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Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Prepared for:
Port of Portland

September 27, 2024
32-23011207

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1.0 Introduction

Apex Companies, LLC (Apex) prepared this Basis of Design Report (BODR) for the Willamette Cove Upland Facility (the Facility) as part of Voluntary Cleanup Program (VCP) Agreement EC-NWR-00-26 between the Port of Portland (Port), Metro, and the Oregon Department of Environmental Quality (DEQ). The Facility is defined in the DEQ Environmental Cleanup Site Information (ECSI) database as ECSI No. 2066. For the BODR, the site consists of that portion of the upland Facility landward of the top of the riverbank (referred to as the Site). Investigation and cleanup of the riverbank, beach, and in-water contamination are being conducted separately under the Portland Harbor Superfund Site (PHSS) in-water actions overseen by the U.S. Environmental Protection Agency (EPA).

1.1 Purpose and Objectives

The purpose of this BODR is to build on the Remedial Design Investigation (RDI) Evaluation (Apex, 2023a) by refining the scope of the selected remedial alternative and to describe the objectives, overall approach, schedule, milestone check in points, and specific project elements of the final remedy.

The objectives of the BODR include:

1. Summarize the results of the RDI and discuss if identified data gaps have been adequately investigated such that the remedial design (RD) and remedial action (RA) can proceed;
2. Summarize existing site conditions and site factors which affect technology assignments in the record of decision (ROD), including detailed reasonably anticipated future land use information and other data;
3. Summarize design criteria applicable to the Site;
4. Identify a preferred remedial approach based on consistency with the ROD;
5. Identify long-term monitoring and maintenance considerations for the Site;
6. Identify needed design studies for RD, if any; and
7. Describe a sequencing plan as well as an overall schedule to complete the design studies, RD, and RA for the Site.

1.2 Regulatory Framework

Since 1988, a succession of site-specific investigations and removal actions have been implemented at the Facility. The Facility is defined within the DEQ ECSI database as No. 2066. In November 2000, the Port and Metro entered into a voluntary agreement (ECVC-NWR-00-26) with DEQ to perform a remedial investigation/feasibility study (RI/FS) and implement any needed source control measures to prevent releases to Portland Harbor. In December 2000, the EPA identified the Portland Harbor area of the lower Willamette

River as a Superfund Site (ID No. ORSFN1002155) and placed it on the National Priorities List (NPL) due to concerns regarding contamination in Willamette River sediments posing risks to human health and the environment. The EPA selected a final action for Portland Harbor in their January 2017 ROD.

In 2001, the EPA entered into a Memorandum of Understanding (MOU) with the DEQ, six federally recognized Native American Tribes, the National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of the Interior, and the Oregon Department of Fish and Wildlife (ODFW). Under this MOU, the DEQ is the lead agency for addressing sources of contamination in the upland portions of the Superfund Site (i.e., source control), and the EPA is the support agency.

Prior to 2000, environmental assessments were conducted at the Facility related to property transfers. The Facility is located within Portland Harbor, so following designation of the Portland Harbor Superfund Site, the DEQ determined that the Facility could pose a threat as a source of contamination to the harbor and that further upland assessment was required.

The Port and Metro conducted the RI of the Facility between April 2001 and September 2002. The RI combined historical information (prior to 2001) and results of the investigation to develop a conceptual site model and a list of contaminants of interest. Multiple subsequent investigations were conducted between 2002 and 2017 to further investigate areas identified in the RI and resolve data gaps. Interim removal actions were completed in 2004 to address liquid phase petroleum at the inner cove (Ash Creek, 2005), in 2008 to remove metals hot spots on the eastern Central Parcel (Ash Creek/Newfields, 2008), and in 2015/2016 to remove human health hot spots, primarily on the Central Parcel (Apex, 2016). These removal actions included off-site disposal of approximately 20, 1,000, and 5,000 tons of soil, respectively. An FS and a source control evaluation were conducted in 2019 (Apex, 2019).

Based on the FS, the DEQ defined the remedial action objectives (RAOs) and selected a final remedial action for the Site in the March 2021 ROD (DEQ, 2021). The ROD and this BODR address soil only. Groundwater is being further assessed through ongoing source control evaluation, and if needed, groundwater cleanup will be addressed in a separate action. In summary, the selected soil remedial action in the ROD consists of the following elements:

- Excavation and off-site disposal of soil exceeding hot spot levels for human health;
- Excavation and off-site disposal of soil exceeding non-dioxin/furan (e.g., metals including mercury) hot spot levels for ecological health;
- Consolidation and on-site capping[1] (using a demarcation layer and minimum 3 feet of clean material) of a) soil posing an excess risk to humans but below hot spot levels; and b) soil with higher risk levels relative to plants and animals, including hot spots;

[1] In 2022, the Metro Council elected to implement the contingency remedy in the ROD whereby soil designated for excavation and on-site capping in a consolidation cell will instead be disposed of off-site in a regulated landfill.

- Allowance for alternative techniques to save native trees during excavations;
- In-place covering of residual soil contamination posing a lower-level risk to plants and animals following off-site disposal and on-site consolidation[1] and capping. Cover thickness would be determined based on the level of residual risk; however, a minimum of 1 foot of clean topsoil will be necessary with 3 feet of clean soil cap in areas with remaining ecological hot spots;
- Long-term monitoring and maintenance of all engineering controls, including consolidation area[1] caps and soil covers. A cap inspection and maintenance plan, a contaminated media management plan, and a community and outreach plan will be developed;
- Institutional controls, including recording of a deed restriction or equivalent, with the property identifying the nature of contamination, use restrictions (e.g., no residential usage), and necessary long-term controls; and
- A contingency remedy incorporated by DEQ that allows for Metro to elect to perform additional measures during remedial design and in consultation with DEQ to align with final plans for use of the Site.[2] Under this framework, Metro can eliminate or greatly reduce the volume of soil to be consolidated on-site and instead transport the excavated soil off-site for disposal at a regulated waste facility.

Implementation of the selected remedy (including the contingency remedy that Metro has elected to perform) will allow for full access to the Site, on and off trails, in accordance with Metro's intended future use as a nature park.

1.3 Coordination with In-Water Remedial Design Processes

The Site is located upland of the Willamette Cove In-Water Project Area that is the portion of the Portland Harbor Superfund Site between approximately river miles (RMs) 6.1 and 6.9 along the east bank of the Willamette River. The Site remedial design process will require ongoing coordination with the In-Water Remedial Design Group (In-Water Group) to check that the selected remedy satisfies the remedial action objectives of the Site and the in-water project within the transition area, primarily the riverbank. To achieve this, both parties are engaged in ongoing regularly scheduled coordination meetings and shared design document review, and opportunities for realizing efficiencies in remedial actions are being discussed. In addition, Metro property ownership extends from the upland area to the ordinary low water line (OLWL) on the riverbank, and Metro and the Port will coordinate with the In-Water Group on future land-use planning goals, long term maintenance requirements and community priorities.

[2] As indicated in the prior footnote, the Metro Council has elected to implement this contingency remedy.

1.4 Report Organization

This document is organized in the following manner:

- Section 2 provides a description of the Facility and the Site and refinement of the conceptual site model (Objectives 1 and 2);
- Section 3 presents design criteria and performance standards (Objectives 3 and 4);
- Section 4 summarizes general monitoring and maintenance requirements (Objective 5);
- Section 5 describes design studies (Objective 6);
- Section 6 presents remedial design stages, the conceptual sequencing plan, and scheduling (Objective 7); and
- Section 7 is a list of references.

2.0 Site Description and Conceptual Site Model Refinement

2.1 Site Description and Physical Setting

The Site is located along the east bank of the Willamette River in the St. Johns area of Portland, Oregon. Figure 1 shows the location of the Site between River Miles 6 and 7 on the Willamette River and is mostly in Section 12 of Township 1 North, Range 1 West, Willamette Meridian. The Facility has been owned by Metro since 1996. Figure 2 provides a current plan of the Site, Facility, and the surrounding area. For the purposes of describing the Site, it has been divided into West, Central, and East Parcels as shown on Figure 2.

2.1.1 Extent of the Site

The Site is approximately 3,000 feet long and varies from 80 to 650 feet in width. The edge of the cove is up to 800 feet from the main river channel; it was created primarily as a result of the placement of the embankment leading up to the Burlington Northern Santa Fe (BNSF) railroad bridge. The Facility as defined in the VCP Agreement covers approximately 24 acres that are inland from the OLWL. However, the scope of work for the VCP Agreement limits the work to areas inland from the mean high water (MHW) line (defined as 13.3 feet, North American vertical datum 88 [NAVD88]) to the property line with the Union Pacific Railroad (UPRR). DEQ and EPA have agreed that the riverbank portion of the Facility (defined as the area from the waterline to the top of bank [TOB]) will be addressed as part of in-water activity. Although the FS included the upper portion of the riverbank, the ROD and upland RA work does not include any portion of the Facility below the TOB. Therefore, as stated in Section 1.0, the Site for the RA is that portion of the Facility from the TOB to the inland property line and covers an area of approximately 18.63 acres, divided as follows: West Parcel (4.28 acres); Central Parcel (7.76 acres); and East Parcel (6.59 acres).

2.1.2 Structures and Improvements

There are no buildings on the Site. Indications of previous structures include remnant debris, a large concrete slab foundation, a paved roadway in the eastern portion of the Site, and several smaller concrete slabs, vaults, and foundations.

Nine groundwater monitoring wells are present on the Site, generally located along the top of bank (see Figure 2).

Per the City of Portland GIS (www.portlandmaps.com), a buried City of Portland stormwater line crosses the Site near the west end of the Central Parcel. Associated with the stormwater line are three concrete manholes. The stormwater line consists of 18-inch concrete pipe between the manholes. From the last manhole to the outfall on the riverbank, the line is constructed of 30-inch concrete pipe.

2.1.3 Topography

The Site is situated on a terrace created by historical filling. Overall, the topography of this terrace is relatively flat, with an elevation ranging between 30 and 45 feet (all elevations in the report refer to NAVD88 unless otherwise noted). The surface elevations generally decrease from the West Parcel (35 to 45 feet) to the Central Parcel (30 to 40 feet) and to the East Parcel (30 to 35 feet). Berms and hummocks are occasionally present on the West Parcel and the edges of the East Parcel.

Adjacent to the Site, the riverbank is generally a steep slope down to the river. The BNSF railroad embankment along the southeast perimeter of the cove rises steeply approximately 30 feet higher than the East Parcel. North of the Site, across the UPRR tracks, is a naturally formed bluff rising 50 to 60 feet above the West Parcel, 60 to 120 feet above the Central Parcel, and 120 feet above the East Parcel. This bluff rises at approximately 5H:4V adjacent to the East and Central Parcels. Near the West Parcel, the slope is approximately 10H:3V.

2.1.4 Vegetation and Habitat Types

In 2015, Metro conducted a vegetation survey of the Facility that identified approximately 1,000 native trees on the Site. Figure 3 shows the general extent of native trees on the Site. Native species identified on the Site include:

- Pacific Madrone;
- Bigleaf Maple;
- Oregon Ash;
- Black Cottonwood;
- Oregon White Oak;

- Pacific Willow; and
- Scouler's Willow.

There are four major habitat types at or adjacent to the Site: shallow water, riparian forest, oak–madrone woodland, and mixed woodland.

2.1.5 Surrounding Properties

The Site is bordered on the northeast by the UPRR tracks. Farther to the northeast is a vegetated bluff. A residential area is present on top of the bluff and farther inland. Bordering the northwest side of the Site is a vacated portion of North Richmond Avenue with industrial property beyond. Toward the river, the Site is bordered by the riverbank and the surface water of the cove and Willamette River. To the southeast is an embankment for the BNSF railroad bridge over the Willamette River. On the opposite side of this embankment is the former McCormick & Baxter Creosoting Company, a federal Superfund Site (McCormick & Baxter). There is a sediment cap made of a concrete block mat and layers of sand and gravel adjacent to McCormick and Baxter that extends into Willamette Cove (see Figure 2).

2.1.6 Cultural Resources

A cultural resource survey of the Facility was conducted in 2003 (Archaeological Investigations Northwest, Inc., 2003) with the conclusion that there are no significant archaeological or historical resources identified. However, it is possible that significant resources may be encountered if future activity were to disturb the original floodplain surface and underlying native soils north and east of the 1910 shoreline. In addition, during part of the 2016 removal action, an archaeologist was on site to observe the debris encountered in one area of the Central Parcel. The archaeologist concluded that the brick and other debris encountered should not be recorded as an archaeological site.

Willamette Cultural Resources Associates (Willamette CRA) conducted a review of selected previous cultural resource works for the Site. An updated Willamette CRA review is being drafted and is intended to determine the status of previously completed cultural resources work at the Site and recommend future steps for consideration. Recommendations originating from the updated study that are applicable to the upland remedial action will be addressed in RD.

2.1.7 Geology

Regional Geology. The Site is in the southwestern portion of the Portland Basin, which consists of an elongated structural trough bounded by the Tualatin Mountains to the west, the Lewis River to the north, the foothills of the Cascade Range to the east, and the Clackamas River to the south (McFarland and Morgan, 1996 [United States Geological Survey 2470-A]). In the Portland area, the Columbia River Basalt forms the basement unit of the basin. Sediments filling the basin consist of the Troutdale Formation overlain by

quaternary alluvial and catastrophic flood deposits. In localized areas, surface soils include fill placed by human activity.

The banks of the Willamette River within Portland Harbor are characterized by fill material, fine-grained flood deposits, and recent alluvium (collectively referred to as FFA) and encompass a broad range of soil textures and hydraulic properties. The FFA unit is the primary unit of importance in characterizing the interactions between upland groundwater and the river because it forms most of the river channel as well as the adjacent uplands, and most of the upland impacted soil and groundwater occurs within this unit (EPA, 2016).

Site Geology. The geology beneath the Site consists of fill and alluvial deposits overlying the Troutdale Formation. Early maps of the area indicate the current upland portion of the Site consisted of a strip of lowland adjacent to the current UPRR railroad tracks. Based on historical maps and photographs, fill was placed on this lowland and outward into the Willamette River prior to and concurrent with development. The thickness of the fill across the Site is generally in the range of 20 to 30 feet; however, in places, it could be up to 60 feet (such as in a former log pond on the West Parcel filled in the early 1970s).

The West Parcel consists of a mixture of roughly equal amounts of silty sand, sandy silt, and silt with some clean sand. The Central and East Parcels consist mostly of sand or silty sand. The observed soil types are consistent with the known fill history where much of the Central and East Parcels were filled in a few large events, but the West Parcel was filled in multiple small events from a variety of sources (Apex, 2019).

2.1.8 Existing Conditions and Site Use

The Site is currently vacant, covered with invasive and native vegetation, and it provides habitat for opportunistic use by wildlife. The Site is not managed for any human use and is posted to prohibit trespassing. However, trespassers do come on the Site (e.g., persons experiencing houselessness, joggers/walkers, people seeking casual recreation, and anchored boaters coming ashore for various reasons).

The Site is currently zoned under the City of Portland Zoning Title 33 as an open space (OS) zone with "g" (River General) and "q" (River Water Quality) greenway overlay zones (City of Portland, 2023a). The open space zone is intended to preserve and enhance public and private open, natural, and improved park and recreational areas. Greenway regulations are also intended to protect, conserve, enhance, and maintain the natural, scenic, historical, economic, and recreational qualities of lands along Portland's rivers. Specifically, the "g" overlay is intended to allow public use and enjoyment of the waterfront, to enhance the river's scenic and natural qualities, and to implement the City of Portland's Willamette Greenway responsibilities, including a regional trail. The "q" overlay is designed to protect the functional values of water quality resources by limiting or mitigating the impact of development in the 50- to 200-foot setback from the top of bank. Nearby zoning includes commercial (EG2), residential (R2 and R5), open space (OS), and industrial (IH and IG2).

The Site is included in a citywide inventory that identified scenic resources (City of Portland, 2023b) and is identified as a scenic viewpoint. The zoning map shows a public-use trail through the Site (City of Portland, 2023a). This trail is proposed as part of the North Portland Greenway Trail Alignment Plan adopted in 2013. The trail alignment was originally adopted in 1987 as part of the Willamette Greenway Trail. The segment traversing Willamette Cove is a gap in the alignment identified in the Regional Trail Strategy, which makes eliminating gaps a priority (City of Portland, 2016).

