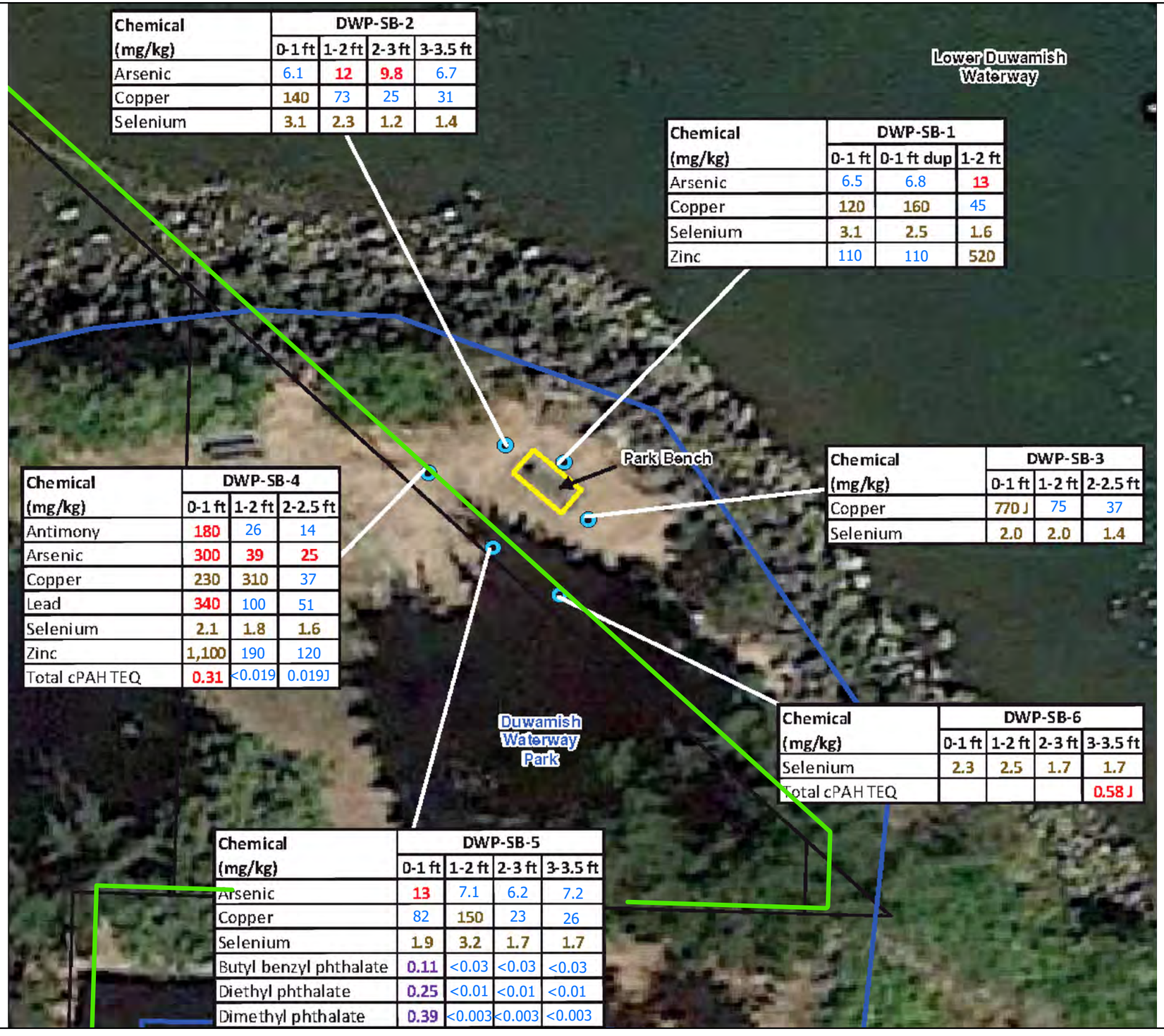
Sediment data collected by others near the Park were reviewed. Eleven samples within and adjacent to the beach area at the Park in the LDW were downloaded from Ecology's EIM and analytical results for SMS COCs are included in Appendix A, Table 12 for samples DR-06, DR197, B7A0086, SS101, SS100, LDW-SSB7, LDW-2284, SS533-comp, and BNK5-1 (see Figure 11). All samples were collected from 0-10 cm, except for samples SS533-comp (0 to 43 cm) and LDW-2284 (0 to 30 cm). Several metals (arsenic, chromium, lead, and zinc) exceeded the Site screening levels in one or more samples. Total PCBs exceeded the Site screening level of 130 µk/kg in one sample (LDW-SS533-COMP) collected in 2010 from 0 to 43 cm. Several SVOCs exceeded benthic RALs or Site screening levels in samples collected from 0 to 10 cm in 1995, 1998, and 2004.

### 3.3.2. Port of Seattle-Managed DNR Land

In April 2021, Ecology sampled soils on the DNR land managed by the Port of Seattle (Leidos 2021). A total of six hand auger borings were completed and samples were collected at the surface, and at various one-foot intervals from each boring (Figure 12). Samples were analyzed for PCBs, metals, PAHs, TPH, SVOCs, and TOC. The concentrations of COCs detected were generally lower than those observed in soils collected previously from the Northeast Meadow. Elevated concentrations of arsenic, antimony, lead and cPAHs exceeded the MTCA CUL for human health direct contact, and copper, selenium, and zinc exceeded the Terrestrial Ecological Evaluation (TEE) CUL for protection of wildlife, plants, and soil biota. In addition, concentrations of butyl benzyl phthalate, diethyl phthalate, and dimethyl phthalate in one surface soil sample exceeded the MTCA CUL for erosion of soil to sediment.

### 3.3.3. SDOT Property

Grid soil sampling completed in July 2020 at the Northeast Meadow is described in Section 3.2.1.4 and included a small portion of SDOT property adjacent to the east of the Park (ECC 2021a)(Figures 4 and 5). Surface soil samples collected from grid cells number 46 and 66 through 70 partially overlapped onto SDOT property. Elevated concentrations of arsenic and lead in several surface soil samples exceeded the respective SSLs.




| Chemical | DWP-SB-2 | | | |
|---|---|---|---|---|
| (mg/kg) | 0-1 ft | 1-2 ft | 2-3 ft | 3-3.5 ft |
| Arsenic | 6.1 | 12 | 9.8 | 6.7 |
| Copper | 140 | 73 | 25 | 31 |
| Selenium | 3.1 | 2.3 | 1.2 | 1.4 |

| Chemical | DWP-SB-1 | | |
|---|---|---|---|
| (mg/kg) | 0-1 ft | 0-1 ft dup | 1-2 ft |
| Arsenic | 6.5 | 6.8 | 13 |
| Copper | 120 | 160 | 45 |
| Selenium | 3.1 | 2.5 | 1.6 |
| Zinc | 110 | 110 | 520 |

| Chemical | DWP-SB-4 | | |
|---|---|---|---|
| (mg/kg) | 0-1 ft | 1-2 ft | 2-2.5 ft |
| Antimony | 180 | 26 | 14 |
| Arsenic | 300 | 39 | 25 |
| Copper | 230 | 310 | 37 |
| Lead | 340 | 100 | 51 |
| Selenium | 2.1 | 1.8 | 1.6 |
| Zinc | 1,100 | 190 | 120 |
| Total cPAH TEQ | 0.31 | <0.019 | 0.019J |

| Chemical | DWP-SB-3 | | |
|---|---|---|---|
| (mg/kg) | 0-1 ft | 1-2 ft | 2-2.5 ft |
| Copper | 770 J | 75 | 37 |
| Selenium | 2.0 | 2.0 | 1.4 |

| Chemical | DWP-SB-6 | | | |
|---|---|---|---|---|
| (mg/kg) | 0-1 ft | 1-2 ft | 2-3 ft | 3-3.5 ft |
| Selenium | 2.3 | 2.5 | 1.7 | 1.7 |
| Total cPAH TEQ | | | | 0.58 J |

| Chemical | DWP-SB-5 | | | |
|---|---|---|---|---|
| (mg/kg) | 0-1 ft | 1-2 ft | 2-3 ft | 3-3.5 ft |
| Arsenic | 13 | 7.1 | 6.2 | 7.2 |
| Copper | 82 | 150 | 23 | 26 |
| Selenium | 1.9 | 3.2 | 1.7 | 1.7 |
| Butyl benzyl phthalate | 0.11 | <0.03 | <0.03 | <0.03 |
| Diethyl phthalate | 0.25 | <0.01 | <0.01 | <0.01 |
| Dimethyl phthalate | 0.39 | <0.003 | <0.003 | <0.003 |

Figure 12. Soil Samples Collected from Hand Auger Borings on Port of Seattle-Managed DNR Land, Duwamish Waterway Park, Seattle, Washington. (Source: Leidos 2021; Prepared for WA DOE)

Legend

- Remedial Investigation Site Boundary
- Soil Boring
- Park Bench
- King County Parcel

NOTES:

Detected exceedances of three PCUL soil criteria are presented. All samples are included.

Prioritization of PCUL Exceedances:

(1) Soil Direct Contact (SL-1)

(2) Simplified Terrestrial Ecological Evaluation (SL-9)

(3) Erosion of Soil to Sediment (SL-8)

*Background Source: Google Earth (Imagery Date: 8/2020).

Soil criteria not exceeding preliminary screening levels are indicated in blue.

N

0 7.5 15 30 Feet

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### 3.3.4. Duwamish Waterway Park Addition

In June 2021, a Phase I Environmental Site Assessment (ESA) was performed at the Duwamish Waterway Park Addition (also known as the United Site Services property) property, currently owned by SPR, and leased to USS (ECC 2021b). The property was formerly occupied by Long Painting. USS operates a portable toilet rental business at the property. Portable toilets, hand wash stations, and service trucks are stored outdoors on the property.

The Phase I ESA identified the following Recognized Environmental Conditions (RECs) at the Property:

- Potential soil and groundwater contamination associated with three different sets of two 10,000-gallon underground storage tanks (USTs) containing diesel fuel and gasoline installed at the property between 1977-1998 and then later removed between 1998-2003.
- Potential impacts to soil and groundwater from metals, VOCs, and PCBs associated with manufacture and storage of paints during operation of the property by Long Painting.
- Potential presence of historic septic systems and heating oil USTs associated with several single-family homes previously located on the property.
- Potential for surface soil contamination with lead and arsenic from the Asarco smelter plume.

The site investigation history summarized in the Phase I ESA is as follows:

- Former Fuel USTs Area- Former Long Painting Company Site (1022 South Elmgrove Street, Seattle WA 98108). The northwestern portion of the Subject Property was previously used as an auto repair facility and two 10,000-gallon USTs and associated dispensers and product piping were located on the southwestern portion. Two 10,000-gallon USTs were installed in August of 1998. These USTs were removed in October of 1998.

- In 1997, a Phase I and Phase II investigations were conducted by AGRA Earth and Environmental Inc. (AGRA) and six groundwater monitoring wells were installed. Soil and groundwater samples were collected and analyzed for Total Petroleum Hydrocarbons (TPH), TPH-gasoline, TPG-diesel, and TPH-oil, and benzene, toluene, ethylbenzene, and total xylenes (BTEX). No compounds were detected above method detection limits.

- In October 1998, the two 10,000-gallon USTs were removed by AGRA and the USTs were reportedly in good condition with minor corrosion but no holes; groundwater was not encountered. Soil samples were collected and tested for TPH-gasoline, TPG-diesel, and TPH-oil, and BTEX compounds. TPH-diesel was detected at levels below the MTCA cleanup standards. In November 1998 two fiberglass USTs and associated product lines were installed in the same location as the previous USTs.

- Between 2000-2002, Kleinfelder conducted site assessment, soil removal and groundwater monitoring in regards to a historic diesel spill not associated with the USTs. No Further Action (NFA) status was granted on February 4, 2003.

- In June 2003, the two fiberglass 10,000-gallon USTs were removed and the tanks were reportedly in excellent condition. Soil samples and one groundwater grab sample were collected. All soil sample results were either below the laboratory method reporting limit of below Model Toxic Control Act (MTCA) Method A Cleanup Levels. However, water samples exceeded MTCA Method A Cleanup levels for TPH-gasoline, benzene, MTBE, and total lead.

- In September 2003, groundwater samples were collected again and analyzed for TPH-G, BTEX, and MTBE, and the analytical results were below the laboratory method reporting limits. Based on analytical results for soil samples collected at the limits of the UST excavation in June 2003 and analytical results for the geoprobe groundwater samples collected in September 2003, site soil and groundwater meet MTCA Method A Cleanup Standards.

Also in June 2021, a Phase II ESA (ECC 2021c) was subsequently performed to follow-up on the RECs identified in the Phase I ESA:

- Former use of the property as an auto repair shop.
- Potential for contaminated dredge spoils to have been deposited from the LDW onto the property.

A total of 12 soil samples were collected at depths of 2 to 10 feet bgs from hand auger and push probe borings. The laboratory analytical results are summarized as follows:

- Concentrations of diesel- and lube oil-range total petroleum hydrocarbons, PCBs, and most heavy metals (antimony, barium, cadmium, lead, mercury, selenium, or silver) detected in soils did not exceed the MTCA Method A CULs for unrestricted land use.
- Concentrations of arsenic in two samples exceeded the MTCA Method A CUL of 20 mg/kg for unrestricted land use.
- Concentrations of total cPAHs exceeded the MTCA Method A CUL of 0.1 mg/kg in four samples.

# 4. REMEDIAL INVESTIGATION WORK PLAN

This section describes the procedures and scope of work that Herrera will perform to complete the RI per WAC 173-340-350(7). The RI will address data gaps and characterize the nature and extent of contamination present in the soil, sediment, groundwater and seeps, and surface water at the site, thus providing data necessary to select a preferred cleanup action alternative to achieve regulatory closure of the site.

## 4.1. PRELIMINARY CONCEPTUAL SITE MODEL

This section describes the preliminary Conceptual Site Model (CSM) based on available data for the Site and adjacent land.

The fill brought on site in 1989 is the likely source of localized contamination in the Northeast Meadow. Historical documents suggest that fill material donated from Long Painting was likelyplaced in the location of a former house at 1022 South Monroe Street after it was moved. The Site may have also been impacted by fill brought on site at a different time or from aerial deposition from surrounding industries and/or the former Asarco Smelter plume. Consistent with Ecology's Dirt Alert website, the majority of the Park is in the smelter deposition zone with low arsenic concentrations, below 20 mg/kg (Ecology 2022a).

Previous investigations completed at the Site focused on arsenic and lead as the primary COCs. Based on review of previous data for investigations completed on and adjacent to the Site, and Ecology's 2021 opinion Letter, the list of COCs being investigated for this RI includes:

- Metals (antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc),
- PAHs,
- PCBs, and
- Phthalates (bis[2-ethylhexyl] phthalate, butyl benzyl phthalate, diethyl phthalate, and dimethyl phthalate). Samples will also be analyzed to screen for two other common phthalates (di-n-butyl phthalate and di-n-octyl phthalate).

Some of these COCs have been detected at the Site in soil and sediment. This RI Workplan includes investigation of groundwater, seeps, and surface water.

The exposure pathways for soil and sediment include direct contact, ingestion, and inhalation of soil particles by human and ecological receptors. Groundwater at the Site is not used and will not be used in the future as a drinking water source.

Potential receptors at risk from exposure at the Site are human and ecological receptors. The human receptors include park users during recreational activities in the upland and beach areas, and workers during park construction or maintenance activities. The ecological receptors are terrestrial wildlife (birds and burrowing animals) and freshwater aquatic species.

The main transport mechanisms for arsenic and lead at the site are:

- Leaching of metals in the vadose zone soil to the underlying saturated zone soils and/or groundwater
- Leaching of metals in the saturated zone soil to groundwater
- Erosion of surface soils to beach sediment along the Duwamish Waterway
- Erosion of surface soils to surface water (Duwamish Waterway)

Herrera will update and refine the CSM as additional site data are collected during the RI.

## 4.2. Site Screening Levels for Soil, Sediment, Groundwater, and Surface Water

Site-specific cleanup levels will be developed as the RI is completed and will be finalized as part of the FS. Cleanup levels developed during the FS may differ from SSLs based on the results of the RI. A preliminary evaluation of screening levels was performed based on the preliminary conceptual model described in Section 4.1 for the purpose of screening existing Site data and to identify appropriate analytical methods and detection limits for the Sampling and Analysis Plan (SAP). The evaluation considered potentially applicable cleanup levels based on Site use, contaminant transport pathways, and potential receptors.

Ecology's LDW study area screening level tool (LDW Tool) was used to generate SSLs for soil, sediment, groundwater, surface water (Ecology 2022b). The SSLs were used to evaluate historic Site data and determine COCs, and to assess analytical methods and associated detection limits for all media. The tool includes potential cleanup levels, ARARs, and other potentially applicable screening levels, and generate the most stringent preliminary screening levels for the COCs selected by the user that are applicable to site-specific conditions (i.e., potable or non-potable groundwater, bank erosion to sediment, etc.).

### 4.2.1. Soil

The Site and adjacent properties are zoned for industrial use and are characterized by manufacturing, shipping, warehouses, water transportation and other industrial activities. Access to the Site is unrestricted to the general public and future use of the site will continue to be as a Park. Groundwater at the Site is not currently being used and is not expected to be a potential

future source of potable water. Therefore, groundwater is not considered potable in the context of determining preliminary screening levels.

Groundwater from the Site discharges to surface water within the LDW. Surface water in the LDW is comprised of marine, brackish, and fresh water. Soil screening levels protective of groundwater and surface water were considered. Based on the current and future use of the Site, site transport pathways, and potential receptors, the following were considered potentially applicable soil screening levels for identification of analytical methods and detection limits:

- Lowest most stringent applicable soil screening level based on the LDW Tool and ARAR Table - V. 14, based on non-potable surface water scenario
- Natural Background Levels from the LDW Tool
- Practical quantitation limits (PQLs) obtained from analytical laboratories in accordance with WAC 173340-709, WAC 173-340-705(6), and WAC 173-340-707. The preliminary soil screening levels are listed in Appendix A, Table 1.

In general, the listed screening levels are the most stringent applicable screening level based on the LDW Tool, with the following exceptions:

- Background: If the lowest regulatory criterion is less than the background concentration, the preliminary soil screening level was set at the background concentration.
- Method PQL: If the lowest regulatory criterion is less than the PQL, the preliminary soil screening level was set at the PQL, unless the PQL is less than the background concentration. In that case, the soil SSL level was set at the background concentration.

### 4.2.2. Sediment

Sediment adjacent to the Site has been potentially affected by contaminants present in the LDW outside the Site and/or from past Site activities. Screening levels used to evaluate Site sediment data are based on the LDW Tool, similar to the process described above for soil. Based on the current and future use of the Site, site transport pathways, and potential receptors, the following were considered potentially applicable sediment screening levels for identification of analytical methods and detection limits:

- Lowest most stringent applicable sediment screening level based on the LDW Tool and ARAR Table - V. 14
- Natural Background Levels from Ecology's LDW Screening Level Table
- PQLs obtained from analytical laboratories in accordance with WAC 173-340-709, WAC 173-340-705(6), and WAC 173-340-707.

The SSLs are listed in Appendix A, Table 2. In general, the listed screenings are the most stringent applicable screening levels based on the LDW Tool, with the following exceptions:

- Background: If the lowest regulatory criterion is less than the background concentration, the SSL was set at the background concentration.

- PQL: If the lowest regulatory criterion is less than the PQL, the sediment SSL was set at the PQL, unless the PQL is less than the background concentration. In that case, the SSL was set at the background concentration.

### 4.2.3. Groundwater and Seeps

Groundwater at the Site or potentially affected by the Site is not currently being used for drinking water and is not a potential future source of potable or drinking water due to its proximity to the LDW. Drinking water at the Site is supplied by the City of Seattle. Based upon these factors, the LDW Tool was used to develop SSLs for groundwater based on a non-potable groundwater scenario. The most stringent potential screening levels and ARARs were considered based on protection of Site ecological receptors and human health, protection of surface water, and protection of sediment.

The following is a description of the steps used to select screening levels for groundwater at the Site:

- Lowest most stringent non-potable surface water screening level listed in the LDW Tool and ARAR Table - V. 14

- Natural Background Levels from the LDW Tool

- PQLs in accordance with WAC 173-340-709, WAC 173-340-705(6), and WAC 173-340-707

The proposed groundwater SSLs are listed in Appendix A, Table 3. The groundwater SSLs were selected as the lower of the non-potable surface water screening levels based on the LDW Tool with the following exceptions:

- Background: If the lowest regulatory criterion is less than the background concentration, the groundwater SSL was set at the background concentration.

- PQL: If the lowest regulatory criterion is less than the PQL, the SSL was set at the PQL, unless the PQL is less than the background concentration. In that case, the SSL was set at the background concentration.

## 4.3. Preliminary Identification of Cleanup Action Components

An interim action was completed at the site from 2020 to 2021 using the site characterization and cleanup approaches outlined in Ecology's Tacoma Smelter Plume Model Remedies Guidance (Ecology 2019). The interim action employed excavation and removal of contaminated soils for offsite disposal and capping with clean soil to prevent human direct contact with contaminants. Based on our knowledge of the site history, cleanup actions at the site may include:

- Additional excavation work to address residual contaminated soil
- Additional containment
- Institutional controls
- Natural recovery/attenuation

Cleanup action alternatives for the site will be developed and evaluated during the FS, described in Section 5 of this work plan. The FS will result in a preferred cleanup action alternative for the site.

## 4.4. Data Gaps

This section identifies data gaps that will need to be addressed in Ecology's opinion to completely characterize the nature and extent (lateral and vertical) of contamination present in all media. Previous investigations have focused primarily on arsenic and lead as COCs at the site; Ecology suspects the following COCs (Ecology 2021):

- Total polychlorinated biphenyls (PCBs)
- Metals (antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc)
- Total carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and
- Phthalates (bis[2-ethylhexyl] phthalate, butyl benzyl phthalate, diethyl phthalate, and dimethyl phthalate).

Data gaps for each media at the site are discussed below for soil, sediment, groundwater and seeps, and surface water.

### 4.4.1. Soil

Most data collected has focused on the distribution of total arsenic and lead at the site, primarily in surface soils. Data gaps would include determining the lateral and vertical extent of other suspected COCs down to the standard MTCA Point of Compliance (POC) depth for soils of 15 feet bgs.

Arsenic and lead concentrations at the site are well characterized, with a total of 213 soil samples collected and analyzed at various times before, during, and after the interim action and park renovations.

Data gaps for other metals include the limited number of samples for antimony, copper, and zinc, which were only analyzed in five samples along the upper beach area and in six soil samples collected by Ecology's contractor in 2020 adjacent to the Northeast Meadow.

Historical soil sampling results, however, indicate that chromium, mercury, selenium, and silver were not detected above SSLs and the cadmium concentrations that exceeded the SSL of 0.77 mg/kg in two samples in the Northeast Meadow and have since been removed. Barium concentrations in most samples exceeded the SSL of 8.3 mg/kg, but are orders of magnitude below the MTCA Method B CULs for direct contact (16,000 mg/kg) or protection of groundwater, saturated (83 mg/kg).

Data gaps for organic COCs include phthalates, which have not previously been studied except by Ecology's contractor in 2020 directly adjacent to the Northeast Meadow. For TPH, no diesel- or motor oil-range TPH were detected in three soil samples collected in the Northeast Meadow and no concentrations exceeded preliminary CULs in six samples collected by Ecology's contractor in 2020 adjacent to the Northeast Meadow. PCBs were not detected in three samples from the Northeast Meadow, and concentrations in six samples collected by Ecology's contractor in 2020 adjacent to the Northeast Meadow were either non-detect or only slightly exceeded the most stringent preliminary CUL. In addition, PCB concentrations were below the SSL in four of the five samples collected along the upper beach area and PCBs were not detected in a fifth sample above the laboratory reporting limit. For cPAHs, 21 samples exceeded the SSL of 0.00016 mg/kg, but only sample exceeded the MTCA Method A CUL of 0.1 mg/kg from a grid sample in the northeast meadow.

### 4.4.2. Sediment

The lateral extent of sediments to a depth of 10 cm have been well characterized. However, the vertical extent of sediment contaminant concentrations below that depth has not been determined. Sediment characterization should also include identifying areas of sediment erosion and deposition, and delineation of the transition zone between upper portions of the beach area that are considered soil media above the MHHW elevation and lower portions of the beach are that are considered sediment media. Several surface sediment samples have been collected from 0 to 10 cm throughout the beach area to assess potential human health exposures to

COCs. Additional sampling of subsurface sediment down to 45 cm depth is needed to characterize risk to ecological receptors.

In addition to the suspected COCs listed above, samples should be characterized for physical properties of sediment that affect toxicity and habitat quality (grain size and total organic carbon).

### 4.4.3. Groundwater and Seeps

Groundwater and seep characterization has not occurred at the site, therefore, the lateral and vertical extent of groundwater contaminant concentrations above MTCA CULs has not been determined for all suspected COCs.

### 4.4.4. Surface Water

The distribution and concentrations of hazardous substances in the surface waters, as well as features that affect the fate and transport of all suspected hazardous substances has not been adequately characterized. The extent of contamination to surface waters as they are related to groundwater discharge areas (seeps) and runoff from soil to the waterway has not been characterized.

## 4.5. Overview of Planned RI Field Investigation

This section provides a brief overview of the planned RI field investigation work required to address the data gaps described above in Section 4.4. Table 2 presents a summary of the sampling and analysis plan. The SAP in Appendix C provides a complete description of RI field methods and sampling procedures to be employed, and includes a Quality Assurance Project Plan (QAPP) to ensure that the investigation data are defensible and usable for their intended purpose. A site-specific Health and Safety Plan (HASP) to guide the field work is included in Appendix D. Figure 2 in the SAP depicts the proposed investigation sampling locations.

### 4.5.1. Soil

A drilling subcontractor will facilitate the completion of several soil borings using a direct-push drill rig to collect surface soil and subsurface soil samples in the Central Meadow and Northeast Meadow. Soil samples will be collected from nine locations at three depth intervals 0-6 inches, 1-5 feet, and either 5-10 feet or 10-15 feet depending on site conditions. A total of 27 soil samples (plus two field duplicates) will be analyzed for all COCs listed in Section 4.1 above.

**Table 2. Sampling and Analysis Plan for the Duwamish Waterway Park Site Remedial Investigation.**

| Sample Type | Sample Location | Number of Samples | Sample Analysis |
|---|---|---|---|
| Surface soil–push probe grab | Seven push probe locations throughout Central and Northeast Meadows | 8: One soil sample from 0–6 inches bgs in 7 borings, plus 1 duplicate | Total metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), PAHs, and phthalates. Up to 3 PCB samples based on soil observations (staining, etc.). |
| Subsurface soil–push probe grab | Seven push probe locations throughout Central and Northeast Meadows | 15: One soil sample from the 2–5 foot interval in 7 borings and one soil sample from the 5–10 foot or 10–15 foot interval (depending on site conditions) in 7 borings, plus 1 duplicate | Total metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), , PAHs, and phthalates. Up to 3 PCB samples based on soil observations (staining, etc.). |
| Sediment– grab | Seven locations along the Beach Area at low tide | 8: One sediment sample from 0– 45 cm (0–18 inches) bgs at 7 locations, plus 1 duplicate | Total metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), PCB aroclors, PAHs, phthalates, grain size, and TOC. |
| Groundwater–push probe grab | Two push probes completed in Central Meadow and one push probe completed in Northeast Meadow | 3: One water sample from 3 borings | Total and dissolved metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), PCB aroclors, PAHs, and phthalates. |
| Groundwater–seep grab | Two seeps along the Beach Area, adjacent to and distant from stormwater trench | 8: Four water samples from 2 seep locations collected twice >1 hour apart during 2 storm events | Total and dissolved metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), PAHs, and phthalates. PCBs only if detected in soil and groundwater samples. |
| Surface water–grab | One catch basin at stormwater trench inflow at north end of Central Meadow | 5: One water sample from the catch basin collected twice >1 hour apart during 2 storm events (concurrent with seeps), plus 1 duplicate | Total and dissolved metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), PAHs, and phthalates. PCBs only if detected in soil and groundwater samples. |

Total metals include: Ag (silver), As (arsenic), Cd (cadmium), Cu (copper), Hg (mercury), Pb (lead), Sb (antimony), Se (selenium), and Zn (zinc).

PAHs = polycyclic aromatic hydrocarbons

PCB aroclors = polychlorinated biphenyls as aroclors

Phthalates include bis(2-ethylhexyl) phthalate; butyl benzyl phthalate; diethyl phthalate; dimethyl phthalate; di-n-butyl phthalate; and di-n-octyl phthalate.

### 4.5.2. Sediment

Surface sediment samples will be collected at seven locations in the Beach Area during low tide. The samples will be collected from the 0-45 cm depth interval for comparison to human and ecological health criteria. The seven samples (plus one field duplicate) will be analyzed for COCs listed in Section 4.1 above, and including grain size and TOC.

### 4.5.3. Groundwater and Seeps

Three groundwater samples will be collected from temporary wells installed at the direct-push soil borings described in Section 4.5.1 above. Two well locations will be selected in the Central Meadow and one location at the Northeast Meadow. Intertidal seep samples will be collected on two occasions during two storm events at two locations, one adjacent to and the other distant from the stormwater dispersion trench. The eight samples analyzed for all COCs listed in Section 4.1 above, and including both total and dissolved metals.

### 4.5.4. Surface Water

Surface water samples will be collected on two occasions during two storm events of approximately 0.25 inch of rainfall at the catch basin draining to the stormwater dispersion trench. The four samples (plus one field duplicate) will be analyzed for all COCs listed in Section 4.1 above, and including both total and dissolved metals.

# 5. FEASIBILITY STUDY WORK PLAN

This section describes the draft procedures and scope of work that Herrera will use to complete the FS in conjunction with SPR per WAC 173-340-350 (8). The FS will result in selection of a preferred cleanup action alternative that will inform the design of a Cleanup Action Plan to remediate the Site.

## 5.1. INITIAL SCREENING OF ALTERNATIVES

Cleanup action alternatives will initially be screened to reduce the number of alternatives for the final detailed evaluation. This initial screening of alternatives will determine: 1) which cleanup action alternatives do not meet the minimum requirements specified in WAC 173-340-360 (so that a detailed analysis is unnecessary), and 2) alternatives or components that are not technically possible at the site.

## 5.2. GENERAL FS REQUIREMENTS

General requirements for the FS are listed in WAC 173-340-350(8)(c)(i) and summarized below:

- The FS shall include cleanup action alternatives that protect human health and the environment.
- If model remedy (per WAC 173-340-390) is not appropriate for the Site, a reasonable number and type of alternatives shall be evaluated, taking into account the Site characteristics, including current site conditions and physical constraints.
- Each alternative may consist of one or more cleanup action components, including, but not limited to: source control and offsite disposal or treatment, onsite containment of the hazardous substances with engineering controls, and institutional controls and monitoring.
- A minimum of two cleanup action alternatives will be evaluated. The preferred remedy will be selected using a disproportionate cost analysis (DCA) as described in WAC 173-340-360(3)(e).
- Alternatives may include, as appropriate, proposed remediation levels as described under WAC 173-340-355.
- If necessary, the FS will evaluate the residual threats that accompany each alternative and determine if remedies are protective of human health as well as ecological receptors. The

FS shall include alternatives with the standard point of compliance for each media containing hazardous substances. The FS may include, as appropriate, alternatives with conditional points of compliance.

- Each alternative shall be evaluated based on the requirements and criteria specified in WAC 173-340-360 under Selection of Cleanup Actions.

# 6. REPORTING AND SCHEDULE

## 6.1. REPORTING

Herrera will prepare a draft RI report for review by Ecology and other Stakeholders that presents the results of all site characterization work including the work proposed under this Work Plan. The draft RI will include updated text, tables, and figures to summarize all data collected for the Site. The RI will also include an updated conceptual site model (CSM), Terrestrial Ecological Evaluation (TEE), and proposed cleanup standards and points of compliance for all Site media. Herrera will prepare a final RI that addresses comments received on the draft.

Herrera will prepare a draft FS that provides a brief summary of the RI, presents the remedial action objectives, and identifies and screens available remediation technologies. The FS will also describe and evaluate remedial action alternatives, and identify a preferred alternative based on the Disproportionate Cost Analysis (DCA) ranking.

All environmental sample data will be submitted to Ecology in an electronic format suitable for transfer into Ecology's EIM system.

## 6.2. SCHEDULE

The project schedule is subject to change based on a number of factors including the amount of time required by SPR and/or Ecology and Stakeholders to review documents submitted for review. The anticipated project schedule is presented in Table 3.

**Table 3. Anticipated Schedule for the Duwamish Waterway Park Remedial Investigation and Feasibility Study.**

| Document or Activity | Approximate Date Dependent on Duration of Document Review | |
|---|---|---|
| | 2 Weeks | 90 Days Maximum Under VCP Program |
| Revised Draft Work Plan/SAP/QAPP to SPR | April 21, 2022 | NA |
| Draft Work Plan/SAP/QAPP to Ecology | April 27, 2022 | NA |
| Final Work Plan/SAP/QAPP | June 3, 2022 | August 2022 |
| Field Work, Sampling, Laboratory Analysis and Data Evaluation | June – August 2022 | August – October 2022 |
| Draft RI/FS to Ecology | November 2022 | February 2023 |
| Final RI/FS to Ecology | January 2023 | March 2023 |

# 7. REFERENCES

AECOM. 2012. Final Feasibility Study, Lower Duwamish Waterway, Seattle, Washington. Prepared for the Lower Duwamish Waterway Group by AECOM. October 31.

City of Seattle. 2019. City of Seattle Generalized Zoning Map. Viewed February 16, 2022: <http://www.seattle.gov/dpd/research/GIS/webplots/Smallzonemap.pdf>.

ECC. 2018. Phase I Environmental Site Assessment and Hazardous Materials Survey, Duwamish Waterway Park. Prepared for City of Seattle Parks and Recreation by Eco Compliance Corporation, Seattle, Washington. May 31.

ECC. 2019a. Soil Sample Results for Duwamish Waterway Park. Prepared for City of Seattle Parks and Recreation by Eco Compliance Corporation, Seattle, Washington. January 28.

ECC. 2019b. Soil Sample Results for Duwamish Waterway Park, Seattle. Prepared for City of Seattle Parks and Recreation by Eco Compliance Corporation, Seattle, Washington. March 1.

ECC. 2021a. Site Remediation and Soil Sampling Report, Duwamish Waterway Park. Prepared for City of Seattle Parks and Recreation by Eco Compliance Corporation, Seattle, Washington. February 8.

ECC. 2021b. Phase I Environmental Site Assessment Report, Duwamish Waterway Park Addition. Prepared for City of Seattle Parks and Recreation by Eco Compliance Corporation, Seattle, Washington. June 15.

ECC. 2021c. Phase II Environmental Site Assessment Soil Sampling Report, Duwamish Waterway Park Addition. Prepared for City of Seattle Parks and Recreation by Eco Compliance Corporation, Seattle, Washington. June 24.

Ecology. 2019. Tacoma Smelter Plume Model Remedies Guidance: Sampling and cleanup of arsenic and lead contaminated soils. Washington Department of Ecology Publication Number 19-09-101. Olympia, Washington.

Ecology. 2022a. Tacoma Smelter Plume Map. Viewed February 15, 2022, on the Washington Department of Ecology's Dirt Alert website <https://apps.ecology.wa.gov/dirtalert/?lat=47.476497&lon=-122.204204&zoom=12>.

Ecology. 2022b. Lower Duwamish Waterway Preliminary Cleanup Level Workbook downloaded February 15, 2022, from the Washington Department of Ecology website at: <https://apps.ecology.wa.gov/cleanupsearch/site/1643#site-documents>.

Galster R.W. and Laprade, W.T. 1991. Geology of Seattle, Washington United States of America. Bulletin of the Association of Engineering Geologists Vol. XXVII, No. 3.

Herrera. 2009. Phase II Environmental Site Assessment Report, South Park Bridge Replacement Project, Seattle, Washington. Prepared for King County Department of Transportation by Herrera Environmental Consultants, Inc., Seattle, Washington. September 21.

King County. 2022. King County Districts and Development Conditions for parcel number 7327901195. Viewed February 15, 2022, at King County GIS Center website. <https://www5.kingcounty.gov/kcgisreports/dd_report.aspx?PIN=7327901195>.

LDWG. 2004. Lower Duwamish Waterway Bathymetric Survey. Prepared by the Lower Duwamish Waterway Group by Windward Environmental, February 6.

LDWG. 2010. Lower Duwamish Waterway Remedial Investigation, Final Remedial Investigation Report, prepared for the Lower Duwamish Waterway Group by Windward Environmental, July.

Leidos. 2021. Final Data Summary Report, Lower Duwamish Waterway Park, Seattle. Prepared for the Department of Ecology by Leidos, Inc., Bothell, Washington. September 21.

Troost, K.G., D.B. Booth, A.P. Wisher, and S.A. Shimel. 2005. The Geologic Map of Seattle – A Progress Report.

Troost, Kathy G., and Derek B. Booth. 2008. Geology of Seattle and the Seattle Area, Washington. In Landslides and Engineering Geology of the Seattle, Washington, Area, edited by Rex L. Baum, Jonathan W. Godt, and Lynn M. Highland, pp. 1-35. Reviews in Engineering Geology XX. The Geological Society of America, Boulder.

USACE. 1919. US Army Corps of Engineers Map Showing Route of Duwamish Waterway through Commercial Waterway District No. 1, King County, Washington. Map E12-4-12.1. Revised September 1, 1919.

USGS. 2005. US Geological Survey. Preliminary Geologic Map of Bainbridge Island, Washington by Ralph A. Haugerud. Open-File Report 2005-1387. <http://pubs.usgs.gov/of/2005/1387/of2005-1387.pdf>.