Metro is planning to develop a nature park at Willamette Cove that will provide fish and wildlife habitat, offer low-impact recreation activities, and incorporate nature-friendly amenities. The Site's habitat and conservation objectives will be balanced with human access. Recreational opportunities will be determined after extensive Tribal and community conversations and would likely include the North Portland Greenway Trail, secondary trails, nature viewing points, beach access, water access, environmental education programs, cultural elements and interpretation, art, and information signs.

2.2 Remedial Design Dataset

The Port and Metro conducted an RDI in 2022 in accordance with the DEQ-approved *RDI Work Plan* (Apex, 2022). The results of the RDI were presented in the *Draft RDI Evaluation Report* (Apex, 2023a). The DEQ provided written comments on the *Draft RDI Evaluation Report* in a letter dated July 31, 2023 (DEQ, 2023), which requested a response from the Port and Metro to DEQ's comments in lieu of a revised report. The Port and Metro provided responses to DEQ's July 2023 comments in a letter dated October 4, 2023 (Apex, 2023b).

Two primary data types were collected during the RDI: incremental sampling methodology (ISM) samples and 5-point composite samples. The decision units (DUs) sampled during the RDI are shown on Figure 4. The RDI data will be used to prepare the remedial design. The data are presented in Tables 2a through 5b in the RDI report (Apex, 2023a). For decision units where replicate samples were collected, the design will be based on the maximum concentration among the replicates within each DU for each constituent of concern (COC).

2.3 Nature and Extent of Constituents of Concern

2.3.1 Nature and Extent Summary

The goal of the RD investigation was to laterally and vertically (to a depth of 3 feet) delineate COCs exceeding relevant screening levels. The results of the sampling described above demonstrated the following:

- COCs exceeding preliminary remediation goals (PRGs) in soil extend laterally throughout the entire Site;
- In most DUs, COCs exceeding PRGs in soil extend at least to the depth of sampling during this investigation (3 feet below ground surface [bgs]);

- Except for low detections in a few samples (maximum exceedance ratio of less than 1.2), COC concentrations in soil beneath the concrete slabs on the East Parcel are below PRGs;
- Primary ecological risk drivers are total dioxins/furans toxic equivalent (D/F TEQ), mercury, and lead on all parcels and polychlorinated biphenyls (PCBs) on the West Parcel. Total D/F TEQ and mercury ecological hot spots are present on the Central and East Parcels, and PCBs, mercury, and chromium ecological hot spots are present on the West Parcel. One replicate sample on the Central Parcel was found to be at the lead ecological hot spot level; and
- Primary human health risk drivers are total D/F TEQ (all parcels) and carcinogenic polycyclic aromatic hydrocarbons (cPAHs; Central Parcel). Based on the RDI data, there are no human health hot spots remaining on the Site.

2.3.2 Vertical Concentration Trends

Based on historical development and site use presented in the remedial investigation (Hart Crowser, 2003), a general model for vertical contaminant trends was developed and summarized as follows:

- The East Parcel and much of the Central Parcel were filled early in the 20th century, prior to significant industrial development in Portland Harbor. These fills were sourced from dredge sands and possibly fill from development of the adjacent BNSF cut/embankment. Because these fills were placed prior to industrial development, it is expected that the fill materials were not contaminated at the time of placement;
- The west end of the Central Parcel was only partially filled in the original site development. The timing of filling to present grade is uncertain, but the upper portions of this area were likely filled after industrial operations began.
- Some portions of the central area of the Central Parcel were disturbed after filling as evidenced by a small area of brick debris containing dioxins/furans to depths of about 5 feet (excavated during the 2015/2016 removal action);
- Much of the West Parcel was filled in the 1970s using fill sourced from multiple industrial facilities that included impacts from COCs; and
- Releases during historical site use would likely be associated with surface spills or surface deposition, and the COCs (metals, semi-volatile organic compounds, PCBs, and dioxins/furans) are relatively immobile.

Based on this historical summary, roughly the eastern half of the Site likely has COC concentrations that decrease with depth. Expected concentration trends in the west portion of the Central Parcel are uncertain, and the West Parcel likely does not have clear concentration trends within the upper 20 to 30 feet.

The RDI data were reviewed to evaluate vertical concentration trends. The analysis focused on locations with relatively higher concentrations, so the data set was selected as follows.

- Each DU has a data set consisting of three data points (corresponding to the three depths sampled) for each COC. There are 15 COCs, but high molecular weight polycyclic aromatic hydrocarbons (HPAHs), low molecular weight PAHs (LPAHs), and cPAHs were evaluated together, for a total of 13 COCs assessed. Each DU except DU-41 (East Parcel soil berm) was evaluated for a total of 43 DUs. This gives a total of 559 potential data sets to evaluate (13 COCs at each of 43 DUs).
- Data sets where all three depths had a COC concentration that was either less than twice the detection limit or below the DEQ default background concentration were excluded from the evaluation. Just over half of the data sets met those criteria, leaving 277 data sets to be evaluated.

Each data set was plotted (concentration versus depth) and visually assessed for a vertical concentration trend (each data set consists of three data points, insufficient for a more rigorous statistical analysis) with results summarized below by Parcel and COC.

	Portion of Data Sets Showing Decreasing Concentration with Depth						
Parcel	All COCs	All Risk Driver COCs	Lead	Mercury	D/F	PAHs	PCBs
West	59%	52%	33%	100%	67%	--	33%
Central	92%	95%	93%	94%	100%	94%	--
East	71%	86%	40%	100%	100%	--	--

Overall, 80 percent of the data sets show a decreasing concentration with depth, strongly supporting that COC concentrations decrease with depth. The Parcel results are consistent with the Site history discussion above where it was concluded that the Central and East Parcels are likely to show decreasing contamination with depth whereas the West Parcel may not. The relationship is even stronger when focusing on the primary risk drivers on the Central and East Parcels where (excluding lead on the East Parcel that has a limited data set) 94 to 100 percent of the data sets show decreasing concentrations with depth. Additionally, DU-14 is entirely within the area of the 2015 removal action (where surface soils were removed and replaced with clean topsoil). Excluding DU-14 from the analysis, 100 percent of risk driver COCs on the Central Parcel demonstrate a decreasing concentration with depth.

2.3.3 Preliminary Assessment of On-Site Borrow Potential

The discussion in Section 2.3.2 indicates that cleaner soil may be found at depth on the eastern half of the Site, suggesting that soil suitable for use as fill may be present on the Site. Two areas are being considered for significant excavation: layback of the riverbanks and beneath the concrete slabs on the East Parcel. A preliminary assessment of the potential volume of borrow soil available for use as fill was conducted by comparing the RDI soil data in these areas to cleanup levels (CULs; see Section 3.2.2).

Riverbank Layback. Bank layback is being evaluated by the In-Water Group and has not yet been established. However, where there is sufficient room for layback, target slopes would likely be on the order of 5:1 (horizontal:vertical) for the lower slopes and 3:1 for the upper slopes. The eastern 700 feet of the Central Parcel has sufficient widths for this type of layback and would result in moving the top of slope landward on the order of 70 feet. That area would generally correspond to DU-16, DU-19, and DU-26. The data for the 2- to 3-foot depth from these DUs were compared to CULs, and mercury, lead, zinc, PCBs, and dioxin/furans exceeded CULs at least once. The data for these COCs were used to extrapolate concentrations with depth, and concentrations are predicted to be less than CULs below a depth of less than 4 feet. Excluding the top 4 feet of soil, a 70-foot bank layback over a distance of 700 feet could generate 18,000 cubic yards of clean fill.

East Parcel Concrete Slabs. The concrete slabs on the East Parcel are represented primarily by DU-39 and DU-40. In these DUs, only one sample exceeds CULs (Selenium exceeds the CUL by a factor of 1.2 in sample DU-39 [1-2].) In general, all of the soil in these DUs would be suitable for re-use. Using assumptions for cut slopes similar to above for bank layback, an off-channel habitat excavation in the area of the concrete slabs could generate on the order of 20,000 cubic yards of clean fill.

As discussed in Section 3.3.6, Metro is developing a master plan for future site use that includes habitat restoration. Ultimately, these plans may include excavation beyond that needed for site remediation, potentially generating additional clean fill for on-site re-use.

2.4 Data Gap Identification

Based on the evaluation of the RDI data discussed above, the remaining data gaps include:

- Vertical delineation of COCs beyond 3 feet in areas proposed for 3 feet of excavation;
- Vertical delineation of COCs beneath the soil berms on the East Parcel (DU-41); and
- Vertical delineation of COCs in potential borrow areas beneath concrete slabs and along the riverbank.

3.0 Performance Standards and Design Elements

3.1 Preliminary Remedial Design

The planned remedy generally consists of removal and off-site disposal of soil with COCs above hot spot levels[3] or posing an excess risk to humans followed by installation of a cap over remaining soil exceeding

[3] The ROD does not require off-site disposal of dioxin/furan ecological hot spots, but those hot spots are required to be excavated and placed into the consolidation cell. With Metro exercising the contingency remedy, materials that were

ecological risk levels. Based on evaluation of the data collected during the RDI, excavation depths (where needed) are anticipated to range from less than 1 foot bgs to at least 3 feet bgs. The thickness and composition of the soil cap may vary depending on the excavation depth and residual contamination. Site restoration will be conducted in coordination with the Metro master plan currently under development and the in-water remedial action.

3.2 Performance Standards

3.2.1 Remedial Action Objectives

RAOs are the objectives or goals for the RA established in the ROD (DEQ, 2021) to achieve protection for human and ecological receptors. The ROD identified the following RAOs:

1. Prevent exposure of human receptors (recreational/park user, transient trespasser, construction worker) to soil containing COCs at concentrations exceeding acceptable risk levels (based on exposure to individual COCs or the cumulative impact of simultaneous exposure to multiple COCs);
2. Prevent exposure of ecological receptors (mammals, birds, invertebrates, plants) to soil containing COCs at concentrations exceeding individual and cumulative acceptable risk levels;
3. Remove or treat soil hot spots of contamination to the extent feasible and practicable; and
4. Prevent further migration of contaminated upland soil to the river, to the extent practicable.

3.2.2 Cleanup Levels (CULs)

The CUL is defined as the soil concentration corresponding to the acceptable risk level (or the background concentration if the acceptable risk level is less than background) for the corresponding COC, receptor, and exposure area. The CUL values and the use of CULs in RD are discussed below.

Receptor-specific risk-based concentrations (RBCs) were developed in the baseline risk assessments (Formation Environmental, 2013 and 2014) and the feasibility study (Apex, 2019). The lowest RBC (or the background concentration, whichever is greater) for each COC was selected as the PRG[4] for that COC. PRGs were identified separately for ecological and human receptors. The RBCs and PRGs are presented in Tables 1 and 2 (adopted from Tables 3 and 6 of the ROD with arsenic background revised per direction of DEQ)[5] for human and ecological receptors, respectively. Table 3 presents the CULs. CULs will be used in RD as follows:

planned for the consolidation cell will be disposed of off-site. Therefore, the remedial design calls for all excavated hot spots to be disposed of off-site.

[4] PRGs are conservative screening levels used during the remedial design investigation to assure that data collected will adequately characterize the nature and extent of contamination for use in RD. The PRGs correspond to the lowest CUL for each of ecological and human receptors.

[5] DEQ comment letter on the Remedial Design Investigation Evaluation Report (RDI Report, Apex March 22, 2023) dated July 31, 2023, General Comment number 4.

- Immobile receptors (plants, invertebrates): For immobile receptors, soil concentrations representing DUs of approximately 0.5 acres will be compared to CULs. RD will define removal or risk management actions in each DU where a COC concentration equals or exceeds a CUL for immobile receptors. The CUL for each COC for immobile receptors is the lower of the plant or invertebrate RBC (or the background concentration, whichever is greater) for that COC.
- Mobile receptors (birds, mammals, humans): For mobile receptors, soil concentrations representing exposure areas (exposure point concentrations) will be compared to CULs. The exposure areas evaluated will be the West, Central, and East Parcels, generally consistent with baseline risk calculations (Formation Environmental, 2013 and 2014).[6] The exposure point concentration for a parcel will be calculated as the 90 percent upper confidence limit of the mean (90 UCL) of the applicable data from the DUs within that parcel. As a result, for mobile receptors, it is possible for an individual DU COC concentration to exceed the CUL but the exposure point concentration for the parcel to be less than the CUL. In that event, no risk management would be required for that COC/receptor on that parcel. RD will address removal or risk management actions on each parcel where a COC exposure point concentration equals or exceeds a CUL for mobile receptors (generally focusing on addressing the DUs with higher COC concentrations until the risk at the parcel is acceptable). The CUL for each COC for mobile ecological receptors is the lesser of the bird or mammal RBC (or the background concentration, whichever is greater) for that COC. For human health, the CUL for each COC is the lowest of the human receptor RBCs (or the background concentration, whichever is greater) for that COC (i.e., the RBCs for the park user receptor).

3.2.3 Hot Spots

For soil, a hot spot exists if the Site presents an unacceptable risk and if the contamination is highly concentrated, highly mobile, or cannot be reliably contained. Hot spots were evaluated in the feasibility study (Apex, 2019), and only high-concentration hot spots were identified. For all receptors, hot spots are evaluated on a point-by-point basis. Therefore, soil concentrations representing DUs of approximately 0.5 acres will be compared to hot spot levels. The RD will define removal (to the extent feasible and practicable) or risk management actions in each DU where a COC concentration equals or exceeds a hot spot level. The hot spot level used in the RD is the lowest of the hot spot levels for any receptor. Table 3 lists the hot spot levels and corresponding receptors that define the hot spot levels.

[6] The Central Parcel had three exposure areas in the Baseline Risk Assessment: Central Beach, Wharf Road, and Upland. The Central Beach exposure area is below top of bank, so it is not part of the Site. The Wharf Road exposure area evaluated dioxin/furan exposure only in a small area near the east end of the Central Parcel (part of which is below top of bank) but will not be separately evaluated going forward. The Central Parcel Upland exposure area corresponds almost entirely to the Central Parcel portion of the Site. The East Parcel had two exposure areas in the Baseline Risk Assessment: Inner Cove Beach and Upland. The Inner Cove Beach exposure area is below top of bank so is not part of the Site. The East Parcel Upland exposure area corresponds almost entirely to the East Parcel portion of the Site.

3.3 Design Elements

Remedial design elements are described in the following sections. Each of these elements will be defined in detail in the drawings and specifications that will be prepared during RD (see Section 6).

3.3.1 Site Clearing

Except in locations where native trees may be preserved (discussed below), areas targeted for excavation or capping will be cleared of vegetation and debris. This section discusses design requirements for site clearing.

Debris Removal. Debris on the Site consists primarily of concrete foundations (including metal reinforcing bars) associated with historical buildings but may also include wood pilings and smaller debris such as brick or wood, metal, glass, and ceramic fragments. Debris will be removed to the depth of the proposed excavation. Debris extending below the excavation depth may be removed or cut off at the limits of the excavation. Smaller debris (on the order of 2 feet in the longest dimension) may be removed with excavated soil. Larger debris will be removed separately and recycled if it can be adequately decontaminated. Otherwise, debris will be disposed of with the contaminated soil. During debris removal, protocols described in the Oregon SHPO Archaeological Inadvertent Discovery Plan template will be followed.

Invasive Species Removal. Invasive species, including roots, will be cleared from the entire Site and disposed of in an off-site landfill. In areas targeted for excavation, root removal may be conducted in conjunction with excavation.

Native Tree Preservation. During the ROD comment period, DEQ received substantial support from the public to preserve native trees. In the 2015 removal action, special techniques were used to successfully preserve native trees within the removal action area. These special techniques, implemented within the driplines of the trees and intended to preserve tree roots, limit excavation depths and residual soil cover thicknesses to approximately 6 inches. Therefore, given the widespread presence of COCs exceeding CULs and/or hot spot levels to depths greater than 6 inches, tree preservation would have a corresponding increase in residual risk. During RD, native tree preservation will be evaluated on a case-by-case basis using the following guidelines:

- Tree preservation will be considered only in DUs where planned excavation depths are 1 foot or less (these areas are likely to be limited to portions of the West and East Parcels); and
- Tree preservation will be limited to maintain human health risks at acceptable levels.

Following these guidelines will likely result in very limited preservation of native trees.

Woody Debris Salvage. The design will evaluate potential for salvage of large trees cleared from the Site for re-use in habitat enhancement or other site features, if deemed safe. At a minimum, some or all the native

trees cleared from the Site without root balls will be stockpiled for reuse in upland restoration or as in-water large woody debris. (The number needed for salvage will be determined during design, including consultation with the In-Water Group.) If it is desired to salvage trees with intact root balls, all contaminated soil must be removed from the root ball. The design will evaluate potential for salvage of large trees that include root balls.

Cleared Vegetation Disposal. Disposal of the cleared vegetation that does not contain invasive species or contaminated soil will be at the discretion of the contractor but may include chipping for on-site use as mulch or disposal at a composting facility. Vegetation containing soil (e.g., grubbed roots) or invasive species will be disposed of in an off-site landfill.

3.3.2 Soil Excavation

The lateral and vertical excavation of soil will be designed to remove soil exceeding hot spots or human health CULs. The input data for the excavation design will be the RDI data for Layers 1, 2, and 3 in each DU.[7]

3.3.2.1 Human Health[8] and Ecological Hot Spot Excavation

Except in special cases discussed further below, each layer that has a soil concentration that exceeds a hot spot level will be targeted for excavation over the full lateral extent of the DU and the full 1-foot thickness of the layer. Figure 5 schematically depicts the soil cells (each 1-foot layer within each DU) that exceed hot spot levels.

Partial Layer Excavation. For practical reasons, the RDI data were collected over depth intervals of 1 foot, but there is no expectation that the vertical extent of contamination conforms to those depth intervals. Construction grading on the other hand can generally achieve tolerances on the order of 0.1 foot. Therefore, to the extent that the soil data suggests that contamination may extend only partially through a layer,[9] the design excavation depth will be to the center of that layer.[10] Removal of the hot spot will be verified with sampling, and additional excavation would be conducted if warranted based on protocols to be defined in the forthcoming verification sampling plan. Based on an evaluation of the soil data, the following layers have a high probability that COC concentrations are below hot spot levels in the lower portion of the layer, and these layers will be targeted for partial removal (the upper 0.5 feet) in the initial excavation plan:

[7] Layers 1 through 3 correspond to the 1-foot-thick layers sampled as part of the RDI: Layer 1 is the 0- to 1-foot depth; Layer 2 is the 1- to 2-foot depth; and Layer 3 is the 2- to 3-foot depth.
[8] Based on the RDI data, there are no human health hot spots remaining on the Site. However, in the event that subsequent data collection (e.g., verification sampling) identifies a human health hot spot, this process will be used to address that hot spot.
[9] Evaluated considering such factors as the magnitude of exceedance in the subject layer and the change in concentration compared to the overlying layer.
[10] This design process is a practicability assessment of the tradeoff between the impacts of doing unnecessary excavation versus the impacts of conducting additional rounds of verification sampling and potentially additional excavation. The impacts analysis considers such factors as effectiveness, reliability, implementability, short-term impacts, and cost.

- DU-12, Layer 3
- DU-16, Layer 3
- DU-17, Layer 2
- DU-19, Layer 3
- DU-21, Layer 3
- DU-24, Layer 2
- DU-25, Layer 2
- DU-27, Layer 2
- DU-28, Layer 3
- DU-42, Layer 2

Buried Hot Spots. From Figure 5, there are three DUs (DU-1, DU-6, and DU-30) with hot spots that are overlain by soil that does not exceed hot spot levels. Excavation requirements for these DUs were evaluated further considering the marginal impacts to excavate the hot spot compared to the marginal risk reduction. Section 3.3.3 describes the cap design process, showing that cap thicknesses will be 2.5 feet or greater except where the lowest residual risks remain following excavation. The ROD requires a minimum of 3 feet of cap over any remaining hot spots, so cap thicknesses will be similar whether the hot spot is removed or not. Considering marginal risks and impacts, these three DUs were evaluated for excavation as follows:

- DU-1: The risk associated with Layer 2 in DU-1 is on the order of 20 times greater than the risks associated with adjacent DUs (hazard quotient of 103 compared to adjacent DUs with hazard quotients of 4 to 8 – see Figure 5). Excavation of DU-1 will result in significant risk reduction, so excavation of DU-1 to a depth of 2 feet is warranted.
- DU-6: DU-6 has a maximum hazard quotient of 10. This is similar to the residual risks in surrounding DUs (hazard quotients in adjacent DUs for layers that will not be excavated range from 4 to 9). Since excavation to 2 feet in DU-6 will not substantively reduce the residual risk, no hot spot excavation is proposed for DU-6.
- DU-30: DU-30 has a maximum hazard quotient of 11. This is similar to the residual risks in surrounding DUs (maximum hazard quotient is 6 in adjacent DUs for layers that will not be excavated). Since excavation to 3 feet in DU-30 will not substantively reduce the residual risk, no hot spot excavation is proposed for DU-30.

Considering the hot spot removal evaluation above, Figure 5 schematically depicts the preliminary excavation depth to address hot spots.[11]

[11] DU-41 is a soil pile present on the north side of the East Parcel. The three samples from DU-41 exceed hot spot levels, so the soil pile will be removed. Design excavation depths beneath the DU-41 soil pile will match the bottom

3.3.2.2 Additional Excavation to Address Excess Human Health Risk

Additional excavation will be conducted beyond hot spot removals if necessary to achieve acceptable risk levels for human health. The risk remaining after hot spot removals (i.e., the residual risk) will be evaluated using the data corresponding to soil that will remain on Site after the hot spot removals. Human health risk (and therefore the need for additional excavation) will be evaluated separately for the West, Central, and East Parcels. Additional excavation to address human health risk will be evaluated as follows.

- **Step 1: Determine if There Are Any Residual Human Health CUL Exceedances.** The residual COC concentrations for each DU are compared to the human health CULs. If there are no exceedances, then no additional excavation is needed.
- **Step 2: Evaluate the Residual Parcel Exposure Point Concentrations.** If there is at least one CUL exceedance on a parcel, the residual human health risk for that parcel will be estimated using procedures consistent with the baseline risk assessment and considering ISM data evaluation guidance, as follows:
    - Human health risks will be calculated separately for each parcel that has a CUL exceedance.
    - Because human health risk will be addressed by removing soil from the Site (i.e, caps will be needed only to achieve acceptable risks levels for ecological receptors, not human health), the residual risk will be estimated using replacement values corresponding to the fill that will replace the removed layer. Replacement values will be estimated from concentrations in potential on-site borrow soil from beneath the concrete slabs on the East Parcel but will not be greater than CUL concentrations.
    - Data from DUs that fall entirely within areas planned for bank layback will be excluded.
    - The composite data will be used as if the composite concentrations are representative of the conditions beneath the concrete slabs.[12]

  If the resulting exposure point concentrations are less than the CULs, no further excavation is needed to address human health risk. For those COCs/parcels that exceed CULs, the evaluation will proceed to Step 3.

elevation of the adjacent DU excavations. Additional smaller soil piles are present along the east edge of the East Parcel. These soil piles may or may not have been sampled as part of the incremental sampling conducted on the East Parcel. Unless otherwise demonstrated by future sampling, above-grade piles in this area will be removed in their entirety. Excavation depths for the DUs beneath soil piles will begin at the level of the adjacent surrounding grade.

[12] Verification sampling using ISM methods will be conducted during remedial action to verify that human health risks are acceptable.

- **Step 3: Define Additional Excavation Needed to Address Excess Human Health Risk.** For those COCs where the 90 UCL concentration from Step 2 exceeds the CUL, additional excavation will be proposed, and the residual risk evaluation will be refined using the following:
    - The DU/layer with the greatest exposed leave surface residual COC concentration will be targeted for removal.
    - Exposure point concentrations will be re-calculated with the updated data set using the same procedure as Step 2.
    - This process of removing the next greatest COC concentration and updating the exposure point concentration will be repeated as needed until the exposure point concentration meets the CUL.
- **Step 4: Define Additional Excavation Needed to Address Localized Excess Human Health Risk.** The risk evaluations conducted in Steps 2 and 3 will be conducted consistent with the baseline risk assessment (Formation 2013), evaluating the risk for exposure areas corresponding to the West, Central, and East Parcels. While these Parcels generally correspond to the historical site uses, in some cases (e.g., the former coal dock near the West/Central Parcel boundary), historical activities may have been focused in smaller areas or crossed over parcel boundaries. Risks calculated solely based on exposure areas corresponding to the parcels could obscure potential risks associated with these smaller areas or areas that overlap parcel boundaries. To assess these potential localized risks, residual COC concentrations (concentrations remaining after hot spot excavations and excavations to address human health risk described above) that exceed human health CULs will be plotted on a site plan. Clusters of exceedances that are significantly smaller than the exposure areas or that cross parcel boundaries will be further evaluated for potential concern considering the future site use as a nature park.
- **Step 5: Define Additional Excavation Needed to Address Shallow Surface Soil (0 to 1 foot) Excess Risk.** The risk evaluations in Steps 2 and 3 will be conducted consistent with the baseline risk assessment, evaluating the risk for exposure to surface soil defined as a depth range of 0 to 3 feet below the ground surface. As discussed in Section 2.3.2, COC concentrations in soil generally decrease with depth on the Central and East Parcels. To assess potential uncertainty in residual risks, the residual data associated with the top 1 foot (from the bottom of the proposed excavation) will be compared to the full residual data set (data within 3 feet of the bottom of the proposed excavation). A practicability evaluation, comparing the marginal risk reduction to the effort associated with additional excavation, will be conducted to identify if further excavation of surface soil is warranted.

Using the procedure described in this section, Appendix A presents the preliminary evaluation of additional excavation needed to address human health risk. Figure 5 schematically depicts the additional excavation to address human health risk.

3.3.2.3 Additional Excavation to Address Higher Relative Ecological Risk

The ROD requires that "soil with higher risk levels relative to plants and animals" be excavated. To evaluate potential additional excavation to address this requirement, rank-order curves of hazard quotients (HQs) and hazard indexes (HIs) were prepared for plants, invertebrates, birds, and mammals. Figures 6A and 6B show the HQs and HIs, respectively. On the figures, different symbols are used for layers targeted for no excavation, partial excavation, or full excavation. These figures illustrate that all layers with higher relative HQs or HIs (i.e., layers that fall above the knee of the rank-order curve) are targeted for full excavation. In fact, the first layer that is not targeted for full removal falls well below the knee of the curve for all receptors. Therefore, no additional excavation is needed to address higher relative/cumulative risks for ecological receptors. These figures will be updated as needed during RD.

3.3.2.4 Preliminary Excavation Plan

Using the excavation design processes described in Sections 3.3.2.1 through 3.3.2.3, Figure 7 presents the preliminary excavation plan. The proposed excavation in DU-1 through DU-26, DU-28, DU-42, and a portion of DU-27 is driven by hot spot removal. Excavation in the remainder of the East Parcel is driven by human health risk. This excavation plan will be refined in RD, including potential adjustments for constructability and park planning. Regardless, the excavation planning for the BODR or RD is the initial targeted excavation only; verification sampling and additional excavation will be conducted as needed to achieve the performance standards defined in Section 3.2. Verification sampling is discussed in Section 4.2.

Preservation of native trees will be evaluated in RD. Beneath trees that are preserved, if any, excavation will be on the order of 6 inches in depth.

Based on the preliminary excavation plan on Figure 7, the estimated soil excavation volume is 50,000 cubic yards.

3.3.2.5 Residual Risk Screening

Based on the preliminary excavation depths presented on Figure 7, this section summarizes the residual risks remaining following remedial action.

Residual human health exposure point concentrations were evaluated in Appendix A. Those concentrations and the corresponding residual excess cancer risks are summarized below.

COC	Human Health	Post-Remediation Exposure Point Concentrations in mg/kg	Post-Remediation Residual Human Health Excess Cancer Risk

	CUL (mg/kg)	West Parcel	Central Parcel	East Parcel	West Parcel	Central Parcel	East Parcel
Arsenic	8.8	NA[13]	NA	5.4	NA	NA	< Background
D/F TEQ	1.50E-05	1.0E-05	5.9E-06	1.5E-05	6.7E-07	3.9E-07	9.9E-07
cPAHs	0.55	0.39	0.03	0.12	7.1E-07	4.7E-08	2.3E-07

The acceptable excess risk level for individual COCs for human health is 1E-06. The excess risk levels summarized above are each less than the acceptable risk level, so post-remediation risk levels are acceptable for human health.[14]

Residual ecological risk following excavation is summarized on Figures 8 through 11 showing maximum residual hazard quotients for each ecological receptor. Residual ecological risk is summarized below for each receptor.

- Plants (Figure 8) – Residual risks for plants are acceptable for most of the Site. On the west end of the West Parcel and the east end of the East Parcel hazard quotients range from 1.0 to 2.4 (data are limited on the Central Parcel). The primary residual risk driver for plants is zinc with contributions from copper, lead, and antimony.
- Invertebrates (Figure 9) – Hazard quotients for invertebrates range from 1.0 to 3.0 throughout most of the Site (data are limited on the Central Parcel). The primary residual risk drivers for invertebrates are metals (zinc, mercury, and copper).
- Birds (Figure 10) – Hazard quotients for birds range from 1.0 to 10.6 throughout most of the Site (data are limited on the Central Parcel). Mercury hot spots are present at two decision units (DU-6 on the West Parcel and DU-30 on the East Parcel). The primary residual risk driver for birds is mercury, except on the East Parcel where it is primarily lead.
- Mammals (Figure 11) – Hazard quotients for mammals range from 1.2 to 6.6 throughout most of the Site (data are limited on the Central Parcel). The primary residual risk driver for mammals is D/F TEQ with contributions from PCBs and nickel.

These excess ecological risks will be managed by caps as discussed in the next section.

[13] NA = Not applicable. The maximum detected concentration on the parcel is less than the background concentration so an exposure point concentration was not calculated.
[14] The acceptable risk level for cumulative risk is 1E-05. Summing the risks for individual COCs results in cumulative risk levels of less than 1E-05.

3.3.3 Capping

After soil removal is completed as described in Section 3.3.2, soil caps will be installed at locations that have unacceptable ecological residual risk. Figure 12 presents typical sections showing the site restoration and cap types to be used. In general, caps will consist of soil ranging in thickness from 1 to 3 feet (inclusive of the surface layer that will consist of a minimum of 1 foot of topsoil planted with native grasses, shrubs, and trees). Caps will be designed using the following approach.

- **Step 1: Identify DUs with Residual Hazard Index Less Than One.** No cap will be installed where the residual ecological hazard index is less than 1. These areas will be restored with 1 foot of topsoil planted with native grasses, shrubs, and trees (see Detail A, Figure 12).
- **Step 2: Identify DUs with a Residual Hazard Quotient Equal to or Greater Than Ten.** Where residual concentrations equal or exceed a hazard quotient of 10, the cap will consist of 3 feet of soil with a demarcation layer separating the native soil from the cap to provide a visible indicator if the cap is breached (see Figure 12, Detail C).
- **Step 3: Determine Cap Thicknesses for Residual Hazard Index Greater Than One and a Maximum Residual Hazard Quotient Less Than Ten.** For all other residual ecological conditions, the cap will consist of 1 to 3 feet of soil with no demarcation layer (see Figure 12, Detail B). The assumptions that form the basis for the cap design include:
    - Cap thickness should be proportional to the residual risk.
    - Cap requirements will be evaluated for each DU for all receptors.
    - The cap thickness will be designed to be protective even if in the long term the upper 3 feet of soil thoroughly mixes through natural processes (e.g., burrowing animals). The cap thickness will be designed by determining the thickness required such that, if the top 3 feet of soil is thoroughly mixed, the resulting COC concentrations will produce a hazard index less than 1 for each ecological receptor.[15]

Using the procedure described in this section, Appendix B presents the preliminary evaluation of caps needed to address residual ecological risk. Figure 13 presents the preliminary capping thicknesses. This capping plan will be refined in the RD, including potential adjustments for constructability, preservation of native trees, or habitat considerations. Within the drip line of preserved native trees, if any, the cap will consist of topsoil with a thickness corresponding to the depth of excavation within the tree drip line. That thickness is anticipated to be on the order of 6 inches.

[15] Note that the cap will be protective regardless of whether mixing occurs. If there is no mixing, the cap will remain in place providing a clean soil layer barrier between ecological receptors and the underlying soil. If there is complete mixing, the resultant concentrations will be below the CULs.

Based on the preliminary capping plan on Figure 13, the estimated cap volume is 82,000 cubic yards (52,000 cubic yards of general fill and 30,000 cubic yards of topsoil).

Verification sampling will be conducted during site excavation. These data, together with RDI data representing soil remaining after excavation, will be used to confirm or adjust cap thicknesses using the procedure above. Verification sampling is discussed in Section 4.2.

The caps will be managed through periodic monitoring and maintenance in accordance with a Cap Inspection and Maintenance Plan and a contaminated media management plan that will be developed in the RD/RA work plan (see Section 4.4).