Wikipedia. 2022. History of the Duwamish People reviewed February 7, 2022 at Wikipedia website. <https://en.wikipedia.org/wiki/Duwamish_people#:~:text=Villages%20at%20the%20then-mouth%20of%20the%20Duwamish%20River,in%20what%20is%20now%20the%20City%20of%20Seattle>.

Wilbur. 2004a. Hazardous Materials Technical Report – South Park Bridge Report. Prepared for the King County, Department of Transportation by Wilbur Consulting, Inc., a subconsultant for Parsons Brinckerhoff, Inc., Seattle, Washington. February 2004.

# APPENDIX A

# Data Tables

| Table 1. Site Screening Levels for Soil, Duwamish Waterway Park, Seattle, Washington. | | | | |
|---|---|---|---|---|
| **Chemical** (All concentrations in mg/kg) | **Preliminary Cleanup Level (LDW Most Stringent Screening Level From Categories SL-1, 3, 4, and 6-9)[a]** | **Background Concentration** | **Practical Quantitation Limit** | **Soil Site Screening Level (mg/kg - After Adjustment for Background and PQL)** |
| ***PCBs*** | | | | |
| Total PCB Aroclors | 5.5E-07 | - | 5.00E-02 | 0.05 |
| ***Dioxin/Furans*** | | | | |
| 2,3,7,8 TCDD | 1.3E-09 | - | 5.00E-07 | 0.0000005 |
| ***Metals*** | | | | |
| Antimony | 4.1E+00 | - | 5.00E+00 | 5.0 |
| Arsenic | 6.7E-01 | 7.3E+00 | 1.00E+01 | 7.3 |
| Barium | 8.3E+00 | - | 2.50E+00 | 8.3 |
| Cadmium | 8.3E-03 | 7.7E-01 | 5.00E-02 | 0.77 |
| Chromium (total) | 4.2E+01 | 4.8E+01 | 5.00E-01 | 48 |
| Copper | 6.9E-02 | 3.6E+01 | 5.00E-01 | 36 |
| Lead | 5.0E+01 | 2.4E+01 | 5.00E+00 | 50 |
| Mercury, inorganic | 1.3E-03 | 7.0E-02 | 2.50E-01 | 0.25 |
| Selenium | 3.0E-01 | - | 1.00E+01 | 10 |
| Silver | 1.6E-02 | - | 5.00E-01 | 0.5 |
| Zinc | 5.0E+00 | 8.5E+01 | 2.50E+00 | 85 |
| ***SVOCs - PAHs*** | | | | |
| Acenaphthene | 2.8E-02 | - | 6.70E-03 | 0.028 |
| Acenaphthylene | 1.3E+00 | - | 6.70E-03 | 1.3 |
| Anthracene | 5.1E-02 | - | 6.70E-03 | 0.051 |
| Benzo(a)anthracene[b] | - | - | 6.70E-03 | - |
| Benzo(b)fluoranthene[b] | - | - | 6.70E-03 | - |
| Benzo(k)fluoranthene[b] | - | - | 6.70E-03 | - |
| Total benzofluoranthenes | 3.2E+00 | - | - | 3.2 |
| Benzo(g,h,i)perylene | 6.7E-01 | - | 6.70E-03 | 0.67 |
| Benzo(a)pyrene | 1.6E-05 | - | 6.70E-03 | 0.0067 |
| Chrysene[b] | - | - | 6.70E-03 | - |
| Dibenzo(a,h)anthracene[b] | - | - | 6.70E-03 | - |
| Dibenzofuran | 2.9E-02 | - | 3.30E-02 | 0.033 |
| Fluoranthene | 9.0E-02 | - | 6.70E-03 | 0.09 |
| Fluorene | 2.9E-02 | - | 6.70E-03 | 0.029 |
| Indeno(1,2,3-cd)pyrene | - | - | 6.70E-03 | - |
| 1-Methylnaphthalene | 2.3E+00 | - | 6.70E-03 | 2.26 |

## Table 1. Site Screening Levels for Soil, Duwamish Waterway Park, Seattle, Washington.

| **Chemical** (All concentrations in mg/kg) | **Preliminary Cleanup Level (LDW Most Stringent Screening Level From Categories SL-1, 3, 4, and 6-9)[a]** | **Background Concentration** | **Practical Quantitation Limit** | **Soil Site Screening Level (mg/kg - After Adjustment for Background and PQL)** |
|---|---|---|---|---|
| 2-Methylnaphthalene | 3.9E-02 | - | 6.70E-03 | 0.039 |
| Naphthalene | 2.1E-03 | - | 6.70E-03 | 0.0067 |
| Pentachlorophenol | 1.8E-06 | - | 6.70E-03 | 0.0067 |
| Phenanthrene | 1.5E+00 | - | 6.70E-03 | 1.5 |
| Pyrene | 1.4E-01 | - | 6.70E-03 | 0.137 |
| Total cPAH TEQ | 1.6E-05 | - | - | 0.000016 |
| ***Phthalates*** | | | | |
| Bis(2-ethylhexyl) phthalate | 5.1E-03 | - | 3.30E-02 | 0.03 |
| Butyl benzyl phthalate | 1.0E-04 | - | 3.30E-02 | 0.03 |
| Diethyl phthalate | 3.4E-02 | - | 1.70E-01 | 0.17 |
| Dimethyl phthalate | 1.9E-02 | - | 3.30E-02 | 0.03 |
| Di-n-butyl phthalate | 1.5E-02 | - | 1.70E-01 | 0.17 |
| Di-n-octyl phthalate | 3.3E-01 | - | 3.30E-02 | 0.33 |

Shaded value is the value selected as the Site screening level

[a] Based on most conservative soil screening levels from the Lower Duwamish Waterway Preliminary Cleanup Level Workbook (Ecology 2022).

[b] Chemical will be analyzed based on total cPAHs)

cPAHs = carcinogenic polycyclic aromatic hydrocarbons

CUL = cleanup level

GW = groundwater

LDW = Lower Duwamish Waterway

mg/kg = milligram per kilogram

na = not applicable

PAHs = polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

ROD = Record of Decision

SL - Screening Level Category

SL-1 = Direct Contact Unrestricted

SL-3 = Protect Surface Water via Ggroundwater Vadose Zone

SL-4 = Protect Sediment via Groundwater Vadose Zone

SL-6 = Protection of Surface Water via Groundwater Saturated Zone

SL-7 = Protection of Sediment via Groundwater Saturated Zone

SL-8 = Protection of Sediment via Bank Erosion

SL-9 = Site-specific Terrestrial Ecological Evaluation (TEE) Unrestricted

SMS = sediment management standard

SVOCs = semi-volatile organic compounds

TEQ = toxicity equivalency quotient

| Table 2. Site Screening Levels for Sediment, Duwamish Waterway Park, Seattle, Washington. | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Chemical** | **Bioaccumulative?** | **Target Sediment Concentration<br><br>Minimum ROD CUL + SMS Lower Tier SCO** | **Minimum LDW ROD RAL Overall** | **Preliminary Cleanup Level (LDW Most Stringent Screening Level of Target Sediment Concentration or Min. LDW ROD RAL Overall)[a]** | **Lower Tier Natural Background LDW ROD Table 3 SCUM Table 10-1** | **Practical Quantitation Limit** | **Sediment Site Screening Level (mg/kg - After Adjustment for Background and PQL)** |
| ***PCBs (mg/kg dw)*** | | | | | | | |
| Total PCB Aroclors | Yes | 1.3E-01 | 1.3E-01 | 1.3E-01 | - | 5.0E-02 | 0.13 |
| ***Dioxin/Furans (mg/kg dw)*** | | | | | | | |
| 2,3,7,8 TCDD | Yes | 2.3E-05 | - | 2.3E-05 | - | 5.0E-07 | 0.000023 |
| ***Metals (mg/kg dw)*** | | | | | | | |
| Antimony | No | 9.7E+01 | - | 9.7E+01 | - | 5.0E+00 | 97.3 |
| Arsenic | Yes | 7.0E+00 | 2.8E+01 | 7.0E+00 | 7.0E+00 | 1.0E+01 | 7.0 |
| Barium | No | 4.9E+04 | - | 4.9E+04 | - | 2.5E+00 | 49000 |
| Cadmium | | 5.1E+00 | 5.1E+00 | 5.1E+00 | 8.0E-01 | 5.0E-02 | 0.8 |
| Chromium (total) | | 2.6E+02 | 2.6E+02 | 2.6E+02 | 6.2E+01 | 5.0E-01 | 62 |
| Copper | | 3.9E+02 | 3.9E+02 | 3.9E+02 | 4.5E+01 | 5.0E-01 | 45 |
| Lead | | 4.5E+02 | 4.5E+02 | 4.5E+02 | 2.1E+01 | 5.0E+00 | 21 |
| Mercury, inorganic | Yes | 4.1E-01 | 4.1E-01 | 4.1E-01 | 2.0E-01 | 2.5E-01 | 0.2 |
| Selenium | No | 1.2E+03 | - | 1.2E+03 | - | 1.0E+01 | 1200 |
| Silver | | 6.1E+00 | 6.1E+00 | 6.1E+00 | 2.4E-01 | 5.0E-01 | 0.24 |
| Zinc | | 4.1E+02 | 4.1E+02 | 4.1E+02 | 9.3E+01 | 2.5E+00 | 93 |
| ***SVOCs - PAHs (mg/kg dw)*** | | | | | | | |
| Acenaphthene | No | 5.0E-01 | 5.0E-01 | 5.0E-01 | - | 6.7E-03 | 0.5 |
| Acenaphthylene | | 1.3E+00 | - | 1.3E+00 | | 6.7E-03 | 1.3 |
| Anthracene | | 9.6E-01 | 9.6E-01 | 9.6E-01 | | 6.7E-03 | 0.96 |
| Benzo(a)anthracene | | 1.3E+00 | 1.3E+00 | 1.3E+00 | | 6.7E-03 | 1.3 |

| Table 2. Site Screening Levels for Sediment, Duwamish Waterway Park, Seattle, Washington. | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Chemical** | **Bioaccumulative?** | **Target Sediment Concentration<br><br>Minimum ROD CUL + SMS Lower Tier SCO** | **Minimum LDW ROD RAL Overall** | **Preliminary Cleanup Level (LDW Most Stringent Screening Level of Target Sediment Concentration or Min. LDW ROD RAL Overall)[a]** | **Lower Tier Natural Background LDW ROD Table 3 SCUM Table 10-1** | **Practical Quantitation Limit** | **Sediment Site Screening Level (mg/kg - After Adjustment for Background and PQL)** |
| Benzo(b)fluoranthene[b] | No | - | - | - | - | 6.7E-03 | - |
| Benzo(k)fluoranthene[b] | | - | - | - | | 6.7E-03 | - |
| Total benzofluoranthenes | | 3.2E+00 | 3.2E+00 | 3.2E+00 | | - | 3.2 |
| Benzo(g,h,i)perylene | | 6.7E-01 | 6.7E-01 | 6.7E-01 | | 6.7E-03 | 0.67 |
| Benzo(a)pyrene | | 1.6E+00 | 1.6E+00 | 1.6E+00 | | 6.7E-03 | 1.6 |
| Chrysene | | 1.4E+00 | 1.4E+00 | 1.4E+00 | | 6.7E-03 | 1.4 |
| Dibenzo(a,h)anthracene | | 2.3E-01 | 2.3E-01 | 2.3E-01 | | 6.7E-03 | 0.23 |
| Dibenzofuran | | 5.4E-01 | 5.4E-01 | 5.4E-01 | | 3.3E-02 | 0.54 |
| Fluoranthene | | 1.7E+00 | 1.7E+00 | 1.7E+00 | | 6.7E-03 | 1.7 |
| Fluorene | | 5.4E-01 | 5.4E-01 | 5.4E-01 | | 6.7E-03 | 0.54 |
| Indeno(1,2,3-cd)pyrene | | 6.0E-01 | 6.0E-01 | 6.0E-01 | | 6.7E-03 | 0.6 |
| 1-Methylnaphthalene | | 3.9E+01 | - | 3.9E+01 | | 6.7E-03 | 39 |
| 2-Methylnaphthalene | | 6.7E-01 | 6.7E-01 | 6.7E-01 | | 6.7E-03 | 0.67 |
| Naphthalene | | 2.1E+00 | 2.1E+00 | 2.1E+00 | | 6.7E-03 | 2.1 |
| Pentachlorophenol | | 3.6E-01 | 3.6E-01 | 3.6E-01 | | 3.6E-01 | 0.36 |
| Phenanthrene | | 1.5E+00 | 1.5E+00 | 1.5E+00 | | 6.7E-03 | 1.5 |
| Pyrene | | 2.6E+00 | 2.6E+00 | 2.6E+00 | | 6.7E-03 | 2.6 |
| Total cPAH TEQ | Yes | 5.9E-01 | 1.4E+00 | 5.9E-01 | 9.00E-03 | - | 0.59 |
| ***Phthalates (mg/kg dw)*** | | | | | | | |
| Bis(2-ethylhexyl) phthalate | No | 1.3E+00 | 1.3E+00 | 1.3E+00 | - | 3.3E-02 | 1.3 |
| Butyl benzyl phthalate | | 6.3E-02 | 6.3E-02 | 6.3E-02 | | 3.3E-02 | 0.063 |

## Table 2. Site Screening Levels for Sediment, Duwamish Waterway Park, Seattle, Washington.

| Chemical | Bioaccumulative? | Target Sediment Concentration<br><br>Minimum ROD CUL + SMS Lower Tier SCO | Minimum LDW ROD RAL Overall | Preliminary Cleanup Level (LDW Most Stringent Screening Level of Target Sediment Concentration or Min. LDW ROD RAL Overall)[a] | Lower Tier Natural Background LDW ROD Table 3 SCUM Table 10-1 | Practical Quantitation Limit | Sediment Site Screening Level (mg/kg - After Adjustment for Background and PQL) |
|---|---|---|---|---|---|---|---|
| Diethyl phthalate | No | 2.0E-01 | - | 2.0E-01 | - | 1.7E-01 | 0.2 |
| Dimethyl phthalate | | 7.1E-02 | 7.1E-02 | 7.1E-02 | | 3.3E-02 | 0.071 |
| Di-n-butyl phthalate | | 1.4E+00 | - | 1.4E+00 | | 1.70E-01 | 1.4 |
| Di-n-octyl phthalate | | 6.2E+00 | - | 6.2E+00 | | 3.30E-02 | 6.2 |

Shaded value is the value selected as the Site screening level

[a] Based on the Lower Duwamish Waterway Preliminary Cleanup Level Workbook (Ecology 2022).

[b] Chemical will be analyzed based on total cPAHs)

cPAHs = carcinogenic polycyclic aromatic hydrocarbons

CUL = cleanup level

DW = dry weight

GW = groundwater

LDW = Lower Duwamish Waterway

µg/L = micrograms per liter

na = not applicable

PAHs = polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

PQL = practical quantitation limit

RAL = remedial action level

ROD = Record of Decision

SL - Screening Level Category

SMS = sediment management standard

SVOCs = semi-volatile organic compounds

TEQ = toxicity equivalency quotient

**Table 3. Site Screening Levels for Groundwater and Surface Water, Duwamish Waterway Park, Seattle, Washington.**

| Chemical (All concentrations in ug/L) | Preliminary Cleanup Level (LDW Most Stringent Screening Level from Categories GW-2, GW-3, and GW-4)[a] | Background Concentration | Practical Quantitation Limit | Groundwater Site Screening Level (ug/L - After Adjustment for Background and PQL) |
|---|---|---|---|---|
| ***PCBs*** | | | | |
| Total PCB Aroclors | 7.0E-06 | - | 5.00E-02 | 0.05 |
| ***Dioxin/Furans*** | | | | |
| 2,3,7,8 TCDD | 5.1E-09 | - | 5.00E-06 | 0.000005 |
| ***Metals*** | | | | |
| Antimony | 9.0E+01 | - | 5.50E+00 | 90 |
| Arsenic | 1.4E-01 | 8.00E+00 | 3.30E+00 | 8.0 |
| Barium | 2.0E+02 | - | 2.80E+01 | 200 |
| Cadmium | 1.2E+00 | - | 4.40E+00 | 4.4 |
| Chromium (trivalent) | 2.7E+01 | - | 1.10E+01 | 27 |
| Copper | 3.1E+00 | - | 1.10E+01 | 11 |
| Lead | 5.6E+00 | - | 1.10E+00 | 5.6 |
| Mercury, inorganic | 2.5E-02 | - | 2.50E-02 | 0.025 |
| Selenium | 7.1E+01 | - | 5.60E+00 | 71 |
| Silver | 1.9E+00 | - | 1.10E+01 | 11 |
| Zinc | 8.1E+01 | - | 2.80E+01 | 81 |
| ***SVOCs - PAHs*** | | | | |
| Acenaphthene | 5.3E+00 | - | 1.00E-01 | 5.3 |
| Acenaphthylene | - | - | 1.00E-01 | 0.1 |
| Anthracene | 2.1E+00 | - | 1.00E-01 | 2.1 |
| Benzo(a)anthracene | 1.6E-04 | - | 1.00E-02 | 0.01 |
| Benzo(b)fluoranthene | 1.6E-04 | - | 1.00E-02 | 0.01 |
| Benzo(k)fluoranthene | 1.6E-03 | - | 1.00E-02 | 0.01 |
| Total benzofluoranthenes[b] | - | - | - | - |
| Benzo(g,h,i)perylene[b] | - | - | - | - |
| Benzo(a)pyrene | 1.6E-05 | - | 1.00E-02 | 0.01 |
| Chrysene | 1.6E-02 | - | 1.00E-02 | 0.01 |
| Dibenzo(a,h)anthracene | 1.6E-05 | - | 1.00E-02 | 0.01 |
| Dibenzofuran | 3.1E+00 | - | 1.00E+00 | 3.1E+00 |
| Fluoranthene | 1.8E+00 | - | 1.00E-01 | 1.8E+00 |
| Fluorene | 3.7E+00 | - | 1.00E-01 | 3.7E+00 |
| Indeno(1,2,3-cd)pyrene | 1.6E-04 | - | 1.00E-01 | 0.1 |
| 1-Methylnaphthalene | 8.0E+02 | - | 1.00E-01 | 800 |
| 2-Methylnaphthalene | 1.4E+01 | - | 1.00E-01 | 14 |

**Table 3. Site Screening Levels for Groundwater and Surface Water, Duwamish Waterway Park, Seattle, Washington.**

| Chemical (All concentrations in ug/L) | Preliminary Cleanup Level (LDW Most Stringent Screening Level from Categories GW-2, GW-3, and GW-4)[a] | Background Concentration | Practical Quantitation Limit | Groundwater Site Screening Level (ug/L - After Adjustment for Background and PQL) |
|---|---|---|---|---|
| Naphthalene | 1.4E+00 | - | 1.00E-01 | 1.4 |
| Pentachlorophenol | 2.0E-03 | - | 5.00E+00 | 5 |
| Phenanthrene | - | - | 1.00E-01 | 0.10 |
| Pyrene | 2.0E+00 | - | 1.00E-01 | 2 |
| Total cPAH TEQ | 9.7E-03 | - | - | 0.01 |
| ***Phthalates*** | | | | |
| Bis(2-ethylhexyl) phthalate | 4.6E-02 | - | 1.00E+00 | 0.05 |
| Butyl benzyl phthalate | 1.3E-02 | - | 1.00E+00 | 0.01 |
| Diethyl phthalate | 9.3E+01 | - | 1.00E+00 | 93 |
| Dimethyl phthalate | 5.9E+01 | - | 5.00E+00 | 59 |
| Di-n-butyl phthalate | 4.6E+01 | - | 5.00E+00 | 46 |
| Di-n-octyl phthalate | 2.30E+00 | - | 1.00E+00 | 2.3 |

Shaded value is the value selected as the Site screening level

[a] Based on the Lower Duwamish Waterway Preliminary Cleanup Level Workbook (Ecology 2022).

[b] Chemical will be analyzed based on total cPAHs)

cPAHs = carcinogenic polycyclic aromatic hydrocarbons

CUL = cleanup level

GW = groundwater

GW-2 = Protect Surface Water

GW-3 = Protect Sediment

GW-4 = Protect Inoor Air

µg/L = micrograms per liter

na = not applicable

PAHs = polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

PCUL = preliminary cleanup level

ROD = Record of Decision

SMS = sediment management standard

SVOCs = semi-volatile organic compounds

TEQ = toxicity equivalency quotient

| Table 4. Soil Sampling Results (July 2, 2014 ) Prior to Trail Construction, Duwamish Waterway Park, Seattle, Washington. | | | | |
|---|---|---|---|---|
| Sample ID | Site Screening Level[a] | 1 | 2 | 3 |
| Depth (inches) | | 0-3 | 0-3 | 0-3 |
| **Metals (mg/kg)** | | | | |
| Arsenic | 7.3 | **61** | **69** | **7** |
| Barium | 8.3 | **70.8** | **104** | **82.0** |
| Cadmium | 0.77 | **0.6** | **0.9** | **0.7** |
| Chromium | 48 | **26.3** | **42.4** | **28.6** |
| Lead | 50 | **89** | **135** | **32** |
| Mercury | 0.25 | **0.06** | **0.09** | **0.08** |
| Selenium | 10 | ND (5.0) | ND (5.0) | ND (5.0) |
| Silver | 0.5 | ND (0.3) | ND (0.3) | ND (0.3) |
| **cPAHs (mg/kg) (composite sample)** | | | | |
| Benzo(a)anthracene | NA | ND (0.180) | | |
| Total benzofluoranthenes | NA | ND (0.180) | | |
| Benzo(a)pyrene | 3.2 | ND (0.180) | | |
| Chrysene | NA | **0.200** | | |
| Dibenzo(a,h)anthracene | NA | ND (0.180) | | |
| Indeno(1,2,3-cd)pyrene | NA | ND (0.180) | | |
| Total cPAHs TEQ[b] | 0.00016 | **0.027** | | |
| **Dioxins/Furans (mg/kg) (composite sample)** | | | | |
| 2,3,7,8-TCDD | 0.0000052 | **0.0000019** | | |

**Bold** values were detected above the reporting limit.

**Shaded** values exceed the preliminary screening level.

[a] Refer to Appendix A, Table 1 on how Site screening levels for soil were selected using Ecology's LDW study area screening level tool (Ecology 2022).

[b] Total carcinogenic polycyclic aromatic hydrocarbons (cPAHs) toxicity equivalency (TEQ) concentration was calculated using one-half the reporting limit for compounds that were not detected above the reporting limit.

MTCA = Model Toxics Control Act

mg/kg = milligram per kilogram

NA = not applicable

ND = not detected above the laboratory reporting limits (shown in parentheses)

**Table 5. Soil Sampling Results (January 18, 2019) for Soil Borings, Duwamish Waterway Park, Seattle, Washington.**

| Sample ID | Site Screening | 1A | 1B | 2A | 2B | 3A | 3B | B-1A | B-1B | B-2A | B-2B | B-3A | B-3B | B-4A | B-4B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (feet) | Level[a] | 0.5-1 | 2-2.5 | 0.5-1 | 2-2.5 | 0.5-1 | 2-2.5 | 3-4 | 8-9 | 3-4 | 8.5-9.5 | 4-5 | 8.5-9.5 | 3-4 | 8-9 |
| **Total Metals (mg/kg)** | | | | | | | | | | | | | | | |
| Arsenic | 7.3 | **11.8** | **11.9** | **8.35** | **20.3** | **16.9** | **15.8** | **6.13** | **6.33** | **6.98** | **5.99** | **6.71** | **6.64** | **261** | **7.33** |
| Barium | 8.3 | **58.4** | **26.7** | **39.9** | **85.3** | **58.9** | **62.2** | **27.9** | **25.4** | **15.8** | **21.0** | **20.0** | **28.2** | **89.9** | **21.0** |
| Cadmium | 0.77 | **0.462** | **0.279** | **0.345** | **1.63** | **0.564** | **0.586** | **0.174 J** | **0.171 J** | **0.223** | **0.176 J** | **0.168 J** | **0.210 J** | **1.32** | **0.262** |
| Chromium (total) | 48 | **17.7** | **10.6** | **12.7** | **26.2** | **18.3** | **22.0** | **8.02** | **8.40** | **9.82** | **8.04** | **9.50** | **9.90** | **33.0** | **8.27** |
| Lead | 50 | **11.6** | **14.6** | **12.6** | **23.0** | **52.4** | **26.5** | **0.799** | **0.676 J** | **1.56 J** | **0.702 J** | **0.948 J** | **1.25 J** | **284** | **0.882 J** |
| Mercury | 0.25 | **0.114** | **0.0356** | **0.109** | **0.134** | **0.124** | **0.162** | ND (0.0261) | ND (0.0213) | ND (0.0197) | ND (0.0222) | ND (0.0237) | ND (0.0218) | **0.0760** | ND (0.0250) |
| Selenium | 10 | **2.09** | **1.13 J** | **0.945 J** | ND (30.4) | **2.13 J** | **2.41 J** | **1.80 J** | **0.827 J** | **1.35 J** | **1.54 J** | **1.67 J** | **1.88 J** | **2.67 J** | **1.82 J** |
| Silver | 0.5 | ND (0.332) | ND (0.309) | ND (0.353) | ND (1.820) | ND (0.362) | ND (0.352) | ND (0.294) | ND (0.320) | ND (0.299) | ND (0.310) | ND (0.303) | ND (0.355) | 0.308 J | ND (0.354) |
| **PAHs (mg/kg)** | | | | | | | | | | | | | | | |
| Acenaphthene | 0.0280 | **0.0021 J** | **0.0045 J** | ND (0.0049) | **0.0319** | **0.0012 J** | **0.0064** | ND (0.0048) | ND (0.0047) | ND (0.0048) | **0.0030 J** | ND (0.0049) | **0.0008 J** | **0.0027 J** | ND (0.0049) |
| Acenaphthylene | 1.3 | ND (0.0048) | **0.0022 J** | ND (0.0049) | **0.0029 J** | **0.0020 J** | ND (0.0047) | ND (0.0048) | ND (0.0047) | ND (0.0048) | ND (0.0050) | ND (0.0049) | ND (0.0048) | **0.0023 J** | ND (0.0049) |
| Anthracene | 0.0510 | **0.0038 J** | **0.0026 J** | **0.0042 J** | **0.0099** | **0.0032 J** | **0.0043 J** | ND (0.0048) | ND (0.0047) | ND (0.0048) | ND (0.0050) | ND (0.0049) | ND (0.0048) | **0.0039 J** | ND (0.0049) |
| Benzo(a)anthracene | NA | **0.0125** | **0.0087** | **0.0116** | **0.0198** | **0.0158** | **0.0101** | ND (0.0048) | ND (0.0047) | **0.0012 J** | **0.0016 J** | ND (0.0049) | ND (0.0048) | **0.0150** | ND (0.0049) |
| Benzo(b)fluoranthene | NA | **0.0133** | **0.0132** | **0.0112** | **0.0119** | **0.0206** | **0.0136** | **0.0015 J** | ND (0.0047) | **0.0025 J** | ND (0.0050) | ND (0.0049) | ND (0.0048) | **0.0148** | ND (0.0049) |
| Benzo(j)fluoranthene | NA | **0.0069** | **0.0063** | **0.0052** | **0.0053** | **0.0099** | **0.0059** | ND (0.0048) | ND (0.0047) | **0.0009 J** | ND (0.0050) | ND (0.0049) | ND (0.0048) | **0.0081** | ND (0.0049) |
| Benzo(k)fluoranthene | NA | **0.0054** | **0.0050** | **0.0053** | **0.0036** | **0.0091** | **0.0050** | ND (0.0048) | ND (0.0047) | **0.0012 J** | ND (0.0050) | ND (0.0049) | ND (0.0048) | **0.0085** | ND (0.0049) |
| Benzo(g,h,i)perylene | 0.670 | **0.0117** | **0.0186** | **0.0096** | **0.0073** | **0.0200** | **0.0102** | ND (0.0048) | ND (0.0047) | **0.0025 J** | ND (0.0050) | **0.0013 J** | ND (0.0048) | **0.0269** | **0.0016 J** |
| Benzo(a)pyrene | 0.0067 | **0.0117** | **0.0113** | **0.0111** | **0.0085** | **0.0192** | **0.0096** | ND (0.0048) | ND (0.0047) | **0.0018 J** | **0.0008 J** | **0.0010 J** | ND (0.0048) | **0.0191** | **0.0007 J** |
| Chrysene | NA | **0.0189** | **0.0155** | **0.0172** | **0.0286** | **0.0244** | **0.0187** | ND (0.0048) | ND (0.0047) | **0.0030 J** | **0.0030 J** | ND (0.0049) | **0.0010 J** | **0.0200** | **0.0012 J** |
| Dibenzo(a,h)anthracene | NA | **0.0086** | **0.0099** | **0.0081** | **0.0108** | **0.0099** | **0.0079** | ND (0.0048) | ND (0.0047) | **0.0063 J** | **0.0064** | ND (0.0049) | ND (0.0048) | **0.0101** | ND (0.0049) |
| Dibenzofuran | 0.029 | **0.0101** | **0.0064** | **0.0099** | **0.0501** | **0.0029 J** | **0.0111** | ND (0.0048) | ND (0.0047) | ND (0.0048) | **0.0068** | ND (0.0049) | ND (0.0048) | **0.0019 J** | ND (0.0049) |
| Fluoranthene | 0.090 | **0.0281** | **0.0182** | **0.0254** | **0.0350** | **0.0324** | **0.0229** | ND (0.0048) | ND (0.0047) | **0.0032 J** | **0.0033 J** | **0.0011 J** | **0.0014 J** | **0.0302** | **0.0013 J** |
| Fluorene | 0.029 | **0.0027 J** | **0.0015 J** | **0.0016 J** | ND (0.0048) | **0.0013 J** | **0.0025 J** | ND (0.0048) | ND (0.0047) | ND (0.0048) | **0.0013 J** | ND (0.0049) | **0.0010 J** | **0.0021 J** | ND (0.0049) |
| Indeno(1,2,3-cd)pyrene | NA | **0.0107** | **0.0144** | **0.0084** | **0.0105** | **0.0187** | **0.0093** | ND (0.0048) | ND (0.0047) | **0.0020 J** | ND (0.0050) | ND (0.0049) | ND (0.0048) | **0.0187** | ND (0.0049) |
| 1-Methylnaphthalene | 2.3 | **0.0232** | **0.0138** | **0.0223** | **0.1400** | **0.0048 J** | **0.0198** | **0.0009 J** | **0.0009 J** | **0.0006 J** | **0.0128** | **0.0005 J** | **0.0009 J** | **0.0028 J** | **0.0022 J** |
| 2-Methylnaphthalene | 0.039 | **0.0247** | **0.0148** | **0.0205** | **0.1540** | **0.0045 J** | **0.0184** | **0.0012 J** | **0.0011 J** | ND (0.0048) | **0.0159** | ND (0.0049) | **0.0015 J** | **0.0043 J** | **0.0035 J** |
| Naphthalene | 0.0067 | **0.0152** | **0.0099** | **0.0130** | **0.0884** | **0.0051** | **0.0089** | ND (0.0048) | ND (0.0047) | ND (0.0048) | **0.0095** | ND (0.0049) | ND (0.0048) | **0.0045 J** | **0.0016 J** |
| Phenanthrene | 1.5 | **0.0468** | **0.0278** | **0.0318** | **0.1280** | **0.0261** | **0.0410** | **0.00171 J** | **0.0013 J** | **0.0018 J** | **0.0202** | **0.0009 J** | **0.0026 J** | **0.0193** | **0.0032 J** |
| Pyrene | 0.14 | **0.0243** | **0.0181** | **0.0251** | **0.0401** | **0.0308** | **0.0213** | ND (0.0048) | **0.0007 J** | **0.0026 J** | **0.0032 J** | **0.0014 J** | **0.0014 J** | **0.0313** | **0.0022 J** |
| Total cPAHs TEQ | 0.000016 | **0.0169** | **0.0166** | **0.0157** | **0.0144** | **0.0269** | **0.0143** | **0.0035** | **0.0036** | **0.0031** | **0.0024** | **0.0023** | **0.0036** | **0.0260** | **0.0019** |

**Bold** values were detected above the reporting limit.

**Shaded** values exceed the preliminary screening level.

[a] Refer to Appendix A, Table 1 on how Site screening levels were selected using Ecology's LDW study area screening level tool

[b] Total carcinogenic polycyclic aromatic hydrocarbons (cPAHs) toxicity equivalency (TEQ) concentration was calculated using one-half the reporting limit for compounds that were not detected above the reporting limit.

cPAHs = carcinogenic polycyclic aromatic hy

J = result is estimated

mg/kg = milligram per kilogram

ND = not detected above the laboratory reporting limits (shown in parentheses)

PAHs = polyaromatic hydrocarbons

TEQ = toxicity equivalency quotient

**Table 6. Soil Sampling Results (2019 and 2020) from Grid Sampling, Duwamish Waterway Park, Seattle, Washington.**

| | | Arsenic | Lead |
|---|---|---|---|
| Site Screening Level[a] | | 7.3 | 50 |
| Sample ID[b] | Depth (inches) | Result (mg/kg) | |
| 1 | 0-6 | **10.1** | **43.7** |
| 2 | | **5.08** | **24.3** |
| 3 | | **5.22** | **25.3** |
| 4 | | **5.05** | **24.2** |
| 4A | 7-12 | **11.4** | **66.3** |
| 5 | 0-6 | **11.7** | **36.5** |
| 6 | | **6.56** | **45.7** |
| 6A | 7-12 | **6.30** | **23.7** |
| 7 | 0-6 | **6.54** | **35.4** |
| 8 | | **7.19** | **38.3** |
| 9 | | **6.78** | **33.9** |
| 10 | | **7.12** | **41.8** |
| 11 | | **3.83** | **87.1** |
| 12 | | **7.32** | **36.5** |
| 13 | | **8.56** | **31.0** |
| 14 | | **6.53** | **37.6** |
| 15 | | **6.04** | **32.6** |
| 15A | 7-12 | **13.1** | **46.2** |
| 16 | 0-6 | **5.22** | **82.1** |
| 17 | | **6.12** | **34.8** |
| 18 | | **7.47** | **36.9** |
| 18A | 7-12 | **7.22** | **20.9** |
| 19 | 0-6 | **7.39** | **37.7** |
| 20 | | **7.37** | **32.7** |
| 21 | | **5.36** | **51.5** |
| 22 | | **7.81** | **40.7** |
| 23 | | **9.47** | **46.1** |
| 24 | | **9.19** | **45.1** |
| 25 | | **7.42** | **30.9** |
| 25A | 7-12 | **8.18** | **26.0** |
| 26 | 0-6 | **7.67** | **60.5** |
| 27 | | **14.0** | **48.0** |
| 28 | | **16.8** | **51.8** |
| 28A | 7-12 | **15.2** | **68.8** |
| 29 | 0-6 | **9.36** | **43.8** |
| 30 | | **7.98** | **29.6** |
| 31 | | **6.32** | **57.8** |
| 31A | 7-12 | **6.57** | **13.5** |
| 32 | 0-6 | **11.9** | **33.7** |
| 33 | 0-6 | **8.99** | **31.8** |
| 34 | | **7.30** | **31.3** |
| 35 | | **7.69** | **38.2** |
| 36 | | **5.86** | **47.4** |
| 37 | | **9.12** | **39.1** |
| 38 | | **5.89** | **26.3** |
| 39 | | **6.74** | **27.1** |
| 39A | 7-12 | **7.96** | **18.4** |
| 40 | 0-6 | **11.7** | **38.9** |
| 41 | | **6.43** | **46.8** |
| 42 | | **7.83** | **34.3** |
| 42A | 7-12 | **7.36** | **20.6** |
| 43 | 0-6 | **7.01** | **25.8** |
| 44 | | **5.91** | **25.7** |
| 45 | | **10.2** | **47.6** |
| 46 | | **41.7** | **95.1** |
| 47 | | **7.72** | **40.2** |
| 48 | | **6.81** | **29.6** |
| 49 | | **16.1** | **38.1** |
| 50 | | **4.77** | **25.6** |
| 51 | | **15.5** | **93.8** |
| 52 | | **23.7** | **155** |
| 52A | 7-12 | **32.6** | **82.2** |
| 53 | 0-6 | **74.4** | **134** |
| 54 | | **6.09** | **28.9** |
| 55 | | **4.82** | **19.6** |
| 56 | | **8.51** | **27.4** |
| 56A | 7-12 | **4.13** | **28.5** |
| 57 | 0-6 | **10.1** | **34.0** |
| 58 | | **34.6** | **75.7** |
| 59 | | **104** | **174** |
| 60 | | **71.3** | **146** |
| 61 | | **8.25** | **64.5** |
| 62 | | **4.10** | **19.6** |
| 63 | | **25.4** | **82.8** |
| 63A | 7-12 | **12.6** | **20.8** |
| 64 | 0-6 | **109** | **186** |
| 65 | | **154** | **188** |
| 66 | 0-6 | **21.9** | **74.4** |
| 67 | | **62.9** | **122** |
| 68 | | **17.4** | **57.6** |
| 69 | | **63.5** | **119** |
| 70 | | **118** | **242** |
| 71 | | **72.1** | **115** |
| 71A | 7-12 | **53.6** | **82.2** |
| 72 | 0-6 | **19.1** | **133** |
| 73 | | **8.90** | **55.1** |
| 74 | | **86.2** | **144** |
| 75 | | **57.7** | **104** |
| 76 | | **98.8** | **170** |

**Bold** values were detected above the reporting limit.

**Shaded** values exceed the preliminary screening level.

[a] Refer to Appendix A, Table 1 on how Site screening levels were selected using Ecology's LDW study area screening level tool

[b] Samples 1 through 65 collected in February 2019.

[c] Samples 66 through 76 collected on July 22, 2020.

mg/kg = milligram per kilogram

**Table 7. Interim Action Analytical Results (October 2020) for Subsurface Samples Collected for other Contaminants of Concern, Duwamish Waterway Park, Seattle, Washington.**

| Sample ID | Site Screening Level[a] | DX-1 | DX-2 | DX-3 |
|---|---|---|---|---|
| Grid | | 65 | 66 | 46 |
| Depth (inches) | | 36 | 36 | 36 |
| **Metals (mg/kg)** | | | | |
| Arsenic | 7.3 | NA[b] | NA[b] | NA[b] |
| Barium | 8.3 | **86.7** | **31.8** | **15.4** |
| Cadmium | 0.77 | ND (1.0) | ND (1.0) | ND (1.0) |
| Chromium (total) | 48 | **8.42** | **5.51** | **4.96** |
| Lead | 50 | NA[b] | NA[b] | NA[b] |
| Mercury | 0.14 | ND (1.0) | ND (1.0) | ND (1.0) |
| Selenium | 10 | ND (1.0) | ND (1.0) | ND (1.0) |
| Silver | 0.5 | ND (1.0) | ND (1.0) | ND (1.0) |
| **PAHs (mg/kg)** | | | | |
| Acenaphthene | 0.028 | ND (0.05) | ND (0.01) | ND (0.01) |
| Acenaphthylene | 1.3 | ND (0.05) | ND (0.01) | ND (0.01) |
| Anthracene | 0.051 | ND (0.05) | ND (0.01) | ND (0.01) |
| Benzo(a)anthracene | NA | **0.069** | ND (0.01) | ND (0.01) |
| Benzo(b)fluoranthene | NA | **0.14** | ND (0.01) | ND (0.01) |
| Benzo(k)fluoranthene | NA | ND (0.05) | ND (0.01) | ND (0.01) |
| Benzo(g,h,i)perylene | 0.67 | **0.10** | ND (0.01) | ND (0.01) |
| Benzo(a)pyrene | 0.0067 | **0.11** | ND (0.01) | ND (0.01) |
| Chrysene | NA | **0.11** | ND (0.01) | ND (0.01) |
| Dibenzo(a,h)anthracene | NA | ND (0.05) | ND (0.01) | ND (0.01) |
| Fluoranthene | 0.09 | **0.17** | ND (0.01) | ND (0.01) |
| Fluorene | 0.03 | ND (0.05) | ND (0.01) | ND (0.01) |
| Indeno(1,2,3-cd)pyrene | NA | **0.092** | ND (0.01) | ND (0.01) |
| 1-Methylnaphthalene | 2.26 | ND (0.05) | ND (0.01) | ND (0.01) |
| 2-Methylnaphthalene | 0.039 | ND (0.05) | ND (0.01) | ND (0.01) |
| Naphthalene | 0.0067 | ND (0.05) | ND (0.01) | ND (0.01) |
| Phenanthrene | 1.5 | **0.075** | ND (0.01) | ND (0.01) |
| Pyrene | 0.14 | **0.20** | ND (0.01) | ND (0.01) |
| Total cPAHs TEF | 0.000016 | **0.15** | ND (0.01) | ND (0.01) |
| **TPH (mg/kg)** | | | | |
| Diesel Range | 260 | ND (50) | ND (50) | ND (50) |
| Motor Oil Range | 260 | ND (250) | ND (250) | ND (250) |
| **PCBs (mg/kg)** | | | | |
| Total PCBs | 0.05 | ND (0.02) | ND (0.02) | ND (0.02) |

**Bold** values were detected above the reporting limit.

**Shaded** values exceed the preliminary screening level.

[a] Refer to Appendix A, Table 1 on how Site screening levels were selected using Ecology's LDW study area screening level tool

[b] Samples were not analyzed for total arsenic and lead

mg/kg = milligram per kilogram

NA = not applicable

**Table 8. Interim Action (2020 to 2021) Arsenic and Lead Concentrations, Duwamish Waterway Park, Seattle, Washington.**

| | 2020 Pre Interim Action | | | | 2021 Post Interim Action | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Site Screening Level[a] | Arsenic 7.3 | Lead 50 | | | | Site Screening Level[a] | Arsenic 7.3 | Lead 50 |
| Sample Grid | Sample ID | Sample Depth (inches) | Result (mg/kg) | | Excavated Depth (inches) | Excavation Location | Sample ID | Sample Depth (inches) | Result (mg/kg) | |
| 46 | 46 | 0-6 | **41.7** | **95.1** | 12 | bottom | 46-18 | 12-18 | **1.74** | **1.17** |
| | | | | | | south sidewall | 46-S | | **7.49** | **27.6** |
| | | | | | | west sidewall | 46-W | | **12.0** | **74.6** |
| 52 | 52 | 0-6 | **23.7** | **155** | 6-8 | tree area | 52-6 | 6-14 | **6.71** | **62.3** |
| | 52A | 7-12 | **32.6** | **82.2** | | tree area | 52-12 | | **2.41** | **11.1** |
| 53 | 53 | *0-6* | **74.4** | **134** | 6-8 | tree area | 53-6 | 6-14 | **1.28** | ND (1.0) |
| | | | | | | tree area | 53-12 | 6-26 | **1.54** | **1.94** |
| | | | | | 12 | bottom | 53-18 | 12-18 | **4.26** | **159** |
| 59 | 59 | 0-6 | **104** | **174** | 6-8 | tree area | 59-6 | 6-14 | **12.6** | **193** |
| | | | | | | tree area | 59-12 | 6-26 | **112** | **226** |
| | | | | | 12 | bottom | 59-18 | 12-18 | **85.9** | **164** |
| | | | | | | picnic pad | PT-12 | | **6.78** | **55.1** |
| 60 | 60 | 0-6 | **71.3** | **146** | 6-8 | tree area | 60-6A | 6-14 | **29.1** | **365** |
| | | | | | | tree area | 60-12A | 6-26 | **4.69** | **5.22** |
| | | | | | 18 | bottom | 60-24 | 18-24 | **139** | **220** |
| 64 | 64 | 0-6 | **109** | **186** | 24 | bottom | 64-30 | 24-30 | **12.1** | **160** |
| | | | | | | NW sidewall | 64-N | 36 | **26.8** | **58.2** |
| | | | | | | NE sidewall | 64-NB | | **23.2** | **86.3** |
| 65 | 65 | 0-6 | **154** | **188** | 24 | bottom | 65-30 | 24-30 | **11.7** | **78.7** |
| | | | | | | NW sidewall | 65-NA | 36 | **242** | **347** |
| | | | | | | NE sidewall | 65-NB | | **195** | **312** |
| 66 | 66 | 0-6 | **21.9** | **74.4** | 6-8 | tree area | 66-6 | 6-14 | **1.62** | **1.26** |
| | | | | | | tree area | 66-12 | 6-26 | **3.59** | **19.0** |
| | | | | | | tree area | 66-18 | 12-18 | **1.88** | **1.7** |
| 67 | 67 | 0-6 | **62.9** | **122** | 6-8 | tree area | 67-6 | 6-14 | **24.8** | **118** |
| | | | | | | tree area | 67-12 | 6-26 | **6.26** | **82.2** |
| | | | | | | tree area | 67-6A | 6-14 | **2.32** | **1.48** |
| | | | | | | tree area | 67-12A | 6-26 | **2.30** | **1.60** |
| | | | | | 12 | bottom | 67-18 | 12-18 | **2.55** | **1.46** |
| 71 | 71 | 0-6 | **72.1** | **115** | 6-8 | tree area | 71-6 | 6-14 | **1.92** | **2.39** |
| | 71A | 7-12 | **53.6** | **82.2** | | tree area | 71-12 | | **4.74** | **12.5** |
| | | | | | 18 | bottom | 71-24 | 18-24 | **7.11** | **64.8** |
| 72 | 72 | 0-6 | **19.1** | **133** | 6-8 | tree area | 72-6 | 6-14 | **3.74** | **38.7** |
| | | | | | | tree area | 72-12 | 6-26 | **5.90** | **32.4** |
| 74 | 74 | 0-6 | **86.2** | **144** | 24 | bottom | 74-30 | 24-30 | **210** | **282** |
| | | | | | | NW sidewall | 74-NA | 36 | **236** | **249** |
| | | | | | | NE sidewall | 74-NB | | **89.1** | **96.1** |
| 75 | 75 | 0-6 | **57.7** | **104** | 6-8 | tree area | 75-6 | 6-14 | **2.56** | **1.81** |
| | | | | | | tree area | 75-12 | 6-26 | **2.93** | **2.01** |
| | | | | | 12 | bottom | 75-18 | 12-18 | **4.28** | **26.3** |
| | | | | | | N sidewall | 75-N | | **16.0** | **84.4** |
| B-3 | See Table 5 | | | | 36 | Excavation bottom | H3-36 (at B-3) | 36 | **22.5** | **24** |
| B-4 | B-4A | 3-4 (feet) | **261** | **284** | 7 (feet) | N sidewall | B4N-5.5 | 5.5 (feet) | **2.19** | **1.55** |
| | | | | | | S Sidewall | B4S-5.5 | | **2.72** | **1.80** |
| | | | | | | E Sidewall | B4E-5.5 | | **2.10** | **1.34** |
| | | | | | | W sidewall | B4W-5.5 | | **2.71** | **46.1** |

**Bold** values were detected above the reporting limit.

**Shaded** values exceed the preliminary screening level.

[a] Refer to Appendix A, Table 1 on how Site screening levels were selected using Ecology's LDW study area screening level tool

mg/kg = milligram per kilogram

**Table 9. 2021 Park Renovations and Confirmation Soil Sampling Results, Duwamish Waterway Park, Seattle, Washington.**

| | | | | Arsenic | Lead |
|---|---|---|---|---|---|
| | | | Site Screening Level[a] | 7.3 | 50 |
| Sample ID | Sample Date | Description | Depth (inches bgs) | Result (mg/kg) | |
| B18 | 10/20/2020 | By Bench in Landscaped Area | 12-18 | **114** | **171** |
| P18 | | | | **14.4** | 26.4 |
| PT-6 | 10/27/2020 | Grid 59 by picnic table, prior to excavation work | 0-6 | **85.2** | **139** |
| PT-12 | | | 6-12 | **6.78** | **55.1** |
| PT-18 | | Grid 59 after excavation | 12-18 | **1.87** | **1.20** |
| PW-12 | | West Landscaped Area along Shoreline | 0-12 | **5.95** | **45.7** |
| PC-12 | | Central Landscaped Area along Shoreline | | **7.61** | **48.4** |
| PE-12 | | *East Landscaped Area along Shoreline* | | **6.62** | **44.0** |
| UT-1 | 1/7/2021 | Utility Trench | 30-36 | **5.27** | **95.5** |
| UT-2 | | Utility Trench | | **1.44** | **1.01** |
| UT-3 | | Utility Trench | 48-54 | **1.13** | ND (1.0) |
| UT-4 | | Utility Trench | | **2.19** | **4.27** |
| UT-5 | | Utility Trench | | **1.28** | ND (1.0) |
| UT-6 | | Utility Trench | | **1.68** | ND (1.0) |
| UT-7 | | Utility Trench | 54-60 | ND (1.0) | ND (1.0) |
| UT-8 | | Utility Trench | | **1.16** | ND (1.0) |
| UT-9 | | Utility Trench | 42-28 | **1.10** | ND (1.0) |
| UT-10 | 1/29/2021 | Utility Trench | 54-60 | **1.53** | **1.13** |
| UT-11 | | Utility Trench | | **1.44** | **1.05** |
| 58W-1 | 5/10/2021 | Irrigation Trench | 30-36 | **2.83** | **11.2** |
| 58W-2 | | Irrigation Trench | | **8.13** | **46.5** |
| C1-6 | 8/20/2021 | grid | 0-6 | **9.80** | **24.7** |
| C1-12 | | grid | 6-12 | **8.19** | **28.8** |
| C2 | | grid | 0-6 | **7.02** | **19.9** |
| C4 | | grid | | **6.22** | **23.8** |
| C5 | | grid | | **5.46** | **19.1** |
| C7 | | grid | | **5.63** | **18.1** |
| C8 | | grid | | **6.22** | **18.0** |
| C10 | | grid | | **5.44** | **17.5** |
| C10-12 | | grid | 6-12 | **9.87** | **21.0** |
| C11 | | grid | 0-6 | **5.88** | **21.2** |
| C12 | | grid | | **5.45** | **17.9** |
| C13 | | grid | | **5.59** | **20.2** |
| C14 | | grid | | **6.31** | **25.2** |
| C15 | | grid | | **16.5** | **140** |
| C16 | | grid | | **6.40** | **21.7** |
| C17 | | grid | | **5.75** | **19.4** |
| C18 | | grid | | **6.21** | **22.8** |
| C19 | | grid | | **5.59** | **20.0** |
| C21 | | grid | | **5.50** | **21.1** |

**Bold** values were detected above the reporting limit.
**Shaded** values exceed the preliminary screening level.

[a] Refer to Appendix A, Table 1 on how Site screening levels were selected using Ecology's LDW study area screening level tool
mg/kg = milligram per kilogram ND = not detected above the dete

**Table 10. Duwamish Waterway Park Beach Area Upland Soil Sampling Results.**

| Analyte | Unit | Site Screening Level (mg/kg) | Sample Identification | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DWWP-B-1[e] | | DWWP-B-2[e] | | DWWP-B-3[e] | | DWWP-B-4[e] | | DWWP-B-5[e] | |
| **Metals and Trace Elements** | | | | | | | | | | | | |
| Antimony | mg/kg | 5 | **0.595** | | **0.281** | | **0.217** | | **0.267** | | 0.2 U | |
| Arsenic | mg/kg | 7.3 | **2.36** | | **2.64** | | **2.31** | | **2.32** | | **1.87** | |
| Cadmium | mg/kg | 0.77 | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| Chromium | mg/kg | 48 | **7.81** | | **7.34** | | **6.51** | | **7.46** | | **6.05** | |
| Copper | mg/kg | 36 | **13.4** | | **12.3** | | **8.28** | | **8.08** | | **7.05** | |
| Lead | mg/kg | 50 | **20.5** | | **13.9** | | **7.35** | | **7.22** | | **4.56** | |
| Mercury | mg/kg | 0.25 | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U |
| Selenium | mg/kg | 10 | 1 U | | 1 U | | 1 U | | 1 U | | 1 U | |
| Silver | mg/kg | 0.5 | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| Zinc | mg/kg | 85 | **47.1** | | **40.9** | | **27.9** | | **28.1** | | **27.6** | |
| **Organic Chemicals** | | | | | | | | | | | | |
| 2,4-Dimethylphenol | mg/kg | -- | 0.012 | UJ | 0.0037 | UJ | **0.0037** | J | 0.0037 | UJ | 0.0012 | UJ |
| 2-Methylphenol | mg/kg | -- | 0.0055 | UJ | 0.0023 | UJ | 0.0023 | UJ | 0.0023 | UJ | 0.0055 | UJ |
| 3-Methylphenol + 4-Methylphenol | mg/kg | -- | 0.10 | U | 0.10 | U | 0.10 | U | 0.10 | U | 0.10 | U |
| Benzoic acid | mg/kg | -- | 0.25 | UJ | 0.25 | UJ | 0.25 | U | 0.25 | U | 0.25 | U |
| Benzyl alcohol | mg/kg | -- | 0.0038 | UJ | 0.0059 | UJ | 0.0059 | UJ | 0.0059 | UJ | 0.0038 | UJ |
| Dibenzofuran | mg/kg | 0.033 | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U |
| Phenol | mg/kg | -- | 0.05 | U | 0.05 | U | 0.05 | U | 0.05 | U | 0.05 | U |
| N-Nitrosodiphenylamine | mg/kg | -- | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U |
| **Phthalates** | | | | | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | mg/kg | 0.03 | **0.042** | J | **0.039** | J | **0.051** | J | **0.048** | J | **0.020** | J |
| Butylbenzyl phthalate | mg/kg | 0.03 | **0.0075** | J | **0.012** | J | **0.010** | J | 0.009 | UJ | 0.002 | UJ |
| Diethyl phthalate | mg/kg | 0.17 | 0.050 | U | 0.050 | U | 0.050 | U | 0.050 | U | 0.050 | U |
| Dimethyl phthalate | mg/kg | 0.03 | **0.0021** | J | **0.0036** | J | **0.0023** | J | **0.0037** | J | **0.0017** | J |
| Di-n-butyl phthalate | mg/kg | 0.17 | 0.050 | U | 0.050 | U | 0.050 | U | 0.050 | U | 0.050 | U |
| Di-n-octyl phthalate | mg/kg | 0.33 | 0.050 | U | 0.050 | U | 0.050 | U | 0.050 | U | 0.050 | U |
| **PCBs** | | | | | | | | | | | | |
| Total PCBs[a] | mg/kg | 0.05 | **0.025** | | **0.0117** | | **0.0062** | | **0.0059** | | 2.00 | U |
| **PAHs** | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 0.028 | 0.001 | U | 0.001 | U | 0.001 | U | 0.001 | U | 0.001 | U |
| Acenaphthylene | mg/kg | 1.3 | **0.0** | | 0.001 | U | 0.001 | U | 0.001 | U | 0.001 | U |
| Anthracene | mg/kg | 0.051 | **0.0016** | | 0.001 | U | 0.001 | U | 0.001 | U | 0.001 | U |
| Benz[a]anthracene | mg/kg | -- | **0.0160** | | **0.01** | | **0.0086** | | **0.0031** | | **0.0024** | |
| Total Benzofluoranthenes (calc'd)[b] | mg/kg | 3.2 | **0.0388** | | **0.0277** | | **0.0199** | | **0.0103** | | **0.0074** | |
| Benzo(ghi)perylene | mg/kg | 0.670 | **0.0094** | | **0.0092** | | **0.0069** | | **0.0029** | | **0.0025** | |
| Benzo(a)pyrene | mg/kg | 0.0067 | **0.019** | | **0.013** | | **0.010** | | **0.0040** | | **0.0030** | |

**Table 10. Duwamish Waterway Park Beach Area Upland Soil Sampling Results.**

| Analyte | Unit | Site Screening Level (mg/kg) | Sample Identification | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DWWP-B-1[e] | | DWWP-B-2[e] | | DWWP-B-3[e] | | DWWP-B-4[e] | | DWWP-B-5[e] | |
| Chrysene | mg/kg | -- | **0.019** | | **0.013** | | **0.0097** | | **0.0046** | | **0.0033** | |
| Dibenzo(a,h)anthracene | mg/kg | -- | **0.0021** | | **0.0023** | | **0.0017** | | 0.001 | U | 0.001 | U |
| Fluoranthene | mg/kg | 0.090 | **0.026** | | **0.016** | | **0.014** | | **0.0061** | | **0.0043** | |
| Fluorene | mg/kg | 0.029 | 0.001 | U | 0.001 | U | 0.001 | U | 0.001 | U | 0.001 | U |
| Indeno(1,2,3-cd)pyrene | mg/kg | -- | **0.0110** | | **0.0097** | | **0.0074** | | **0.0030** | | **0.0026** | |
| 2-Methylnaphthalene | mg/kg | 0.039 | 0.001 | U | 0.001 | U | 0.001 | U | **0.0016** | | 0.001 | U |
| Naphthalene | mg/kg | 0.0067 | 0.001 | U | 0.001 | U | 0.001 | U | **0.0026** | | 0.001 | U |
| Phenanthrene | mg/kg | 1.5 | **0.0092** | | **0.0051** | | **0.0043** | | **0.0037** | | **0.0018** | |
| Pyrene | mg/kg | 0.137 | **0.0280** | | **0.0170** | | **0.0170** | | **0.0062** | | **0.0047** | |
| Total HPAH (calc'd)[c] | mg/kg | -- | **0.169** | | **0.118** | | **0.0952** | | **0.0402** | | **0.0304** | |
| Total LPAH (calc'd)[d] | mg/kg | -- | **0.0121** | | **0.0051** | | **0.0043** | | **0.0063** | | **0.0018** | |
| Total cPAH TEQ (calc'd) | mg/kg | 0.000016 | **0.0260** | | **0.0180** | | **0.0140** | | **0.0057** | | **0.0045** | |
| **Chlorinated Organics** | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | mg/kg | -- | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U |
| 1,2-Dichlorobenzene | mg/kg | -- | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U |
| 1,4-Dichlorobenzene | mg/kg | -- | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U |
| Hexachlorobenzene | mg/kg | -- | **0.0053** | | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U |
| Hexachlorobutadiene | mg/kg | -- | 0.00064 | UJ | 0.00087 | UJ | 0.00087 | UJ | 0.00087 | UJ | 0.00064 | UJ |
| Pentachlorophenol | mg/kg | 0.0067 | 0.010 | UJ | 0.010 | UJ | 0.010 | UJ | 0.010 | UJ | 0.010 | UJ |

**Bold** values were detected above the reporting limit.

**Shaded** values exceed the preliminary screening level.

Notes:

[a] Total PCBs were derived based on the sum of the detected concentrations of Aroclors® 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, and 1268.

[b] Total benzofluoranthenes represents the sum of detected concentrations of the b and k isomers of benzofluoranthenes. The j isomer was not reported by the l

[c] Total HPAH represents the sum of detected concentrations of the following compounds: benz(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, pyrene, and total benzofluoranthenes.

[d] Total LPAH represents the sum of detected concentrations of the following compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, an

[e] Samples DWWP-B-1 through DWWP-B-4 were located above the MHHW elevation of 11.1 feet, and are therefore analyzed as upland soils, and not included when calculating average Site concentrations of contaminants.

Abbreviations

-- = no criteria available
J= Result is considered estimated
U = not detected at given reporting limit
µg/kg = microgram per kilogram
mg/kg = milligram per ki

**Table 11. Duwamish Waterway Park Beach Sediment Sampling Results.**

| Analyte | Unit | LDW RAL[a] (Category 3) | SMS Marine Criteria[b] SCO | SMS Marine Criteria[b] CSL | Site Screening Level (ug/kg) | Maximum Site Value | Sample Identification DWWP-B-6 | |
|---|---|---|---|---|---|---|---|---|
| Total Organic Carbon (TOC) | percent | -- | -- | -- | | 1.03 | 0.15 | U |
| **Metals and Trace Elements** | | | | | | | | |
| Antimony | mg/kg dw | -- | -- | -- | 97.3 | 1.87 | 0.2 U | |
| Arsenic | mg/kg dw | 114 | 57 | 93 | 7.0 | 12 | 1.58 | |
| Cadmium | mg/kg dw | 10.2 | 5.1 | 6.7 | 0.8 | 0.2 | 0.2 | U |
| Chromium | mg/kg dw | 520 | 260 | 270 | 62 | 16.4 | 6.28 | |
| Copper | mg/kg dw | 780 | 390 | 390 | 45 | 95.8 | 7.33 | |
| Lead | mg/kg dw | 900 | 450 | 530 | 21 | 42.4 | 4.01 | |
| Mercury | mg/kg dw | 0.82 | 0.41 | 0.59 | 0.25 | 0.1 | 0.1 | U |
| Silver | mg/kg dw | 12.2 | 6.1 | 6.1 | 0.24 | 0.2 | 0.2 | U |
| Zinc | mg/kg dw | 820 | 410 | 960 | 93 | 67.4 | 23.9 | |
| **Organic Chemicals** | | | | | | | | |
| 2,4-Dimethylphenol | ug/kg dw | 58 | 29 | 29 | -- | 75 | 12 | UJ |
| 2-Methylphenol | ug/kg dw | 126 | 63 | 63 | -- | 47 | 5.5 | UJ |
| 3-Methylphenol + 4-Methylphenol | ug/kg dw | 1,340 | 670 | 670 | -- | 2,000 | 100 | U |
| Benzoic acid | ug/kg dw | 1,300 | 650 | 650 | -- | 5,000 | 250 | U |
| Benzyl alcohol | ug/kg dw | 114 | 57 | 73 | -- | 120 | 3.8 | UJ |
| Dibenzofuran | ug/kg dw | 1,080 | 540 | 540 | 540 | 100 | 5.0 | U |
| Phenol | ug/kg dw | 840 | 420 | 1,200 | -- | 1,000 | 50 | U |
| N-Nitrosodiphenylamine | ug/kg dw | 56 | 28 | 40 | -- | 100 | 5.0 | U |
| **Phthalates** | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | ug/kg dw | 2,600 | 1,300 | 1,900 | 1,300 | 260 | 6.6 | J |
| Butylbenzyl phthalate | ug/kg dw | 126 | 63 | 900 | 63 | 190 | 2.1 | UJ |
| Diethyl phthalate | ug/kg dw | 400 | 200 | >1,200 | 200 | 1,000 | 50 | U |
| Dimethyl phthalate | ug/kg dw | 142 | 71 | 160 | 71 | 84 | 1.2 | UJ |
| Di-n-butyl phthalate | ug/kg dw | 2,800 | 1,400 | 1,400 | 1,400 | 1,000 | 50 | U |
| Di-n-octyl phthalate | ug/kg dw | 12,400 | 6,200 | 6,200 | 6,200 | 1,000 | 50 | U |
| **PCBs** | | | | | | | | |
| Total PCBs[c] | ug/kg dw | 260 | 130 | 1,000 | 130 | 91.0 | 2.00 | U |
| **PAHs** | | | | | | | | |
| Acenaphthene | ug/kg dw | 1,000 | 500 | 500 | 530 | 31.0 | 1.1 | |
| Acenaphthylene | ug/kg dw | 2,600 | 1,300 | 1,300 | 1,300 | 20.0 | 1.0 | U |
| Anthracene | ug/kg dw | 1,920 | 960 | 960 | 960 | 47.0 | 3.7 | |
| Benz[a]anthracene | ug/kg dw | 2,600 | 1,300 | 1,600 | 1,300 | 68.0 | 7.1 | |
| Total Benzofluoranthenes (calc'd)[f] | ug/kg dw | 6,400 | 3,200 | 3,600 | 3,200 | 117 | 13.5 | |
| Benzo(ghi)perylene | ug/kg dw | 1,340 | 670 | 720 | 670 | 20.0 | 4.3 | |
| Benzo(a)pyrene | ug/kg dw | 3,200 | 1,600 | 1,600 | 1,600 | 63.0 | 9.0 | |
| Chrysene | ug/kg dw | 2,800 | 1,400 | 2,800 | 1,400 | 73.0 | 9.5 | |

**Table 11. Duwamish Waterway Park Beach Sediment Sampling Results.**

| | | Sample Identification | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **DWWP-B-8** | | **DWWP-B-10** | | **DWWP-B-12** | | **DWWP-B-14** | | **DWWP-B-15** | | **DWWP-B-17** | | **DWWP-B-19** | | **DWWP-B-21** | | **DWWP-B-23** | | **DWWP-B-25** | |
| Total Organic Carbon (TOC) | percent | 0.15 | U | 0.15 | U | 0.15 | U | 0.23 | | 0.15 | U | 0.15 | U | 0.22 | | 0.18 | | 0.30 | | 1.01 | J |
| **Metals and Trace Elements** | | | | | | | | | | | | | | | | | | | | | |
| Antimony | mg/kg dw | 0.2 | U | 0.2 | U | 0.904 | | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.243 | |
| Arsenic | mg/kg dw | 2.22 | | 1.61 | | 3.85 | | 3.65 | | 1.61 | | 3.25 | | 3.22 | | 3.20 | | 5.37 | | 5.60 | |
| Cadmium | mg/kg dw | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| Chromium | mg/kg dw | 6.20 | | 5.74 | | 6.07 | | 7.89 | | 8.48 | | 6.54 | | 6.91 | | 7.35 | | 7.04 | | 11.7 | |
| Copper | mg/kg dw | 6.79 | | 6.09 | | 7.71 | | 14.6 | | 6.68 | | **95.8** | | 9.50 | | 9.64 | | 8.20 | | 17.7 | |
| Lead | mg/kg dw | 4.55 | | 4.75 | | 7.79 | | 13.1 | | 7.73 | | 12.1 | | 12.6 | | 7.94 | | 2.36 | | 12.8 | |
| Mercury | mg/kg dw | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U |
| Silver | mg/kg dw | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| Zinc | mg/kg dw | 25.6 | | 23.9 | | 29.3 | | 38.4 | | 26.8 | | 29.3 | | 30.9 | | 31.7 | | 20.6 | | 48.5 | |
| **Organic Chemicals** | | | | | | | | | | | | | | | | | | | | | |
| 2,4-Dimethylphenol | ug/kg dw | 12 | UJ | 7.5 | UJ | 12 | UJ | 12 | UJ | 3.7 | UJ | 3.7 | UJ | 3.7 | UJ | 3.7 | UJ | 3.7 | UJ | 75 | UJ |
| 2-Methylphenol | ug/kg dw | 5.5 | UJ | 4.7 | UJ | 5.5 | UJ | 5.5 | UJ | 2.3 | UJ | 2.3 | UJ | 2.3 | UJ | 2.3 | UJ | 2.3 | UJ | 47 | UJ |
| 3-Methylphenol + 4-Methylphenol | ug/kg dw | 100 | U | 100 | U | 100 | U | 100 | U | 100 | U | 100 | U | 100 | U | 100 | U | 100 | U | 2,000 | U |
| Benzoic acid | ug/kg dw | 250 | U | 250 | UJ | 250 | U | 250 | U | 250 | U | 250 | U | 250 | UJ | 250 | U | 250 | U | 5,000 | U |
| Benzyl alcohol | ug/kg dw | 3.8 | UJ | 12 | UJ | 3.8 | UJ | 3.8 | UJ | 5.9 | UJ | 5.9 | UJ | 5.9 | UJ | 5.9 | UJ | 5.9 | UJ | 120 | UJ |
| Dibenzofuran | ug/kg dw | 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 | 100 | U |
| Phenol | ug/kg dw | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 1,000 | U |
| N-Nitrosodiphenylamine | ug/kg dw | 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 | 100 | U |
| **Phthalates** | | | | | | | | | | | | | | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | ug/kg dw | 8.6 | J | 26 | UJ | 9.3 | J | 8.5 | J | 16 | J | 19 | J | 16 | J | 32 | J | 14 | J | 260 | UJ |
| Butylbenzyl phthalate | ug/kg dw | 2.1 | UJ | 19 | UJ | 2.1 | UJ | 2.1 | UJ | 9.4 | UJ | 9.4 | UJ | 9.4 | UJ | 9.4 | UJ | 9.4 | UJ | 190 | UJ |
| Diethyl phthalate | ug/kg dw | 50 | U | 100 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 1,000 | U |
| Dimethyl phthalate | ug/kg dw | 1.2 | UJ | 4.2 | UJ | 1.2 | UJ | 1.2 | UJ | 2.1 | UJ | 2.1 | UJ | 2.1 | UJ | 2.1 | UJ | 2.1 | UJ | 42 | UJ |
| Di-n-butyl phthalate | ug/kg dw | 50 | U | 100 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 1,000 | U |
| Di-n-octyl phthalate | ug/kg dw | 50 | U | 100 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 50 | U | 1,000 | U |
| **PCBs** | | | | | | | | | | | | | | | | | | | | | |
| Total PCBs[c] | ug/kg dw | 2.00 | U | 2.00 | U | 2.00 | U | 22.0 | | 2.00 | U | 5.40 | | 8.60 | | 2.00 | U | 2.00 | U | 10.3 | |
| **PAHs** | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | ug/kg dw | 1.0 | U | 2.7 | | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.6 | | 1.0 | U | 20.0 | U |
| Acenaphthylene | ug/kg dw | 1.0 | U | 2.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 20.0 | U |
| Anthracene | ug/kg dw | 1.0 | U | 6.4 | | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 4.8 | | 1.0 | U | 20.0 | U |
| Benz[a]anthracene | ug/kg dw | 3.5 | | 11.0 | | 1.2 | | 1.2 | | 1.7 | | 2.9 | | 1.8 | | 8.1 | | 1.0 | U | 33.0 | |
| Total Benzofluoranthenes (calc'd)[f] | ug/kg dw | 6.2 | | 17.4 | | 1.0 | U | 2.6 | | 2.9 | | 7.9 | | 4.7 | | 14.6 | | 1.0 | U | 41.0 | |
| Benzo(ghi)perylene | ug/kg dw | 1.6 | | 2.1 | | 1.0 | U | 1.0 | | 1.1 | | 2.1 | | 1.7 | | 3.0 | | 1.0 | U | 20.0 | U |
| Benzo(a)pyrene | ug/kg dw | 3.7 | | 10.0 | | 1.0 | U | 1.7 | | 1.7 | | 3.4 | | 2.3 | | 8.5 | | 1.0 | U | 31.0 | |
| Chrysene | ug/kg dw | 3.6 | | 11.0 | | 1.0 | U | 1.8 | | 2.1 | | 4.3 | | 2.5 | | 8.7 | | 1.0 | U | 39.0 | |

**Table 11. Duwamish Waterway Park Beach Sediment Sampling Results.**

| | | Sample Identification | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **DWWP-B-27** | | **DWWP-B-29** | | **DWWP-B-31** | | **DWWP-B-33** | | **DWWP-B-35** | | **DWWP-B-37** | | **DWWP-B-39** | | **DWWP-B-41** | | **DWWP-B-43** | |
| Total Organic Carbon (TOC) | percent | 0.64 | | 0.79 | | 0.31 | | 0.49 | | 0.41 | | 0.38 | | 0.34 | | 0.21 | | 1.03 | |
| **Metals and Trace Elements** | | | | | | | | | | | | | | | | | | | |
| Antimony | mg/kg dw | 0.312 | | 0.812 | | 0.2 U | | 0.38 | | 0.217 | | 0.211 | | 0.322 | | 0.255 | | 1.87 | |
| Arsenic | mg/kg dw | 5.39 | | 6.15 | | 4.16 | | 5.05 | | 4.35 | | 3.76 | | 3.97 | | 3.95 | | **12.0** | |
| Cadmium | mg/kg dw | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| Chromium | mg/kg dw | 8.95 | | 7.81 | | 7.20 | | 16.4 | | 7.54 | | 7.41 | | 8.35 | | 6.41 | | 10.4 | |
| Copper | mg/kg dw | 14.2 | | 12.7 | | 13.0 | | 13.0 | | 10.2 | | 9.60 | | 14.7 | | 9.78 | | 20.8 | |
| Lead | mg/kg dw | **42.4** | | 11.0 | | 9.17 | | 10.1 | | 23.1 | | 7.27 | | 8.89 | | 5.83 | | 16.4 | |
| Mercury | mg/kg dw | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U | 0.1 | U |
| Silver | mg/kg dw | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U | 0.2 | U |
| Zinc | mg/kg dw | 37.7 | | 42.6 | | 34.0 | | 40.2 | | 40.4 | | 30.4 | | 39.2 | | 26.8 | | 67.4 | |
| **Organic Chemicals** | | | | | | | | | | | | | | | | | | | |
| 2,4-Dimethylphenol | ug/kg dw | 75 | UJ | 75 | UJ | 7.5 | UJ | 75 | UJ | 75 | UJ | 7.5 | UJ | 7.5 | UJ | 7.5 | UJ | 15 | UJ |
| 2-Methylphenol | ug/kg dw | 4.7 | UJ | 47 | UJ | 4.7 | UJ | 47 | UJ | 47 | UJ | 4.7 | UJ | 4.7 | UJ | 4.7 | UJ | 9.4 | UJ |
| 3-Methylphenol + 4-Methylphenol | ug/kg dw | 200 | U | 2,000 | U | 200 | U | 2,000 | U | 2,000 | U | 200 | U | 200 | U | 200 | U | 400 | U |
| Benzoic acid | ug/kg dw | 500 | U | 5,000 | U | 500 | U | 5,000 | U | 5,000 | U | 500 | U | 500 | U | 500 | U | 1,000 | U |
| Benzyl alcohol | ug/kg dw | 12 | UJ | 120 | UJ | 12 | UJ | 120 | UJ | 120 | UJ | 12 | UJ | 12 | UJ | 12 | UJ | 24 | UJ |
| Dibenzofuran | ug/kg dw | 10.0 | U | 100 | U | 10.0 | U | 100 | U | 100 | U | 10.0 | U | 10.0 | U | 10.0 | U | 20.0 | U |
| Phenol | ug/kg dw | 100 | U | 1,000 | U | 100 | U | 1,000 | U | 1,000 | U | 100 | U | 100 | U | 100 | U | 200 | U |
| N-Nitrosodiphenylamine | ug/kg dw | 10.0 | U | 100 | U | 10.0 | U | 100 | U | 100 | U | 10.0 | U | 10.0 | U | 10.0 | U | 20.0 | U |
| **Phthalates** | | | | | | | | | | | | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | ug/kg dw | 52 | J | 260 | UJ | 45 | J | 260 | UJ | 260 | UJ | 37 | J | 45 | J | 36 | J | 130 | J |
| Butylbenzyl phthalate | ug/kg dw | 19 | UJ | 190 | UJ | 19 | UJ | 190 | UJ | 190 | UJ | 19 | UJ | 19 | UJ | 19 | UJ | 45 | UJ |
| Diethyl phthalate | ug/kg dw | 100 | U | 1,000 | U | 100 | U | 1,000 | U | 1,000 | U | 100 | U | 100 | U | 100 | U | 200 | U |
| Dimethyl phthalate | ug/kg dw | 4.2 | UJ | 42 | UJ | 42 | UJ | 42 | UJ | 42 | UJ | 4.2 | UJ | 4.2 | UJ | 4.2 | UJ | 84 | UJ |
| Di-n-butyl phthalate | ug/kg dw | 100 | U | 1,000 | U | 100 | U | 1,000 | U | 1,000 | U | 100 | U | 100 | U | 100 | U | 200 | U |
| Di-n-octyl phthalate | ug/kg dw | 100 | U | 1,000 | U | 100 | U | 1,000 | U | 1,000 | U | 100 | U | 100 | U | 100 | U | 200 | U |
| **PCBs** | | | | | | | | | | | | | | | | | | | |
| Total PCBs[c] | ug/kg dw | 8.40 | | 12.0 | | 12.0 | | 7.80 | | 7.90 | | 12.9 | | 13.0 | | 91.0 | | 18.7 | |
| **PAHs** | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | ug/kg dw | 2.0 | U | 20.0 | U | 2.0 | U | 20.0 | U | 20.0 | U | 2.0 | U | 2.0 | U | 4.1 | | 31.0 | |
| Acenaphthylene | ug/kg dw | 2.0 | U | 20.0 | U | 2.0 | U | 20.0 | U | 20.0 | U | 2.0 | U | 2.0 | U | 2.0 | U | 4.0 | U |
| Anthracene | ug/kg dw | 2.0 | U | 20.0 | U | 2.0 | U | 20.0 | U | 20.0 | U | 2.2 | | 2.0 | U | 5.7 | | 47.0 | |
| Benz[a]anthracene | ug/kg dw | 6.8 | | 20.0 | U | 4.0 | | 20.0 | U | 20.0 | U | 11.0 | | 5.6 | | 11.0 | | 68.0 | |
| Total Benzofluoranthenes (calc'd)[f] | ug/kg dw | 20.6 | | 20.0 | U | 13.4 | | 20.0 | U | 20.0 | | 25.7 | | 17.3 | | 19.5 | | 117 | |
| Benzo(ghi)perylene | ug/kg dw | 4.2 | | 20.0 | U | 3.7 | | 20.0 | U | 20.0 | U | 4.8 | | 3.1 | | 4.5 | | 13.0 | |
| Benzo(a)pyrene | ug/kg dw | 8.9 | | 20.0 | U | 5.4 | | 20.0 | U | 20.0 | U | 12.0 | | 7.4 | | 11.0 | | 63.0 | |
| Chrysene | ug/kg dw | 12.0 | | 20.0 | U | 6.2 | | 20.0 | U | 20.0 | U | 13.0 | | 7.7 | | 12.0 | | 73.0 | |