3.3.4 Imported Soil and On-Site Borrow

Soil used for site restoration (capping materials and topsoil) will be obtained from on-site materials or imported from off-site sources. In either case, unless otherwise approved by the DEQ, these soils will have concentrations of COCs below the CULs. Prior to use, the soil will be evaluated for compliance with these criteria. Samples of borrow soil collected for laboratory analysis will be analyzed for dioxin/furans, metals (antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc), PCBs, and PAHs (including dibenzofurans).

Imported Soil. Soil may be imported from off-site for use as temporary roadways and staging pads, general fill, or topsoil. Gravel (soil with particle sizes greater than No. 4 sieve size) from a virgin commercial source will be presumed to meet acceptance criteria and will not be sampled for chemical analysis. The method and frequency of sampling imported general fill and topsoil will be submitted to the DEQ for approval and will be determined based on the source of the material. In general, materials imported from a virgin, commercial source would have a lower sampling frequency. Recycled materials or soil imported from private sources would have a greater sampling frequency.

On-Site Borrow. Potential sources of on-site borrow are discussed in Section 2.3.3. The method and frequency of sampling borrow materials will be submitted to the DEQ for approval.

3.3.5 Finish Grades

Currently, the Site is relatively flat with no clear drainage channels. Most rainfall infiltrates into the ground surface. The intent with post-remediation finish grades (after excavation/capping) is to maintain these characteristics, emphasizing infiltration of rainfall. Finish grades may vary by several feet from current grades, but overall drainage will be maintained. Areas where there could be greater change between current and finish grades include where the riverbank is laid back, areas used for on-site borrow, or future park features. The In-Water Group is evaluating layback of portions of the riverbank. The park design team is collaborating with the In-Water Group and the upland remediation design team to minimize grade changes. Areas between

the current top of bank and the new top of bank may have larger grade changes, and surface runoff on the riverbank will be directed toward the river (again, riverbank layback, including erosion protection, will be addressed by the In-Water Group). If borrow materials are obtained from an on-site area, finish grade likely will be much lower in that area. Restoration of that area will account for the grade change and include habitat restoration consistent with the final elevations. The future park may include additional excavation for in-water habitat (in collaboration with the In-Water Group) or mounded areas to accommodate variable habitats and/or program elements within the park.

Based on the preliminary excavation depths and capping thicknesses shown on Figures 7 and 13, respectively, Figure 14 shows the approximate change in grade relative to current existing grade. The grades shown on Figure 14 include 1 foot of topsoil on DUs with no planned capping and do not account for final grades associated with removal of soil piles, preserved native trees, bank layback, potential on-site borrow areas, or park features. The grading plan will be refined in RD, including potential refinements associated with constructability, habitat, or drainage considerations and coordination with the in-water design or future park features.

3.3.6 Site Restoration

Site restoration will consist of planting finish grade with native grasses, shrubs, and trees to establish native vegetation that will prevent surface erosion and support native species. Metro is planning for final site use as a nature park (Metro's preliminary concepts are summarized below), and site restoration for the remedial action will be consistent with that planned final use.

Metro has developed a Site Conservation Plan (SCP) and is currently developing a Site Master Plan. Based on the SCP, the conservation targets for the Facility include shallow water habitat along the Willamette River migratory fish pathway, riparian forest, and oak-madrone woodland. Metro is not a partner in the in-water RD; however, Metro is collaborating with the In-Water Group to discuss opportunities for improving water quality and restoring fish habitat for salmon and lamprey. Pertinent recommended restoration actions which could apply to the Facility include work to:

- Protect, restore, and create shallow water and off-channel habitats;
- Improve aquatic habitat complexity and diversity;
- Improve riparian buffer density, health, and width and establish high species diversity;
- Maintain and expand Oregon white oak-madrone habitat;
- Restore floodplain function and connectivity; and
- Remove invasive species to reduce habitat stress and create more resilient habitats.

3.3.7 Use of Green Remediation Practices

Some of the work activities will impose negative environmental impacts that are anticipated and necessary in exchange for the reduction in risk associated with hazardous substances at the Site. Work will be conducted consistent with *Green Remediation Best Management Practices: Excavation and Surface Restoration* (EPA, 2008) and DEQ's Green Remediation Policy to promote, support, and implement sustainable practices that lessen the overall environmental impact of the cleanup. Green remediation approaches will be incorporated in deliverables throughout the design process. Some of the green remediation strategies to be evaluated in RD include, but are not limited to:

- Use of alternative fuels (e.g. biodiesel) to operate heavy machinery;
- Conserve raw materials such as borrowing clean soil from on-site sources rather than importing soil to the extent practicable;
- Minimize use of potable water;
- Recycle/reuse (e.g., composting, reuse of woody debris) cleared vegetation;
- Replant with native vegetation;
- Minimize disturbance of mature native vegetation where possible;
- Control/remove invasive species;
- Sequence work to improve efficiency;
- Consider the carbon footprint associated with travel routes and modes of material transportation for both import and export;
- Use alternative routes and modes of travel where practicable to reduce the impact on the local community;
- Restrict the idling times for heavy equipment and trucks when not being actively operated;
- Perform routine and on-time maintenance on heavy machinery and trucks to assure fuel efficiency;
- Control and mitigate dust, odors, noise, and light impacts; and
- Identify waste minimization measures and uses of recycled materials.

3.4 Institutional and Engineering Controls

Institutional and engineering controls will include a contaminated media management plan, signs, and designated pathways to be used indefinitely where capping is installed. A deed restriction identifying the presence of capped areas and residual contamination will be required. Metro will agree to place restrictions on property deeds that limit site uses to passive recreation activities. Park uses will be unrestricted. There will be restrictions on park maintenance associated with the cap (e.g., restrictions on alterations of the cap, excavations).

Outside capped areas, site use would be unrestricted and determined based on Metro's site master plan.

3.5 Permits/Permit Exemptions

Remedial actions conducted under Oregon cleanup rules must comply with federal, state, and local laws, including obtaining required permits except to the extent that state and local permits may be exempted pursuant to ORS 465.315(3) or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This section identifies applicable or relevant and appropriate requirements (ARARs), permitting needs, and the permit requirements that could be exempted. For permits where exemptions may be proposed, the applicable substantive requirements of those permits are identified.

3.5.1 Site Development Permit

The selected upland RA consists primarily of earthwork activities. The work will include tree removal, where necessary, and excavation and/or filling. Earthwork activities will impact an area of greater than one acre. Permits (or permit exemptions associated with earthwork activities) include a site development permit from the City of Portland and a construction stormwater permit (1200-C) to address runoff of stormwater during implementation of the RA in accordance with Portland City Code Title 10. The 1200-C permit requires an erosion and sediment control plan (ESCP) and a contaminated media management plan. No other permits are anticipated associated with the earthwork activities. Requirements for tree preservation and/or replacement under city code Title 11 may also be applicable.

3.5.2 Greenway Review

Because a portion of the work will be conducted adjacent to the top of bank, city permitting includes requirements associated with Greenway review in accordance with Chapter 33.440 of the Portland Zoning Code. The Greenway review addresses issues of public access, flood protection, transportation connections, and potential impacts to recreational users. These requirements may include tree/shrub preservation or replacement as part of a mitigation plan.

3.5.3 Waste Designation

Federal and state waste designation laws and rules (e.g., the Resource Conservation and Recovery Act, Land Disposal Restrictions, and the Toxic Substances Control Act) define the requirements for disposal of soil removed from the Site.

For the 2015/16 removal action, the removed soil was evaluated (including testing for leachability of metals), and it was determined that the excavated soil is not a hazardous waste (Apex, 2014). Additionally, selected archived samples from the RDI with higher total metals concentrations were submitted for Toxicity

Characteristic Leaching Procedure (TCLP) analysis, and results were below hazardous waste limits. An updated waste designation will be prepared as part of RD.

3.5.4 Federal Emergency Management Agency Floodplain Regulations

A portion of the Site in the East and Central Parcels is located within the Federal Emergency Management Agency (FEMA) mapped Special Flood Hazard Area of the Willamette River. FEMA regulations 44 CFR § 60.3(d)(2) and (3) prohibit encroachments that would result in any increase in flood levels during occurrence of base flood discharge. A site-specific analysis will be performed during RD to evaluate potential flood impacts.

3.5.5 Cultural Resources

Recommendations resulting from the studies discussed in Section 2.1.6 will be addressed during RD.

3.6 Future Land Use

The Site is zoned as open space. Future changes in land use at the Site will include the development of passive recreation opportunities within a natural area context including a regional trail, water access, nature viewing points, beach access, environmental education programs, cultural elements and interpretation, art, and information signs. Master planning for future development is underway by Metro with the intent to facilitate increased public access, recreational activities, and beneficial use of the Site and the adjacent riverbank and river. Development of the Site will be coordinated with the In-Water Group to ensure compatibility with the Site design.

3.7 Easement and Access Requirements

The Site is not currently managed for any human use and is officially restricted with limited controls to discourage foot traffic access (locked gates, concrete barriers, and signs). However, trespassers frequently bypass the restrictions and traverse the Site. The Site is accessible by vehicle from North Edgewater Street to the east and North Richmond Avenue to the west. A locked gate is present at the north end of North Edgewater Street one block south of its intersection with North Willamette Boulevard. A gravel roadway is present on the Central and East Parcels, but vehicle access is limited by concrete blocks/rubble at the North Edgewater Street entrance. Access to the Site from the river is also restricted by use of signsbut no physical barriers.

The Site and the riverbank down to the OLWL are owned by Metro, and the submerged lands below the OLWL are owned by the State of Oregon and managed by the Department of State Lands. An access agreement is in place between Metro and the Port to provide access to the Site for RA activities. To the extent that access to the Site is needed from the river, access will be coordinated with the State of Oregon.

3.8 Community Impacts

Best management practices (BMPs) and mitigation measures will be developed in the RD to address the community impacts including concerns about air quality, noise, odor, and light. Exceedances of health-based standards may result in additional controls being put in place so that construction impacts are mitigated to the extent practicable.

3.9 Constructability Considerations

This section considers the ease of construction of the remedial action. These considerations will be evaluated and addressed to the extent practicable during RD to reduce or prevent errors, delays, cost overruns, and health and safety issues during the RA. The following constructability considerations will be accounted for during development of the RD:

- Quantity and size of debris to be removed. Surface and subsurface debris will impact the ability to perform excavation and place capping effectively. Debris will be removed wherever practicable.
- Potential utilities. These obstructions will be identified, and the design will be adapted as needed. Based on prior site work, there are no utilities expected within the proposed excavation.
- Access issues as discussed in Section 3.7.
- Impacts of excavation/capping on adjacent riverbank slopes.
- Construction materials. The project will require imported fill materials as discussed in Section 3.3.4. The RA will be conducted at the same time as other remedial actions throughout Portland Harbor. These simultaneous activities may place stress on available materials from vendors who will be supplying other remediation projects in the area. Materials in high demand may include sand and gravel. To mitigate some of those risks, acquiring materials early and outside of potential seasonal price increases should be considered. This could include negotiating a preferred pricing structure or considering an early downpayment for securing minimum volumes of material. Materials could be acquired directly from the supplier or suppliers, perhaps through a separate procurement process. The suppliers could potentially be charged with generating, storing, and maintaining materials for contractor use at appropriate times during construction.
- Material Transport. Based on preliminary excavation depths and cap thicknesses, on the order of 50,000 cubic yards of soil will be exported from the Site, and approximately 30,000 to 90,000 cubic yards of soil could be imported to the Site (the range of potential import volumes depends on such factors as the final cap thicknesses, the amount of bank layback conducted for the in-water work, and the amount of on-site soil that can be used for fill). Material transportation options include truck, rail, and barge. Each of these options will be evaluated during RD considering such factors as availability, impacts to community, coordination with in-water work, and costs.

- Sequencing of construction and coordination with in-water/riverbank construction. The in-water construction intends to use the upland facility for staging and water treatment, and the in-water construction will likely include layback of the riverbank. The upland construction may include material transport via barge. These activities require careful coordination between the upland team and the In-Water Group to avoid delays and additional costs.

4.0 Monitoring and Maintenance

4.1 Construction Monitoring

Monitoring will be performed during RA activities to confirm that the construction engineering controls are maintained and in working order. Construction engineering controls will include but not be limited to dust control, stormwater best management practices, and activities designed to limit off-site discharge of contaminated soil (e.g., brushing off trucks, containment of material conveyance to barge, etc.). Management of excavation depths and lateral extent will be monitored through global positioning system instrumentation either attached to construction equipment or with periodic surveys.

4.2 Verification Sampling of Soil Concentrations

Soil sampling and chemical analysis will be conducted during RA to verify removal of soil to the extent required by the remedial action objectives and design standards. The type and frequency of verification sampling will be detailed in the RD/RA work plan but will generally follow the same protocol that was used for the RDI sampling including the same DU boundaries, 30-point ISM samples (including in DUs that were previously sampled with composite samples), 1-foot depth intervals, and the same analyte list as used in the RDI. The verification sampling data will be used to update residual concentrations and residual risk estimates. The updated data will be used together with the processes described in Sections 3.3.2 and 3.3.3 to conduct additional excavation or adjust cap thicknesses, as appropriate.

4.3 Long-Term Remedy Performance Monitoring

There are several uncertainties at the Site that make it difficult to predict the long-term reliability of the remedial action described above, including:

- Heterogeneity in the subsurface;
- Potential changes in future groundwater or surface water use patterns (i.e., beneficial uses);
- Potential changes in future land use and zoning;
- Changes in community concerns regarding remedial actions; and
- Long-term performance of remedial cap areas.

Because of these uncertainties, a periodic monitoring, review, and contingency plan will be developed that will evaluate the performance of the remedy and any changes that may affect the ability of the remedy to meet the RAOs. The objective of the periodic monitoring, review, and contingency plan will be to maintain the overall protectiveness of the selected remedy by establishing a series of decision criteria and related response actions for each potential area of uncertainty identified above and in the RAOs.

The first component of the contingency plan will be a review of both remedy performance and local land and water uses. If supplemental monitoring is necessary and indicates that the RAOs are not being met, additional remedial actions will be evaluated to ensure that human health and the environment are protected.

4.4 Remedy Maintenance

Three separate plans will be prepared to evaluate the effectiveness of source removals and long-term monitoring and maintenance of engineering controls, including caps and soil covers. A cap inspection and maintenance plan, a contaminated media management plan, and a community and outreach plan will be developed. In addition to regular inspection, the cleanup action will be subject to periodic reviews, which provide an opportunity to evaluate the implementation and performance of the remedy to determine if it remains protective of human health and the environment. A draft of each plan shall be submitted with the draft Intermediate (60%) RD for DEQ review and comment. Final plans shall be submitted for DEQ approval addressing DEQ's comments on the draft plans. The draft and final plans shall be submitted according to the schedule of deliverables in the approved RD/RA work plan and shall include, at a minimum:

- Details regarding on-site impacts and remedy selection;
- Description of inspection requirements and schedule;
- Proposed inspection locations;
- Documentation and data reporting, including a proposed schedule for data report submittals;
- Description of institutional controls to be implemented for subsurface construction or maintenance activities under the cap, to include health and safety training and procedures, contaminated media characterization and management, and excavation closure;
- Notification requirements for cap disturbance;
- Proposed trigger mechanisms and assessment criteria that would warrant evaluation of contingency measures;
- A contingency plan to include identification of potential response actions and a description of the procedures and process for evaluating and implementing potential response actions;
- A description of assessment criteria for modifications to the long-term inspection program; and
- A description of periodic reviews of local land uses and beneficial water uses to be conducted, including procedures, reporting, and schedule.

5.0 Design Studies

5.1 Supplemental Remedial Design Investigation

At present, there is sufficient data to complete remedial design. The data gaps identified in Section 2.4 will be addressed as follows:

- Vertical delineation of COCs beyond depths of 3 feet or beneath soil berms on the East Parcel will be addressed with verification sampling during RA;
- Vertical delineation of COCs in potential borrow areas along the riverbank will be conducted as part of supplemental riverbank sampling being conducted by the In-Water Group; and
- Vertical delineation of COCs in potential borrow areas beneath concrete slabs will be conducted in supplemental sampling if it is determined that borrow from these areas is feasible for the planned site restoration.

If supplemental sampling is needed and requested by DEQ, a supplemental RDI work plan will be prepared and submitted to DEQ for review and approval. Following the supplemental RDI field investigations, a Supplemental RDI Evaluation Report will be prepared to summarize the results. The Supplemental RDI Evaluation Report will be submitted to DEQ for approval.