**Table 11. Duwamish Waterway Park Beach Sediment Sampling Results.**

| Analyte | Unit | LDW RAL[a] (Category 3) | SMS Marine Criteria[b] SCO | SMS Marine Criteria[b] CSL | Site Screening Level (ug/kg) | Maximum Site Value | Sample Identification DWWP-B-6 | |
|---|---|---|---|---|---|---|---|---|
| Dibenzo(a,h)anthracene | ug/kg dw | 460 | 230 | 230 | 230 | 20.0 | 1.1 | |
| Fluoranthene | ug/kg dw | 3,400 | 1,700 | 2,500 | 1,700 | 150 | 23.0 | |
| Fluorene | ug/kg dw | 1,080 | 540 | 540 | 540 | 23.0 | 1.0 | U |
| Indeno(1,2,3-cd)pyrene | ug/kg dw | 1,200 | 600 | 690 | 600 | 20.0 | 5.0 | |
| 2-Methylnaphthalene | ug/kg dw | 1,340 | 670 | 670 | 670 | 20.0 | 1.0 | U |
| Naphthalene | ug/kg dw | 4,200 | 2,100 | 2,100 | 2,100 | 20.0 | 1.0 | U |
| Phenanthrene | ug/kg dw | 3,000 | 1,500 | 1,500 | 1,500 | 170 | 17.0 | |
| Pyrene | ug/kg dw | 5,200 | 2,600 | 3,300 | 2,600 | 150 | 22.0 | |
| Total HPAH (calc'd)[e] | ug/kg dw | 24,000 | 12,000 | 17,000 | -- | 775 | 94.5 | |
| Total LPAH (calc'd)[d] | ug/kg dw | 10,400 | 5,200 | 5,200 | -- | 271 | 21.8 | |
| Total cPAH TEQ (calc'd) | ug/kg dw | 1,000 | -- | -- | 9.0 | 85 | 12.0 | |
| **Chlorinated Organics** | | | | | | | | |
| 1,2,4-Trichlorobenzene | ug/kg dw | 62 | 31 | 51 | -- | 100 | 5.00 | U |
| 1,2-Dichlorobenzene | ug/kg dw | 70 | 35 | 50 | -- | 100 | 5.00 | U |
| 1,4-Dichlorobenzene | ug/kg dw | 220 | 110 | 110 | -- | 100 | 5.00 | U |
| Hexachlorobenzene | ug/kg dw | 44 | 22 | 70 | -- | 100 | 5.00 | U |
| Hexachlorobutadiene | ug/kg dw | 22 | 11 | 120 | -- | 17.0 | 0.64 | UJ |
| Pentachlorophenol | ug/kg dw | 720 | 360 | 690 | 360 | 200 | 10 | UJ |
| **Organic Chemicals** | | | | | | | | |
| Dibenzofuran | mg/kg OC | 30 | 15 | 58 | -- | 12.7 | NA | |
| N-Nitrosodiphenylamine | mg/kg OC | 22 | 11 | 11 | -- | 12.7 | NA | |
| **Phthalates** | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | mg/kg OC | 94 | 47 | 78 | -- | 33 | NA | |
| Butylbenzyl phthalate | mg/kg OC | 9.8 | 4.9 | 64 | -- | 24 | NA | |
| Diethyl phthalate | mg/kg OC | 122 | 61 | 110 | -- | 127 | NA | |
| Dimethyl phthalate | mg/kg OC | 106 | 53 | 53 | -- | 8 | NA | |
| Di-n-butyl phthalate | mg/kg OC | 440 | 220 | 1,700 | -- | 127 | NA | |
| Di-n-octyl phthalate | mg/kg OC | 116 | 58 | 4,500 | -- | 127 | NA | |
| **PCBs** | | | | | | | | |
| Total PCBs | mg/kg OC | 24 | 12 | 65 | -- | 4.19 | NA | |
| **PAHs** | | | | | | | | |
| Acenaphthene | mg/kg OC | 32 | 16 | 57 | -- | 3.01 | NA | |
| Acenaphthylene | mg/kg OC | 132 | 66 | 66 | -- | 2.54 | NA | |
| Anthracene | mg/kg OC | 440 | 220 | 1,200 | -- | 4.56 | NA | |
| Benz[a]anthracene | mg/kg OC | 220 | 110 | 270 | -- | 6.60 | NA | |
| Total Benzofluoranthenes (calc'd) | mg/kg OC | 4,650 | 230 | 450 | -- | 11.36 | NA | |
| Benzo(ghi)perylene | mg/kg OC | 62 | 31 | 78 | -- | 2.54 | NA | |
| Benzo(a)pyrene | mg/kg OC | 198 | 99 | 210 | -- | 6.12 | NA | |

**Table 11. Duwamish Waterway Park Beach Sediment Sampling Results.**

| Analyte | Unit | Sample Identification | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | DWWP-B-8 | | DWWP-B-10 | | DWWP-B-12 | | DWWP-B-14 | | DWWP-B-15 | | DWWP-B-17 | | DWWP-B-19 | | DWWP-B-21 | | DWWP-B-23 | | DWWP-B-25 | |
| Dibenzo(a,h)anthracene | ug/kg dw | 1.0 | U | 2.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 20.0 | U |
| Fluoranthene | ug/kg dw | 2.4 | | 23.0 | | 2.9 | | 2.4 | | 2.9 | | 8.1 | | 3.7 | | 21.0 | | 1.0 | U | 71.0 | |
| Fluorene | ug/kg dw | 1.0 | U | 2.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.4 | | 1.0 | U | 20.0 | U |
| Indeno(1,2,3-cd)pyrene | ug/kg dw | 1.8 | | 2.7 | | 1.0 | U | 1.1 | | 1.2 | | 2.4 | | 1.7 | | 3.4 | | 1.0 | U | 20.0 | U |
| 2-Methylnaphthalene | ug/kg dw | 1.0 | U | 2.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 20.0 | U |
| Naphthalene | ug/kg dw | 1.0 | U | 2.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 1.0 | U | 20.0 | U |
| Phenanthrene | ug/kg dw | 1.0 | U | 23.0 | | 1.0 | U | 1.0 | U | 1.1 | | 3.8 | | 1.3 | | 19.0 | | 1.0 | U | 57.0 | |
| Pyrene | ug/kg dw | 2.8 | | 26.0 | | 2.5 | | 2.5 | | 3.1 | | 7.2 | | 3.4 | | 22.0 | | 1.0 | U | 75.0 | |
| Total HPAH (calc'd)[e] | ug/kg dw | 25.6 | | 103 | | 6.6 | | 14.3 | | 16.7 | | 38.3 | | 21.8 | | 89.3 | | 1.0 | U | 290 | |
| Total LPAH (calc'd)[d] | ug/kg dw | 1.0 | U | 32.1 | | 1.0 | U | 1.0 | U | 1.1 | | 3.8 | | 1.3 | | 26.8 | | 1.0 | U | 57.0 | |
| Total cPAH TEQ (calc'd) | ug/kg dw | 4.9 | | 13.0 | | 0.9 | | 2.3 | | 2.4 | | 4.8 | | 3.2 | | 11.0 | | 0.8 | U | 42.0 | |
| **Chlorinated Organics** | | | | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | ug/kg dw | 5.00 | U | 10.0 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 100 | U |
| 1,2-Dichlorobenzene | ug/kg dw | 5.00 | U | 10.0 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 100 | U |
| 1,4-Dichlorobenzene | ug/kg dw | 5.00 | U | 10.0 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 100 | U |
| Hexachlorobenzene | ug/kg dw | 5.00 | U | 10.0 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 5.00 | U | 100 | U |
| Hexachlorobutadiene | ug/kg dw | 0.64 | UJ | 1.7 | UJ | 0.64 | UJ | 0.64 | UJ | 0.87 | UJ | 0.87 | UJ | 0.87 | UJ | 0.87 | UJ | 0.87 | UJ | 17 | UJ |
| Pentachlorophenol | ug/kg dw | 10 | UJ | 20 | UJ | 10 | UJ | 10.0 | UJ | 10.0 | UJ | 10.0 | UJ | 10.0 | UJ | 10.0 | UJ | 10.0 | UJ | 200 | UJ |
| **Organic Chemicals** | | | | | | | | | | | | | | | | | | | | | |
| Dibenzofuran | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 9.90 | U |
| N-Nitrosodiphenylamine | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 9.90 | U |
| **Phthalates** | | | | | | | | | | | | | | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 26 | UJ |
| Butylbenzyl phthalate | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 19 | UJ |
| Diethyl phthalate | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 99.0 | U |
| Dimethyl phthalate | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 4.2 | UJ |
| Di-n-butyl phthalate | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 99.0 | U |
| Di-n-octyl phthalate | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 99.0 | U |
| **PCBs** | | | | | | | | | | | | | | | | | | | | | |
| Total PCBs | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 1.0 | |
| **PAHs** | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 2.0 | U |
| Acenaphthylene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 2.0 | U |
| Anthracene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 2.0 | U |
| Benz[a]anthracene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 3.3 | |
| Total Benzofluoranthenes (calc'd) | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 4.1 | |
| Benzo(ghi)perylene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 2.0 | U |
| Benzo(a)pyrene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 3.1 | |

**Table 11. Duwamish Waterway Park Beach Sediment Sampling Results.**

| Analyte | Unit | Sample Identification | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | DWWP-B-27 | | DWWP-B-29 | | DWWP-B-31 | | DWWP-B-33 | | DWWP-B-35 | | DWWP-B-37 | | DWWP-B-39 | | DWWP-B-41 | | DWWP-B-43 | |
| Dibenzo(a,h)anthracene | ug/kg dw | 2.0 | U | 20.0 | U | 2.0 | U | 20.0 | U | 20.0 | U | 2.0 | U | 2.0 | U | 2.0 | U | 5.2 | |
| Fluoranthene | ug/kg dw | 15.0 | | 20.0 | U | 11.0 | | 32.0 | | 30.0 | | 23.0 | | 12.0 | | 26.0 | | 150 | |
| Fluorene | ug/kg dw | 2.0 | U | 20.0 | U | 2.0 | U | 20.0 | U | 20.0 | U | 2.0 | U | 2.0 | U | 3.0 | | 23.0 | |
| Indeno(1,2,3-cd)pyrene | ug/kg dw | 4.8 | | 20.0 | U | 4.0 | | 20.0 | U | 20.0 | U | 5.5 | | 3.8 | | 5.4 | | 19.0 | |
| 2-Methylnaphthalene | ug/kg dw | 2.0 | U | 20.0 | U | 2.0 | U | 20.0 | U | 20.0 | U | 2.0 | U | 2.0 | U | 2.0 | U | 5.3 | |
| Naphthalene | ug/kg dw | 2.0 | U | 20.0 | U | 2.0 | U | 20.0 | U | 20.0 | U | 2.0 | U | 2.0 | U | 2.0 | U | 4.0 | U |
| Phenanthrene | ug/kg dw | 7.6 | | 20.0 | U | 5.2 | | 23.0 | | 20.0 | U | 10.0 | | 5.5 | | 26.0 | | 170 | |
| Pyrene | ug/kg dw | 15.0 | | 20.0 | U | 11.0 | | 30.0 | | 27.0 | | 25.0 | | 12.0 | | 26.0 | | 150 | |
| Total HPAH (calc'd)[e] | ug/kg dw | 87.3 | | 20.0 | U | 58.7 | | 62.0 | | 77.0 | | 120 | | 68.9 | | 115 | | 775 | |
| Total LPAH (calc'd)[d] | ug/kg dw | 7.6 | | 20.0 | U | 5.2 | | 23.0 | | 20.0 | U | 12.2 | | 5.5 | | 38.8 | | 271 | |
| Total cPAH TEQ (calc'd) | ug/kg dw | 12.0 | | 20.0 | U | 7.7 | | 20.0 | U | 16.0 | | 16.0 | | 10.0 | | 15.0 | | 85.0 | |
| **Chlorinated Organics** | | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | ug/kg dw | 10.0 | U | 100 | U | 10.0 | U | 100 | U | 100 | U | 10.0 | U | 10.0 | U | 10.0 | U | 20.0 | U |
| 1,2-Dichlorobenzene | ug/kg dw | 10.0 | U | 100 | U | 10.0 | U | 100 | U | 100 | U | 10.0 | U | 10.0 | U | 10.0 | U | 20.0 | U |
| 1,4-Dichlorobenzene | ug/kg dw | 10.0 | U | 100 | U | 10.0 | U | 100 | U | 100 | U | 10.0 | U | 10.0 | U | 10.0 | U | 20.0 | U |
| Hexachlorobenzene | ug/kg dw | 10.0 | U | 100 | U | 10.0 | U | 100 | U | 100 | U | **75.0** | | 10.0 | U | 10.0 | U | 20.0 | U |
| Hexachlorobutadiene | ug/kg dw | 1.7 | UJ | 17 | UJ | 1.7 | UJ | 17 | UJ | 17 | UJ | 1.7 | UJ | 1.7 | UJ | 0.17 | UJ | 0.34 | UJ |
| Pentachlorophenol | ug/kg dw | 20.0 | UJ | 200 | UJ | 20.0 | UJ | 200 | UJ | 200 | UJ | 20.0 | UJ | 20.0 | UJ | 20.0 | UJ | 40 | UJ |
| **Organic Chemicals** | | | | | | | | | | | | | | | | | | | |
| Dibenzofuran | mg/kg OC | 1.56 | U | 12.7 | U | NA | | NA | | NA | | NA | | NA | | NA | | 1.94 | U |
| N-Nitrosodiphenylamine | mg/kg OC | 1.56 | U | 12.7 | U | NA | | NA | | NA | | NA | | NA | | NA | | 1.94 | U |
| **Phthalates** | | | | | | | | | | | | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | mg/kg OC | 8.1 | J | 33 | UJ | NA | | NA | | NA | | NA | | NA | | NA | | 12.6 | J |
| Butylbenzyl phthalate | mg/kg OC | 3.0 | UJ | 24 | UJ | NA | | NA | | NA | | NA | | NA | | NA | | 4.4 | UJ |
| Diethyl phthalate | mg/kg OC | 15.6 | U | 127 | U | NA | | NA | | NA | | NA | | NA | | NA | | 19.4 | U |
| Dimethyl phthalate | mg/kg OC | 0.7 | UJ | 5.3 | UJ | NA | | NA | | NA | | NA | | NA | | NA | | 8.2 | UJ |
| Di-n-butyl phthalate | mg/kg OC | 15.6 | U | 127 | U | NA | | NA | | NA | | NA | | NA | | NA | | 19.4 | U |
| Di-n-octyl phthalate | mg/kg OC | 15.6 | U | 127 | U | NA | | NA | | NA | | NA | | NA | | NA | | 19.4 | U |
| **PCBs** | | | | | | | | | | | | | | | | | | | |
| Total PCBs | mg/kg OC | 1.3 | | 1.5 | | NA | | NA | | NA | | NA | | NA | | NA | | 1.8 | |
| **PAHs** | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg OC | 0.3 | U | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 3.0 | |
| Acenaphthylene | mg/kg OC | 0.3 | U | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 0.4 | U |
| Anthracene | mg/kg OC | 0.3 | U | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 4.6 | |
| Benz[a]anthracene | mg/kg OC | 1.1 | | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 6.6 | |
| Total Benzofluoranthenes (calc'd) | mg/kg OC | 3.2 | | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 11.4 | |
| Benzo(ghi)perylene | mg/kg OC | 0.7 | | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 1.3 | |
| Benzo(a)pyrene | mg/kg OC | 1.4 | | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 6.1 | |

**Table 11. Duwamish Waterway Park Beach Sediment Sampling Results.**

| Analyte | Unit | LDW RAL[a] (Category 3) | SMS Marine Criteria[b] SCO | SMS Marine Criteria[b] CSL | Site Screening Level (ug/kg) | Maximum Site Value | Sample Identification DWWP-B-6 | |
|---|---|---|---|---|---|---|---|---|
| Chrysene | mg/kg OC | 220 | 110 | 460 | -- | 7.09 | NA | |
| Dibenzo(a,h)anthracene | mg/kg OC | 24 | 12 | 33 | -- | 2.54 | NA | |
| Fluoranthene | mg/kg OC | 320 | 160 | 1,200 | -- | 14.56 | NA | |
| Fluorene | mg/kg OC | 46 | 23 | 79 | -- | 2.54 | NA | |
| Indeno(1,2,3-cd)pyrene | mg/kg OC | 68 | 34 | 88 | -- | 2.54 | NA | |
| 2-Methylnaphthalene | mg/kg OC | 76 | 38 | 64 | -- | 2.54 | NA | |
| Naphthalene | mg/kg OC | 198 | 99 | 170 | -- | 2.54 | NA | |
| Phenanthrene | mg/kg OC | 200 | 100 | 480 | -- | 16.50 | NA | |
| Pyrene | mg/kg OC | 2,000 | 1,000 | 1,400 | -- | 14.56 | NA | |
| Total HPAH (calc'd) | mg/kg OC | 1,920 | 960 | 5,300 | -- | 75.3 | NA | |
| Total LPAH (calc'd) | mg/kg OC | 740 | 370 | 780 | -- | 26.3 | NA | |
| **Chlorinated Organics** | | | | | | | | |
| 1,2,4-Trichlorobenzene | mg/kg OC | 1.62 | 0.81 | 1.8 | -- | 12.7 | NA | |
| 1,2-Dichlorobenzene | mg/kg OC | 4.6 | 2.3 | 2.3 | -- | 12.7 | NA | |
| 1,4-Dichlorobenzene | mg/kg OC | 6.2 | 3.1 | 9 | -- | 12.7 | NA | |
| Hexachlorobenzene | mg/kg OC | 0.76 | 0.38 | 2.3 | -- | 12.7 | NA | |
| Hexachlorobutadiene | mg/kg OC | 7.8 | 3.9 | 6.2 | -- | 2.2 | NA | |

Notes:

Green highlighted results are greater than the most stringent PCUL value (**bold exceedances** =detected, non-bold = non-detected).

Blue text results are greater than the SCO value.

Red text results are greater than the RAL value.

[a] Project site is located in Lower Duwamish Waterway Recovery Category 3. The remedial action level (RAL) applies to the 10 centimeter (cm) depth interval.

[b] Marine sediment cleanup objective (SCO) and cleanup screening level (CSL) values: Ecology's Sediment Cleanup Manual (SCUM) Table 8-1.

[c] Total PCBs were derived based on the sum of the detected concentrations of Aroclors® 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, and 1268.

[d] Total LPAH represents the sum of detected concentrations of the following compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

[e] Total HPAH represents the sum of detected concentrations of the following compounds: benz(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, pyrene, and total benzofluoranthenes.

[f] Total benzofluoranthenes represents the sum of detected concentrations of the b and k isomers of benzofluoranthenes. The j isomer was not reported by the laboratory.

[g] Samples DWWP-B-1 through DWWP-B-4 were located above the MHHW elevation of 11.1 feet, and are therefore analyzed as upland soils, and not included when calculating average Site concentrations of contaminants.

Abbreviations

-- = no criteria available
DW = dry weight
OC = organic carbon normalized
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
> criteria value indicates that the toxic level is unknown, but above the concentration shown.
NA = When total organic carbon (TOC) values are outside the recommended range of 0.5 to 3.5 percent, dry weight concentrations are used to compare with dry weight apparent effects thresholds (AETs), rather than carbon normalized criteria.

**Table 11. Duwamish Waterway Park Beach Sediment Sampling Results.**

| Analyte | Unit | Sample Identification | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | DWWP-B-8 | | DWWP-B-10 | | DWWP-B-12 | | DWWP-B-14 | | DWWP-B-15 | | DWWP-B-17 | | DWWP-B-19 | | DWWP-B-21 | | DWWP-B-23 | | DWWP-B-25 | |
| Chrysene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 3.9 | |
| Dibenzo(a,h)anthracene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 2.0 | U |
| Fluoranthene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 7.0 | |
| Fluorene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 2.0 | U |
| Indeno(1,2,3-cd)pyrene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 2.0 | U |
| 2-Methylnaphthalene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 2.0 | U |
| Naphthalene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 2.0 | U |
| Phenanthrene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 5.6 | |
| Pyrene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 7.4 | |
| Total HPAH (calc'd) | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 28.7 | |
| Total LPAH (calc'd) | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 5.6 | |
| **Chlorinated Organics** | | | | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 9.9 | U |
| 1,2-Dichlorobenzene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 9.9 | U |
| 1,4-Dichlorobenzene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 9.9 | U |
| Hexachlorobenzene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 9.9 | U |
| Hexachlorobutadiene | mg/kg OC | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 1.7 | UJ |

Notes:

Green highlighted results are greater than the most stringent PCUL value (**bold exceedances** =detected, non-bold = non-detected).

Blue text results are greater than the SCO value.

Red text results are greater than the RAL value.

[a] Project site is located in Lower Duwamish Waterway Recovery Category 3. The remedial action level (RAL) applies to the 10 centimeter (cm) depth interval.

[b] Marine sediment cleanup objective (SCO) and cleanup screening level (CSL) values: Ecology's Sediment Cleanup Manual (SCUM) Table 8-1.

[c] Total PCBs were derived based on the sum of the detected concentrations of Aroclors® 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, and 1268.

[d] Total LPAH represents the sum of detected concentrations of the following compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

[e] Total HPAH represents the sum of detected concentrations of the following compounds: benz(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, pyrene, and total benzofluoranthenes.

[f] Total benzofluoranthenes represents the sum of detected concentrations of the b and k isomers of benzofluoranthenes. The j isomer was not reported by the laboratory.

[g] Samples DWWP-B-1 through DWWP-B-4 were located above the MHHW elevation of 11.1 feet, and are therefore analyzed as upland soils, and not included when calculating average Site concentrations of contaminants.

Abbreviations

-- = no criteria available
DW = dry weight
OC = organic carbon normalized
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
> criteria value indicates that the toxic level is unknown, but above the concentration shown.
NA = When total organic carbon (TOC) values are outside the recommended range of 0.5 to 3.5 percent, dry weight concentrations are used to compare with dry weight apparent effects thresholds (AETs), rather than carbon normalized criteria.

**Table 11. Duwamish Waterway Park Beach Sediment Sampling Results.**

| | | Sample Identification | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **DWWP-B-27** | | **DWWP-B-29** | | **DWWP-B-31** | | **DWWP-B-33** | | **DWWP-B-35** | | **DWWP-B-37** | | **DWWP-B-39** | | **DWWP-B-41** | | **DWWP-B-43** | |
| Chrysene | mg/kg OC | 1.9 | | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 7.1 | |
| Dibenzo(a,h)anthracene | mg/kg OC | 0.3 | U | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 0.5 | |
| Fluoranthene | mg/kg OC | 2.3 | | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 14.6 | |
| Fluorene | mg/kg OC | 0.3 | U | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 2.2 | |
| Indeno(1,2,3-cd)pyrene | mg/kg OC | 0.7 | | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 1.8 | |
| 2-Methylnaphthalene | mg/kg OC | 0.3 | U | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 0.5 | |
| Naphthalene | mg/kg OC | 0.3 | U | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 0.4 | U |
| Phenanthrene | mg/kg OC | 1.2 | | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 16.5 | |
| Pyrene | mg/kg OC | 2.3 | | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 14.6 | |
| Total HPAH (calc'd) | mg/kg OC | 13.6 | | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 75.3 | |
| Total LPAH (calc'd) | mg/kg OC | 1.2 | | 2.5 | U | NA | | NA | | NA | | NA | | NA | | NA | | 26.3 | |
| **Chlorinated Organics** | | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | mg/kg OC | 1.6 | U | 12.7 | U | NA | | NA | | NA | | NA | | NA | | NA | | 1.9 | U |
| 1,2-Dichlorobenzene | mg/kg OC | 1.6 | U | 12.7 | U | NA | | NA | | NA | | NA | | NA | | NA | | 1.9 | U |
| 1,4-Dichlorobenzene | mg/kg OC | 1.6 | U | 12.7 | U | NA | | NA | | NA | | NA | | NA | | NA | | 1.9 | U |
| Hexachlorobenzene | mg/kg OC | 1.6 | U | 12.7 | U | NA | | NA | | NA | | NA | | NA | | NA | | 1.9 | U |
| Hexachlorobutadiene | mg/kg OC | 0.27 | UJ | 2.2 | UJ | NA | | NA | | NA | | NA | | NA | | NA | | 0.033 | UJ |

Notes:

Green highlighted results are greater than the most stringent PCUL value (**bold exceedances** =detected, non-bold = non-detected).

Blue text results are greater than the SCO value.

Red text results are greater than the RAL value.

[a] Project site is located in Lower Duwamish Waterway Recovery Category 3. The remedial action level (RAL) applies to the 10 centimeter (cm) depth interval.

[b] Marine sediment cleanup objective (SCO) and cleanup screening level (CSL) values: Ecology's Sediment Cleanup Manual (SCUM) Table 8-1.

[c] Total PCBs were derived based on the sum of the detected concentrations of Aroclors® 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, and 1268.

[d] Total LPAH represents the sum of detected concentrations of the following compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

[e] Total HPAH represents the sum of detected concentrations of the following compounds: benz(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, pyrene, and total benzofluoranthenes.

[f] Total benzofluoranthenes represents the sum of detected concentrations of the b and k isomers of benzofluoranthenes. The j isomer was not reported by the laboratory.

[g] Samples DWWP-B-1 through DWWP-B-4 were located above the MHHW elevation of 11.1 feet, and are therefore analyzed as upland soils, and not included when calculating average Site concentrations of contaminants.

Abbreviations

-- = no criteria available
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NA = When total organic carbon (TOC) values are outside the recommended range of 0.5 to 3.5 percent, dry weight concentrations are used to compare with dry weight apparent effects thresholds (AETs), rather than carbon normalized criteria.

**Table 12. Nearby Existing Sediment Sampling Results from Ecology's EIM Database.**

| Analyte | Unit | LDW RAL[a] (category 3) | SMS Marine Criteria[b] SCO | SMS Marine Criteria[b] CSL | Site Screening Level | Maximum Site Value | Study Specific Location ID[g] BNK5-1 | | DR-06 | | SS100 | | LDW-SS533 -COMP | | SS101 | | DR197 | | LDW-2284 | | B7A0086 | | LDW-SSB7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EIM Study ID | | | | | | | LDWAOC3 | | EBCHEM | | LSWRRUN2 | | LDWSed Dioxin2010 | | LDWRRUN1 | | LODRIV98 | | LDWRSub 2006 | | LDWRTHIC | | | |
| Date Sampled | | | | | | | 6/12/2018 | | 10/9/1995 | | 3/11/2005 | | 1/12/2010 | | 1/20/2005 | | 8/20/1998 | | 2/23/2006 | | 8/30/2004 | | 3/18/2005 | |
| Sampling Depth (centimeters) | | | | | | | 0-10 | | NR | | 0-10 | | 0-43 | | 0-10 | | 0-10 | | 0-30 | | 0-10 | | 0-10 | |
| Total Organic Carbon (TOC) | percent | -- | -- | -- | -- | 2.19 | 0.19 | | 0.69 | | 0.79 | | 1.4 | | 1.09 | | 1.3 | | 1.08 | | 1.64 | | 2.19 | |
| **Metals and Trace Elements** | | | | | | | | | | | | | | | | | | | | | | | | |
| Arsenic | mg/kg dw | 114 | 57 | 93 | 7.0 | 8.9 | 2.4 | | 5.9 | J | **7.5** | | 4.3 | | 4.9 | | **8.9** | | 6 | U | 6.56 | J | **8.9** | |
| Cadmium | mg/kg dw | 10.2 | 5.1 | 6.7 | 0.8 | 0.4 | 0.04 | J | 0.19 | | 0.3 | U | -- | | 0.2 | U | 0.12 | | 0.3 | U | 0.176 | | 0.4 | U |
| Chromium | mg/kg dw | 520 | 260 | 270 | 62 | 119 | 9.6 | | **119** | **J** | 13.5 | | -- | | 12 | | 17 | | 13.6 | | 22.9 | | 24 | |
| Copper | mg/kg dw | 780 | 390 | 390 | 45 | 47.3 | 11 | | 38.1 | | 17.1 | | -- | | 17.2 | | 30 | | 19.1 | | 30.9 | | **47.3** | |
| Lead | mg/kg dw | 900 | 450 | 530 | 21 | 61 | 2.87 | J | **29.9** | | **61** | | -- | | **31** | | 18 | | 14 | | **21.4** | **J** | **26** | |
| Mercury | mg/kg dw | 0.82 | 0.41 | 0.59 | 0.25 | 0.13 | 0.028 | U | 0.132 | J | 0.06 | U | -- | | 0.06 | U | 0.08 | | 0.05 | U | 0.06 | | 0.1 | U |
| Silver | mg/kg dw | 12.2 | 6.1 | 6.1 | 0.24 | 0.7 | 0.03 | J | 0.23 | J | 0.4 | U | -- | | 0.4 | U | 0.14 | | 0.4 | U | 0.139 | | 0.7 | U |
| Zinc | mg/kg dw | 820 | 410 | 960 | 93 | 116 | | | **116** | **J** | 52.1 | | -- | | 53.5 | | 71 | | 42.3 | | 81.6 | | 88 | |
| **Organic Chemicals** | | | | | | | | | | | | | | | | | | | | | | | | |
| 2,4-Dimethylphenol | ug/kg dw | 58 | 29 | 29 | -- | 130 | 23.7 | U | 130 | U | 6.3 | U | -- | | 6.6 | U | 20 | U | 5.9 | U | 100 | UJ | 6.5 | U |
| 2-Methylphenol | ug/kg dw | 126 | 63 | 63 | -- | 56 | | | 56 | U | 6.3 | U | -- | | 6.6 | U | 20 | U | 5.9 | U | 20 | U | 6.5 | U |
| 3-Methylphenol + 4-Methylphenol | ug/kg dw | 1,340 | 670 | 670 | -- | 60 | 19 | U | 56 | U | 20 | U | -- | | 60 | U | 20 | U | 59 | U | 20 | U | 59 | U |
| Benzoic acid | ug/kg dw | 1,300 | 650 | 650 | -- | 1000 | 47.4 | U | 1,000 | U | 63 | U | -- | | 110 | | 200 | U | 110 | J | 400 | U | 65 | U |
| Benzyl alcohol | ug/kg dw | 114 | 57 | 73 | -- | 230 | 19 | U | 230 | U | 20 | U | -- | | 33 | U | 50 | U | 29 | U | 20 | U | 32 | U |
| Dibenzofuran | ug/kg dw | 1,080 | 540 | 540 | 540 | 340 | 19 | U | 340 | J | 20 | U | 4.7 | U | 60 | U | 20 | U | 59 | U | 4.6 | J | 59 | U |
| Phenol | ug/kg dw | 840 | 420 | 1,200 | -- | 95 | 19 | UJ | 95 | B | 20 | U | -- | | 60 | U | 20 | | 59 | U | 13 | U | 59 | U |
| N-Nitrosodiphenylamine | ug/kg dw | 56 | 28 | 40 | -- | 40 | 4.7 | U | | | 6.3 | U | -- | | 33 | U | 40 | U | 8.2 | UJ | 20 | U | 6.5 | U |
| **Phthalates** | | | | | | | | | | | | | | | | | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | ug/kg dw | 2,600 | 1,300 | 1,900 | 1,300 | 150 | 47 | U | | | 24 | U | -- | | 52 | J | 110 | UJ | 43 | J | 63 | J | 150 | |
| Butylbenzyl phthalate | ug/kg dw | 126 | 63 | 900 | 63 | 20 | 19 | U | 3.5 | B | 6.3 | U | -- | | 6.6 | U | 20 | U | 7 | | 11 | J | 6.5 | U |
| Diethyl phthalate | ug/kg dw | 400 | 200 | >1,200 | 200 | 59 | | | | | 5.7 | J | -- | | 6.6 | | 20 | U | 59 | U | 20 | U | 6.5 | |
| Dimethyl phthalate | ug/kg dw | 142 | 71 | 160 | 71 | 59 | 19 | U | 24 | J | 6.3 | U | -- | | 6.6 | U | 20 | U | 59 | U | 7.1 | J | 6.5 | U |
| Di-n-butyl phthalate | ug/kg dw | 2,800 | 1,400 | 1,400 | 1,400 | 60 | | | | | 20 | U | -- | | 60 | U | 20 | U | 59 | U | 20 | U | 59 | U |
| Di-n-octyl phthalate | ug/kg dw | 12,400 | 6,200 | 6,200 | 6,200 | 65 | | | 65 | J | 20 | U | -- | | 36 | J | 20 | U | 59 | U | 40 | U | 59 | U |
| **PCBs** | | | | | | | | | | | | | | | | | | | | | | | | |
| Total PCBs as Aroclors[c] | ug/kg dw | 260 | 130 | 1,000 | 130 | 280 | 26.6 | | | | 72 | | **280** | | 20 | U | 98 | | 72 | J | 61 | | 100 | |
| **PAHs** | | | | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | ug/kg dw | 1,000 | 500 | 500 | 530 | 140 | 19 | U | 140 | U | 20 | U | 7.5 | | 60 | U | 20 | U | 59 | U | 3.5 | J | 59 | U |
| Acenaphthylene | ug/kg dw | 2,600 | 1,300 | 1,300 | 1,300 | 110 | 19 | U | 110 | U | 20 | U | 4.7 | U | 60 | U | 20 | U | 59 | U | 7.1 | | 59 | U |
| Anthracene | ug/kg dw | 1,920 | 960 | 960 | 960 | 130 | 19 | U | 130 | U | 20 | U | 12 | | 60 | U | 20 | U | 59 | U | 20 | | 59 | U |
| Benz[a]anthracene | ug/kg dw | 2,600 | 1,300 | 1,600 | 1,300 | 60 | 19 | U | 40 | U | 22 | | 36 | | 60 | U | 50 | | 59 | U | 38 | | 59 | |
| Total Benzofluoranthenes (calc'd)[f] | ug/kg dw | 6,400 | 3,200 | 3,600 | 3,200 | 230 | 37.9 | U | 62 | U | 26 | | 72 | J | 49 | J | 150 | | 130 | J | 94 | | 230 | |
| Benzo(ghi)perylene | ug/kg dw | 1,340 | 670 | 720 | 670 | 77 | 19 | U | 77 | U | 20 | U | 34 | | 60 | U | 60 | | 59 | U | 41 | | 59 | U |
| Benzo(a)pyrene | ug/kg dw | 3,200 | 1,600 | 1,600 | 1,600 | 66 | 19 | U | 61 | U | 20 | | 42 | | 12 | | 60 | | 59 | U | 46 | | 66 | |
| Chrysene | ug/kg dw | 2,800 | 1,400 | 2,800 | 1,400 | 110 | 19 | U | 58 | U | 25 | | 51 | | 56 | J | 90 | | 50 | J | 78 | | 110 | |
| Dibenzo(a,h)anthracene | ug/kg dw | 460 | 230 | 230 | 230 | 130 | 19 | U | 130 | U | 20 | U | 12 | | 60 | U | 20 | U | 59 | U | 6.9 | | 59 | U |
| Fluoranthene | ug/kg dw | 3,400 | 1,700 | 2,500 | 1,700 | 200 | 19 | U | 110 | J | 36 | | 88 | | 99 | | 130 | | 53 | J | 83 | | 200 | |
| Fluorene | ug/kg dw | 1,080 | 540 | 540 | 540 | 150 | 19 | U | 150 | U | 20 | U | 4.7 | | 60 | U | 20 | U | 59 | U | 2.9 | J | 59 | U |
| Indeno(1,2,3-cd)pyrene | ug/kg dw | 1,200 | 600 | 690 | 600 | 83 | 19 | U | 83 | U | 18 | | 27 | | 12 | | 70 | | 59 | U | 40 | | 6.5 | |
| 2-Methylnaphthalene | ug/kg dw | 1,340 | 670 | 670 | 670 | 270 | 19 | U | 270 | U | 20 | U | 5.1 | | 60 | U | 20 | U | 59 | U | 5.4 | | 59 | U |
| Naphthalene | ug/kg dw | 4,200 | 2,100 | 2,100 | 2,100 | 200 | 19 | U | 200 | U | 20 | U | 4.7 | U | 60 | U | 20 | U | 59 | U | 5.5 | | 59 | U |
| Phenanthrene | ug/kg dw | 3,000 | 1,500 | 1,500 | 1,500 | 59 | 19 | U | 38 | J | 20 | U | 32 | | 41 | J | 50 | | 59 | U | 29 | J | 58 | J |
| Pyrene | ug/kg dw | 5,200 | 2,600 | 3,300 | 2,600 | 160 | 19 | U | 110 | J | 26 | | 79 | | 65 | | 120 | | 61 | | 71 | | 160 | |
| Total HPAH (calc'd)[e] | ug/kg dw | 24,000 | 12,000 | 17,000 | -- | 950 | 37.9 | U | 220 | J | 170 | | 440 | | 290 | J | 730 | | 290 | J | 500 | | 950 | |
| Total LPAH (calc'd)[d] | ug/kg dw | 10,400 | 5,200 | 5,200 | -- | 68 | 19 | U | 38 | J | 20 | U | 56 | | 41 | J | 50 | | 59 | U | 68 | J | 58 | J |
| **Chlorinated Organics** | | | | | | | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | ug/kg dw | 62 | 31 | 51 | -- | 1600 | 4.7 | U | 1,600 | U | 6.3 | U | -- | | 6.6 | U | 20 | U | 5.9 | U | 20 | U | 6.5 | U |
| 1,2-Dichlorobenzene | ug/kg dw | 70 | 35 | 50 | -- | 330 | 4.7 | U | 330 | U | 6.3 | U | -- | | 6.6 | U | 20 | U | 5.9 | U | 20 | U | 6.5 | U |
| 1,4-Dichlorobenzene | ug/kg dw | 220 | 110 | 110 | -- | 770 | 4.7 | U | 770 | U | 6.3 | U | -- | | 6.6 | U | 20 | U | 5.9 | U | 20 | U | 6.5 | U |
| Hexachlorobenzene | ug/kg dw | 44 | 22 | 70 | -- | 870 | 4.7 | U | 870 | U | 0.97 | U | -- | | 3.3 | UJ | 20 | U | 5.9 | U | **63** | | 0.96 | J |

**Table 12 Nearby Existing Sediment Sampling Results from Ecology's EIM Database.**

| Analyte | Unit | LDW RAL[a] (category 3) | SMS Marine Criteria[b] SCO | SMS Marine Criteria[b] CSL | Site Screening Level | Maximum Site Value | Study Specific Location ID[g] BNK5-1 | DR-06 | SS100 | LDW-SS533 -COMP | SS101 | DR197 | LDW-2284 | B7A0086 | LDW-SSB7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EIM Study ID | | | | | | | LDWAOC3 | EBCHEM | LSWRRUN2 | LDWSed Dioxin2010 | LDWRRUN1 | LODRIV98 | LDWRSub 2006 | LDWRTHIC | |
| Date Sampled | | | | | | | 6/12/2018 | 10/9/1995 | 3/11/2005 | 1/12/2010 | 1/20/2005 | 8/20/1998 | 2/23/2006 | 8/30/2004 | 3/18/2005 |
| Sampling Depth (centimeters) | | | | | | | 0-10 | NR | 0-10 | 0-43 | 0-10 | 0-10 | 0-30 | 0-10 | 0-10 |
| Hexachlorobutadiene | ug/kg dw | 22 | 11 | 120 | -- | 2200 | | 2,200 U | 0.97 U | -- | 6.6 U | 20 U | 5.9 U | 20 U | 0.98 U |
| Pentachlorophenol | ug/kg dw | 720 | 360 | 690 | 360 | 750 | 19 U | 750 U | 32 U | -- | 33.0 U | 100 U | 29 U | 100 U | 32 U |
| **Organic Chemicals** | | | | | | | | | | | | | | | |
| Dibenzofuran | mg/kg OC | 30 | 15 | 58 | -- | 49.28 | NA | 49 J | 2.5 U | 0.3 U | 5.5 U | 1.5 U | 5.5 U | 0.3 J | 2.7 U |
| N-Nitrosodiphenylamine | mg/kg OC | 22 | 11 | 11 | -- | 3.08 | NA | | 0.8 U | -- | 3.0 U | 3.1 U | 0.8 UJ | 1.2 U | 0.3 U |
| **Phthalates** | | | | | | | | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | mg/kg OC | 94 | 47 | 78 | 1,300 | 8.46 | NA | | 3.0 U | -- | 4.8 J | 8.5 UJ | 4.0 J | 3.8 J | 6.8 |
| Butylbenzyl phthalate | mg/kg OC | 9.8 | 4.9 | 64 | 63 | 1.54 | NA | 0.5 B | 0.8 U | -- | 0.6 U | 1.5 U | 0.6 0 | 0.7 J | 0.3 U |
| Diethyl phthalate | mg/kg OC | 122 | 61 | 110 | 200 | 5.46 | NA | | 0.7 J | -- | 0.6 | 1.5 U | 5.5 U | 1.2 U | 0.3 |
| Dimethyl phthalate | mg/kg OC | 106 | 53 | 53 | 71 | 5.46 | NA | 3.5 J | 0.8 U | -- | 0.6 U | 1.5 U | 5.5 U | 0.4 J | 0.3 U |
| Di-n-butyl phthalate | mg/kg OC | 440 | 220 | 1,700 | 1,400 | 5.50 | NA | | 2.5 U | -- | 5.5 U | 1.5 U | 5.5 U | 1.2 U | 2.7 U |
| Di-n-octyl phthalate | mg/kg OC | 116 | 58 | 4,500 | 6,200 | 9.42 | NA | 9.4 J | 2.5 U | -- | 3.3 J | 1.5 U | 5.5 U | 2.4 U | 2.7 U |
| **PCBs** | | | | | | | | | | | | | | | |
| Total PCBs | mg/kg OC | 24 | 12 | 65 | 130 | 20 | NA | | 9.1 | **20** | 1.8 U | 7.5 | 6.7 J | 3.7 | 4.6 |
| **PAHs** | | | | | | | | | | | | | | | |
| Acenaphthylene | mg/kg OC | 132 | 66 | 66 | 530 | 15.9 | NA | 15.9 U | 2.5 U | 0.3 U | 5.5 U | 1.5 U | 5.5 U | 0.4 | 2.7 U |
| Acenaphthene | mg/kg OC | 32 | 16 | 57 | 1,300 | 20.3 | NA | 20.3 U | 2.5 U | 0.5 | 5.5 U | 1.5 U | 5.5 U | 0.2 J | 2.7 U |
| Anthracene | mg/kg OC | 440 | 220 | 1,200 | 960 | 18.8 | NA | 18.8 U | 2.5 U | 0.9 | 5.5 U | 1.5 U | 5.5 U | 1.2 | 2.7 U |
| Benz[a]anthracene | mg/kg OC | 220 | 110 | 270 | 1,300 | 5.8 | NA | 5.8 U | 2.8 | 2.6 | 5.5 U | 3.8 | 5.5 U | 2.3 | 2.7 |
| Total Benzofluoranthenes (calc'd) | mg/kg OC | 4,650 | 230 | 450 | 3,200 | 12.0 | NA | 9.0 U | 3.3 | 5.1 J | 4.5 J | 11.5 | 12.0 J | 5.7 | 10.5 |
| Benzo(ghi)perylene | mg/kg OC | 62 | 31 | 78 | 670 | 11.2 | NA | 11.2 U | 2.5 U | 2.4 | 5.5 U | 4.6 | 5.5 U | 2.5 | 2.7 U |
| Benzo(a)pyrene | mg/kg OC | 198 | 99 | 210 | 1,600 | 8.8 | NA | 8.8 U | 2.5 | 3.0 | 1.1 | 4.6 | 5.5 U | 2.8 | 3.0 |
| Chrysene | mg/kg OC | 220 | 110 | 460 | 1,400 | 8.4 | NA | 8.4 U | 3.2 | 3.6 | 5.1 J | 6.9 | 4.6 J | 4.8 | 5.0 |
| Dibenzo(a,h)anthracene | mg/kg OC | 24 | 12 | 33 | 230 | 18.8 | NA | 18.8 U | 2.5 U | 0.9 | 5.5 U | 1.5 U | 5.5 U | 0.4 | 2.7 U |
| Fluoranthene | mg/kg OC | 320 | 160 | 1,200 | 1,700 | 15.9 | NA | 15.9 J | 4.6 | 6.3 | 9.1 | 10.0 | 4.9 J | 5.1 | 9.1 |
| Fluorene | mg/kg OC | 46 | 23 | 79 | 540 | 21.7 | NA | 21.7 U | 2.5 U | 0.3 | 5.5 U | 1.5 U | 5.5 U | 0.2 J | 2.7 U |
| Indeno(1,2,3-cd)pyrene | mg/kg OC | 68 | 34 | 88 | 600 | 12.0 | NA | 12.0 U | 2.3 | 1.9 | 1.1 | 5.4 | 5.5 U | 2.4 | 0.3 |
| 2-Methylnaphthalene | mg/kg OC | 76 | 38 | 64 | 670 | 39.1 | NA | 39.1 U | 2.5 U | 0.4 | 5.5 U | 1.5 U | 5.5 U | 0.3 | 2.7 U |
| Naphthalene | mg/kg OC | 198 | 99 | 170 | 2,100 | 29.0 | NA | 29.0 U | 2.5 U | 0.3 U | 5.5 U | 1.5 U | 5.5 U | 0.3 | 2.7 U |
| Phenanthrene | mg/kg OC | 200 | 100 | 480 | 1,500 | 5.5 | NA | 5.5 J | 2.5 U | 2.3 | 3.8 J | 3.8 | 5.5 U | 1.8 J | 2.6 J |
| Pyrene | mg/kg OC | 2,000 | 1,000 | 1,400 | 2,600 | 15.9 | NA | 15.9 J | 3.3 | 5.6 | 6.0 | 9.2 | 5.6 0 | 4.3 | 7.3 |
| Total HPAH (calc'd) | mg/kg OC | 1,920 | 960 | 5,300 | -- | 56.2 | NA | 31.9 J | 21.5 | 31.4 | 26.6 J | 56.2 | 26.9 J | 30.5 | 43.4 |
| Total LPAH (calc'd) | mg/kg OC | 740 | 370 | 780 | -- | 5.51 | NA | 5.5 J | 2.5 U | 4.0 | 3.8 J | 3.8 | 5.5 U | 4.1 J | 2.6 J |
| **Chlorinated Organics** | | | | | | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | mg/kg OC | 1.62 | 0.81 | 1.8 | -- | 232 | NA | 232 U | 0.8 U | -- | 0.6 U | 1.5 U | 0.5 U | 1.2 U | 0.3 U |
| 1,2-Dichlorobenzene | mg/kg OC | 4.6 | 2.3 | 2.3 | -- | 48 | NA | 48 U | 0.8 U | -- | 0.6 U | 1.5 U | 0.5 U | 1.2 U | 0.3 U |
| 1,4-Dichlorobenzene | mg/kg OC | 6.2 | 3.1 | 9 | -- | 112 | NA | 112 U | 0.8 U | -- | 0.6 U | 1.5 U | 0.5 U | 1.2 U | 0.3 U |
| Hexachlorobenzene | mg/kg OC | 0.76 | 0.38 | 2.3 | -- | 126 | NA | 126 U | 0.1 U | -- | 0.3 UJ | 1.5 U | 0.5 U | **3.8** | 0.04 J |
| Hexachlorobutadiene | mg/kg OC | 7.8 | 3.9 | 6.2 | -- | 319 | NA | 319 U | 0.1 U | -- | 0.6 U | 1.5 U | 0.5 U | 1.2 U | 0.04 U |

Notes:

Green highlighted results are greater than the most stringent PCUL value (**bold exceedeances** =detected, non-bold = non-detected).

Blue text results are greater than the SCO value.

Red text results are greater than the RAL value.

[a] Project site is located in

[b] Marine sediment cleanup

[c] Total PCBs were derived based on the sum of the detected concentrations of Aroclors® 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, and 1268.

[d] Total LPAH represents the sum of detected concentrations of the following compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene.

[e] Total HPAH represents the

[f] Total benzofluoranthenes represents the sum of detected concentrations of the b and k isomers of benzofluoranthenes. The j isomer was not reported by the laboratory.

[g] Sample data downloaded from Ecology's Environmental Information Management (EIM) database in February 2022.

Abbreviations

-- = no criteria available

> criteria value indicates that the toxic level is unknown, but above the concentration shown.

U = not detected at given reporting limit

J= Result is considered estimated

B = The associated compound was detected in the laboratory method blank. The reported result is not background corrected.

NR = Not reported

OC = organic carbon normalized

DW = dry weight

µg/kg = microgram per kilogram

mg/kg = milligram per kilogram

NA = When total organic

# APPENDIX B

# October 2021 Beach Sediment Sampling Memo

Seattle
Parks & Recreation

# Memorandum

**Date:** March 7, 2022
**To:** File
**From:** Crystal Thimsen, PMP, Sr. Environmental Analyst, Seattle Parks and Recreation (SPR); edited by Herrera Environmental Consultants, Inc.
**Subject:** October 2021 Beach Sediment Sampling Summary – Duwamish Waterway Park

## Introduction

In October 2021, surface sediment samples were collected from the beach area at Duwamish Waterway Park (Site) to characterize the sediments as part of ongoing site characterization of the park. The sample results are being evaluated and submitted to the Washington State Department of Ecology (Ecology) as part of a revised Remedial Investigation report.

## Sampling Methodology

On October 6, 2021, sediment samples were collected at the beach area at the Site, following the guidelines in Ecology's *Sediment Cleanup User's Manual*, December 2019. The beach sediment sampling methodology conducted as part of the Lower Duwamish Waterway Group (LDWG) Remedial Investigation was also reviewed to ensure that comparable samples were collected. Sediment sampling was conducted between 11:30 AM and 12:24 PM by Crystal Thimsen (SPR) and D. McAlister (Eco Compliance Corporation).

Station Locations. At total of 43 sample stations (DWWP-B-1 through DWWP-B-43) were established throughout the beach area (see Figure 1 attached). Most stations were established on a grid using a fiberglass tape measure and spaced approximately 10 feet apart. Three sample stations (DWWP-B-3, DWWP-B-5, and DWWP-B-15) were located along the path heading down to the beach that provides public access, and five stations (DWWP-B-1 through DWWP-B-5) were located near the top of the beach area above the Mean Higher High Water (MHHW) elevation of 11.1 feet. For the purposes of data analysis, the five stations above the MHHW are considered upland soils and analyzed with the other upland soils collected throughout the Central Meadow and Northeast Meadow. The sediment samples stations were marked on an aerial photograph of the site in the field, then plotted in CAD, and northing and easting coordinates (i.e., latitude and longitude) were derived from the plotted locations.

Sample Collection. One discrete surface sediment sample was collected from each of the 43 stations by walking on the beach during low tide conditions. The low tide was 1.57 feet mean lower low water (MLLW) at 11:33 AM on October 6, 2021 at the Duwamish Waterway, Eighth Avenue South tide station. The tide ranged from +1.6 to +2.0 feet MLLW during sample collection. Each sample was collected with a stainless-steel spoon from a depth of 0 to 10 centimeters and placed directly into a laboratory supplied 8-ounce jar. Prior to sampling and after each sample was collected, sample spoons were decontaminated with Alconox followed by a rinse with deionized water. Jars were placed on ice in a cooler and securely stored overnight until they were delivered to Friedman and Bruya (Seattle, Washington) with a signed chain-of-custody form for storage and analysis.

Sample Analysis. A total of 25 of the 43 samples were analyzed for the requested parameters and the remaining 18 samples were archived for possible future analysis. The 20 stations with samples analyzed as

sediment are shown in Figure 11, and the 5 samples analyzed as upland soils are shown in Figure 8. The surface sediment samples were analyzed for the following parameters:

- Metals (antimony, arsenic, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc) by EPA Method 6020B and mercury by EPA Method 1631E
- Semivolatile Organic Compounds (SVOCs) by EPA Method 8270E
- Polychlorinated Biphenyls (PCBs) by EPA Method 8082A
- Total Organic Carbon (TOC) by EPA Method 9060 (subcontracted to Fremont Analytical in Seattle, Washington).

## Data Validation

U.S. Environmental Protection Agency (EPA) Level 2A validation was performed for the 20 sediment samples analyzed for the parameters indicated. A list of samples validated is provided in Table 1. The laboratory's performance was reviewed in accordance with quality control (QC) criteria established by the laboratory and in the specified methods.

**Table 1. Duwamish Waterway Park Sediment Samples Validated.**

| Sample ID | Date/Time Collected | Friedman and Bruya Laboratory ID | Fremont Analytical Laboratory ID |
|---|---|---|---|
| DWWP-B-6 | 10/06/21 / 11:35 | 110127-06 | 2110123-006 |
| DWWP-B-8 | 10/06/21 / 11:37 | 110127-08 | 2110123-007 |
| DWWP-B-10 | 10/06/21 / 11:39 | 110127-10 | 2110123-008 |
| DWWP-B-12 | 10/06/21 / 11:41 | 110127-12 | 2110123-009 |
| DWWP-B-14 | 10/06/21 / 11:43 | 110127-14 | 2110123-010 |
| DWWP-B-15 | 10/06/21 / 11:56 | 110127-15 | 2110123-011 |
| DWWP-B-17 | 10/06/21 / 11:58 | 110127-17 | 2110123-012 |
| DWWP-B-19 | 10/06/21 / 12:00 | 110127-19 | 2110123-013 |
| DWWP-B-21 | 10/06/21 / 12:02 | 110127-21 | 2110123-014 |
| DWWP-B-23 | 10/06/21 / 12:04 | 110127-23 | 2110123-015 |
| DWWP-B-25 | 10/06/21 / 12:06 | 110127-25 | 2110123-016 |
| DWWP-B-27 | 10/06/21 / 12:08 | 110127-27 | 2110123-017 |
| DWWP-B-29 | 10/06/21 / 12:10 | 110127-29 | 2110123-018 |
| DWWP-B-31 | 10/06/21 / 12:12 | 110127-31 | 2110123-019 |
| DWWP-B-33 | 10/06/21 / 12:14 | 110127-33 | 2110123-020 |
| DWWP-B-35 | 10/06/21 / 12:00 | 110127-35 | 2110123-021 |

**Table 1 (continued). Duwamish Waterway Park Sediment Samples Validated.**

| Sample ID | Date/Time Collected | Friedman and Bruya Laboratory ID | Fremont Analytical Laboratory ID |
|---|---|---|---|
| DWWP-B-37 | 10/06/21 / 12:00 | 110127-37 | 2110123-022 |
| DWWP-B-39 | 10/06/21 / 12:00 | 110127-39 | 2110123-023 |
| DWWP-B-41 | 10/06/21 / 12:00 | 110127-41 | 2110123-024 |
| DWWP-B-43 | 10/06/21 / 12:00 | 110127-43 | 2110123-025 |

Custody, Preservation, Holding Times, and Completeness – Acceptable. The samples were properly preserved and sample custody was maintained from sample collection to receipt at the laboratory. Samples were analyzed within the required method holding timed. The laboratory reports were complete and contained results for all samples and tests requested on the chain-of-custody (COC) forms.

Laboratory Reporting Limits – Acceptable with Discussion. Laboratory reporting limits were reasonable for the methods analyzed. However, due to necessary dilutions performed by the laboratory for potential matrix interferences several samples had elevated RLs for SVOCs. The laboratory reported several SVOCs to the method detection limit (MDL). Sample results reported at or above the MDL, but below the RL were qualified as estimated (flagged J). The following SVOCs were reported to the MDL: benzyl alcohol, 2-methylphenol, 2,4-dimethylphenol, hexachlorobutadiene, dimethyl phthalate, pentachlorophenol, benzyl butyl phthalate, and bis(2-ethylhexyl) phthalate.

Calibration Criteria – Acceptable with Qualification. The laboratory indicated that benzoic acid had calibration results that were outside of acceptance criteria. The laboratory did not provide calibration results in the data package. Therefore, benzoic acid results that were flagged by the laboratory as “ca” were qualified as estimated (flagged J), as shown in the table below.

| Sample ID | Parameter | Reason for Qualification | Flag |
|---|---|---|---|
| DWWP-B-10 | Benzoic Acid | Calibration data outside of control limits | UJ |
| DWWP-B-19 | Benzoic Acid | Calibration data outside of control limits | UJ |

Method Blank Analysis – Acceptable with Qualification. Method blanks were analyzed at the required frequency. Method blanks did not contain levels of target analytes above the laboratory reporting limits, with the following exception. Bis (2-ethylhexyl) phthalate was detected in one of the method blanks above the MDL, but less than the RL (0.0027 milligrams per kilogram [mg/kg]). Associated sample results that were reported above the MDL and less than 10X the MB result were qualified as estimated (flagged J), as shown in the following table.

| Sample ID | Parameter | Reason for Qualification | Flag |
|---|---|---|---|
| DWWP-B-6 | Bis(2-ethylhexyl) phthalate | Method blank contamination | J |
| DWWP-B-8 | Bis(2-ethylhexyl) phthalate | Method blank contamination | J |
| DWWP-B-12 | Bis(2-ethylhexyl) phthalate | Method blank contamination | J |
| DWWP-B-14 | Bis(2-ethylhexyl) phthalate | Method blank contamination | J |
| DWWP-B-15 | Bis(2-ethylhexyl) phthalate | Method blank contamination | J |
| DWWP-B-17 | Bis(2-ethylhexyl) phthalate | Method blank contamination | J |
| DWWP-B-19 | Bis(2-ethylhexyl) phthalate | Method blank contamination | J |
| DWWP-B-23 | Bis(2-ethylhexyl) phthalate | Method blank contamination | J |

Laboratory Control Sample Analysis – Acceptable. Laboratory control samples (LCS) or laboratory control/laboratory control duplicate samples (LCS/LCSD) were analyzed with project samples for all analyses at the required frequency. The percent recovery values for all parameters met the criteria established by the laboratory or analytical method.

Surrogate Spike Analysis – Acceptable. Surrogate compounds were analyzed with project and laboratory QC samples for SVOC and PCB analyses, as required by the analytical methods. Surrogate recovery values for SVOC (ranging from 47 to 112 percent) and PCB (61 to 99 percent) analyses met the control limits established by the laboratory (ranging from 23 to 150 percent for SVOCs, and 23 to 127 percent for PCBs).

Matrix Spike Analysis – Acceptable with Qualification. Matrix spike (MS) samples were analyzed for SVOCs, and matrix spike/matrix spike duplicate (MS/MSD) were analyzed for metals and TOC. All percent recovery values met the criteria established by the laboratory or analytical method, with the exceptions noted below. The percent recovery value for TOC in the MS sample for DWWP-25 (72 percent) exceeded the 75 to 125 percent control limits established by the method. The TOC results for sample DWWP-B-25 were qualified as estimated (flagged J) due to matrix spike exceedance, as shown in the table below.

| Sample ID | Parameter | Reason for Qualification | Flag |
|---|---|---|---|
| DWWP-B-25 | TOC | Matrix spike recovery low | J |

Laboratory Duplicate Analysis – Acceptable with Discussion. Laboratory duplicate and MS/MSD samples were analyzed for TOC, MS/MSD samples were analyzed for metals, and LCS/LCSD samples were analyzed for SVOCs and PCBs. The relative percent difference (RPD) was calculated for each analyte where both duplicate values were greater than five times the reporting limit (RL). The difference between duplicate values was calculated if the detected compound concentration was less than five times the RL in either the sample or the duplicate. The RPD values or difference values met the control limits established by the laboratory or specified method, with the exception noted below.

The RPD value for di-n-butyl phthalate (29 percent) exceeded the less than 20 percent criterion established by the laboratory. No data were qualified because all other criteria were met and di-n-butyl phthalate was not detected above the RL for any sample.

## Results

Sample results are presented in Table 2 (attached) for benthic contaminants of concern from the Washington State Sediment Management Standards (WAC 173-204). The results are compared to the following benthic criteria:

- Lower Duwamish Waterway Remedial Action Level (RAL) for Recovery Category 3 as designated for the project area by the Record of Decision (EPA 2014)
- Marine Sediment Cleanup Objective (SCO)
- Marine Sediment Cleanup Screening Level (CSL)

Draft sample results are compared to human health based RALs in Table 2 that are based on site average values.

**Table 3. Duwamish Waterway Park Sediment Results Compared to Human Health Based RALs.**

| Analyte | Unit | LDW RAL[a] (Category 3) | Average Site Value |
|---|---|---|---|
| Total PCBs | mg/kg OC | 12 | 1.42 |
| | µg/kg dw | 230 | 12.2 |
| Arsenic | mg/kg | 57 | 4.2 |
| Total cPAHs (TEQ) | µg/kg dw | 1,000 | 14.4 |

[a] Project site is located in Lower Duwamish Waterway Recovery Category 3. The remedial action level (RAL) applies to intertidal sediment in the top 10-centimeter depth interval. Values taken from the LDW Record of Decision (EPA 2014, Table 28).

The draft sample results show that the beach has good sediment quality. No RALs were exceeded for detected metals, PAHs, or PCBs. There were only two RAL exceedances for detected concentrations of hexachlorobenzene in two samples for station B-1 based on the organic carbon normalized result and for station B-37 based on the dry weight result. No other benthic RALs were exceeded and no human health RALs were exceeded.

# APPENDIX C

# Sampling and Analysis Plan

# DRAFT
# SAMPLING AND ANALYSIS PLAN

## DUWAMISH WATERWAY PARK
## REMEDIAL INVESTIGATION

**Prepared for**
**City of Seattle Parks and Recreation**

**Prepared by**
**Herrera Environmental Consultants, Inc.**

HERRERA

# SAMPLING AND ANALYSIS PLAN

## DUWAMISH WATERWAY PARK
## REMEDIAL INVESTIGATION

Prepared for
City of Seattle Parks and Recreation
300 Elliott Avenue, Suite 100
Seattle, Washington 98119

Prepared by
Herrera Environmental Consultants, Inc.
2200 Sixth Avenue, Suite 1100
Seattle, Washington 98121
Telephone: 206-441-9080

DRAFT
April 26, 2022

# SIGNATURE PAGE PROJECT TEAM

Approval signatures indicate that each member of the project team has reviewed this Sampling and Analysis Plan (SAP) and agree to follow the methods and Quality Assurance (QA) procedures contained herein. Herrera Environmental Consultants, Seattle, Washington, have prepared this SAP on behalf of City of Seattle Parks and Recreation (SPR).

_____ Date:_____

Jean H. Lee, SPR Project Manager

_____ Date:_____

Scott Stevens, SPR Park Engineer

_____ Date:_____

George Iftner,
Client Project Manager/Lead Investigator,
Herrera Environmental Consultants

_____ Date:_____

Gina Catarra, Field Manager,
Herrera Environmental Consultants

_____ Date:_____

Drilling Company TBD

_____ Date:_____

David Baumeister, Laboratory Manager,
OnSite Environmental, Inc.

# CONTENTS

# APPENDICES

# TABLES



# FIGURES

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| COC | chemicals of concern |
| cPAHs | carcinogenic polycyclic aromatic hydrocarbons |
| CRM | certified reference material |
| CSL | cleanup screening level |
| CUL | cleanup level |
| EPA | Environmental Protection Agency |
| FOA | frequency of analysis |
| HDPE | high-density polyethylene |
| HPAH | high molecular weight polynuclear aromatic hydrocarbon compounds |
| LDW | Lower Duwamish Waterway |
| LPAH | low molecular weight polynuclear aromatic hydrocarbon compounds |
| MDL | method detection limit |
| MS/MSD | matrix spike/matrix spike duplicate |
| PAH | polycyclic aromatic hydrocarbons |
| PCB | polychlorinated biphenyl |
| PPE | personal protective equipment |
| PSEP | Puget Sound Estuary Program |
| PSLs | preliminary screening levels |
| QA/QC | quality assurance/quality control |
| RI | Remedial Investigation |
| RL | reporting limits |

| | |
|---|---|
| RPD | relative percent difference |
| SAP | Sampling and Analysis Plan |
| SDOT | Seattle Department of Transportation |
| SSL | site screening level |
| SMARM | Sediment Management Annual Review Meeting |
| SRM | standard reference material or sediment reference material |
| SMS | Sediment Management Standards |
| SPR | Seattle Parks & Recreation |
| TEE | Terrestrial Ecological Evaluation |
| TOC | total organic carbon |

# 1. INTRODUCTION

This Sampling and Analysis Plan (SAP) describes the methodology for characterizing upland soils, groundwater, surface water, and sediment for the Duwamish Waterway Park Remedial Investigation (RI) in Seattle, Washington. This SAP in includes a Quality Assurance Project Plan (QAPP) and provides the overall study design, team responsibilities, project phases, sample collection methods, chemical analysis, quality assurance methods, and data reporting requirements.

Duwamish Waterway Park (Park) is located at 7900 10th Avenue South, adjacent to the Duwamish River, in Seattle, Washington (Figure 1). The RI boundary where sampling activities covered under this SAP will occur is referred to as the Site and includes the two main Park parcels owned by Seattle Parks and Recreation (SPR): parcel number 7327901195 situated north/south, and a smaller triangular shaped parcel number 7327902355 to the east. Other adjacent parcels to be investigated during a future RI separately from this RI and include:

- Washington Department of Natural Resources land managed by the Port of Seattle to the north,
- Port of Seattle parcel to the east (parcel number 7327902346),
- Seattle Department of Transportation (SDOT) property along former South Monroe Street to the south and east, and
- Duwamish Waterway Park Addition owned by SPR and leased to United Site Services to the east.

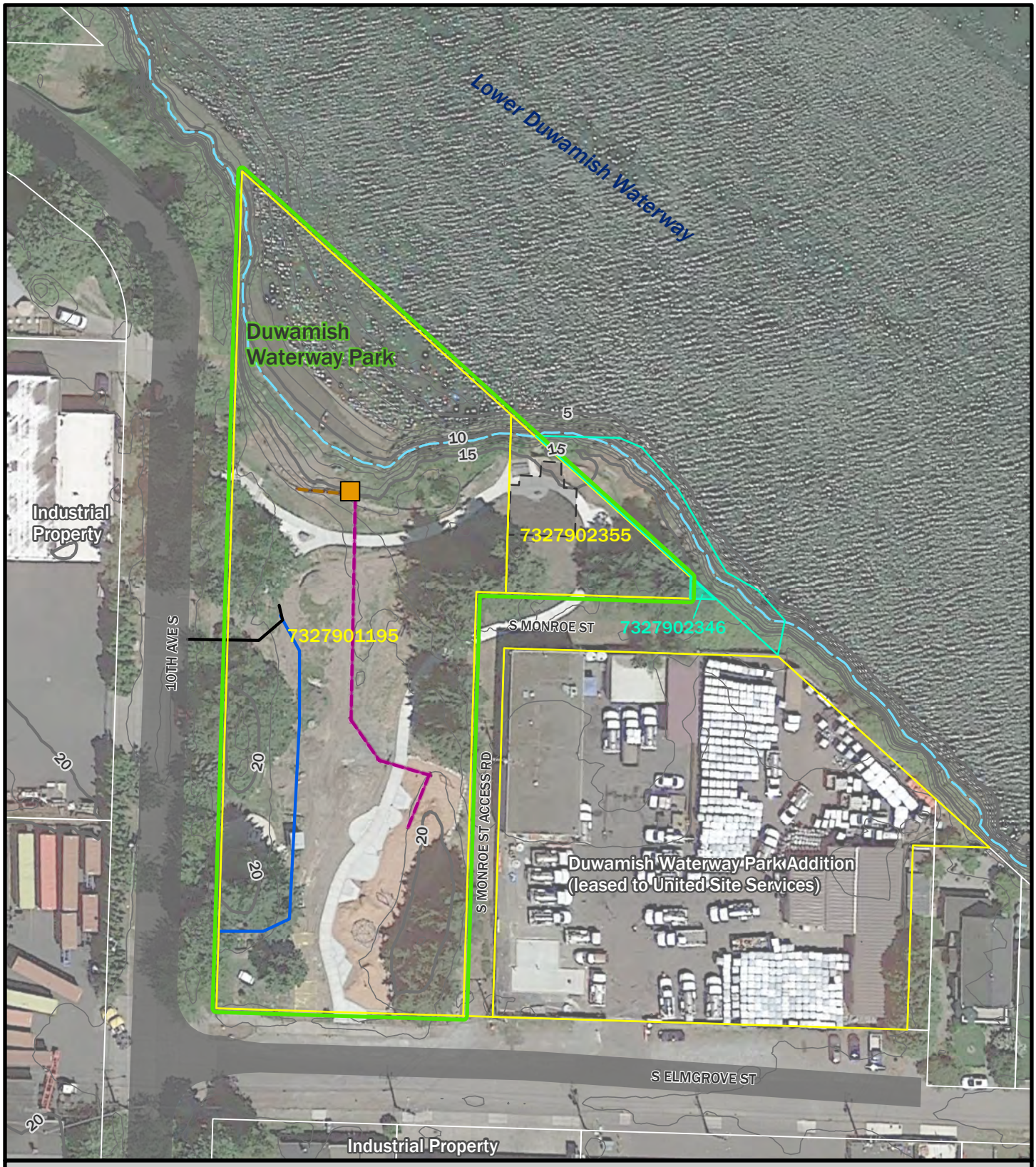
The Site is a 1.26-acre park located in the City of Seattle's South Park neighborhood that lies adjacent to the Duwamish River (also referred to as the Lower Duwamish Waterway [LDW]). Several different phases of environmental sampling have previously been completed (as summarized in the Work Plan) to characterize potential contamination in soil and sediment at the Site, but several data gaps remain. This SAP is designed to close those data gaps by obtaining additional data via sampling of soils, groundwater and seeps, surface water, and beach sediment.

The goal of this SAP is to document procedures to be used for sample collection, field analysis, laboratory analysis, and data analysis to ensure high quality, scientifically defensible results. This document includes the following sections:

- Project Background
- Project Team and Responsibilities

- Data Collection and Sample Handling Methods
- Laboratory Methods
- Quality Assurance and Quality Control Methods
- Reporting

Refer to the main text of the Work Plan for additional information regarding the site physical setting, geology and hydrology, and environmental history.




Legend

- Remedial Investigation Site Boundary
- Seattle Parks Parcels
- Port of Seattle Parcel
- Department of Natural Resources (Managed by Port of Seattle)
- King County Tax Parcel Boundaries
- Footprint of Former House
- Catch Basin
- Dispersion Trench
- Stormwater Drainpipe
- Sanitary Side Sewer
- Water Service Line

Elevation Contours (DNR 2016)

- 5 FT Contour
- 1 FT Contour
- Mean Higher High Water (11.1 FT MLLW)

**Figure 1. Site Map of Duwamish Waterway Park, Seattle, Washington.**

N

0 50 100 200 Feet

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Aerial: EagleView Technologies, 2019

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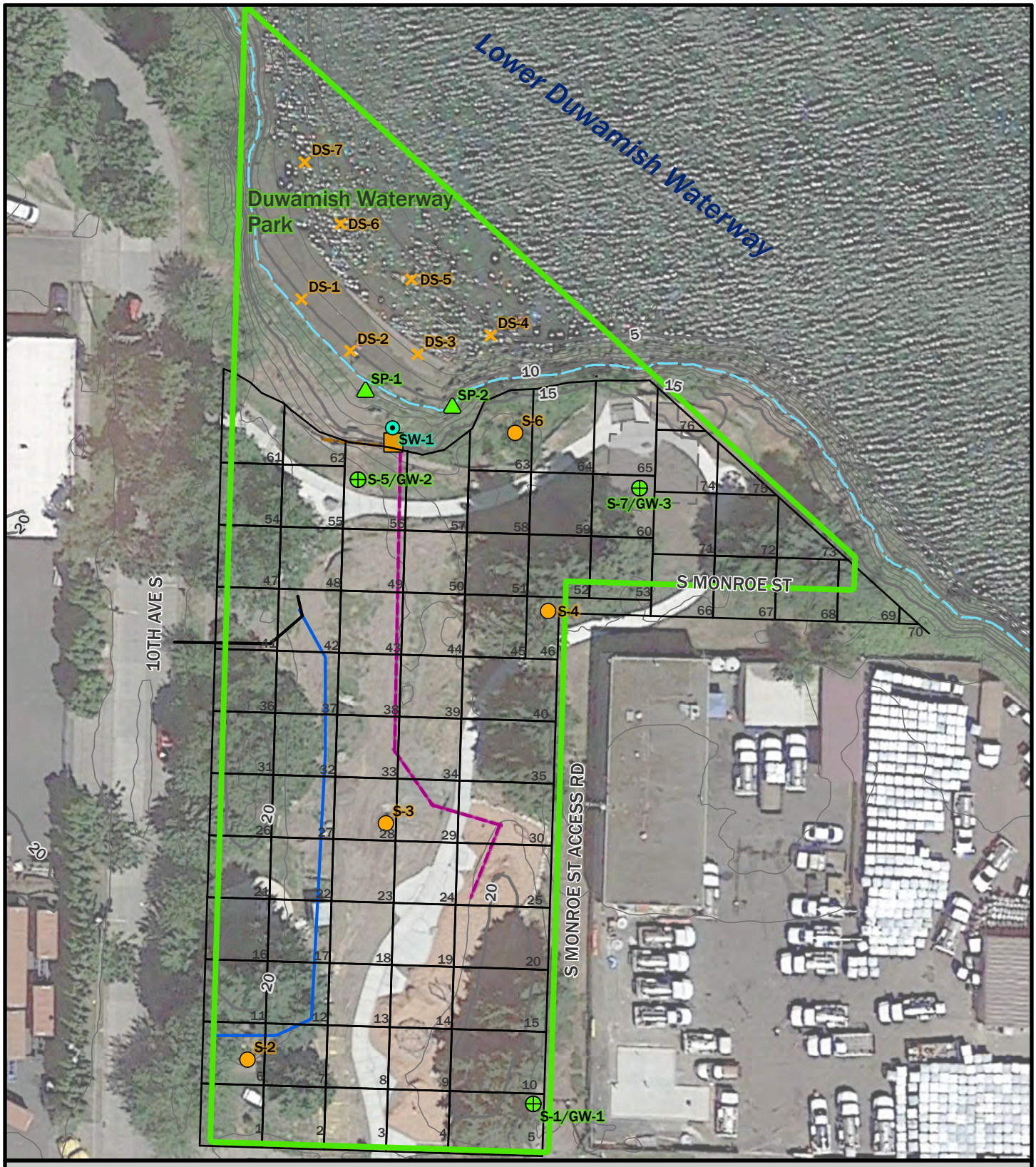


Legend

- Remedial Investigation Site Boundary

Elevation Contours (DNR 2016)

- 5 FT Contour
- 1 FT Contour
- Mean Higher High Water (11.1 FT NAVD88)
- Catch Basin
- Dispersion Trench
- Utility Trench
- Sanitary Side Sewer
- Water Service Line

Proposed Sample Locations

- Soil
- Soil and Groundwater
- Surface Water
- Seep
- Sediment
- Footprint of Former House

**Figure 2. Proposed 2022 Remedial Investigation Sample Locations, Duwamish Waterway Park, Seattle, Washington.**

N

0 25 50 100 Feet

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Aerial: EagleView Technologies, 2019

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# 2. PROJECT BACKGROUND

SPR has operated Duwamish Waterway Park since 1975 and previous uses of the site appear to have been primarily residential (ECC 2018). The properties adjacent to the Park were agricultural and residential until more industrial properties appear in the 1950s and 1960s. The Park is also located in an area that may have been impacted by the former Asarco Smelter plume as well as aerial deposition from other nearby industrial properties.