5.2 Remnant Structures Evaluation

As described in Section 2.1.2, a large concrete slab foundation, several smaller concrete slabs, a portion of paved roadway, and other remnant debris are present. These remaining structures were generally characterized during the pre-remedial design investigation. However, there may be additional buried debris present, which will be evaluated and managed during RA.

5.3 Borrow Source Identification

As described in Section 2.3.3, there are two potential opportunities for on-site clean fill borrow material: the bank layback area and the soil beneath the large concrete slab in the East Parcel. Further evaluation will be required to determine the suitability of this material for reuse on site.

5.4 Erosion Protection Evaluation

An erosion and sedimentation control plan is a required element of the 1200-C construction stormwater permit as described in Section 3.5.1. That plan will include best management practices that will be implemented during construction to control sediment runoff.

5.5 Seismic Design Evaluation

RD will evaluate seismic hazards resulting the recommended design earthquake for Portland Harbor (ground motion with a 10% probability of exceedance in 50 years). Associated seismic damage from this hazard level includes liquefaction of riverbanks or destabilization and displacement of riverbanks. These evaluations are being conducted primarily by the In-Water Group. If needed, further evaluation will be conducted for the upland design.

The primary risk associated with seismic hazards is exposure of contaminated soil resulting from failures related to liquefaction or the riverbank slope. The results of the seismic design evaluation will be used to determine mitigating measures against the exposure of contaminated soil. If these measures are impractical or ineffective, appropriate maintenance and repair measures will be included in the operations and maintenance plan.

5.6 Climate Change

Climate change is expected to result in changes to the hydrology (both in seasonal patterns of river flow and peak storm event flows) in the Willamette and Columbia Rivers, as well as sea level rise, and thus impact remedy design (EPA, 2021). The effects of climate change on peak flows, dam operations, typical base flow river stages, and sea level rise on river hydrodynamics in the in-water project area will be considered as part of the flood rise impact evaluation being conducted as part of the in-water 30% design and will be used to inform the upland RD.

5.7 Additional RD Investigations

Addressing current data gaps is discussed in Section 5.1. If additional data gaps are identified during the 30% Design, they will be evaluated and addressed during the 60% Design.

6.0 Remedial Design Stages, Conceptual Sequencing Plan, and Scheduling

Development of the RD/RA work plan is the initial stage of the design. The 30% RD documents and supporting deliverables follow the RD/RA work plan. The 60%, 95%, and 100% final (if necessary) RD stages present progressive refinements of the remedial design. Construction bidding and selection will be based on the DEQ-approved 95% or 100% RD plans and specifications package. RA scheduling and implementation will proceed following selection of the remediation contractor. A summary of the design stages, sequencing, and schedule is provided in the following sections.

6.1 Remedial Design/Remedial Action Work Plan

The RD/RA work plan will be submitted following completion of the BODR and will include the scope of work and schedule for the RD activities and submittal requirements. The draft RD/RA work plan will be submitted within 90 days of DEQ's approval of the BODR.

6.2 30% Design

Upon completion of approximately 30% of the RD effort and prior to submittal of the 60% RD report, a presentation will be prepared and presented to the DEQ. The general 30% (preliminary) RD presentation contents will consist of the following:

- Design objectives, criteria, and standards;
- Description of design elements;
- Preliminary drawings and schematics;
- Description of problems encountered or anticipated that may delay the project schedule; and
- Preliminary construction schedule.

6.3 60%, 95% and 100% Design

An intermediate (60% RD) report will be prepared and submitted to DEQ for review and comment and will:

- Include the same elements as the 30% RD;
- Be a continuation and expansion of the 30% RD; and
- Address DEQ comments on the 30% RD.

The pre-final (95% RD) report will be prepared with a compilation of the major design items reflecting approximately 95% completion. The pre-final report will serve as the draft design report and may constitute construction-ready drawings. The pre-final report will include the following as applicable:

- Design criteria/standards;
- Final design/analysis calculations;
- Drawing index and final stamped drawings suitable for bidding and construction;
- Final stamped specifications suitable for bidding and construction;
- Final construction schedule;
- Description of RA activities;
- Description of construction quality assurance/quality control; and

- Equipment startup and operator training requirements.

If necessary, a final (100% RD) report will be prepared to incorporate revisions required by DEQ based on review of the pre-final design and will provide the basis for the RA activities.

6.4 Remedial Action Implementation

Implementation of the remedial action will be initiated following approval of the final design (95% or 100% RD) by the DEQ and selection of the remediation contractor. The RD/RA work plan will include an anticipated implementation schedule, which will be refined as necessary in the subsequent 30%, 60%, and 95% RD deliverables. As the site remediation and in-water remediation will be coordinated to the extent feasible, scheduling changes may occur as the implementation planning progresses.

7.0 References

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Table 1
Receptor Specific Risk-Based Concentrations, Preliminary Remediation Goals, and Hot Spot Values for Soil – Human Health
Willamette Cove Upland Facility

Analyte	Regional Background Concentrations - Portland Basin		Receptor Specific RBCs												Human Health PRGs	
			Recreational Trespasser/Park User				Transient Trespasser				Construction Worker					
			Cancer		Non-Cancer		Cancer		Non-Cancer		Cancer		Non-Cancer		PRG	Hot Spot
	Mean	95% UPL	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot		
Concentration in mg/kg																
Antimony	0.29	0.56	--	--	24	243	--	--	98	980	--	--	31	310	**24**	**243**
Arsenic	4.4	8.8	1.4	140	74	740	29	2,900	370	3,700	15	1,500	97	970	**8.8**	**140**
Chromium	39	76	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	24	34	--	--	11,000	110,000	--	--	56,000	560,000	--	--	14,000	140,000	**11,000**	**110,000**
Lead	27	79	--	--	400	4,000	--	--	800	8,000	--	--	800	8,000	**400**	**4,000**
Mercury	0.073	0.23	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	23	47	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	0.33	0.71	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	105	180	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cPAHs	--	--	0.55	55	60	600	32	3,200	270	2,700	17	1,700	74	740	**0.55**	**55**
Total PCBs	--	--	0.74	74	4	40	14	1,400	18	180	8.4	840	4.9	49	**0.74**	**40**
Dioxin/Furan TEQ	--	--	1.50E-05	1.50E-03	1.70E-04	1.70E-03	3.20E-04	3.20E-02	1.10E-02	1.10E-01	1.70E-04	1.70E-02	2.30E-04	2.30E-03	**1.50E-05**	**1.50E-03**

Notes:

Background concentrations from *Development of Oregon Background Metals Concentrations in Soil,* Oregon DEQ, March 2013

95% UPL = Upper Prediction Limit (95% confidence)

RBC = Risk Based Concentration

mg/kg = milligrams per kilogram

cPAHs= carcinogenic polycyclic aromatic hydrocarbons

HPAH = high molecular weight polycyclic aromatic hydrocarbons

LPAH = low molecular weight polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

Dioxin/Furan TEQ = 2,3,7,8-TCDD toxicity equivalent

Receptor Specific RBC Concentrations from the Record of Decision for Willamette Cove Upland Site, Oregon Department of Environmental Quality, March 2021 with the exception of arsenic:
arsenic concentration is from the Residual Human Health Risk Assessment Willamette Cove Upland Facility, December 2013

Table 2
Receptor Specific Risk-Based Concentrations, Preliminary Remediation Goals, and Hot Spot Values for Soil – Ecological Receptors
Willamette Cove Upland Facility

Analyte	Regional Background Concentrations - Portland Basin		Receptor Specific Cleanup Levels and RBCs								Ecological PRGs			
			Plant		Invertebrate		Birds		Mammal		Sample Type			
											Discrete/Composite		ISM	
	Mean	95% UPL	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot	RBC	Hot Spot	PRG	Hot Spot	PRG	Hot Spot
Concentration in mg/kg														
Antimony	0.29	0.56	5	50	78	780	--	--	2.7	27	2.7	27	2.7	27
Arsenic	4.4	8.8	18	180	--	--	575	5,750	83	830	18	180	18	180
Chromium	39	76	1	10	0.4	4	87	870	342	3,420	76	76	39	39
Copper	24	34	70	700	80	800	87.7	877	82	820	70	700	70	700
Lead	27	79	120	1,200	1,700	17,000	33	330	122	1,220	79	330	33	330
Mercury	0.073	0.23	0.3	3	0.1	1	0.015	0.15	3.53	35.3	0.23	0.23	0.073	0.15
Nickel	23	47	38	380	280	2,800	139	1,390	20	200	47	200	23	200
Selenium	0.33	0.71	0.52	5.2	4.1	41	3.42	34.2	1.1	11	0.71	5.2	0.52	5.2
Zinc	105	180	160	1,600	120	1,200	673	6,730	201	2,010	180	1,200	120	1,200
Dibenzofuran	--	--	--	--	--	--	--	--	0.01	0.10	0.01	0.1	0.01	0.1
Total HPAH	--	--	--	--	18	180	--	--	5.6	56	5.6	56	5.6	56
Total LPAH	--	--	--	--	29	290	--	--	100	1,000	29	290	29	290
Total PCBs	--	--	40	400	--	--	0.734	7.34	0.098	0.98	0.098	0.98	0.098	0.98
Dioxin/Furan TEQ	--	--	--	--	--	--	8.90E-05	8.90E-04	6.10E-06	6.10E-05	6.10E-06	6.10E-05	6.10E-06	6.10E-05

Notes:

Background concentrations from *Development of Oregon Background Metals Concentrations in Soil,* Oregon DEQ, March 2013

95% UPL = Upper Prediction Limit (95% confidence)

RBC = Risk Based Concentration

mg/kg = milligrams per kilogram

HPAH = high molecular weight polycyclic aromatic hydrocarbons

LPAH = low molecular weight polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

Dioxin/Furan TEQ = 2,3,7,8-TCDD toxicity equivalent

Receptor Specific Screening Level and RBC Concentrations from the Record of Decision for Willamette Cove Upland Site, Oregon Department of Environmental Quality, March 2021

Table 3
Cleanup Levels and Hot Spot Values for Soil
Willamette Cove Upland Facility

Analyte	Human Health		Ecological					
			Immobile			Mobile		
	Cleanup Level	Hot Spot	Cleanup Level	Hot Spot	Basis	Cleanup Level	Hot Spot	Basis
	Concentration in mg/kg							
Antimony	24	240	5	50	Plant	2.7	27	Mamm
Arsenic	8.8	140	18	180	Plant	83	830	Mamm
Chromium	--	--	39	39	Bkgd	87	870	Bird
Copper	11,000	110,000	70	700	Plant	82	820	Mamm
Lead	400	4,000	120	1200	Plant	33	330	Bird
Mercury	--	--	0.1	1	Invert	0.073	0.15	Bird
Nickel	--	--	38	380	Plant	23	200	Bkgd/Mamm
Selenium	--	--	0.52	5.2	Plant	1.1	11	Mamm
Zinc	--	--	120	1,200	Invert	201	2,010	Mamm
cPAHs	0.55	55	--	--	--	--	--	--
Dibenzofuran	--	--	--	--	--	0.01	0.1	Mamm
Total HPAH	--	--	18	180	Invert	5.6	56	Mamm
Total LPAH	--	--	29	290	Invert	100	1,000	Mamm
Total PCBs	0.74	40	40	400	Plant	0.098	0.98	Mamm
Dioxin/Furan TEQ	1.50E-05	1.50E-03	--	--	--	6.10E-06	6.10E-05	Mamm

Notes:

mg/kg = milligrams per kilogram

cPAHs= carcinogenic polycyclic aromatic hydrocarbons

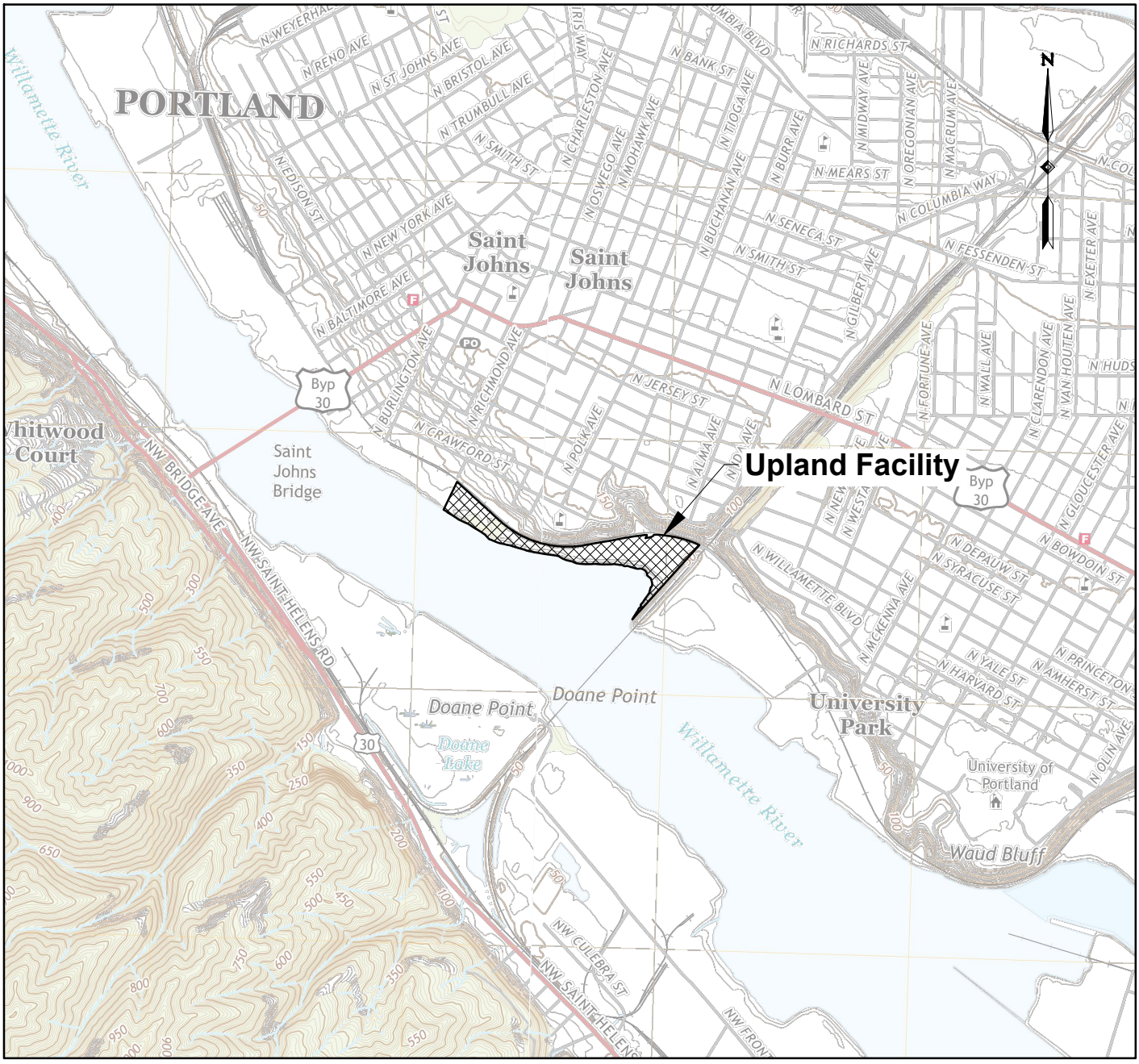
PCBs = polychlorinated biphenyls

Dioxin/Furan TEQ = 2,3,7,8-TCDD toxicity equivalent

Receptor Specific Cleanup Levels from the Record of Decision for Willamette Cove Upland Site, Oregon Department of Environmental Quality, March 2021 with the exception of arsenic: arsenic concentration is from the Residual Human Health Risk Assessment Willamette Cove Upland Facility, December 2013.