From 2014 through 2021 upland soil samples and beach sediment samples were collected to characterize the nature and extent of contamination at the Site and to guide decisions regarding Park redevelopment. Surface soil and subsurface soil samples collected at the site contained elevated concentrations of arsenic and lead that exceeded the Washington State Model Toxics Control Act (MTCA) Method A cleanup level (CUL) for unrestricted land use (Ecology 2013b).and Site screening levels (SSLs) for soil listed in Table 1 in the Work Plan Summaries of historical investigations completed at the Site are included in Section 3 of the Work Plan.

In 2021, soil samples were collected on land immediately adjacent to the north of the two main Park parcels (land managed by the Port of Seattle) by a consultant for Ecology. Sampling results had elevated concentrations of arsenic, as well as antimony, lead and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) that exceeded preliminary screening levels (PSLs) for human health direct contact. Concentrations of copper, selenium, and zinc exceeded the Terrestrial Ecological Evaluation (TEE) CUL for protection of wildlife, plants, and soil biota. In addition, concentrations of butyl benzyl phthalate, diethyl phthalate, and dimethyl phthalate in one surface soil sample exceeded the MTCA CUL for erosion of soil to sediment (Leidos 2021).

Based on that sampling and information reviewed for immediately adjacent properties, the following potential contaminants of concern (COCs) in soil, sediment, groundwater, and surface water include:

- Metals: antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc
- Polycyclic aromatic hydrocarbons (PAHs) and including cPAHs
- Bis(2-ethylhexyl) phthalate, butyl benzyl phthalate, diethyl phthalate, and dimethyl phthalate;
- Polychlorinated biphenyls (PCBs).

# 3. PROJECT TEAM AND RESPONSIBILITIES

Investigation activities for the Duwamish Waterway Park RI will include: (1) project planning and agency coordination, (2) field sample collection, (3) laboratory preparation and analysis, (4) data evaluation and quality assurance/quality control (QA/QC) review, and (5) a draft and final data report. Initial staffing and responsibilities are outlined below that may change through the course of the project.

## 3.1. PROJECT PLANNING AND COORDINATION

The SPR Project Manager and Technical Lead will be Ms. Jean H. Lee. The Project Manager is responsible for all technical aspects of the contract and coordinates the contract administration. The Project Manager ensures the technical requirements of the contract are met, monitors contract performance and maintains communication with the Consultant. Ms. Lee will also review the regulatory requirements with the Consultant to ensure that they are met. She also will assist in technical matters related to the sampling plan and program and will provide review comments to the Consultant.

**SPR Project Manager and Technical Lead**

Ms. Jean H. Lee
300 Elliott Avenue West, Suite 100, Box 17
Seattle, WA 98119
206-256-5951
jeanh.lee@seattle.gov

The consultant, Herrera Environmental Consultants, Inc. (Herrera), is responsible for SAP preparation, field sampling, and reporting. George Iftner will serve as the Consultant Project Manager for Herrera, and will be responsible for coordinating project activities and submitting deliverables to SPR. Any significant deviation from the approved sampling plan will be coordinated with the SPR Project Manager. He will also serve as the Principal Investigator for Herrera and will be responsible for the overall quality control of the project.

Mr. Iftner will direct the field sampling program. He will conduct field collection of soil, groundwater and seep, surface water, and sediment grab samples, coordinate drilling and equipment logistics, ensure conformance to the sampling and handling requirements, maintain the field log, and schedule personnel and subcontractor services. Mr. Iftner will also serve as the Site Safety Officer (the Health and Safety Plan is provided as Attachment A). A drilling contractor will be responsible for completing temporary push-probe borings and facilitating the collection of soil and groundwater samples.

**Consultant Project Manager/Principal Investigator**

Mr. George Iftner
2200 Sixth Avenue, Suite 1100
Seattle, WA 98121
206-787-8210
giftner@herrerainc.com

Mr. Rob Zisette of Herrera will serve as the Quality Control Supervisor for Herrera and will be responsible for overall quality control of all project activities. Rob Zisette will also serve as the Data Quality Control Manager to provide laboratory coordination, QA/QC oversight of analytical laboratory procedures, data review and management coordination, and assurance that reported data are valid and usable in accordance with this SAP.

**Quality Control Supervisor**

Mr. Rob Zisette
2200 Sixth Avenue, Suite 1100
Seattle, WA 98121
206-787-8262
rzisette@herrerainc.com

Ms. Gina Catarra of Herrera will serve as the Data Quality Reviewer to provide EPA Level 2 validation and QA1 validation (for sediment samples) in accordance with the SAP objectives and procedures.

**Data Quality Reviewer**

Ms. Gina Catarra
2200 Sixth Avenue, Suite 1100
Seattle, WA 98121
206-441-9080
gcatarra@herrerainc.com

Mr. David Baumeister of OnSite Environmental, Inc., in Redmond, Washington, will serve as the Analytical Laboratory Project Manager, and will be responsible for the testing and reporting of all conventional and chemical analytes.

**Analytical Laboratory Project Manager**

David Baumeister
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14648 Northeast 95th Street
Redmond, WA 98052
425-883-3881
dbaumeister@onsite-env.com

# 4. SAMPLING PLAN

This section describes the samples that will be collected at some or all of the three main areas that comprise the Site: the Central Meadow (includes the Playground Area), the Northeast Meadow, and the Beach Area. The following samples of soil, sediment, groundwater (including seeps), and surface water will be collected for laboratory analysis during the field investigation activities:

- Surface soil and subsurface soil samples from push-probe borings completed with a geoprobe drill rig at seven locations up to 15 feet deep within the Central Meadow and Northeast Meadow.

- Subsurface sediment grab samples from 0 to 45 centimeters [cm] bgs at seven locations within the Beach Area.

- Groundwater samples from three temporary wells installed using the geoprobe drill rig at three of the boring locations: two within the Central Meadow, and one within the Northeast Meadow.

- Seep grab samples at two locations along the upper beach area; samples collected twice during two separate storm events at low tide concurrent with the surface water samples.

- Surface water (as stormwater flow) grab samples at the catch basin adjacent to the dispersion trench; samples collected twice during two separate storm events at low tide concurrent with the seep grab samples.

Table 4-1 provides a summary of the sample locations, sample types, sample numbers, and analytical requirements.

| Table 4-1. Sampling and Analysis Plan for the Duwamish Waterway Park Site. | | | |
|---|---|---|---|
| **Sample Type** | **Sample Location** | **Number of Samples** | **Sample Analysis** |
| Surface soil – push probe grab | Seven push probe locations throughout Central and Northeast Meadows | 8: One soil sample from 0–6 inches bgs in 7 borings, plus 1 duplicate | Total metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), PAHs, and phthalates. Up to three PCB samples based on soil observations (staining, etc.). |
| Subsurface soil – push probe grab | Seven push probe locations throughout Central and Northeast Meadows | 15: One soil sample from the 2–5-foot interval in 7 borings and one soil sample from the 5–10-foot or 10–15-foot interval (depending on site conditions) in 7 borings, plus 1 duplicate | Total metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), PAHs, and phthalates. Up to three PCB samples based on soil observations (staining, etc.). |
| Subsurface sediment – grab | Seven locations along the Beach Area at low tide | 8: One sediment sample from 0–45 cm (0–18 inches) bgs at 7 locations plus 1 duplicate | Total metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), PCB aroclors, PAHs, phthalates, grain size, and TOC |
| Groundwater – push probe grab | Two push probes completed in Central Meadow and one push probe completed in Northeast Meadow | 3: One water sample from 3 borings | Total and dissolved metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), PCB aroclors, PAHs, and phthalates. |
| Groundwater – seep grab | Two seeps along the Beach Area, adjacent to and distant from stormwater trench | 8: Four water samples from two seep locations collected twice >1 hour apart during two storm events | Total and dissolved metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), PAHs, and phthalates. PCBs only if detected in soil and groundwater samples. |
| Surface water – grab | One catch basin at stormwater trench inflow at north end of Central Meadow | 5: One water sample from the catch basin collected twice >1 hour apart during two storm events (concurrent with seeps) plus 1 duplicate | Total and dissolved metals (Ag, As, Cd, Cu, Hg, Pb, Sb, Se, Zn), PCB aroclors, PAHs, and phthalates. PCBs only if detected in soil and groundwater samples. |

[a] Total metals include: Ag (silver), As (arsenic), Cd (cadmium), Cu (copper), Hg (mercury), Pb (lead), Sb (antimony), Se (selenium), and Zn (zinc).

PAHs = polycyclic aromatic hydrocarbons

PCB aroclors = polychlorinated biphenyls as aroclors

Phthalates include: bis(2-ethylhexyl) phthalate; butyl benzyl phthalate; diethyl phthalate; dimethyl phthalate; di-n-butyl phthalate; and di-n-octyl phthalate.

## 4.1. Field Work and Sample Collection Methods

Soil, sediment, groundwater and seeps, and surface water sample collection methods are described in the following subsections and the proposed sampling locations are depicted on Figure 2. Sample types, containers, holding times, preservation, and storage requirements are summarized in Table 4-2.

**Table 4-2. Data Quality Objectives, Sample Containers, Preservation, and Holding Times.**

| Parameter | Units | Detection Limits | Accuracy (percent) | Precision (percent) | Method Number[a] | Bottle/ Preservative | Maximum Holding Time |
|---|---|---|---|---|---|---|---|
| **Soil/Sediment** | | | | | | | |
| **Metals** | | | | | | | |
| Antimony | mg/kg | 5.0 | 75–125 | 20 | 6010D | 8 oz. WMG[b]/ Cool to <6°C | 180 days |
| Arsenic | | 2.5 | 75–125 | 20 | 6010D | | |
| Cadmium | | 0.50 | 75–125 | 20 | 6010D | | |
| Copper | | 1.0 | 75–125 | 20 | 6010D | | |
| Lead | | 5.0 | 75–125 | 20 | 6010D | | |
| Selenium | | 10 | 75–125 | 20 | 6010D | | |
| Silver | | 0.5 | 75–125 | 20 | 6020B | | |
| Zinc | | 2.5 | 75–125 | 20 | 6010D | | |
| Mercury | | 0.25 | 75–125 | 20 | 7471B | | 28 days |
| **Organic Compounds** | | | | | | | |
| PAHs | µg/kg | 0.0067 | 23–143 | 41% | 8270E/SIM | 8 oz. WMG[b]/ Cool to <6°C | 14 days to extract, 40 days to analyze |
| Phthalates[c] | | 0.033–0.17 | 38–139 | 32 | 8270E | | |
| PCBs (Aroclors) | mg/kg | 0.05 | 62–129 | 20% | 8082 | | |
| **Sediment** | | | | | | | |
| Grain size[d] | Percent | 0.1 | NA | 20 | ASTM D422 | 16 oz. WMG/ Cool to <6°C | 180 days |
| TOC | | 0.042 | 80–120 | 20 | 9060A | 8 oz. WMG/ Cool to <6°C | 14 days |
| **Groundwater (including seeps) and Surface Water** | | | | | | | |
| **Total Metals** | | | | | | | |
| Antimony | µg/L | 5.5 | 75–125 | 20 | 200.8 | 500 mL HDPE/$HNO_3$, cool to <6°C | 180 days |
| Arsenic | | 5.0 | 75–125 | 20 | 200.8 | | |
| Cadmium | | 4.4 | 75–125 | 20 | 200.8 | | |
| Copper | | 11 | 75–125 | 20 | 200.8 | | |
| Lead | | 1.1 | 75–125 | 20 | 200.8 | | |
| Selenium | | 5.6 | 75–125 | 20 | 200.8 | | |
| Silver | | 11 | 75–125 | 20 | 200.8 | | |
| Zinc | | 56 | 75–125 | 20 | 200.8 | | |
| Mercury | | 0.025 | 75–125 | 20 | 7470A | | 28 days |
| **Dissolved Metals** | | | | | | | |
| Antimony | µg/L | 5.0 | 75–125 | 20 | 200.8 | 500 mL HDPE/$HNO_3$, cool to <6°C Field filtered with 0.45 micron filter | 180 days |
| Arsenic | | 3.0 | 75–125 | 20 | 200.8 | | |
| Cadmium | | 4.0 | 75–125 | 20 | 200.8 | | |
| Copper | | 10 | 75–125 | 20 | 200.8 | | |
| Lead | | 1.0 | 75–125 | 20 | 200.8 | | |
| Selenium | | 5.0 | 75–125 | 20 | 200.8 | | |
| Silver | | 10 | 75–125 | 20 | 200.8 | | |
| Zinc | | 50 | 75–125 | 20 | 200.8 | | |
| Mercury | | 0.025 | 75–125 | 20 | 7470A | | 28 days |

| Table 4-2 (continued). Data Quality Objectives, Sample Containers, Preservation, and Holding Times. | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Units** | **Detection Limits** | **Accuracy (percent)** | **Precision (percent)** | **Method Numbera** | **Bottle/ Preservative** | **Maximum Holding Time** |
| **Groundwater (including seeps) and Surface Water (continued)** | | | | | | | |
| **Organic Compounds** | | | | | | | |
| PAHs | µg/L | 0.010–0.10 | 29–131 | 50 | 8270E/SIM | 1 x 1 L AG/ Cool to <6°C | 7 days to extract, 40 days to analyze |
| Phthalates[c] | | 1.0–5.0 | 20–143 | 50 | 8270E | | |
| PCBs | | 0.050 | 80–119 | 20% | 8082 | 1 x 1 L AG/ Cool to <6°C | |

[a] Method numbers and analytical methods are from USEPA 1986 (6010, 7470, 7471, 8082, 8270, 9060).

[b] One 8-oz jar will be collected for metals, SVOCs, and PCBs.

[c] Phthalates include: bis(2-ethylhexyl) phthalate; butyl benzyl phthalate; diethyl phthalate; dimethyl phthalate; di-n-butyl phthalate; and di-n-octyl phthalate.

[d] Grain size analysis will be subcontracted out by OnSite Environmental.

°C = degrees Celsius

AG = amber glass bottle

HDPE = high-density polyethylene

HNO3 = nitric acid

mg/kg = milligrams per kilogram

µg/kg = micrograms per kilogram

µg/L = micrograms per liter

PAHs = polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

TOC = total organic carbon

WMG = wide-mouth glass jar

### 4.1.1. Pre-Drilling Activities

Prior to commencing drilling activities, Underground Utility Location Service (UULS) will be notified of the intent to drill the probes. UULS will contact participating agencies or companies with underground utilities in the area. These utility companies will mark the locations of their utility lines and equipment along the property boundary. A private utility locate service will be retained to locate underground utilities at each proposed boring location. Herrera will also coordinate with SPR to locate and mark the locations of irrigation lines prior to drilling. Drill site conditions will be photo documented prior to beginning drilling. Wooden blocks will be placed adjacent to concrete curbs for access if needed to avoid damaging the curb.

### 4.1.2. Soil Sample Collection from Push-Probe Borings

A total of seven (7) push-probe borings will be completed to 15 feet bgs at locations shown on Figure 2 and depicted as SB-1 through SB-7. The boring locations have been selected to close data gaps by analyzing samples for the wider range of COCs listed above that were identified

during previous investigations on and adjacent to the Site. The boring locations and samples will help better describe subsurface soils throughout the Site, including the boundary between fill material versus native soils. The GPS coordinates of each probe boring location will be recorded and photographs of each soil sample will be provided in a photographic log.

A surface soil sample will be collected at each boring location from 0 to 6 inches bgs to characterize soils for human health risk and potential exposures by terrestrial ecological receptors. To characterize deeper soils down to the 15-foot bgs MTCA standard Point of Compliance for soils, two subsurface soil samples will also be collected at each boring. A 1-foot-long subsurface soil sample will be collected from the 2- to 5-foot depth interval and a second 1-foot-long sample will be collected from the 5- to 10-foot or 10- to 15-foot interval. The specific samples depths selected will be determined by the field geologist to characterize potential contamination based on field observations of soil discoloration (e.g., staining), sheen, or odors. Groundwater samples also will be collected from three of the borings as described in Section 4.1.3.

Push-probe borings will be advanced using a probe-drive sampler attached to driven probe rods. During drilling, discrete soil samples for soil classification, field screening, and chemical analysis will be collected continuously at 5-foot intervals using a probe-drive sampler 5 feet long by 2 inches outside diameter and lined with dedicated clear Lexan® liners. The sampler will be sealed with a piston stop pin while being pushed or driven to the desired sampling depth. The piston stop pin will be retracted into the sampler while the sampler is pushed or driven to obtain a soil sample.

Following retrieval, the soil-filled Lexan® liner will be removed from the sampler and cut open to expose the soil core. Soil encountered during drilling will be visually inspected and classified in accordance with the Unified Soil Classification System (USCS; American Society for Testing and Materials [ASTM] D2488-09).

Soil samples will be prepared for chemical analysis by removing soil from the liner and placing soil into a decontaminated stainless-steel mixing bowl. The samples will be homogenized with a spoon, and aliquots will be placed directly into jars provided by the analytical laboratory. Each sample will be uniquely labeled denoting sample identification number and depth, date and time sampled, and job number. Soil samples will then be placed into a chilled cooler for storage prior to delivery to the analytical laboratory.

### 4.1.3. Groundwater Sample Collection from Push-Probe Borings

Groundwater samples will be collected from temporary wells installed at three push-probe borings depicted as S-1/GW-1, S-8/GW-2 and S-9/GW-3 on Figure 2. Groundwater samples will be collected from probe borings by driving a stainless-steel screened probe to the desired depth, opening the screen, and drawing water via clean dedicated polyethylene tubing connected to a peristaltic pump at the surface. Initial depth to water will be determined by the

field geologist using an electronic water level indicator and based on observations of moisture content and soil texture.

Once the water level has stabilized and after development (approximately 1 to 2 gallons of water purged from each boring), water samples will be collected directly from the tubing into sample containers provided by the laboratory. Samples for dissolved metals analysis will be field filtered using a 0.45-micron high capacity, in-line filter. Immediately upon filling, each container will be securely capped, labeled, and stored in a chilled cooler prior to delivery to the laboratory. Following groundwater collection, each probe borehole will be backfilled from the bottom to ground surface with bentonite chips and capped at the surface with soil.

### 4.1.4. Seep Sample Collection

Seep grab samples will be collected during two separate events at the two locations depicted as SP-1 and SP-2 on Figure 2. Actual seep locations will be adjusted in the field based on flow rates observed to collect water from the highest flowing seeps. The SP-1 location will target drainage from the dispersion trench from the catch basin and the SP-2 location will target groundwater seepage from east of the trench towards the Northeast Meadow. Two samples will be collected at each location during each event at least 1 hour apart.

Seep sampling will be conducted the same day as the surface water grab sampling described in Section 4.1.5. Seep samples will be collected during or immediately after a rainfall event at a low tide (less than +6 feet MLLW). Ideally, the actual seeps sampled in the field will be discharging at a rate greater than 1.0 gallon per minute (gpm), which is a practical minimum flow necessary for representative seep sampling. Each seep location in the field will be physically described in a field log book, photographed, and recorded using a global positioning system (GPS) instrument. The presence of iron-stained sediments, odor, turbidity, or other unusual conditions associated with the seepage will be described in field notes. Seep discharge rates will be measured using the bucket and stopwatch method at a location immediately downstream of the water sampling location.

Seep water samples will be collected with a peristaltic pump using the US EPA (1996b) clean technique that follows a clean-hands and dirty-hands protocol for low-level detection of metals in water samples. Accordingly, the laboratory will provide clean sample bottles for metals analyses as required by the analytical method, and place each bottle into two resealable plastic (Ziploc) bags for transport to the site. Both individuals of the sampling team will wear Tyvek suits and use powder-free nitrile gloves to reduce the potential for sample contamination.

A pre-cleaned collection vessel will be used to prevent disturbance of the sediments by the pump tubing. The collection vessel will consist of a decontaminated, wide-mouth, 250-milliliter sample bottle that has a small opening on one side of the bottom. The bottle will be carefully placed on its side in the seep channel with the mouth oriented upstream and the bottom opening oriented upwards. Polyethylene peristaltic pump tubing will be inserted into the bottom opening where water is withdrawn as it flows into and through the bottle at a depth of

approximately 4 centimeters (cm). Prior to the sampling event, new pump tubing will be prepared by connecting a 2-foot section and a 7-foot section of 1/4-inch-diameter polyethylene tubing to either end of an 18-inch section of medical-grade silicone tubing. All sample tubing and filters will be pre-cleaned by the analytical laboratory in accordance with the method for low-level metals sampling (EPA Method 1669) (EPA 1996b).

Prior to sample collection, a calibrated field instrument (YSI Pro-DSS model) will be used to take field measurements for the following parameters:

- Temperature
- Dissolved oxygen
- pH
- Conductivity
- Salinity
- Turbidity

Field measurements of temperature, dissolved oxygen, pH, conductivity, and salinity shall exhibit no more than a 10 percent difference between the final two measurements.

To collect samples for laboratory analysis, the following sequence will be performed by the clean-hands person and the dirty-hands person:

- Install the seep collection vessel in the seepage (clean hands).
- Set up the peristaltic pump (dirty hands).
- Open pump tubing bag (dirty hands).
- Remove pump tubing from bag (clean hands).
- Insert the silicon pump tubing into the peristaltic pump (dirty hands).
- Insert the intake end of the polyethylene tubing (7-foot length) into the seep collection vessel and the discharge end of the polyethylene pump tubing (2-foot length) into the field meter flow cell (clean hands).
- Turn the peristaltic pump on to a maximum flow rate (approximately 0.2 gpm) and record field measurements (see below) every 3 minutes on at least three occasions (dirty hands).

- Collect samples for total metals and all other unfiltered parameters as follows:
    - Remove the double-bagged sample bottle from cooler and unseal outer and inner bags containing sample bottle (dirty hands).
    - Remove bottle and unscrew cap (clean hands).
    - Rinse bottle and cap three times with filtered sample and fill sample bottle (clean hands).
    - Return sample bottle to inner bag (clean hands).
    - Reseal inner and outer bag, and return double-bagged sample to cooler (dirty hands).
- Collect samples for dissolved metals as follows:
    - Insert discharge end of tubing into new, in-line, 0.45-micron, high-capacity filter (clean hands).
    - Discard the initial 250 mL of filtrate prior to dissolved metals sample collection.
    - Remove the double-bagged dissolved copper and zinc sample bottle from cooler and unseal outer and inner bags containing sample bottle (dirty hands).
    - Remove bottle and unscrew cap (clean hands).
    - Rinse bottle and cap three times with filtered sample and fill sample bottle (clean hands).
    - Return sample bottle to inner bag (clean hands).
    - Reseal inner and outer bag, and return double-bagged sample to cooler (dirty hands).

The samples will be delivered to the analytical laboratory on the day of collection or stored overnight at 4°C and delivered in a cooler with ice to the laboratory on the following day.

### 4.1.5. Surface Water Sample Collection

Surface water grab samples will be collected during three separate events at one location, the upland catch basin depicted as SW-1 on Figure 2. The catch basin sample will characterize Site surface water collected from the Central Meadow area before it discharges to the dispersion trench. Samples will be collected during or immediately after a rainfall event the same day that seep samples are collected. Samples will be collected using a peristaltic pump and dedicated polyethylene and silicone tubing directly into sample containers provided by the analytical

laboratory in accordance with the method for low-level metals sampling (EPA Method 1669) (EPA 1996b) described above for seep sampling. Samples for dissolved metals analysis will be field filtered using a 0.45-micron, high-capacity in-line filter. Immediately upon filling, each container will be securely capped, labeled, and stored in a chilled cooler prior to delivery to the laboratory.

### 4.1.6. Sediment Sample Collection

Surface sediment samples will be collected from 0 to 45 cm bgs at seven locations depicted as DS-1 through DS-7 on Figure 2. The samples will be collected during a low tide (less than +4 feet MLLW). To collect each sample, a 4-inch-diameter Lexan core tube will be covered with a loosely fitted cap to protect the sample from contamination while allowing air release, and then pounded into the sediment with a rubber mallet. Once a depth of 45 cm bgs or greater is reached, the core tube cap will be sealed to retain suction, surrounding sediment will be removed with a shovel to cap the tube bottom, and the core tube will pulled out of the ground. The core will be placed on a clean sheet of foil where it will be cut open, recovery depth will be measured, and contents photographed.

Observations of sediment texture, color, discoloration or odors, etc. along the length of the core will be noted in a field logbook. The core location will be recorded with a GPS unit. The entire sample (0 to 45 cm), excluding any material in contact with the core tube wall or greater than 2 cm in size, will be placed into a decontaminated stainless-steel bowl and thoroughly homogenized using a decontaminated stainless-steel spoon before scooping aliquots into sample containers provided by the analytical laboratory.

### 4.1.7. Sample Identification

The following sample identification codes will be used for project samples:

- Soil samples will be identified as S-1-DD through S-7-DD, with the "DD" digits reflecting the depth the sample was collected from as either 0 (0 to 6 inches bgs), 5 (collected within the 2- to 5-foot interval), 10 (collected within the 5- to 10-foot interval, or 15 (collected within the 10- to 15-foot interval).

- Groundwater samples will be identified as GW-1 through GW-3.

- Seep samples will be identified as SP-1-A or B or SP-2-A or B, with the "A" or "B" digit reflecting whether the sample is the first or second sample collected at the designated location during the sampling event.

- The surface water sample will be identified as SW-1.

- The sediment samples will be identified as DS-1 through DS-7.

Sample labels will be protected by packaging tape wrapped around the entire jar to prevent loss or damage of the labels during handling and storage.

### 4.1.8. Sample Storage and Delivery

All sample containers will be stored in insulated coolers and preserved by cooling with ice or frozen gel-packs. Maximum sample holding and extraction times will be strictly adhered to by field personnel and the analytical laboratories. Sample containers will be placed in plastic bubble-pack bags or wrapped in bubble pack and secured with packaging tape. The cooler will be sealed with strapping tape and a custody seal.

Samples for chemical analyses will be hand-carried to the analytical laboratory at the completion of the sampling event and accompanied by the chain-of-custody record, which identifies the cooler contents. The chain-of-custody form will be signed by the individual relinquishing samples to the laboratory.

### 4.1.9. Field Documentation

A complete record of field activities will be maintained. Documentation necessary to meet QA objectives for this Project include field notes and field forms, sample container labels, and chain-of-custody forms. The field documentation will provide descriptions of all sampling activities, sampling personnel, and weather conditions, and will record all modifications, decisions, and/or corrective actions to the study design and procedures. In addition, photographs of the grab samples will be included in the field documentation.

### 4.1.10. Field Logbooks

A field logbook will be kept on site during field operations. Daily activities will be recorded in a bound field logbook of water-resistant paper. All entries will be made legibly, in indelible ink, and will be signed and dated. Information recorded will include the following:

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

Field logbooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occur during Project field activities. Entries should be factual, detailed, and objective. Unless restricted by weather conditions, all original data recorded in field logbooks and on sample identification labels, chain-of-custody records, and field forms will be

written in waterproof ink. If an error is made, the individual responsible may make corrections simply by crossing out the error and entering the correct information. The erroneous information should not be obliterated. All corrections must be initialed and dated. All documentation, including voided entries, must be maintained within Project files.

### 4.1.11. Chain-of-Custody Procedures

Samples will be retained at all times in the field crew's custody until samples are delivered to the laboratory by Herrera personnel. Chain-of-custody forms will be initiated at the time of sample collection to ensure that all collected samples are properly documented and traceable through storage, transport, and analysis. Information tracked by the chain-of-custody records will include sample identification, date and time of sample collection and receipt, and analyses required. When all line items on the form are completed or when the samples are relinquished, the sample collection custodian will sign and date the form, list the time, and confirm the completeness of all descriptive information contained on the form. Each individual who subsequently assumes responsibility for the samples will sign and date the chain-of-custody form.

The field chain-of-custody terminates when the laboratory receives the samples. The field sample custodian should retain a copy of the completed, signed chain-of-custody form(s) for Project files. Upon receipt of samples at the laboratories, the shipping container seal will be broken and the receiver will record the condition of the samples. The laboratories will maintain chain-of-custody internally to track handling and final disposition of all samples.

## 4.2. Equipment Decontamination Procedures

Sample processing equipment (i.e., spoons, bowls, and reusable containers from which samples are transferred to sample jars) will be washed with a laboratory-grade detergent (e.g., Liquinox) and water solution, and then rinsed with distilled water prior to field operations. Decontaminated equipment will be wrapped or covered with aluminum foil. If dedicated sampling equipment is not used, equipment will be decontaminated before use in order to prevent cross contamination of samples. All decontamination water will be contained in 5-gallon buckets for disposal. Any deviations from these procedures will be documented in the field notebook.

Personal non-disposable field equipment (e.g., boots and waterproof gloves and garments) will be rinsed with water and brushed clean prior to leaving the immediate vicinity of the sample collection area. Special attention will be given to removing mud and sediments that may adhere to boot treads.

## 4.3. WASTE DISPOSAL

Two types of investigation-derived waste will be generated during the activities described in this work plan:

- Soil, sediment, and groundwater not submitted to the laboratories
- Disposable protective clothing and supplies.

Excess soil from geoprobe sampling in upland areas will be placed in a 30-gallon drum provided by the driller. The drum will be labeled to indicate the contents as non-hazardous waste, date and location of collection, contact information, and the drum will be stored on site until the laboratory analytical results are received to determine appropriate disposal at a licensed facility off site (e.g., a Subtitle D or C landfill). Excess sediment from sampling will be disposed in a separate 30-gallon drum. As with the excess soils drum, the sediment drum will be labeled and stored on site until proper disposal can be arranged off site at an approved facility. Excess groundwater generated while sampling from temporary wells installed in geoprobe borings will be placed in a separate 30-gallon drum. The drum will be labeled and stored on site until proper disposal can be arranged off site at an approved facility.

Used personal protective equipment (PPE) such as disposable gloves and supplies (e.g., paper towels and packaging) will be placed in plastic storage bags and disposed of as municipal waste. If PPE contains residual sediment, it will be decontaminated using the procedures outlined in Section 3.7 and then disposed of as non-hazardous material. Recyclable waste material (e.g., cardboard, aluminum) will be recycled, as feasible.

## 4.4. LABORATORY ANALYSES

Mr. David Baumeister of OnSite Environmental, Inc., in Redmond, Washington, will serve as the Analytical Laboratory Project Manager, and will be responsible for the testing and reporting of all conventional and chemical analytes. The analytical laboratory will handle and analyze the submitted samples in accordance with EPA-approved methods and Sediment Management Standards (SMS) and Puget Sound Estuary Protocols (PSEP) methods (see Section 5 – Laboratory Methods). The analytical laboratory report and QA/QC results will be included as appendices in the final data report.

**Analytical Laboratory Project Manager**

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## 4.5. QA/QC MANAGEMENT

Rob Zisette of Herrera will serve as the Consultant Quality Control Supervisor for Herrera, and will be responsible for overall quality control of all project activities. Rob Zisette will also serve as the Data Quality Control Manager to provide laboratory coordination, QA/QC oversight of analytical laboratory procedures, data review and management coordination, and assurance that reported data are valid and usable in accordance with this SAP. George Iftner of Herrera will be responsible for QA/QC management of the field sampling, sample processing, and reporting elements of the project. The SPR Project Manager will be notified immediately of any activities that vary from the written SAP. Ms. Gina Catarra of Herrera will serve as the Data Quality Reviewer to provide EPA Level 2 validation in accordance with the SAP procedures and SMS protocols.

## 4.6. REPORTING

Herrera will prepare data tables and figures for all data collected, describe the field investigation work and any deviations from the SAP, and summarize and analyze the results within the revised RI report. The RI will also include an analysis of the data collected and updates to the Conceptual Site Model (CSM). All laboratory data and a data validation memo will be included as an appendix to the RI. The RI and data validation memo will cover all of the following:

- Field sampling methods, including a summary of sampling, chemical testing, biological testing (if required), and QA/QC procedures
- Any deviations from the SAP
- Sample locations depicted in figures and tables
- Laboratory analyses conducted for each sample
- Chemistry results with both laboratory and data validation qualifiers
- A summary of QA/QC data, including data validation results
- Interpretation and comparison of results to Site Screening Levels and SMS screening criteria in tabular format

# 5. LABORATORY METHODS

All chemical analytical testing procedures used in this Project will be performed in accordance with EPA-approved methods, and SMS and PSEP guidelines for sediment. The laboratory analysis for sediment will be consistent the Sediment Cleanup User's Manual (Ecology 2021). The laboratory participating in this Project (OnSite Environmental, Inc.) is accredited by Ecology for all analytical methods (with the exception of grain size) to be used for this Project, and has instituted internal QA/QC plans accordingly. Grain size analysis will be subcontracted to AmTest Laboratories in Kirkland, Washington, which is accredited by Ecology for the grain size analytical method. Analyses will be required to conform to accepted standard methods and internal QA/QC checks prior to final approval.

## 5.1. ANALYTICAL METHODS

Soil, sediment, groundwater and seeps, and surface water samples will be submitted to OnSite Environmental, Inc. located in Redmond, Washington for chemical analyses. The specific analyses and conventional parameters to be measured, analytical methods, and target reporting limits (RLs) are presented in Table 4-2. Actual sample RLs may vary due to analytical dilutions, percent solids, sample volumes used for analysis, and matrix interferences.

### 5.1.1. Detection Limits and Sample Analysis Scenarios

The samples collected for characterization will be analyzed for the parameters listed in Table 4-2. Laboratory RLs for all COCs are below PSLs. All reasonable means, including additional cleanup steps and method modifications, will be used to achieve sample RLs at or below the associated PSLs.

### 5.1.2. Holding Times

All samples for physical and chemical testing will be maintained at the laboratory at appropriate temperatures and will be analyzed prior to the expiration times specified in Table 4-2.

### 5.1.3. Quality Assurance/Quality Control

The chemistry QA/QC procedures summarized in Table 5-1 will be conducted to ensure data quality and usability for sediment characterization.

| Table 5-1. Laboratory QA/QC Requirements for Conventional Parameters and COCs. | | | | |
|---|---|---|---|---|
| **Analysis Type** | **Method Blanks[a]** | **Duplicates[a]** | **MS/MSD[a]** | **Surrogates[b]** |
| Grain size | | X | | |
| Total solids | | X | | |
| Total organic carbon | X | X[c] | X | |
| Metals | X | X[c] | X | |
| PAHs and phthalates | X | X[c] | X | X |
| PCBs | X | X[c] | X | X |

MS/MSD = matrix spike/matrix spike duplicate

[a] Frequency of Analysis (FOA) = 5 percent or one per batch, whichever is more frequent.

[b] Surrogate spikes required for every sample, including all spiked samples and blanks.

[c] Matrix spike duplicate may be used.

## 5.2. Analytical Laboratory Written Report

Any data qualifiers applied will include descriptions at the time the preliminary data are submitted. Missing information or data not yet reported by the lab will be identified as such.

Reports from the chemistry analytical laboratory for this program will be accompanied by sufficient backup data and QC results to enable independent reviewers to evaluate the quality of the data results. Analytical data will be reported in the units specified by the laboratory RLs listed in Table 4-2.

The analytical laboratory deliverables will include the following:

- Case narrative (including any problems encountered, protocol modifications, and/or corrective actions taken)
- Laboratory data qualifiers and a summary of qualifier definitions
- MDLs and RLs for each result
- Sample analytical and QA/QC results with units
- Appropriate method references for all analytical, preparatory, and cleanup methods used during analyses
- Any protocol deviations from the approved sampling plan
- Surrogate recovery results and control limits
- Matrix spike/matrix spike duplicate (MS/MSD) results and control limits

- Laboratory duplicate/triplicate results and control limits
- Method blank and instrument blank results
- Sample custody records (including original chain-of-custody forms)
- Analytical results in an electronic data delivery format

## 5.3. INDEPENDENT DATA VALIDATION

All chemistry and conventional parameter data generated as part of this investigation will undergo an EPA Level 2B quality assurance review by Herrera. An EPA Level 2B review represents a level of quality assurance review acceptable for most contaminated site and sediment investigations conducted under MTCA or SMS. If data quality concerns are noted, the laboratory will be contacted; and the data will be reanalyzed, qualified, and/or discussed in a data validation checklist. The data validation memorandum will be included as an appendix to the data report.

The analytical laboratory will provide EPA Level 4 chemistry data packages that will allow for the examination of the complete analytical process from calculation of instrument and MDLs, RLs, final dilution volumes, sample size, and wet-to-dry ratios to quantification of calibration compounds and all analytes detected in blanks and environmental samples.

# 6. QUALITY ASSURANCE AND QUALITY CONTROL METHODS

The purpose of Project QA/QC is to provide confidence in the data results through a system of quality control performance checks with respect to data collection methods, laboratory analysis, data reporting, and appropriate corrective actions to achieve compliance with established performance and data quality criteria. This section presents the QA/QC procedures to ensure that the investigation data are defensible and usable for their intended purpose.

## 6.1. MEASUREMENTS OF DATA QUALITY

The tolerable limits for the data reported by the laboratory will be measured through precision, accuracy, representativeness, completeness, and comparability. Acceptance criteria for COCs are presented in Table 4-2.

### 6.1.1. Precision

Precision is a measure of mutual agreement among individual measurements of the same property under prescribed conditions. Precision will be assessed by the analysis of lab duplicates (for conventional parameters and metals) and MS/MSDs (for organics) performed on select samples to determine the reproducibility of the measurements. The relative percent difference (RPD for duplicates)will be compared to the precision objectives listed in Table 4-2.

### 6.1.2. Accuracy

Accuracy is the degree of agreement of a measurement (or an average of multiple measurements), with an accepted reference or true value, usually expressed as the difference between the two values (measured-true), the difference as a percentage of the true value, or as a ratio. Accuracy is a measure of the bias in the system and is expressed as the percent recovery of spiked (matrix or surrogate spike) samples. Accuracy objectives for the percent recovery of matrix spike samples are listed in Table 4-2. Laboratory control will be analyzed with each batch of samples as a further assessment of analytical accuracy in the absence of matrix effects.

### 6.1.3. Representativeness

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

### 6.1.4. Completeness

Completeness refers to the number of valid (i.e., not rejected) data points (i.e., all individual parameter results) achieved divided by the total number of data points expected. For this Project, completeness objectives have been established at 95 percent.

### 6.1.5. Comparability

Comparability is based on the use of established EPA-approved methods for the analysis of the selected parameters. The quantification of the analytical parameters is based on published methods, supplemented with well-documented procedures used in the laboratory to ensure reproducibility of the data.

## 6.2. QA/QC Samples for Chemical Analysis

Field and laboratory QA/QC samples will be used to evaluate the data precision, accuracy, representativeness, and comparability of the analytical results.

### 6.2.1. Field QA/QC Samples

One blind homogenate split (field split) will be collected from one station for all media at the same time as the original sample using identical sampling techniques. Field split results are used to assess the combined precision of the sample collection process and laboratory analysis. One field split sample will be collected and analyzed for all chemicals and conventional parameters. The field split will be designated for the same analyses as the original sample and will be submitted to the laboratory blind with no indication of the associated sample.

### 6.2.2. Laboratory QA/QC Samples

Laboratory QA/QC samples will consist of method blanks, lab duplicates, MS/MSD pairs, and surrogate compounds. The results of these laboratory QA/QC samples will provide information on the accuracy and precision of the chemical analysis, and will be used to verify that the measured concentrations are acceptable. The specific laboratory QA/QC samples to be analyzed are provided in Table 5-1, which will be analyzed for every 20 samples submitted or for each analytical batch of samples.

# 7. REPORTING

Herrera will prepare a data validation memorandum that summarizes the activities associated with collection, transportation, and chemical analyses of soil, sediment, groundwater, and surface water samples collected. The data will be incorporated in the RI report and summarized in tables. The report will include and Level 2B data validation memorandum and laboratory reports for chemical testing will be included as appendices. At a minimum, the following will be included in the RI report:

- Summary of sampling, chemical testing, QA/QC procedures, and any deviations from the approved SAP
- Figures depicting the sampling locations
- Table(s) with sampling location coordinates and sampling information
- Table(s) with analytical results for chemical and conventional testing with both laboratory and validation qualifiers provided (exceedances of SMS criteria will be highlighted)
- A summary of QC data for conventional and chemical testing, including validation results
- Appendices to include daily sampling/processing reports, field notes, sediment logs and photographs, chain-of-custody forms, chemistry data validation QA1 checklists, and the lab report with case narrative
- Results reported in EIM format

# 8. REFERENCES

Anchor QEA. 2016. Sediment Cleanup Action Plan, Seattle Multimodal Terminal at Colman Dock. Prepared for Washington State Ferries by Anchor QEA, LLC, and Herrera Environmental Consultants, Inc., Seattle, Washington. November.

Ecology. 2013a. Sediment Management Standards, Chapter 173-204 WAC. Washington State Department of Ecology, Toxics Cleanup Program, Olympia, Washington. Ecology Publication No. 13-09-055. Revised February 2013. Effective September.

Ecology. 2013b. Model Toxics Control Act Regulation and Statute: MTCA Cleanup Regulation Chapter 173-340. Revised November 2013. Publication No. 94-06.

Ecology. 2021. Sediment Cleanup User's Manual (SCUM): Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC. Washington State Department of Ecology, Toxics Cleanup Program, Olympia, Washington. Ecology Publication No. 12-09-057. December.

NMFS. 2014. Endangered Species Act Section 7 Formal Consultation and Magnuson -Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Seattle Terminal Project, King County, Washington. (HUC 171100190203-Shell Creek-Frontal Puget Sound). National Marine Fisheries Service, Northwest Region, Seattle, Washington. NMFS Tracking No. NWR-2013-9585. March 20.

Plumb, R.H. 1981. Procedures for handling and chemical analysis of sediment and water samples. Technical Report EPA/CE-81-1. US Army Corps of Engineers, Vicksburg, Mississippi.

PSEP. 1986. Recommended Guidelines for Measuring Conventional Sediment Variables in Puget Sound. Prepared for US Environmental Protection Agency, Region 10, Seattle, Washington, by Tetra Tech, Inc., Bellevue, Washington.

PSEP. 1997a. Recommended Guidelines for Measuring Metals in Puget Sound Water, Sediment, and Tissue Samples. US Environmental Protection Agency, Region 10, Seattle, Washington, and Puget Sound Water Quality Action Team, Olympia, Washington.

PSEP. 1997b. Recommended Guidelines for Measuring Organic Compounds in Puget Sound Sediment and Tissue Samples. US Environmental Protection Agency, Region 10, Seattle, Washington.

PSEP. 1997c. Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound. Prepared by US Environmental Protection Agency, Region 10, Seattle, Washington, for the Puget Sound Estuary Program. April.

PSEP. 1997d. Recommended Quality Assurance and Quality Control Guidelines for the Collection of Environmental Data in Puget Sound. Prepared by US Environmental Protection Agency, Region 10, Seattle, Washington for the Puget Sound Estuary Program. April.

PTI. 1989. Data Validation Guidance Manual for Selected Sediment Variables. Prepared by PTI Environmental Services, Bellevue, Washington. June Draft.

# ATTACHMENT A

## Field Forms (To Be Provided With Final)

# APPENDIX D

# Health and Safety Plan

# DRAFT
# SITE-SPECIFIC HEALTH AND SAFETY PLAN

## DUWAMISH WATERWAY PARK
## REMEDIAL INVESTIGATION

**Prepared for**
**City of Seattle Parks and Recreation**

**Prepared by**
**Herrera Environmental Consultants, Inc.**

HERRERA

**Note:**
Some pages in this document have been purposely skipped or blank pages inserted so that this document will print correctly when duplexed.

# SITE-SPECIFIC HEALTH AND SAFETY PLAN

## DUWAMISH WATERWAY PARK
## REMEDIAL INVESTIGATION

Prepared for
City of Seattle Parks and Recreation
300 Elliott Avenue, Suite 100
Seattle, Washington 98119

Prepared by
Herrera Environmental Consultants, Inc.
2200 Sixth Avenue, Suite 1100
Seattle, Washington 98121
Telephone: 206-441-9080

DRAFT
April 18, 2022

# HEALTH AND SAFETY PLAN REVIEW AND APPROVAL

| | | | |
|---|---|---|---|
| Client: | City of Seattle Parks and Recreation | Site Name: | Duwamish Waterway Park |
| Project Name: | Duwamish Waterway Park Remedial Investigation | Project No.: | 21-07735-000 |
| Start Date: | April 2022 | End Date: | September 2022 |

Plan Expiration Date: December 31, 2022

(Last day of expected fieldwork or no longer than 6 months).

The following individuals have reviewed this Health and Safety Plan and have approved its use for the dates specified.

| | | |
|---|---|---|
| Camryn Steiner | | |
| Plan Completed by | Signature | Date |
| George Iftner | | |
| Project Manager | Signature | Date |
| Rob Zisette | | |
| Corporate Health and Safety Officer | Signature | Date |
| George Iftner | | |
| Site Health and Safety Officer | Signature | Date |

This Health and Safety Plan (HASP) is based on federal (29 Code of Federal Regulations [CFR] Part 1910.120) and state (Chapter 296-843-120 Washington Administration Code [WAC]) regulations, which address practices conducted at sites associated with hazardous substances. This HASP is applicable only to employees of Herrera Environmental Consultants, Inc. Consultants, subconsultants, and contractors other than Herrera working at this jobsite are responsible for the health and safety of their own employees and are required to develop their own HASP. Other contractor personnel, who provide site-specific information, may review this HASP; however, Herrera Environmental Consultants, Inc. assumes no responsibility or liability for the use of this document by other parties.

Due to the potentially hazardous nature of this site and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury at this site. The health and safety guidelines in this HASP were prepared specifically for this site based on site conditions, purposes, dates, and personnel specified, and must be amended if these conditions change. This HASP should not be used on any other site without prior research by trained health and safety specialists.

# CONTENTS

# ATTACHMENTS



# TABLES



# FIGURES

# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ACGIH | American Conference of Governmental Industrial Hygienists |
| As | arsenic |
| CFR | Code of Federal Regulations |
| CO | carbon monoxide |
| COC | contaminants of concern |
| CPR | cardiopulmonary resuscitation |
| CUL | Cleanup Levels |
| DWP | Duwamish Waterway Park |
| HASP | health and safety plan |
| HAZWOP | Hazardous Waste Operations |
| Herrera | Herrera Environmental Consultants, Inc. |
| IDLH | immediately dangerous to life and health |
| LDW | Lower Duwamish Waterway |
| LFC | lowest feasible concentration |
| LOP | levels of protection |
| $mg/m^3$ | milligrams per cubic meter |
| MTCA | Model Toxics Control Act |
| mg/kg | milligrams per kilogram |
| NIOSH | National Institute of Occupational Safety and Health |
| OSHA | Occupational Safety and Health Administration |
| Pb | lead |
| PEL | permissible exposure limit |
| PID | photoionization detector |
| PPE | personal protective equipment |
| ppm | parts per million |
| RAL | remedial action level |
| REL | recommended exposure limit |
| RI | Remedial Investigation |
| SCBA | self-contained breathing apparatus |

| | |
|---|---|
| SHSO | site health and safety officer |
| SPR | City of Seattle Department of Parks and Recreation |
| SSL | Site screening level |
| STEL | short-term exposure limit |
| TLV | threshold limit value |
| TWA | time weighted average |
| WAC | Washington Administrative Code |

# INTRODUCTION

This site-specific health and safety plan (HASP) applies to field work associated with site characterization activities for a Remedial Investigation (RI) at the Duwamish Waterway Park (DWP), a site with documented releases of hazardous substance(s) to the environment. Herrera Environmental Consultants, Inc. (Herrera) expects employees, for company-approved field work or personal use, will follow safety procedures and regulations set forth in this safety plan.

## SAFETY POLICY

Herrera's Safety Policy is that health and safety of the staff is of paramount importance. Activities performed under potentially hazardous conditions shall be acknowledged and planned to mitigate personal injury. Herrera's Safety Policy shall apply during company-approved field work only.

## SITE DESCRIPTION AND SCOPE OF WORK

The City of Seattle Department of Parks and Recreation (SPR) has operated Duwamish Waterway Park since 1975. The original park property, the largest portion of the park, was owned by King County until May 2019 when SPR purchased the property. In approximately 1989, SPR expanded the original park by acquiring the residential property east of the original park near the water (the Northeast Meadow).

Based on review of Sanborn fire insurance maps from 1917 to 1967 and aerial photographs from 1936 to 2015 included in a 2018 Phase I Environmental Site Assessment (ESA), previous uses of the Site appear to have been primarily residential (ECC 2018[1]). The Site appeared largely undeveloped with one residential structure on the northeast corner of the park property near the Duwamish River; this structure first appears in 1936 and was removed from the site in 1989 (Figure 2, located in the *Vicinity Map, Site Map, and Background Information* subsection of the *Site Information* section). Historical documents located in SPR property files indicate that the house was moved from the site and that soil fill material donated by Long Painting was placed on site within the footprint of the former house.

Properties adjacent to the Site were agricultural and residential until more industrial properties appear in the 1950s and 1960s. The Site also may have been impacted by aerial deposition from other nearby industrial properties.

[1] ECC. 2018. Phase I Environmental Site Assessment and Hazardous Materials Survey, Duwamish Waterway Park. Prepared for City of Seattle Parks and Recreation by Eco Compliance Corporation, Seattle, Washington. May 31.

## Previous Sampling

Multiple investigations were previously completed from 2014 through 2021 by SPR to characterize the nature and extent of COCs in soil and sediment. Elevated concentrations of arsenic, lead, and total cPAHs detected in soils throughout the site, and phthalates detected on Port of Seattle managed land on the north end of the park site exceeded MTCA Method A Cleanup Levels (CULs) and Site Screening Levels (SSLs).

Sediment sampling conducted by others within and adjacent to the beach area at the Park detected several metals (arsenic, chromium, lead, and zinc) at concentrations that exceeded the SSLs in one or more samples. Total PCBs exceeded the SSL in one sample collected in 2010 from 0 to 43 centimeters (cm) and several SVOCs exceeded benthic remedial action levels (RALs) or SSLs in samples collected from 0 to 10 cm in 1995, 1998, and 2004. In 2021 sediment samples were collected from several locations at a depth of 0 to 10 cm, and there were only two benthic RAL exceedances of hexachlorobenzene in two samples. Concentrations of three metals (arsenic, copper, and lead) exceeded the SSLs in one sample each. And the reporting limits (RLs) for two phthalate COCs, bis(2-ethylhexyl) phthalate and butylbenzyl phthalate, exceeded the SSLs in four samples.

Characterization of surface water (e.g., stormwater), groundwater and seeps has not yet been performed at this site.

## Scope of the Remedial Investigation

The scope of work for the RI includes collecting soil, sediment, groundwater, surface water and seep samples at the Site to address data gaps to completely characterize the nature and extent (lateral and vertical) of contamination present in all media. To address the soil data gaps, a drilling subcontractor will facilitate the completion of soil borings using a direct-push drill rig to collect surface soil and subsurface soil samples in the Central Meadow and Northeast Meadow for analysis of the COCs. Three groundwater samples will be collected from temporary wells installed at the direct-push soil borings.

Subsurface sediment samples will be collected at the Beach Area during low tide. The samples will be collected from the 0 to 45 cm depth interval and analyzed for relevant sediment management standards conventionals, metals, and organics. Surface water and intertidal seep sampling will be conducted at multiple locations in the Beach Area. The water samples will be analyzed for relevant surface water quality standards for conventionals, metals, and organics.

# Detailed Description of Specific Tasks Planned

List each separate task in order of progression:

| Task | Task Description |
|---|---|
| Task 1 | Collect soil and groundwater samples from push-probe borings/temporary monitoring wells. |
| Task 2 | Collect sediment and surface water/intertidal seep samples from the beach area at low tide. |

# Potential Hazards Associated With Field Tasks

## Potential Chemical Hazards

- Contaminants associated with contaminated soils and fill material.

## Potential Physical Hazards

- Slips, trips, and falls
- Drilling with push probe drill rig
- Overhead or underground utilities
- Motor vehicle driving

## Potential Biological Hazards

- Biting or stinging insects such as spiders, bees, or wasps.

## Hazardous Materials

- Will any hazardous materials (chemicals) be used on site (including decontamination)?

  Yes: ☐ No: ☒

- Will any field work be done on a site with known or suspected release of hazardous materials?

  Yes: ☒ No: ☐

Contaminated soil and sediment have been confirmed at the Site.

## Sewers or Other Areas of Potentially Containing Explosive Gases or Vapors

- Will any field work be done in sewers or other areas containing explosive gas/vapors?

  Yes: ☐ No: ☒

## Interior Work and Confined Spaces

- Will any field work be done inside an enclosure, building, or confined space?

  Yes: ☐ No: ☒

## Traffic Control

- Does field work require traffic control around the work area, using barricades, traffic signs, and other traffic control devices?

  Yes: ☐ No: ☒

- Is a city/county/state road use permit required?

  Yes: ☐ No: ☒

- Is a traffic control plan required with the road use permit?

  Yes: ☐ No: ☒

# SITE INFORMATION

## SITE STATUS

- Site Status: Occupied?

  Yes: ☐ No: ☒

## INITIAL SITE ENTRY

- Has this been performed by Herrera?

  Yes: ☒ No: ☐

Herrera staff have conducted initial site visits to Duwamish Waterway Park.

## SITE CONTROL AND SECURITY

- Any site access requirements and special considerations?

  Yes: ☐ No: ☒

- Work will be done in daylight hours?

  Yes: ☒ No: ☐

- Barricades, fencing, or other equipment to be used to mark the perimeter of the site?

  Yes: ☐ No: ☒

- Require work area security (on- and off-hours) to be used?

  Yes: ☐ No: ☒

# Vicinity Map, Site Map, and Background Information

**Post the following two pages.**


Legend

- Study Area
- City Limits
- Waterbody
- Streams (DNR)


**Figure 1.**
**Vicinity Map, Duwamish Waterway Park, Seattle, Washington.**

N

0 750 1,500 3,000 Feet

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Aerial: Maxar, March 2021

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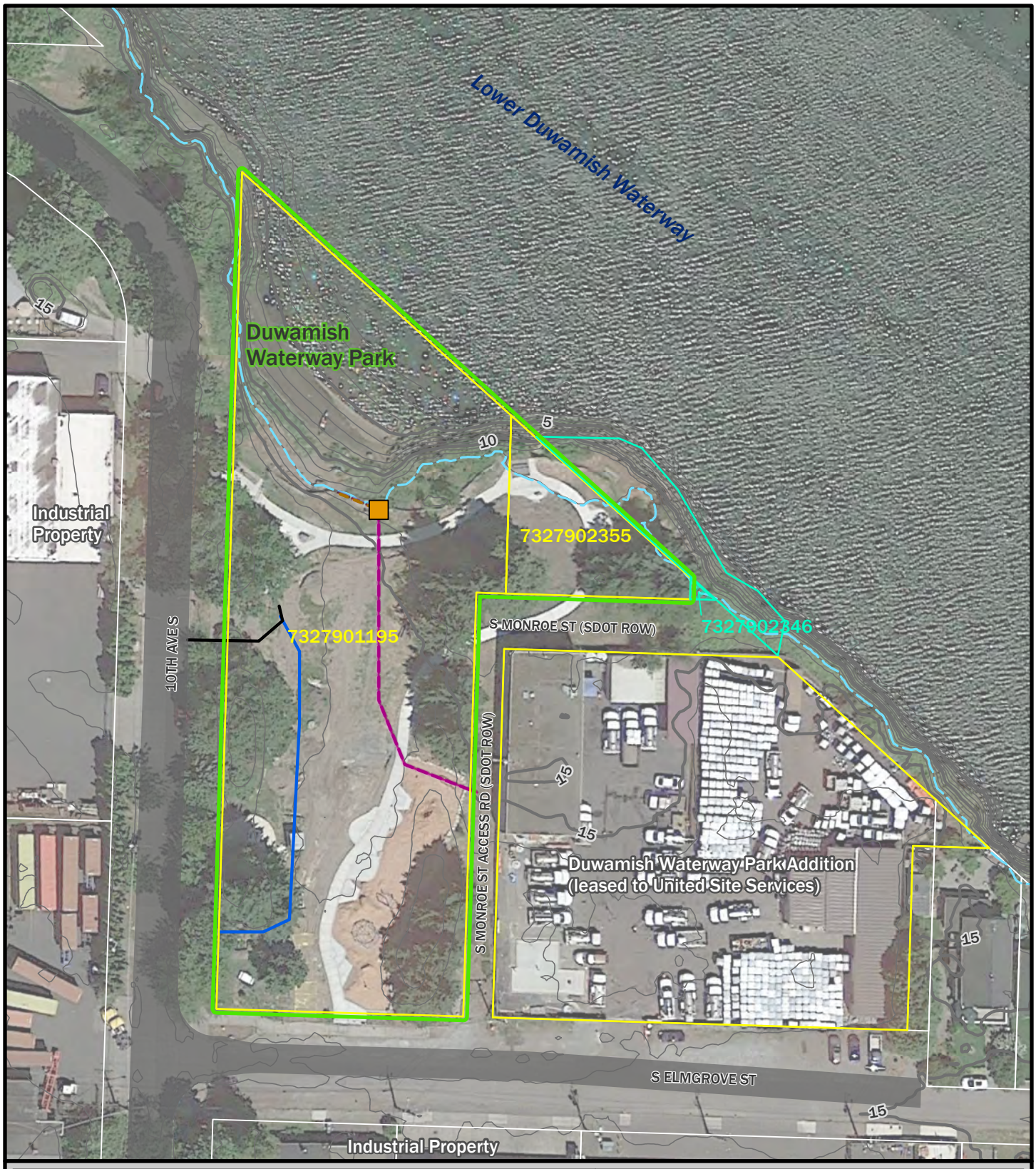


Legend

- Remedial Investigation Site Boundary
- Seattle Parks Parcels
- Port of Seattle Parcel
- Department of Natural Resources (Managed by Port of Seattle)
- King County Tax Parcel Boundaries
- Mean Higher High Water (11.1 FT NAVD88)
- Catch Basin
- Dispersion Trench
- Perforated Stormwater Conveyance Pipe
- Sanitary Side Sewer
- Water Service Line

Elevation Contours (DNR 2016)

- 5 FT Contour
- 1 FT Contour

**Figure 2. Site Map of Duwamish Waterway Park, Seattle, Washington.**

N

0 50 100 200 Feet

HERRERA

Aerial: EagleView Technologies, 2019

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# LOCAL EMERGENCY AND PROJECT TELEPHONE NUMBERS

## SITE ADDRESS AND PHONE NUMBER

Site Address: 7900 10th Avenue South, Seattle, Washington 98108

Site Phone Number: N/A

## LOCAL EMERGENCY PHONE NUMBERS

| Agency | Name | Telephone Number |
|---|---|---|
| Hospital | Harborview Medical Center | 206.744.3000 |
| Police/Fire | City of Seattle | 911 |

## PROJECT PERSONNEL PHONE NUMBERS

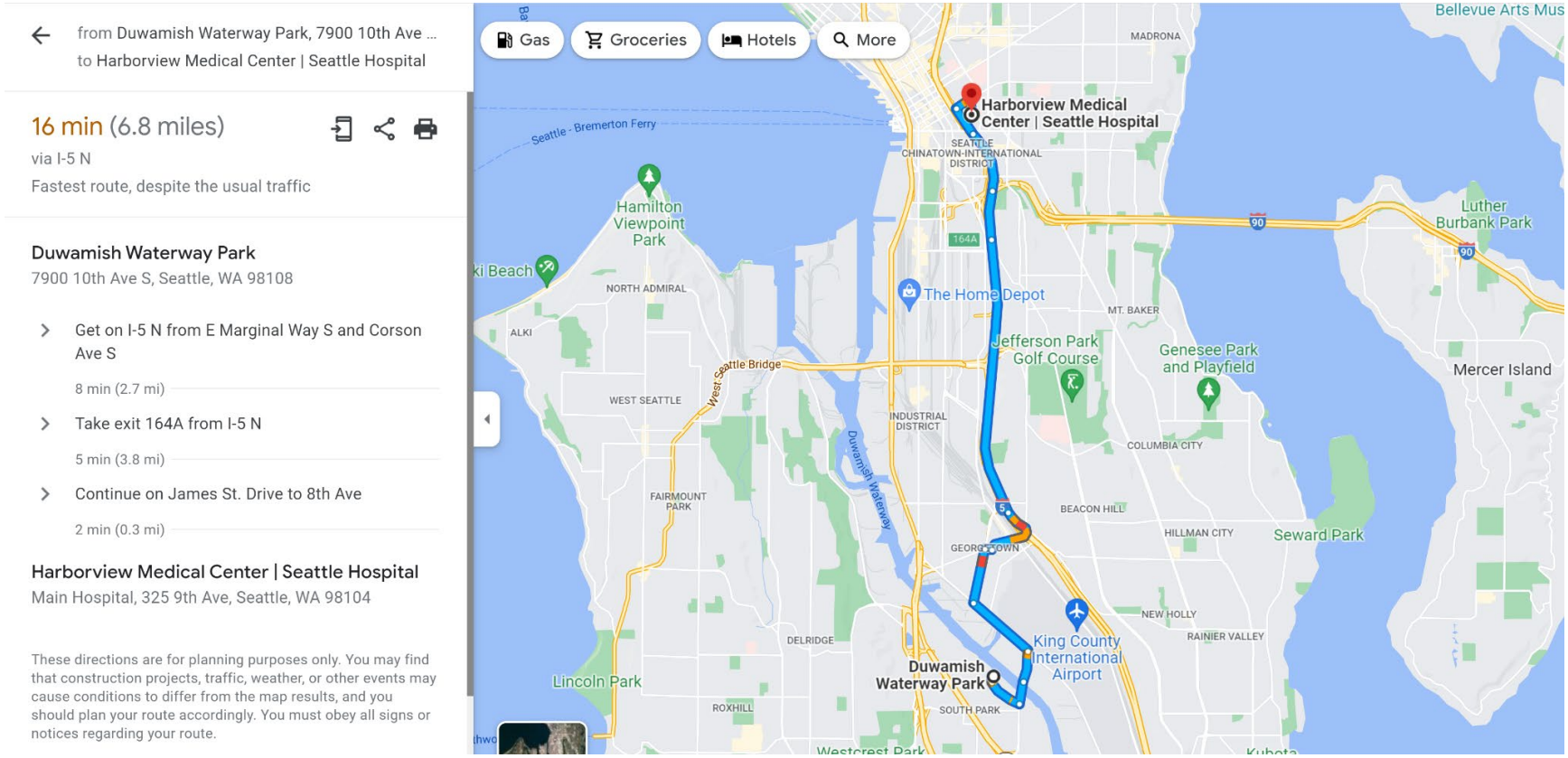
| Role | Name | Telephone Number |
|---|---|---|
| Site Health and Safety Officer | George Iftner | 206.787.8210 office/206.697.0312 mobile |
| Project Manager | George Iftner | 206.787.8210 office/206.697.0312 mobile |
| Principal-in-Charge | Phil Coughlan | 206.787.8242 office/253.686.1910 mobile |
| Site Contact | Jean H. Lee | 206.256.5951 office/206.535.0328 mobile |
| Client Contact/Project Manager | Jean H. Lee | 206.256.5951 office/206.535.0328 mobile |
| Corporate Health and Safety Officer | Rob Zisette | 206.787.8262 office/206.930.6585 mobile |

# EMERGENCY ROUTES

Prior to field work, conduct a drive-by from the work area to the hospital to check for any obstacles (i.e., road closure due to construction, etc.) and change the emergency route(s) to the hospital accordingly.

| | |
|---|---|
| Hospital Name: | Harborview Medical Center |
| Hospital Address: | 325 Ninth Avenue, Seattle, Washington 98104 |
| Hospital Phone Number: | 206.744.3000 |

**Refer to the following page for the route to the hospital, and post the page.**




**Harborview Medical Center – 325 Ninth Avenue, Seattle, Washington 98104**

**Figure 3. Hospital Location and Route Map.**

# EMERGENCY RESPONSE PLAN

## SITE INCIDENT

If an incident (e.g., theft, car accident, property damage) occurs, take the following action:

- Notify the SHSO immediately.
- The SHSO is responsible for immediately notifying the Project Manager and preparing and submitting a Site Incident Report (Attachment 1) to the Corporate Health and Safety Officer within 24 hours.

## INJURY OR EXPOSURE

If an injury or exposure occurs, take the following actions:

- Get first aid for the person immediately.
- Notify the Site Health and Safety Officer (SHSO). The SHSO is responsible for immediately notifying the Project Manager and preparing and submitting an Injury/Exposure Report (Attachment 1) to the Corporate Health and Safety Officer within 24 hours, as well as notifying the employee's supervisor and Principal-in-Charge.
- If a subcontractor employee is injured, the Subcontractor Field Supervisor will also complete an injury/exposure investigation and submit a copy to the Corporate Health and Safety Officer as well.
- The SHSO will assume charge during a medical emergency.
- Employee or employee's doctor must submit a copy of the doctor's report to the Corporate Health and Safety Officer within 24 hours of the initial exam and any subsequent exams.

# KEY PERSONNEL AND REQUIREMENTS

## HASP Organization and Responsibilities

### Key Personnel

| | |
|---|---|
| Principal-in-Charge | Phil Coughlan |
| Corporate Health and Safety Officer | Rob Zisette |
| Herrera Project Manager | George Iftner |
| Herrera Site Health and Safety Officer | George Iftner |
| Herrera Field Personnel | George Iftner |
| Client Project Manager | Jean H. Lee |

#### *Principal-in-Charge*

The Principal-in-Charge provides a point of contact if the Project Manager cannot be accessed during emergency situations.

#### *Project Manager*

The Project Manager provides technical support to the SHSO for health and safety decision-making. Prior to beginning onsite work, the Project Manager will ensure that employee training and medical clearance is current and up-to-date, and that site-specific safety and health concerns, have been addressed prior to field work. It is the responsibility of the Project Manager or designate to take reasonable steps to verify the following:

- Employee training is current and up-to-date
- Each participant is informed of the known risks and physical requirements
- Each participant is shown where remote communication devices are kept (e.g., mobile phones, radios)
- Each participant has read this HASP
- Has determined what safety clothing and equipment is appropriate for this project

- Company and personal equipment taken into the field is thoroughly checked for safety and in good working condition by a qualified person before it is used

- Each participant is instructed in field safety, wearing of safety clothing (e.g., chemical resistant personal protective equipment (PPE), high-visibility reflective clothing, etc.), and safe use of equipment

- Site-specific health and safety concerns (including but not limited to: known or suspected chemical hazards, etc.) have been addressed prior to field work

## Site Health and Safety Officer

The SHSO shall be responsible for coordinating emergency response measures during this project. Workers shall report to the SHSO in the event of an emergency. Within 24 hours of the end of fieldwork, the SHSO will submit the completed (signed) HASP to the Corporate Health and Safety Officer.

The SHSO will oversee the overall HASP. The SHSO has the authority to stop work or prohibit any personnel from working on the site at any time for not complying with any aspect of the HASP.

## Field Lead

Depending on the activity (i.e., installation, monitoring, sampling, demobilization), one member of the field team will be designated as Field Lead for each field task. The Field Lead is responsible for preventing unauthorized entry onto the site, ensuring all appropriate equipment is available and ready for use, and knowing who is on site while activities are occurring.

## Subcontractor Field Supervisor

If a subcontractor is required to perform Herrera's portion of the work, the Subcontractor Field Supervisor is responsible for implementing health and safety for the subcontractor's own employees.

## All Onsite Personnel

Persons on the site have responsibility for their own health and safety, as well as assisting others in carrying out the HASP. Any person observed to be in violation of the HASP should be assisted in complying with the HASP, or reported to the Project Manager, the SHSO, or the Subcontractor Field Supervisor.

Any site personnel may shut down field activities if there is a real or perceived immediate danger to life or health.

# Minimum Training, Immunization, and Medical Surveillance Requirements for Site Personnel

## Training

Field workers have received health and safety training required by Occupational Safety and Health Administration (OSHA) (29 Code of Federal Regulations [CFR] 1910.120) and Washington State Division of Occupational Safety and Health (Chapter 296-843-200 WAC), including some or all the following:

- 40 hours Hazardous Waste Operations training (HAZWOP)
- 8 hours Annual HAZWOP Refresher training
- First Aid and cardiopulmonary resuscitation (CPR) training
- Annual Respirator Fit Testing
- Hazard Communication Training Related to Biological Hazards in Sewer Work
- Annual Medical Clearance

Copies of applicable personnel training certifications are presented in Attachment 5.

## Immunizations

In accordance with recommendations provided by the United States Centers for Disease Control regarding immunizations for wastewater workers, Tetanus/Diphtheria (Td) immunizations shall be administered to field personnel prior to field work potentially associated with wastewater.

## Medical Surveillance

The Herrera medical surveillance program is described in the corporate HASP. In summary, Herrera employees potentially exposed to hazardous substances or health hazards for 30 days or more a year will participate in the program. The medical surveillance program includes a determination of fitness for each individual to work in hazardous environments, including use of various levels of PPE. Medical examinations are conducted on a regular basis (usually annually) and each person's condition reviewed at that time. The Corporate Health and Safety Officer maintains medical records in a designated file and are available for review by each affected employee.

# GENERAL FIELD SAFETY

The SHSO is responsible for establishing and coordinating procedures for evacuation of onsite personnel, including non-Herrera personnel, prior to commencement of work. This plan will be reviewed at the site safety meeting conducted at the beginning of the first day of work (and at subsequent site safety meetings as warranted by changing conditions and addition of new site workers). A Daily Tailgate Health and Safety Meeting Form is to be completed and signed by personnel who attended the site safety meetings (see Attachment 2).

In the event of a potential emergency, as determined by any onsite worker, the SHSO will be notified and site personnel assembled at an area designated during the site safety meeting. The Project Manager, with the aid of the SHSO and other site workers, will decide the appropriate response depending onsite conditions.

## General Field Safety Requirements

- Prior to working on site, a general inspection of hazards will be made by the SHSO. SHSO is responsible for preventing unauthorized entry onto the site and for knowing who is on site.
- Onsite field personnel must have a mobile phone capable of connecting to an emergency contact (i.e., Herrera office, local emergency service).
- Designate at least one vehicle for emergency use.
- High-visibility reflective safety vests, shirt, or jacket that is fluorescent yellow-green, orange-red, or red in color; sturdy boots; and hard hats will be worn.

## Work Limitations and Restrictions

- No eating or drinking is allowed in the work area.
- No smoking or lighting of matches or lighters is allowed in the work area.
- No rings, watches, bracelets, necklaces, or other jewelry that could trap chemical or biological contamination or get caught in moving equipment.
- If respiratory protection is required, no facial hair present that would interfere with respirator fit.

# HAZARD IDENTIFICATION

Hazards may exist in multiple forms on the site and shall be classified among three general categories: chemical, physical, and biological. The following list is meant to convey the general hazard classes that may be encountered on the site. Herrera's COVID-19 Response Plan is provided in Attachment 4.

| Chemical Hazards | | Physical Hazards | | Biological Hazards | |
|---|---|---|---|---|---|
| | Asbestos | X | Motor Vehicle Driving | | Coliform Bacteria |
| | Flammable Liquids/Gases | | Heavy Equipment Operations | | Wastewater |
| X | Metals | X | Drilling Rigs | | Hospital Waste |
| X | Polychlorinated Biphenyl | | Heavy Lifting | X | Stinging/Poisonous Insects |
| | Pesticides/Herbicides | X | Slips, Trips, or Falls | | Bacterial/Viral Agents |
| | Petroleum Hydrocarbons | | Confined Space Entry | | Rodents/Vermin |
| | Volatiles | X | Electrical Hazards | | Large Predatory Animals |
| X | Semi-Volatiles | | Explosives | | Poisonous Snakes |
| | Toxic Liquids/Gases | | Radioactive Isotopes | | |
| | Dioxins/Furans | | Traffic Hazards | | |
| | Oxygen Deficiency | | Water Hazards | | |

## POTENTIAL CHEMICAL HAZARDS

Chemical hazards will be evaluated both by visual examination of site conditions, as well as by use of monitoring equipment. Visual indications of potential chemical hazards include evidence of dead or dying vegetation, dead animals, discolored vegetation, or soil. Monitoring equipment to be used is discussed in the *General Procedures for Air Monitoring* section.

## Regulatory Action Levels

The following table provides information regarding the relative toxicity of chemicals that may be found at the site based on established state or federal cleanup levels.

| Metals | | | Semi-Volatile Organics | | |
|---|---|---|---|---|---|
| **Chemical** | **Matrix** | **Regulatory Action Level[a]** | **Chemical** | **Matrix** | **Regulatory Action Level[a]** |
| Arsenic | Soil, groundwater, and sediment | 0.002 $mg/m^3$ | PAHs (including cPAHs) | Soil, groundwater, and sediment | 0.1 $mg/m^3$ |
| Lead | | 0.050 $mg/m^3$ | | | |
| **Other Organics** | | | **Other** | | |
| PCBs | Soil, groundwater, and sediment | 0.001 $mg/m^3$ | – | – | – |

[a] References for regulatory action levels are NIOSH Pocket Guide to Chemical Hazards 2006; NIOSH short term exposure limit (STEL) and Washington Department of Labor and Industries Permissible Exposure Limits (PELs).

## Exposure Pathways and Permissible Exposure Limits

The following is a list of potential exposure pathways, and the PELs and time weighted averages (TWAs) for chemical and biological hazards that may be encountered on the site. The potential exposure pathways are not limited to those listed. Acute systems of exposure along with odor thresholds and descriptions are given when that information is known. Odor thresholds are not exact and vary with susceptibility or sensitivity involved and will be discussed in the daily safety briefing.