Immobile ecological endpoints include plants and invertebrates

Mobile ecological endpoints include birds and mammals



Linnton and Portland, Oregon
United States Geological Survey
7.5 Minute Series Topographic Map
Contour Interval: 10 feet
Scale: 1 inch = 24,000 feet
Date: 2020

DRAFT

0 2,000 4,000
Scale in Feet

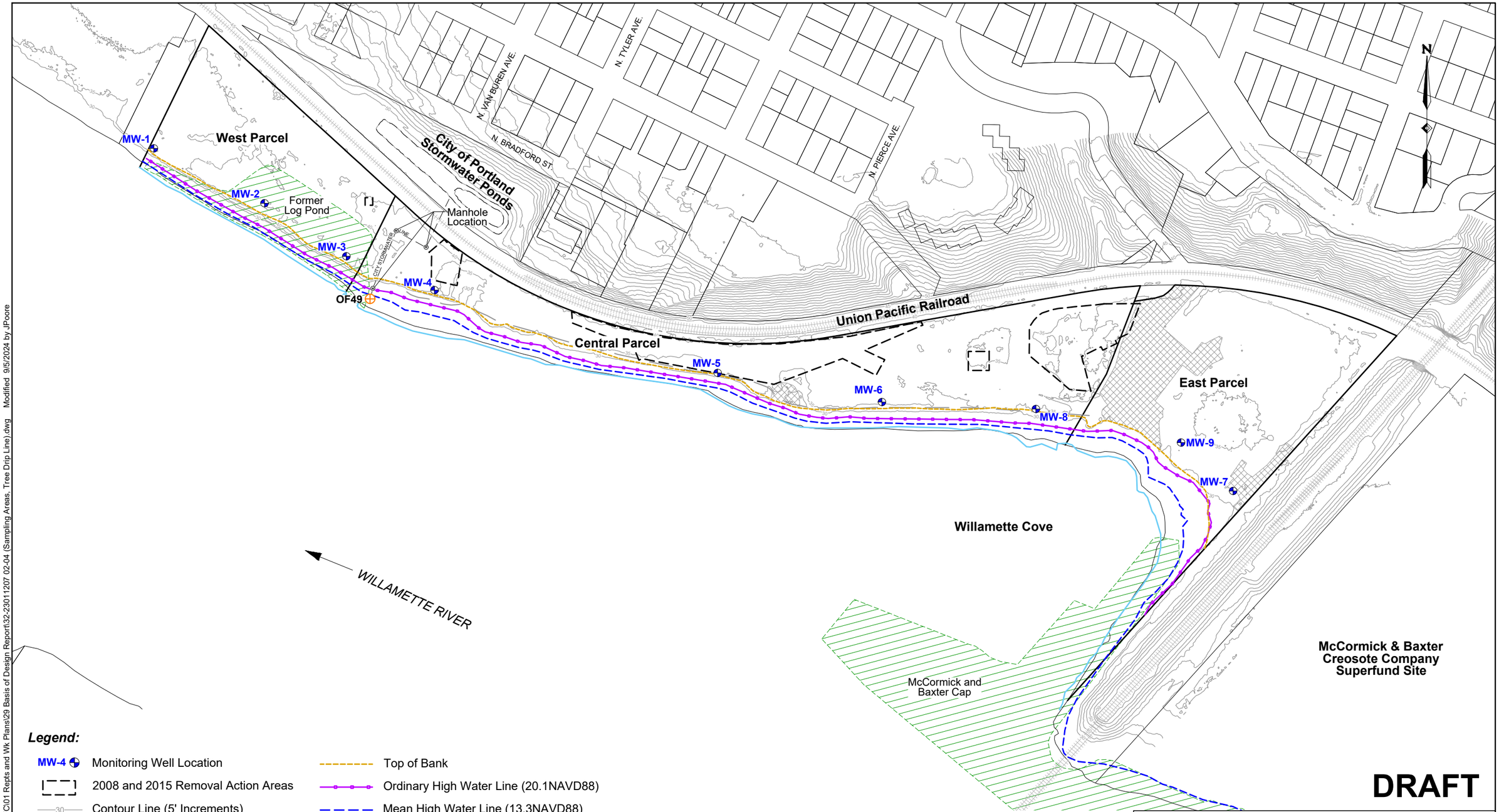
OREGON

Site Location Map

Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 32-23011207	Drawn: JP	Approved: HFC	Figure 1
	September 2024			

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\29 Basis of Design Report\32-23011207 01 (Facility Location).dwg Modified 8/2/2024 by JPoore



Legend:

- MW-4 — Monitoring Well Location
- 2008 and 2015 Removal Action Areas
- 30 — Contour Line (5' Increments)
- Approximate Area Covered by Concrete Slab
- OF49 — City Outfall Location
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

DRAFT

Facility Plan

Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	2
September 2024			

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West Parcel

City of Portland Stormwater Ponds

N. VAN BUREN AVE.

N. TYLER AVE.

N. BRADFORD ST.

N. PIERCE AVE.

Union Pacific Railroad

Central Parcel

East Parcel

Willamette Cove

WILLAMETTE RIVER

N

Legend:

- Approximate Area Covered by Concrete Slab
- Approximate Drip Line of Native Trees
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

0 250 500

Scale in Feet

DRAFT

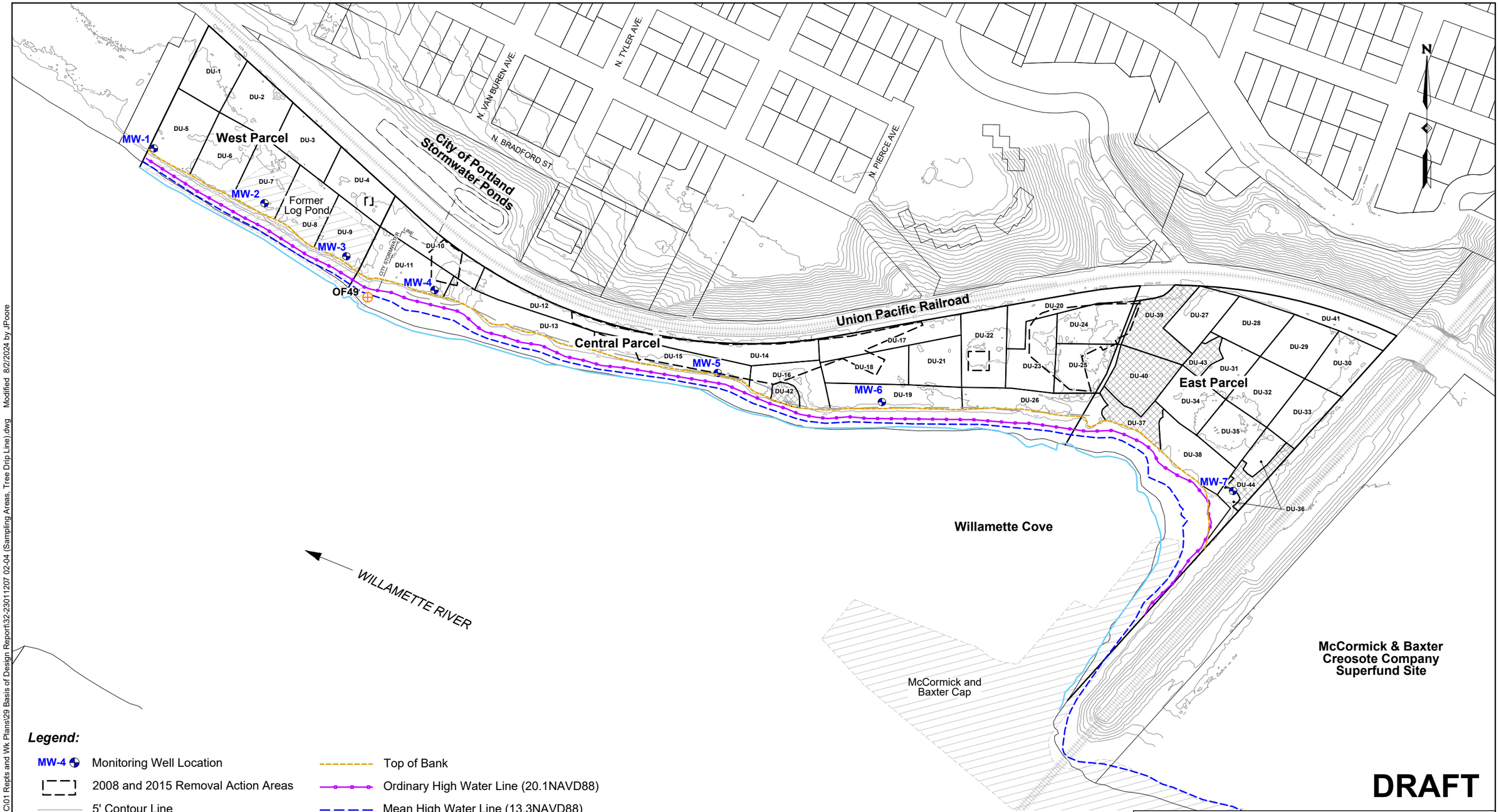
Site Plan with Approximate Drip Line of Native Trees

Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	3
September 2024			

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\29 Basis of Design Report\32-23011207 02-04 (Sampling Areas, Tree Drip Line).dwg Modified 8/2/2024 by JPoore



Legend:

- MW-4 — Monitoring Well Location
- 2008 and 2015 Removal Action Areas
- 5' Contour Line
- Approximate Area Covered by Concrete Slab
- OF49 — City Outfall Location
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- DU-1 — Decision Unit

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

0 250 500

Scale in Feet

DRAFT

Sampling Areas

Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	4

September 2024

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Layer	Depth (ft)	West Parcel									Central Parcel																	East Parcel																						
		DU-1	DU-2	DU-3	DU-4	DU-5	DU-6	DU-7	DU-8	DU-9	DU-10	DU-11	DU-12	DU-13	DU-14	DU-15	DU-16	DU-17	DU-18	DU-19	DU-20	DU-21	DU-22	DU-23	DU-24	DU-25	DU-26	DU-42	DU-27	DU-28	DU-29	DU-30	DU-31	DU-32	DU-33	DU-34	DU-35	DU-36	DU-37	DU-38	DU-39	DU-40	DU-41	DU-43	DU-44
1	0 - 1	4	5	4	5	131	9	20	10	11	71	48	19	77	89	65	341	38	115	44	21	52	40	68	18	51	130	15	17	43	8	8	9	6	6	9	7	7	1	5	0.6	0.1	42	0.5	0.2
2	1 - 2	103	8	1	3	107	10	9	11	9	55	42	18	52	207	85	113	24	71	72	9	18	23	36	12	14	83	12	11	47	3	6	3	1	3	5	2	6	0.5	3	0.6	0	40	0.2	0.2
3	2 - 3	5	0.6	0.7	5	118	9	6	10	9	41	40	14	51	167	38	29	8	45	22	7	10	25	28	6	8	55	8	4	14	3	11	2	4	2	5	2	5	1	2	0.2	0	25	0.1	0.1

Legend:

103 — Maximum Ecological Hazard Quotient Within Layer and Decision Unit

Exceeds Hot Spot Level (Hazard Quotient of 10 or Greater)

Preliminary Hot Spot Excavation Depth

Additional Excavation to Address Human Health Excess Risk

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Hot Spot Exceedances and Preliminary Removal Depths

Basis of Design Report
Willamette Cove Project Area
Portland Harbor Superfund Site

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	5

September 2024

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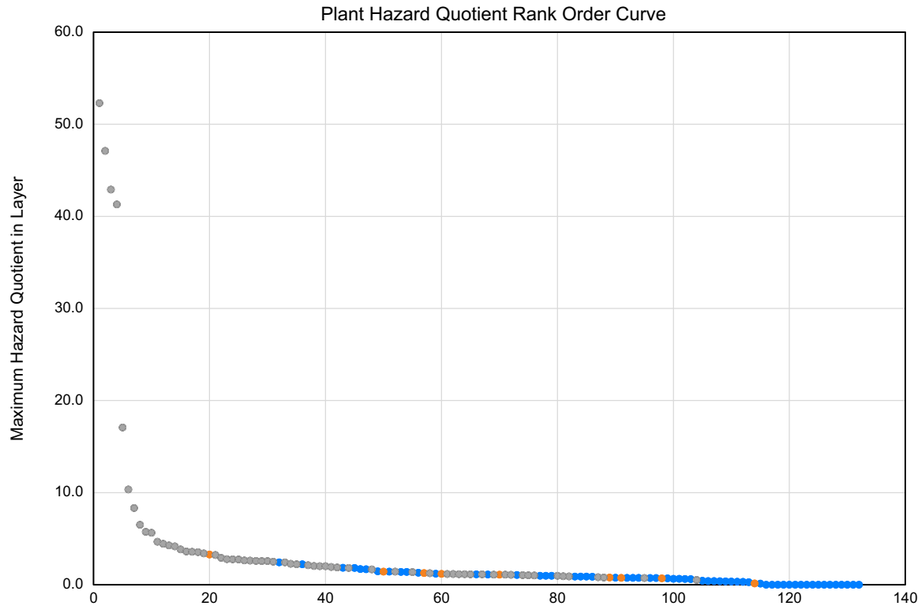
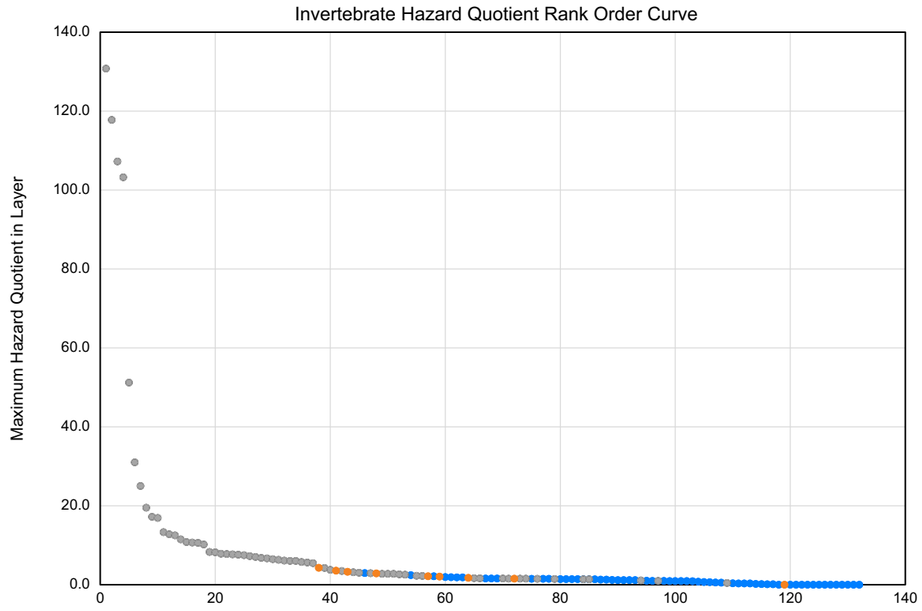
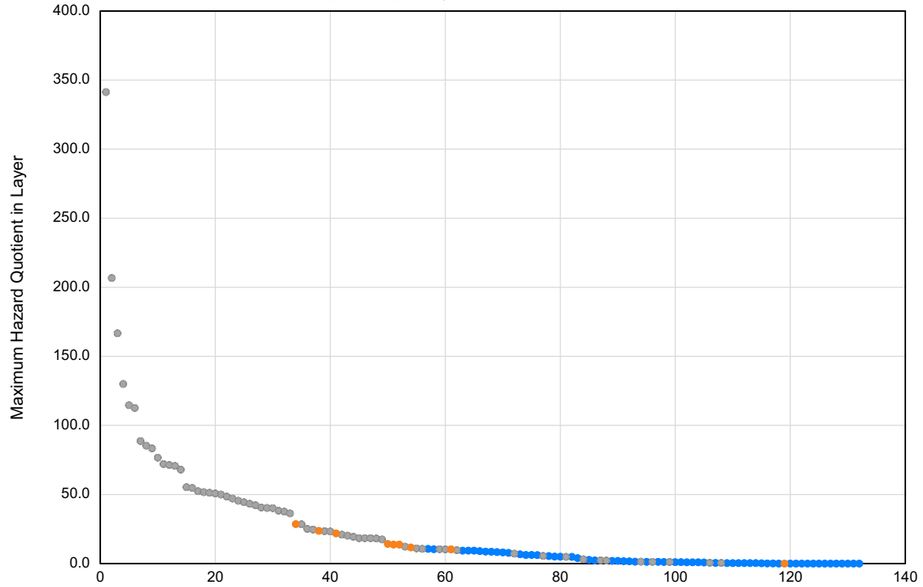
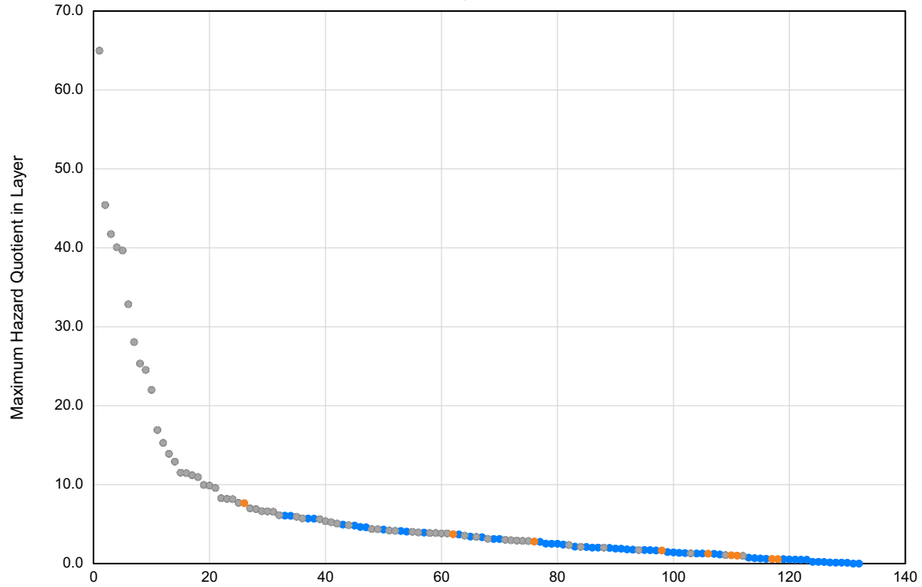




Legend:

- No Removal
- Partial Removal
- Removal





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Ecological Hazard Quotient Rank Order Curves

Basis of Design Report
Willamette Cove Project Area
Portland Harbor Superfund Site

Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 32-23011207	Drawn: JP	Approved: HFC	Figure 6A
	September 2024			

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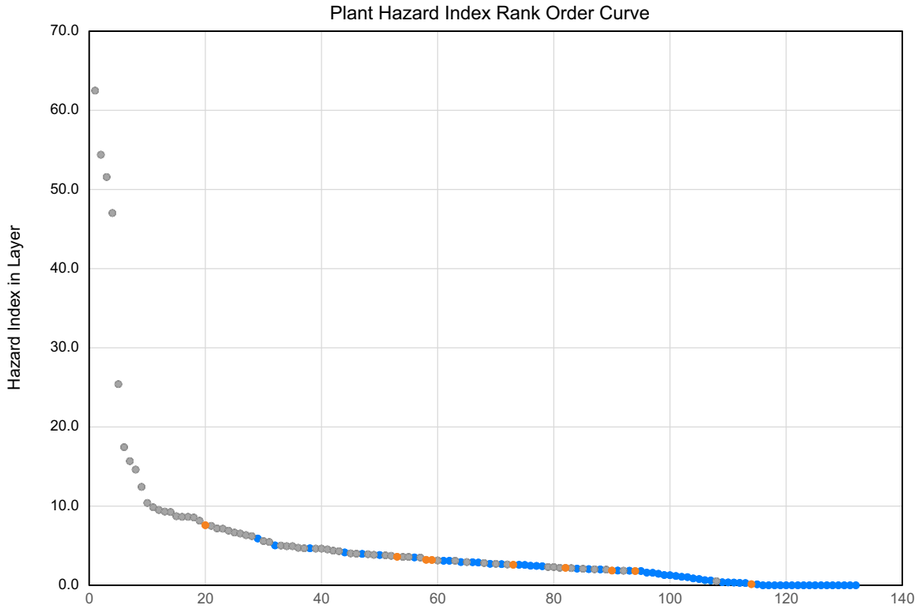
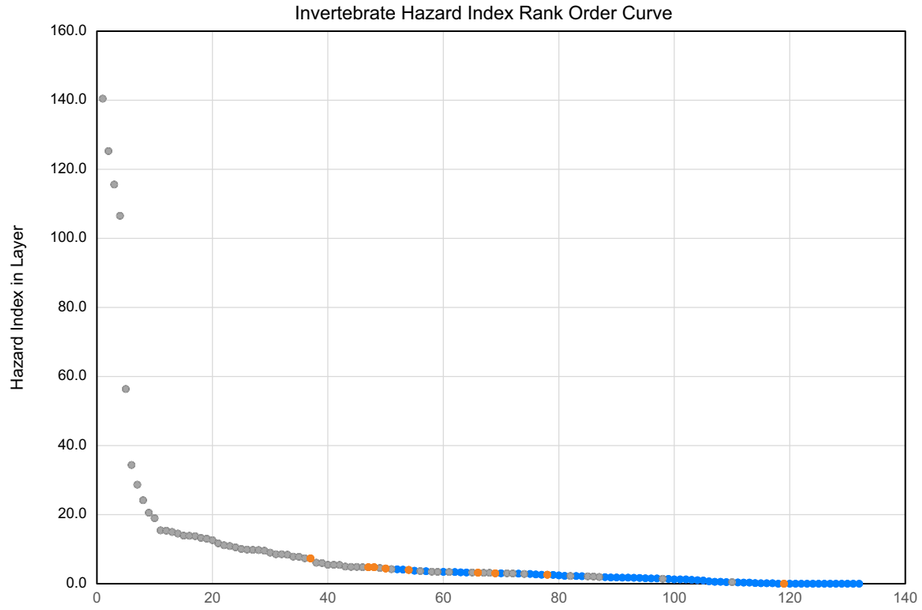
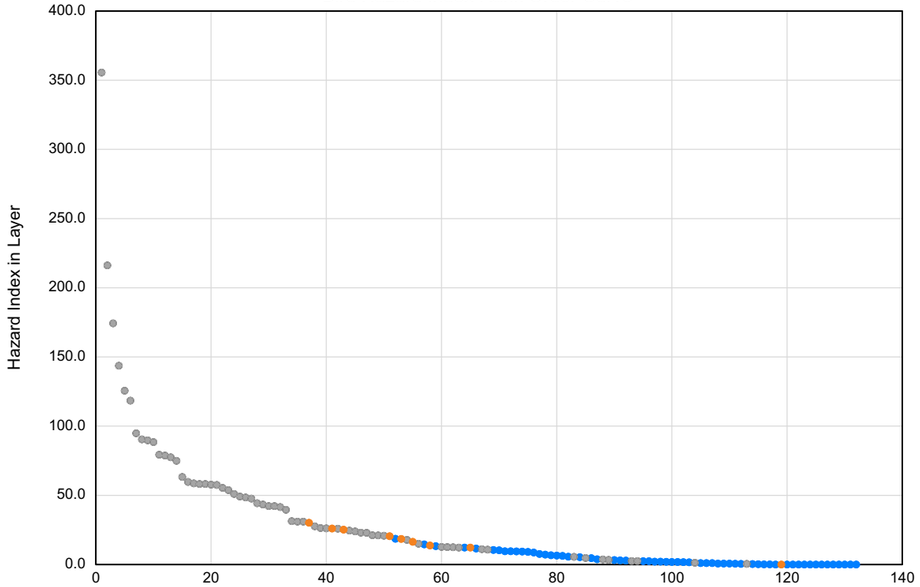
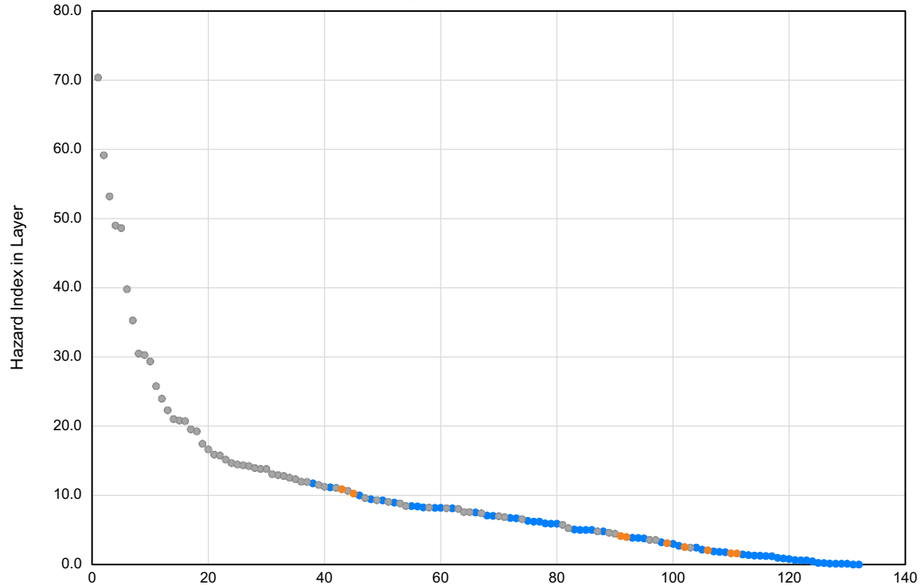




Legend:

- No Removal
- Partial Removal
- Removal





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Ecological Hazard Index Rank Order Curves

Basis of Design Report
Willamette Cove Project Area
Portland Harbor Superfund Site

Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 32-23011207	Drawn: JP	Approved: HFC	Figure **6B**
	September 2024			

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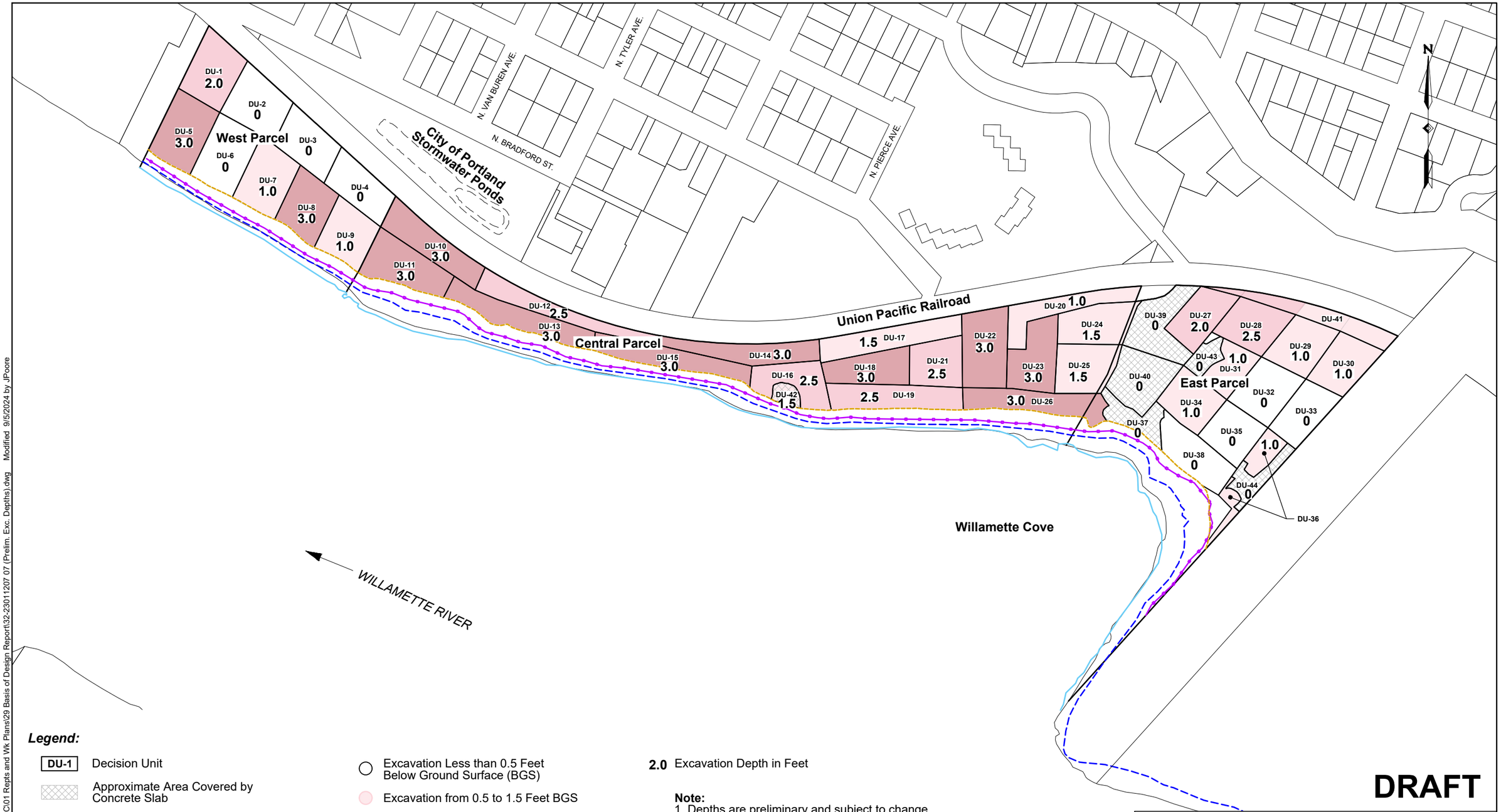

Legend:

- DU-1 — Decision Unit
- Approximate Area Covered by Concrete Slab
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Excavation Less than 0.5 Feet Below Ground Surface (BGS)
- Excavation from 0.5 to 1.5 Feet BGS
- Excavation from 1.5 to 2.5 Feet BGS
- Excavation Greater than 2.5 Feet BGS

2.0 Excavation Depth in Feet

Note:
1. Depths are preliminary and subject to change during remedial design.

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

0 250 500
Scale in Feet

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Preliminary Excavation Depths

Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
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September 2024			

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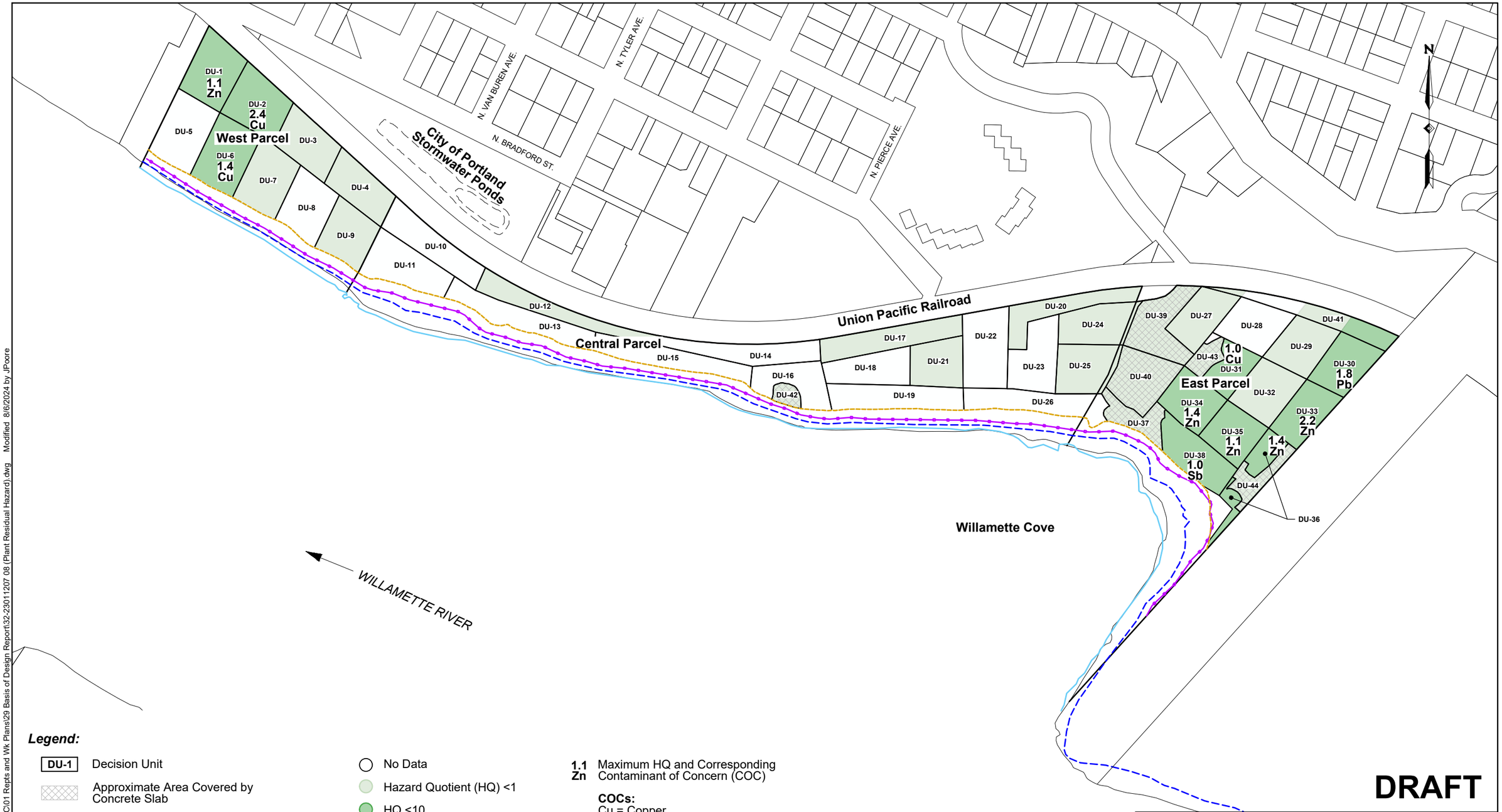