**Table 1. Predominant Potential Site Chemical Hazards.**

| Chemical (or Class) | Exposure Limits (TWA) | | | Other Pertinent Limits | Warning Properties/ Description | Routes of Exposure or Irritation | Acute Health Effects | Chronic Health Effects/ Target Organs |
|---|---|---|---|---|---|---|---|---|
| | OSHA PEL | NIOSH REL | STEL | | | | | |
| Arsenic | 0.010 $mg/m^3$ | 0.002 $mg/m^3$ Carcinogenic | 0.002 $mg/m^3$ Carcinogenic | IDLH = 5 $mg/m^3$ (as As)<br>CEILING (NIOSH) = 0.002 $mg/m^3$ Carcinogenic [15-minute] | Silver-gray or tin-white metal, brittle, odorless solid | Inhalation, absorption, ingestion, skin and/or eye contact | Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin | Carcinogen A1 – Liver, kidneys, skin, lungs, lymphatic system (lung and lymphatic cancer) |
| Lead | 0.050 $mg/m^3$ | 0.050 $mg/m^3$ | – | IDLH = 100 $mg/m^3$ (as Pb) | Heavy, ductile, soft, gray solid | Inhalation, ingestion, skin and/or eye contact | Weakness, exhaustion, insomnia, facial pallor, anorexia, low weight, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremor, paralysis of the wrist and/or ankles; encephalopathy, kidney disease, irritated eyes, hypotension | Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue |
| PAHs | 0.2 $mg/m^3$ | 0.1 $mg/m^3$ Carcinogenic | – | IDLH = 80 $mg/m^3$ Carcinogenic | Black or dark brown oil/tar, mothball-like odor | Inhalation, absorption, skin and/or eye contact | Irritated eyes, skin, and respiratory system; dermatitis, bronchitis | Carcinogen A1 – Respiratory system, skin, bladder, kidneys (lung, kidney, and skin cancer) (potential occupational carcinogen) |

**Table 1 (continued). Predominant Potential Site Chemical Hazards.**

| Chemical (or Class) | Exposure Limits (TWA) | | | Other Pertinent Limits | Warning Properties/ Description | Routes of Exposure or Irritation | Acute Health Effects | Chronic Health Effects/ Target Organs |
|---|---|---|---|---|---|---|---|---|
| | OSHA PEL | NIOSH REL | STEL | | | | | |
| PCBs | 0.5 mg/m$^3$ [skin] | 0.001 mg/m$^3$ LFC Carcinogenic | – | IDLH = 5 mg/m$^3$ Carcinogenic | Colorless to pale-yellow, viscous liquid with a mild hydrocarbon odor | Inhalation, absorption, ingestion, skin and/or eye contact | Irritated eyes, chloracne | Carcinogen A1 – Skin, eyes, liver, reproductive system (pituitary gland and liver tumors, leukemia) |

PEL-TWA = Permissible Exposure Limit-Time Weighted Average (8 hours)

Carcinogenicity Status (ACGIH)

REL-TWA = Recommended exposure limit – time weighted average

A1 – Confirmed human carcinogen

TLV-TWA = Threshold Limit Value-Time Weighted Average (8 hours)

STEL = Short Term Exposure Limit (15 minutes)

IDLH = Immediately Dangerous to Life or Health

LFC = Lowest feasible concentration (no-effect exposure)

CEILING = Ceiling Limit (not to be exceeded, even instantaneously)

NIOSH = National Institute of Occupational Safety and Health

References:

ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. pp. 93–94.

NIOSH Pocket Guide to Chemical Hazards, US Department of Health and Human Services. September 2005.

NIOSH Safety and Health Topic: Focus on Coal Mining – Safety Hazards, Health Hazards, and Mine Rescue. 2006.

## General Procedures for Air Monitoring

Ambient air monitoring equipment will be used as a general survey tool (in combination with visual observations of dust and wetting down soils if needed to prevent dust generation) to indicate the presence of potential airborne contamination. Air monitoring will be used at the beginning of work and periodically throughout the work period. The following air monitoring equipment will be used during sampling:

- **Photoionization detector (PID):** Monitors the presence of ionizable volatile organic vapors (not including methane) by measuring relative concentrations in parts per million (ppm). The PID features a 10.8 eV lamp and is calibrated daily using 100 ppm isobutylene calibration gas. Used for characterizing sample media and for determining whether volatile organic vapors present in the breathing zone at sample locations.

Air monitoring equipment shall be operated according to manufacturer's instructions and applied to site decision-making according to Herrera's standard operating procedures. Air monitoring will be recorded on the Air Monitoring Equipment Calibration/Check Log and Air Monitoring Log (Attachment 3).

The action levels for chemical monitoring are listed in the following table. These action levels are general guidelines derived from the United States Environmental Protection Agency emergency response action levels and are minimum action levels to be observed during field work.

| Table 2. Action Level Table for Chemical Monitoring. | | | | | | |
|---|---|---|---|---|---|---|
| **Monitoring Instrument** | **Chemical (or Class)** | **Action Level** | | **Monitoring Frequency/ Location** | **Level for Respirator[a] Use** | **Level for Work Stoppage** |
| ☒ PID | Volatile organics | **Unknown vapors:**<br>Background to 1 ppm above background: Level D<br>1 to 5 ppm above background (short-term exposure anticipated): Level C<br>5 to 500 ppm above background: Level B | **Contaminant-Specific:** | Conduct initial monitoring at the beginning of task activities, during sampling manhole 44, or if conditions change (e.g., increase in ambient temperature, visual observation of suspect contaminant, detection of suspect odors).<br>Monitor breathing zone at least 15 minutes or fewer if PID alarm sound, indicating ionizable volatile organic vapors above background levels or 50 ppm | ≥5 ppm in breathing zone (continuous exposure) | 5 ppm in breathing zone<br>50 ppm (in Level C PPE)<br>N/A in Level B PPE |

[a] Respirator is full face with combination cartridges.

See Attachment 3 for Air Monitoring Equipment Calibration/Check Log and Air Monitoring Log.

# POTENTIAL PHYSICAL HAZARDS

Potential physical hazards that may be encountered at the site and hazard control measures are summarized in the table below.

| "X" If Applicable | Hazards | Hazard Control Measures |
|---|---|---|
| **X** | Slips, Trips, Falls | • Be aware of obstacles, such as cords, tools, and other equipment that may be present on the ground in the work area.<br>• Identify and mark areas that are potentially slippery (e.g., wet or oily surfaces) with spray paint or flagging and walk around them.<br>• Use handholds.<br>• Wear boots with good traction. |
| **X** | Overhead and Underground Utilities | • Identify/locate existing overhead utilities prior to work.<br>• Ensure that overhead utility lines are at least 15 feet away, and underground utilities are at least 5 feet away, from project activities.<br>• Contact utility companies to confirm locations, as necessary.<br>• Complete Utility Clearance Log (Attachment 2) |
| **X** | Drilling (i.e., hollow-stem auger, push probe, etc.) | • Identify/locate underground utilities prior to drilling activities. Complete Utility Clearance Log (Attachment 2).<br>• Wear hard hat, steel-toed boots, and noise protection.<br>• Maintain line of sight between drillers and field personnel. |
| **X** | Motor Vehicle Driving | • Drive defensively.<br>• If you need to place or receive a phone call, pull off the road to a safe location and stop the vehicle before using your cell phone. Allow voicemail to handle your calls.<br>• Be aware of weather and road conditions when driving (i.e., heavy rain, snow; large puddles in roadway, black ice).<br>• Driver and passengers must wear seatbelts. |
| | Confined Space | • Ensure compliance with 29 CFR 1910.146.<br>• Complete a confined space entry form.<br>• Attach permit for confined space entry.<br>• **Note: No confined space entries will be performed during this work by Herrera personnel**. |

# Potential Biological Hazards

There is a potential for encounters with stinging/poisonous insects while in the field. This hazard will be discussed during the daily tailgate safety meeting to determine if any workers on site have known allergies to stinging insects and emergency medical attention will be sought as necessary.

# Stinging Insect Allergies

## Allergic Reaction Symptoms

The majority of stinging insects in the United States include bees, yellow jackets, hornets, and wasps (fire ants are also considered stinging insects, but are prevalent in the southeastern U.S.). The degree of allergy varies widely. Most people who are not allergic to insect stings generally experience localized pain, itching, swelling, and redness at the sting site (localized reaction). A single bite or sting may result in a localized reaction, but multiple bites or stings may lead to more severe allergic reactions (systemic reaction, where the entire body is affected). The most serious is called anaphylaxis, which can be life-threatening if left untreated immediately. Severe allergic reactions are suspected if a person experiences any of the following symptoms:

- Hives (intense itching at sites other than the sting site)
- Difficulty breathing and/or swallowing
- Hoarseness
- Swelling of the tongue
- Vomiting and/or nausea
- Dizziness and/or fainting

These reactions usually occur within minutes of the sting, but have been known to be delayed up to 24 hours. Persons who have allergic reactions to stinging insects will have a worsened reaction to every subsequent sting. Prompt treatment is essential and emergency help is often needed.

Field personnel who have severe allergic reactions to stinging insects should wear a Medic Alert bracelet or necklace describing their allergy. They should also be prepared when going into the field by carrying with them a bee sting kit (a doctor-prescribed self-injection device with epinephrine [adrenaline]; i.e., Epi-Pen). **Inform team members of your allergy and how to use the bee sting kit before heading out into the field.**

## Avoid Getting Stung

The US Department of Agriculture recommends the following:

- When walking single-file on a trail, allow enough space between the front person and the next person, so that if the front person disturbs an insect nest, the next person does not run into agitated insects.
- Avoid wearing brightly colored, white, or pastel clothing. Studies have found that bees find black color very irritating and blue is comforting to them.
- Don't use cosmetics, hairspray, perfume, or cologne, as well as insect repellant when in the field.
- Food odors attract insects, especially yellow jackets, so be alert when eating outdoors. Avoid open food, as in garbage cans, dumps, and open picnic areas.
- Avoid disturbing likely beehive sites, such as large trees, tree stumps, logs, and large rocks. Yellow jackets nest in the ground and in walls. Hornets and wasps often nest in bushes, trees, and under roofs. Use caution with unusual forms in walls and mounds on the ground.
- If a colony is disturbed, run and find cover as soon as possible. Running in zigzag pattern may be helpful.
- Cover as much of the head and face as possible, without obscuring vision, while running.
- Never stand still or crawl into a hole or other space with no way out.
- Do not slap at the bees. Bees are generally not aggressive and will usually not sting unless disturbed or injured.
- Once clear of stinging insects, remove stingers and seek medical care.

## If Stung by a Stinging Insect

1. **Call emergency medical services if:**
    - Field personnel have a history of severe reactions to insect stings
    - Experiencing any severe symptoms listed above
    - Multiple stings, even for persons not known to have allergic reactions

- Stung in the mouth or nose, even for persons not known to have allergic reactions to stings, since they can lead to swelling and interfere with breathing

2. **Determine if the stinger is still present** (look for a small black dot at the sting site) and remove it immediately if is visible. Bee stingers are barbed stingers with a venom sac attached; it takes 2 to 3 minutes to release all of its venom, so prompt removal of the stinger can reduce the severity of the sting. Avoid removing the stinger by pinching it; otherwise, more venom is injected into the skin. Use a hard object like a credit card or blunt knife to swipe over the area to remove ("flick") the stinger. Wasps, yellow jackets, and hornets have stingers without barbs that are usually retracted upon stinging; these insects can sting people multiple times.

3. **Apply ice or cold packs** to the area to reduce the body's inflammatory response.

4. **Clean the area with soap and water**, then apply hydrocortisone cream to the site to decrease the severity of the reaction. Alternative treatments include applying a paste of meat tenderizer and water or baking soda and water.

5. **Administer an antihistamine**, such as Benadryl (diphenhydramine) and/or non-prescription pain relievers such as ibuprofen or acetaminophen.

# PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

## LEVEL OF PROTECTION

- **Level B**: SCBA or supplied-air respirator with an escape bottle, chemically resistant suit.
- **Level C**: Full-face air-purifying respirator with organic vapor and acid gas cartridges, chemically resistant PPE.
- **Level D**: No respiratory protection. Safety glasses, hard hat, sturdy boots, long-sleeved shirt and pants. Hearing protection, gloves (an inner disposable nitrile glove and outer chemical resistant glove), and other PPE as required.

To protect workers from potential contaminants in sample media, protective clothing will be worn during sampling activities, including Tyvek coveralls, protective eyewear, and chemical resistant boots and gloves. Protective clothing will be discarded or decontaminated between uses.

The following levels of protection (LOPs) have been selected for each work task based on an evaluation of the potential or known hazards, the routes of potential hazard, and performance specifications of the PPE. Onsite monitoring results and other information obtained from onsite activities will be used to modify LOPs and PPE as necessary to ensure sufficient personnel protection.

| Work Task Number | D | C | B | Modifications Allowed |
|---|---|---|---|---|
| 1 and 2 | X | – | – | No |

Note: Use "X" for initial levels of protection. Use "(X)" to indicate LOPs that may be used as site conditions warrant.

## PERSONAL PROTECTIVE EQUIPMENT

Personnel who perform work on site will be minimally required to meet the protective clothing and safety equipment requirements for Level D (minimum required PPE for Level D in the following table is marked by an "*"). Level D status will apply to fieldwork on the site unless the trigger mechanism(s) to Level C or B are activated. Previous work at MH44 indicates PPE and full-face respirators with combination cartridges will be required during sampling activities. The SHSO must notify the Corporate Health and Safety Officer prior to work if Level "C" or "B" is warranted.

| PPE | Task 1 |
|---|---|
| Protective face mask per COVID-19 precautions | X |
| *Safety glasses/goggles | X |
| *Cotton coveralls/long-sleeved shirt and pants | X |
| Rain gear or Tyvek suit for splash protection | X |
| *Hard hat (required at all construction sites) | X |
| *Steel-toed safety boots (as per ANSI Z41) | X |
| *Work gloves | X |
| Neoprene safety boots (as per ANSI Z41 | |
| Solvex or nitrile gloves (for sample handling) | X |
| Ear plugs/muffs when working around geoprobe drill rig | X |
| Reflective safety vest | X |
| Inner gloves:<br>☐ Cotton<br>☒ Nitrile<br>☐ Other: | X |

***** Represents minimum required PPE for Level D work.

# SAFETY EQUIPMENT

**The safety equipment in the following table that is marked by an "X" indicates safety equipment needed for each work task.**

| Safety Equipment | Tasks 1 and 2 |
|---|---|
| *First-aid kit | X |
| *Emergency eye wash | X |
| *Fire extinguisher (Class A, B, C) | X |
| *Photoionization detector | X |

***** Represents minimum required safety equipment.

# DECONTAMINATION

Following are the decontamination procedures that will be employed to prevent contamination of personnel and to prevent cross contamination of sampling equipment during the collection of samples.

## PERSONNEL DECONTAMINATION

| | |
|---|---|
| Decon Solutions: | Hand sanitizer |
| Decon Method: | Remove rain gear; remove and dispose of gloves; wash hands and face with hand sanitizer and wipe dry with paper towel. |
| Exposure Monitoring: | None |
| Level of Protection: | D |
| Location: | Support zone |

Some of the personnel protective clothing that may be used, such as Tyvek suits and gloves, are disposable and no decontamination required following use.

## SAMPLING EQUIPMENT DECONTAMINATION

A decontamination station shall be set up daily during sampling activities. The location of the decontamination station may vary based on the location of sampling activities. Bucket used for sample collection and flow measurement will be decontaminated. The station shall include one or more of the following items:

- Hand sanitizer for hands and face after disposable gloves and rain gear is removed.
- A bucket or tub with a Liquinox soap/water solution and a brush for scrubbing boots, rain gear, gloves, and other non-disposable PPE.
- A second bucket or tub filled with tap or deionized water for rinsing
- Sprayer with potable water used for final rinse.

# WASTE CHARACTERISTICS

## WASTE GENERATION

Waste Anticipated:

Yes: ☒ No: ☐

| Waste Type | Description | Quantity | Packaging Requirements |
|---|---|---|---|
| Solid | Soil cuttings from push probes, sediment from beach sampling | Four 5-gallon buckets or fewer | 30- or 55-gallon drum provided by driller |
| Liquid | Purge Water and Decon Water | 20 gallons or less | 30- or 55-gallon drum provided by driller |
| Incidental | Used disposable gloves, paper towels | 1 bag | Plastic trash bag |

# TRAINING, IMMUNIZATION, AND MEDICAL CLEARANCE

Following is a summary of training, immunization, and/or medical clearance information for personnel who will perform work on the site. Copies of personnel training certificates are presented in Attachment 5.

1. Name: George Iftner Title: Field Personnel, Field Lead Approved PPL: B

   Field Responsibilities: Tasks 1 and 2

| Training | Dates (Month/Year) |
|---|---|
| Current 8-Hour Refresher | April 5, 2022 |
| 40-Hour Hazardous Waste | April 19, 1998 |
| Supervisor | April 19, 2002 |
| First Aid; CPR | September 12, 2019 |
| Confined Space Entry | December 8, 2006 |
| Medical Clearance | May 2020 |
| Immunization: Tetanus/Diphtheria | January 2019 |

2. Name: Nina Maas Title: Field Personnel, Assistant Field Lead Approved PPL: B

   Field Responsibilities: Tasks 1 and 2

| Training | Dates (Month/Year) |
|---|---|
| Current 8-Hour Refresher | May 7, 2021 |
| 40-Hour Hazardous Waste | |
| Supervisor | N/A |
| First Aid; CPR | ? |
| Confined Space Entry | May 17, 2021 |
| Medical Clearance | |
| Immunization: Tetanus/Diphtheria | ? |

# COVID-19 RESPONSE PROCEDURES

Safety procedures applicable to field work during the COVID-19 pandemic are provided in Attachment 4.

# HEALTH AND SAFETY PLAN — ACKNOWLEDGEMENT AND AGREEMENT FORM

The following field personnel have read this HASP and understand the potential and actual hazards present on the site and shall abide by its strictures.

| Name | Signature | Company | Date |
|---|---|---|---|
| Name | Signature | Company | Date |
| Name | Signature | Company | Date |
| Name | Signature | Company | Date |
| Name | Signature | Company | Date |
| Name | Signature | Company | Date |
| Name | Signature | Company | Date |
| Name | Signature | Company | Date |
| Name | Signature | Company | Date |

# ATTACHMENT 1

## Site Incident and Injury/Exposure Reports

# SITE INCIDENT REPORT

(Attach additional documentation as necessary.)

Date of Incident: _____ Time of Incident: _____

Location of Incident: _____

Project Name: _____ Project No.: _____

Type of Incident* (check those that apply):

_____ "Near Miss"
_____ Underground Property Damage
_____ Aboveground Property Damage
_____ Theft
_____ Other (describe) _____

_____ Vehicle Accident
_____ Fire
_____ Evacuation
_____ Regulatory Agency Inspection or Violation

*Submit copy of Health and Safety Plan and attachments for field-related incidents.

Description of Incident: _____

Cause of Incident: _____

Action Taken: _____

Future Corrective Action: _____

Estimated Amount of Damage: _____

| Investigator Name | Signature | Date |
|---|---|---|
| Principal-in-Charge | Signature | Date |

cc: Site Health and Safety Officer, Corporate Health and Safety Officer, and Human Resources within 24 hours of incident.

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# INJURY/EXPOSURE REPORT

**(Attach additional documentation as necessary.)**

Date of Incident: _____ Case No. _____ Time of Day _____

Employee Name _____ Date of Birth _____

Home Address _____ Phone No. _____

Sex Male ___ Female ___ Age ___ Job Title _____ Social Security No. _____

Office Location _____ Date of Hire _____

Where did incident occur? (include address) _____

On employer's premises? Yes ___ No ___ Project Name/No. _____

What was employee doing when incident occurred? (be specific) _____

How did the incident occur? (describe fully) _____

What steps could be taken to prevent such an incident? _____

Object or substance that directly caused incident? _____

Describe the injury or exposure _____

Part of body affected _____

Name and address of physician _____

If hospitalized, name and address of hospital _____

Loss of one or more days of work? Yes ___ No ___ If yes, date last worked _____

Has employee returned to work? Yes ___ No ___ If yes, date returned _____

Did employee die? Yes ___ No ___ If yes, date _____

Completed by (print) _____ Employee signature _____

(Supervisor or Site Health & Safety Officer)

Date _____

Signature _____ PIC Signature _____

Date Date

This report must be completed by the employee's supervisor or Site Health and Safety Officer immediately upon learning of the incident. The completed report must be reviewed and signed by the Principal-in-Charge and transmitted to Corporate Health and Safety Officer within 24 hours of the incident, even if employee is not available to review and sign. Employee or employee's doctor must submit a copy of the doctor's report to Corporate Health and Safety Officer within 24 hours of the initial exam and any subsequent exams. For field injuries, submit a copy of the Health and Safety Plan.

# ATTACHMENT 2

## Daily Tailgate Safety Meeting Form and Utility Clearance Log

# DAILY TAILGATE SAFETY MEETING FORM

First Date of Activity: _____ Time: _____ Site Locations: _____

1. ☐ Discussed activities planned for the day
2. ☐ Individual activities are clear to each crew member
3. ☐ Physical hazards discussed
   - a. ☐ Heat stress
   - b. ☐ Cold stress
   - c. ☐ Slip, trip, and fall hazards
   - d. ☐ Water hazards (streams, boats)
   - e. ☐ Traffic hazards
   - f. ☐ Remote, forested, or hazardous areas
   - g. ☐ Heavy equipment
   - h. ☐ Other:
4. ☐ Biological hazards discussed
   - a. ☐ Stinging insect allergies
   - b. ☐ Other:
5. ☐ Personal protective equipment (PPE) discussed
   - a. ☐ Head protection (hard hat)
   - b. ☐ Eye protection (safety glasses must have side shields )
   - c. ☐ Hearing protection (at all times when working in or around traffic, heavy equipment)
   - d. ☐ Foot protection (steel toes and shanks for work boots)
   - e. ☐ Splash protection (solvent rinse)
   - f ☐ Gloves
     - i. ☐ Environmental conditions (cold)
     - ii. ☐ Protection against cross-contamination (disposal after each use)
     - iii. ☐ Physical hazard (cut, puncture, and abrasion)
6. ☐ Decontamination procedures discussed
   - a. ☐ PPE equipment (rain gear, waders)
   - b. ☐ Sampling equipment
7. ☐ Emergency procedures discussed
   - a. ☐ Route to hospital from site locations(s) above
   - b. ☐ Evacuation procedures
   - c. ☐ Cellular phone, map to hospital, first aid kit, and eyewash with Site Health and Safety Officer/Field Lead
8. ☐ Special conditions/procedures
   - a. ☐ Escort required
   - b. ☐ Locked gates, permits, passes, etc.
9. ☐ Questions/concerns addressed
10. ☐ Other:

Meeting attended by (sign and date for each day of work on site; **USE BACK IF ADDITIONAL SPACE IS REQUIRED**):

| (Print Name) | (Signature) | (Date) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Meeting conducted by: _____ (Title) _____

# UTILITY CLEARANCE LOG

Project Name _____ Date _____

Project Number _____

"One-Call" Confirmation Number and Date Contacted _____

"One-Call" Expiration Date _____

Subcontractor Locating Firm and Invoice Number _____

Facility Contact Person and Telephone Number _____

Facility Drawings Reviewed _____

Verbal/Written Sign-Off of Clearance By Facility Contact _____

Pressurized Lines/Shut-Off Valves Identified* _____

Underground Utilities/Lines Identified*

_____

_____

Underground Utilities/Lines Marked On Site By _____

Overhead Utilities/Lines Identified*

_____

_____

Overhead Utilities/Lines Marked On Site By _____

*Mark on copy of facility drawing or site sketch in HASP.

**Clearance Contact:**

| _____ | _____ | _____ |
|---|---|---|
| Name (Herrera Employee Only) | Signature | Date |

**Clearance Reviewed By:**

| _____ | _____ | _____ |
|---|---|---|
| Name (Herrera Project Manager) | Signature | Date |

# ATTACHMENT 3

# Air Monitoring Equipment Calibration/Check Log and Air Monitoring Log

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# AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG

Project Name: _____

Project Number: _____

| Date | Instrument/ Model No. | Serial No. | Battery Check OK? | Zero Adjust OK? | Calibration Gas (ppm) | Reading (ppm) | Performed By | Comments |
|---|---|---|---|---|---|---|---|---|
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# AIR MONITORING LOG*

Project Name: _____

Project Number: _____

| Date | Time | Location | Source Area/ Breathing Zone | Instrument | Concentrations/ Units | Sampled By | Comments |
|---|---|---|---|---|---|---|---|
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***Notify the Site Health and Safety Officer immediately if a PEL, TLV, or other limit is exceeded.**

# ATTACHMENT 4

# COVID-19 Response Plan

# HERRERA ENVIRONMENTAL CONSULTANTS, INC.
# COVID-19 FIELD AND SHARED EQUIPMENT SAFETY PLAN
# UPDATED JULY 28, 2021

The purpose of this document is to act as a contagion safety guide to augment Herrera's Corporate Health and Safety Plan and Site-Specific Health and Safety Plans in response to the COVID-19 virus outbreak. Herrera's guidance is for all employees to follow the current CDC guidelines throughout all Herrera office and work site locations, including travel to and from those locations. The guidelines can be accessed at the following link: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/index.html.

Current CDC guidelines call for social distancing whenever feasible and have recently been updated to allow exceptions for fully vaccinated people. Herrera is requiring staff to adhere to those guidelines as well as additional guidelines specific to our work. The following guidelines have been prepared to be compliant with the CDC guidelines and to protect our staff, their families, our clients, and the communities in which we work.

This safety plan is to be followed for all projects. If this plan has been modified to include project-specific requirements, then include the following information:

- Project name/number:
- Revision date:

## Fully Vaccinated Staff

Herrera staff are considered fully vaccinated:

- 2 weeks after their second dose in a two-dose series, such as the Pfizer or Moderna vaccines, or
- 2 weeks after a single-dose vaccine, such as Johnson & Johnson's Janssen vaccine.

If you don't meet these requirements, regardless of your age, you are NOT fully vaccinated. Keep taking all precautions specified below until you are fully vaccinated. If you have a condition or are taking medications that weaken your immune system, you may NOT be fully protected even if you are fully vaccinated. Talk to your healthcare provider to determine if you should continue to take all precautions.

Currently, the CDC does not require masks for fully vaccinated people working outdoors but *recommends* masks for fully vaccinated people working indoors in public areas considered to be of substantial or high transmission due to the Delta variant. COVID-19 transmission risk can be

found at https://covid.cdc.gov/covid-data-tracker/#county-view. For example, most counties in western Washington are currently rated as a substantial risk of high transmission.

## Documenting Field Contacts

All field staff will keep a daily log or record in the field notebook of any contacts made during field work with Herrera and non-Herrera staff, including clients and visitors to the jobsite. The basic information documented must include the person's name, company affiliation, date of contact, phone number, and absence of COVID-19 symptoms. Only persons without COVID-19 symptoms are allowed on the jobsite. This information will be used only for contact tracing to identify individuals who may have been exposed if any cases of COVID-19 are confirmed in Herrera staff or those persons with whom contact was made in the field.

## Face Coverings

All *unvaccinated* Herrera staff are required to wear non-medical face coverings during the performance of field work. Face coverings may include cloth face masks, scarves, or bandanas that have multiple layers of fabric. Face coverings should fit snugly over your mouth and nose so breathing air does not bypass around the mask. Refer to the Face Coverings section in the Herrera Corporate Health and Safety Plan for additional mask details.

Fully *vaccinated* Herrera staff must wear a face covering under the following conditions:

- If you have a weakened immune system
- If you work within 6 feet of an unvaccinated person
- If you work indoors in correctional facilities, homeless shelters, schools, public transportation, and certain health care settings, including doctor's offices, long-term care, and hospitals

As directed by King County on July 26, 2021, in response to rapidly increasing cases of the Delta variant, it is recommended that all Herrera staff wear a face covering in indoor spaces that are open to the public, including retail, grocery stores, government buildings, and other businesses and places where members of the public can enter freely. This recommendation does not apply to indoor non-public spaces, including businesses, offices, and other places of employment with limited access. In addition, it is recommended that all Herrera staff wear a face covering working outdoors among a large group of people that may include being within 6 feet of an unvaccinated individual.

## Personal Hygiene

- Wash your hands often with soap and water for at least 20 seconds, especially after you have been in a public place, or after blowing your nose, coughing, or sneezing, and always before eating.
- If soap and water are not readily available, use a hand sanitizer that contains at least 60 percent alcohol. Cover all surfaces of your hands and rub them together until they feel dry.
- Hand sanitizer is available in each Herrera office, in each company vehicle, and in the equipment storage rooms.
- Avoid touching your eyes, nose, and mouth with unwashed hands.
- If you must cough, cover your cough with a tissue and dispose of the tissue in the trash. If a tissue is not available, cough into your elbow.
- Do not shake hands or touch other people while in the field or office.
- Maintain a 6-foot distance from clients, coworkers, and any other people encountered when in the office and in the field with exceptions for fully vaccinated staff wearing masks as noted above.
- Use designated personal protective equipment (PPE) for all field work as required in a Site-Specific Health and Safety Plan.

## Vehicle Use and Hygiene

- To abide by the 6-foot social distancing guideline, multiple unvaccinated staff traveling to a jobsite are required to travel in separate vehicles to minimize exposure (single occupant vehicle transport).
- Fully vaccinated staff may travel together in the same vehicle and work together within 6 feet while wearing masks. In addition, up to one staff person who is not fully vaccinated may travel in a vehicle and work with fully vaccinated staff while all staff wear masks. It is recommended for extra precaution to use vehicle ventilation to the maximum extent practical when unvaccinated staff travel with fully vaccinated staff (i.e., partially open the windows or sunroof and/or operate the fan at medium to high).
- Upon entering a vehicle, wipe down all surfaces that you will be touching with a fresh disinfectant wipe stored in each vehicle. One wipe will suffice for all surfaces. If wipes are not present, replenish vehicle with wipes from office or storage room supplies.

- Use a disinfectant wipe to clean any gas pump handle or credit card reader before and after use (again you should only need one wipe).

- Once you are done with a field vehicle, again wipe down all contacted surfaces with a disinfectant wipe.

- Personal vehicle use is encouraged for staff who are uncomfortable traveling with other staff. Mileage for personal vehicle use will be reimbursed.

## Equipment Use and Hygiene

- Wipe down frequently touched surfaces on all shared equipment (e.g., GPS, laptops, iPads, hand tools, etc.) with a disinfectant wipe prior to picking up at the office or loading into a field vehicle or personal vehicle for the day.

- Proceed with additional decontamination procedures as required by project-specific protocols after wiping down gear with disinfectant wipes.

- Upon returning equipment:

    a. Wipe down frequently touched surfaces on all field gear with disinfectant wipes.

    b. Deep clean dirty areas prior to disinfecting them.

- Plug in any equipment that needs to charge and then wipe down the plugs and touched surfaces.

- Use nitrile gloves and work gloves as much as possible in the field.

Staff are instructed to review these guidelines and respond by email to Human Resources confirming they have read and will abide by these guidelines (bpeterson@herrerainc.com). Your email response is acknowledgement that you have received, read, understood, and will implement these guidelines.

# ATTACHMENT 5

## Personnel Training Certificates

LONGLEAF WILDERNESS MEDICINE

September 12, 2019

Dear George -

Congratulations on completing a **16-Hour Wilderness First Aid Course** with Longleaf Wilderness Medicine!

| | |
|---|---|
| **Course Number:** | Herrera-WFA234 |
| **Course Location:** | Seattle, WA |
| **Issue Date:** | September 12, 2019 |
| **Expiration Date:** | September 12, 2021 |

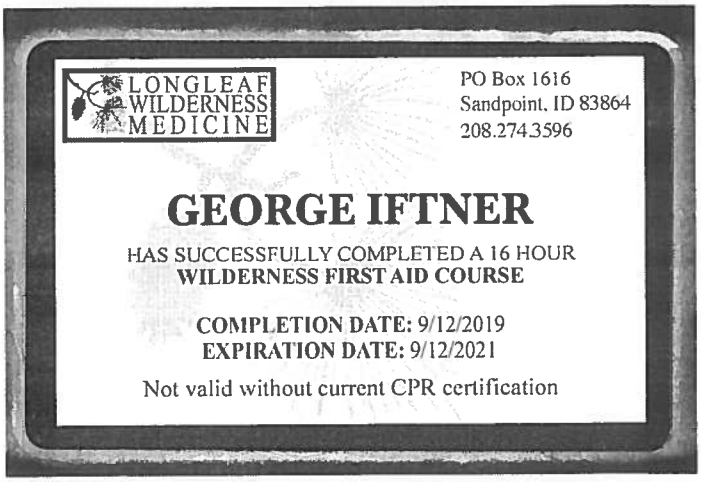
If you have any questions that arise after class, please do not hesitate to get in contact with us. We love to hear from our alumni! If you do lose your card, you can order a new one through the online store on our website.

Thank you again for choosing Longleaf Wilderness Medicine! We hope to see you in another class in the future.

All our best,

LWM Staff

Longleaf Wilderness Medicine
www.longleafmedical.com
208.274.3596



NATIONAL ENVIRONMENTAL TRAINERS

A TPC COMPANY

# Certificate of Completion

## *George Iftner*

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

**HAZWOPER 8 Hour Refresher (Engineers & Scientists) - 1910.120 (e)**

meeting the requirements identified in Title 29 CFR 1910.120.

**Completion Date: 04/06/2022**

**Certificate Number: 312580**

Amy Bonilla
Vice President

Paul Colangelo
Training Facilitator

www.natlenvtrainers.com
info@natlentrainers.com
750 W Lake Cook Rd, Suite 350
Buffalo Grove, IL 60089
1-888-877-7130

# Certificate of Completion

This is to certify that

## George C Iftner

has satisfactorily completed
8 hours of supervisor training in

## Hazardous Waste Operations And Emergency Response

to comply with the training requirements of
OSHA 29 CFR 1910.120 and WAC 296-62-30415

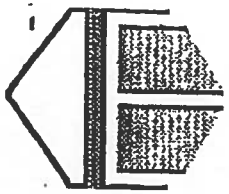
**Certificate Number 1002061**

Training Administration

ARGUS PACIFIC
SAFETY • TRAINING • INDUSTRIAL HYGIENE

Apr 19, 2002
Date(s) of Training

Argus Pacific, Inc. • 1900 W. Nickerson • Suite 315 • Seattle, Washington • 98119 • (206) 285.3373 • fax (206) 285.3927



**IESMC, Inc.**

# Industrial/Environmental Safety Management Consulting, Inc.

P.O. Box 331, Crystal Lake, IL 60039-0331
815-455-1762 Fax: 815-455-1780

*Certifies that*

## *George Iftner*

*has been awarded this certificate for successfully completing*

***40 Hour Hazardous Incident Response Operations EPA (165.5) Training in accordance with 29 CFR 1910.120 and in Cooperation with the U.S. EPA OFFICE OF EMERGENCY AND REMEDIAL RESPONSE***

*Conducted on* April 19, 1998

***Certification #: 0498HW100142***

April 19, 1998 — Date

2.1 CEU

James C. Meldrum, Founder, CEI

# Certificate of Completion

This is to certify that

## George Iftner

has satisfactorily completed
2 hours of refresher training in

## Confined Space Entry

to comply with the training requirements of
WAC 296-809 and OSHA 29 CFR 1910.146.

**Certificate Number 1024796**

Susan N. Mast
Instructor

ARGUS PACIFIC
SAFETY • TRAINING • INDUSTRIAL HYGIENE

Dec 8, 2006
Date(s) of Training

Argus Pacific, Inc. • 1900 W Nickerson • Suite 315 • Seattle, Washington • 98119 • (206) 285.3373 • fax (206) 285.3927

# Certificate of Completion

This is to certify that

## George C. Iftner

has satisfactorily completed
4 hours of training in

## Lead in Construction

to comply with the training requirements of
WAC 296-155-176 and 29 CFR 1926.62

Certificate Number 159427

Instructor

ARGUS PACIFIC
TRAINING • CONSULTING
A Terracon COMPANY

Oct 21, 2016
Dates(s) of Training
Annual Refresher Required

ARGUS PACIFIC, INC / 1900 WEST NICKERSON ST, SUITE 315 / SEATTLE, WASHINGTON 98119 / 206.285.3373 / ARGUSPACIFIC.COM

# Certificate of Completion

*This certifies that*

## Nina Maas

*has successfully completed*

## 8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

**In Accordance w/Federal OSHA Regulation 29 CFR 1910.120(e) & (p)**

And all State OSHA/EPA Regulations as well including 29 CFR 1926.65 for Construction.

**This course (Version 2) is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) (Accreditation # 044).**

Online Training Systems, LLC., Provider #5660170-2, is accredited by the International Association for Continuing Education and Training (IACET) and is accredited to issue the IACET CEU. As an IACET Accredited Provider, Online Training Systems, LLC. offers CEUs for its programs that qualify under the ANSI/IACET Standard. Online Training Systems, LLC. is authorized by IACET to offer 0.8 CEUs for this program.

| Jules Griggs | 2105075207482 | 5/7/2021 |
|---|---|---|
| Instructor | Certificate Number | Issue Date |

*Julius P. Griggs*

Julius P. Griggs
Program Administrator

**Rod Zierenberg**
Training Director

ACCREDITED IACET PROVIDER

Scan this code or visit otsystems.net/v to verify certificate.

This course is distributed by HazMat Student, LLC (http://www.hazmatstudent.com)
Proof of initial certification and subsequent refresher training is NOT required to take refresher training

OTS
HazMat Student, LLC
2828 Cochran St., Suite 322 Simi Valley,CA 93065
http://www.hazmatstudent.com

# CERTIFICATE OF COMPLETION

This certifies that

**Nina Maas**

has successfully completed the course

## Confined Space Entry Training 8 hours (General Industry)

| Course Duration | Completion Date | Certificate # |
| --- | --- | --- |
| 8.0 | 05/17/2021 | 000018861912 |

Official Signature