Legend:

- DU-1 — Decision Unit
- Approximate Area Covered by Concrete Slab
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- No Data
- Hazard Quotient (HQ) <1
- HQ <10
- HQ >10

1.1 Zn Maximum HQ and Corresponding Contaminant of Concern (COC)

COCs:
Cu = Copper
Pb = Lead
Sb = Antimony
Zn = Zinc

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

0 250 500
Scale in Feet

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Plant Residual Hazard Quotient

Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	8
September 2024			

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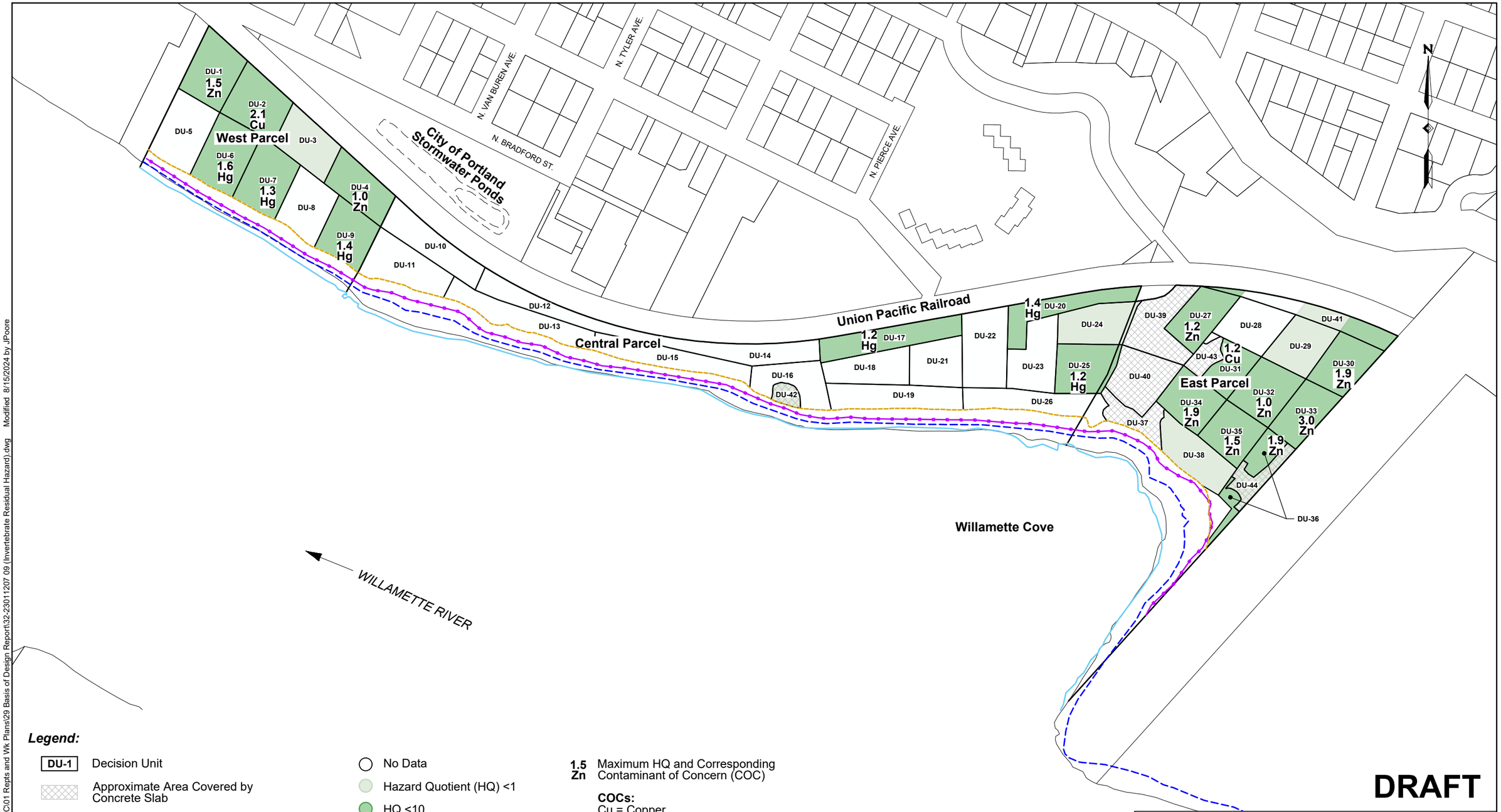

Legend:

- DU-1 — Decision Unit
- Approximate Area Covered by Concrete Slab
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- No Data
- Hazard Quotient (HQ) <1
- HQ <10
- HQ >10

1.5 Zn Maximum HQ and Corresponding Contaminant of Concern (COC)

COCs:
Cu = Copper
Hg = Mercury
Zn = Zinc

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

0 250 500
Scale in Feet

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Invertebrate Residual Hazard Quotient

Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	9
September 2024			

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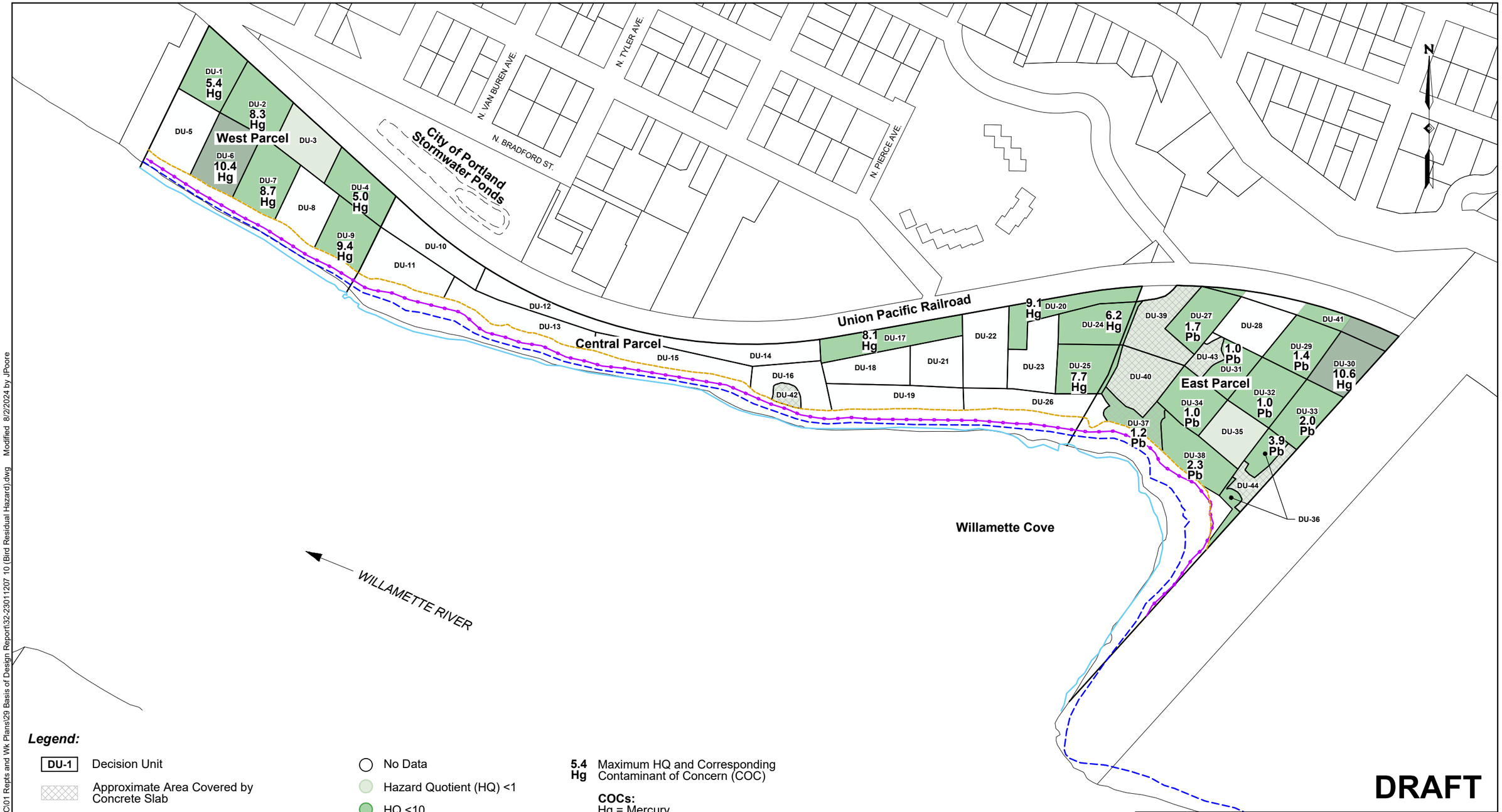

Legend:

- **DU-1** Decision Unit
- Approximate Area Covered by Concrete Slab
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- No Data
- Hazard Quotient (HQ) <1
- HQ <10
- HQ >10

5.4 Hg Maximum HQ and Corresponding Contaminant of Concern (COC)

COCs:
Hg = Mercury
Pb = Lead

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

0 250 500
Scale in Feet

DRAFT

Bird Residual Hazard Quotient

Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	**10**

September 2024

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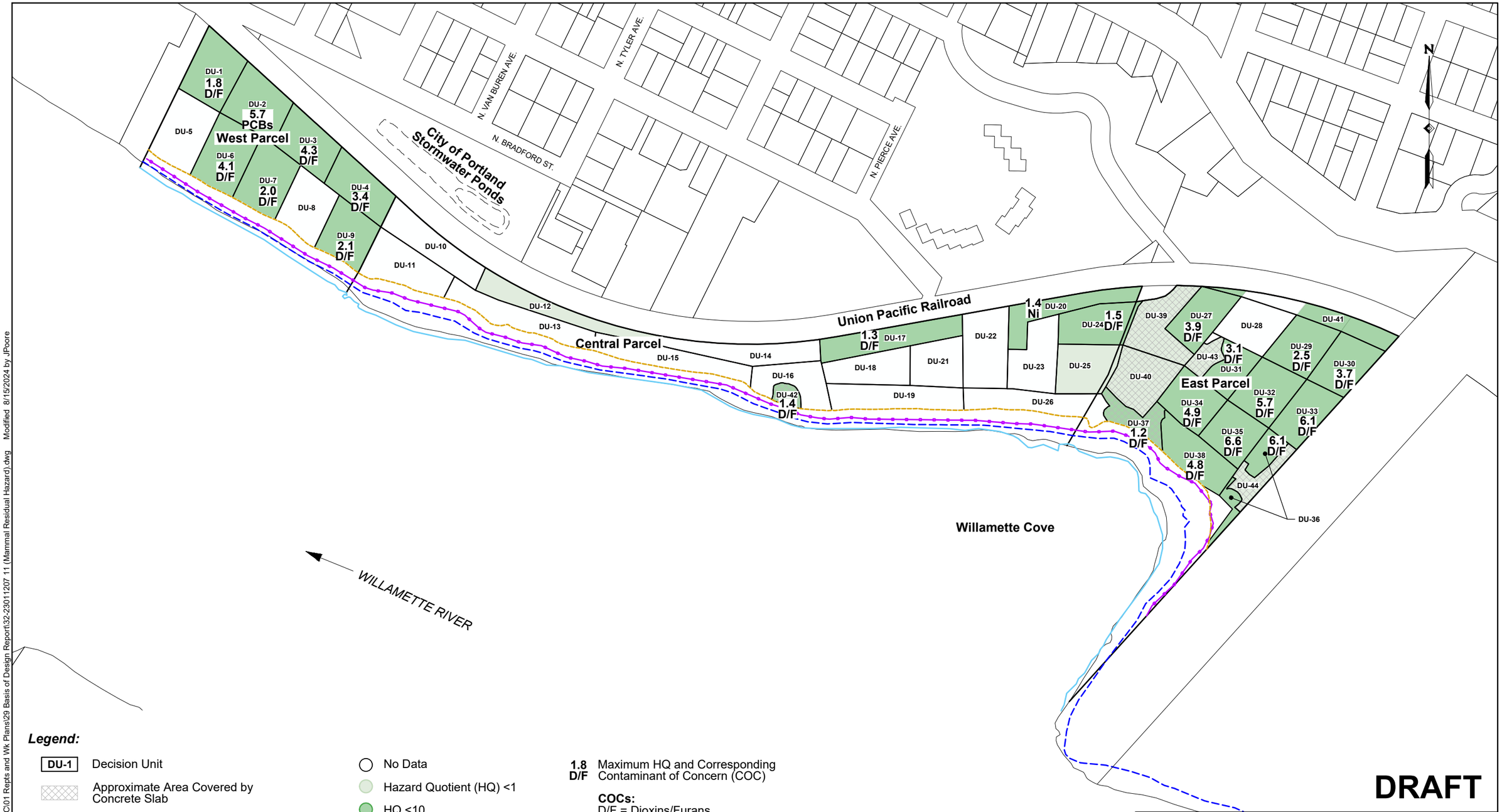

Legend:

- DU-1 — Decision Unit
- Approximate Area Covered by Concrete Slab
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- No Data
- Hazard Quotient (HQ) <1
- HQ <10
- HQ >10

1.8 Maximum HQ and Corresponding
D/F Contaminant of Concern (COC)

COCs:
D/F = Dioxins/Furans
PCBs = Polychlorinated Biphenyls
Ni = Nickel

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

0 250 500
Scale in Feet

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Mammal Residual Hazard Quotient

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Portland, Oregon

Apex Companies, LLC
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Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	11
September 2024			

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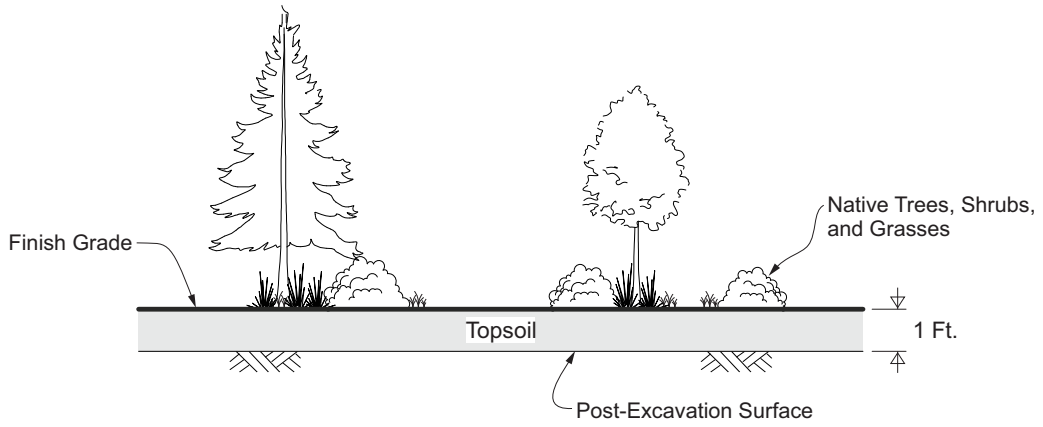
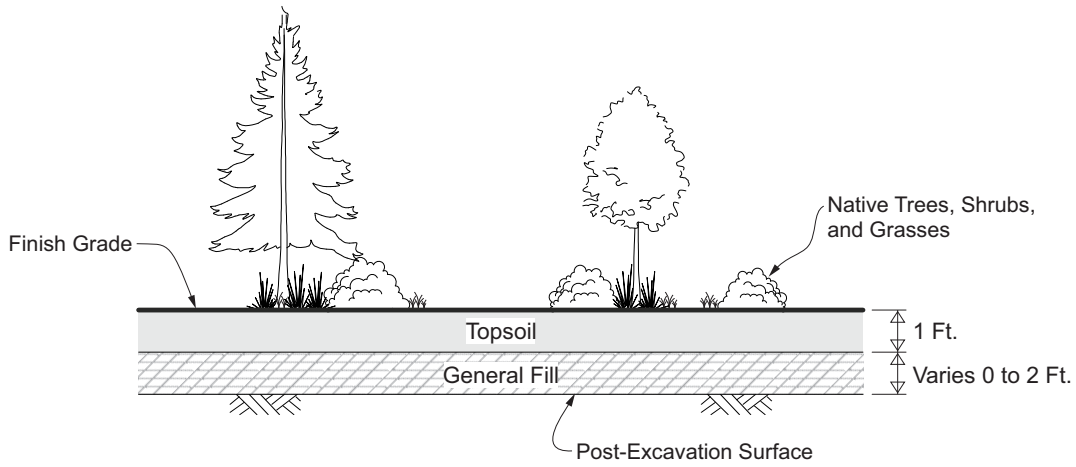


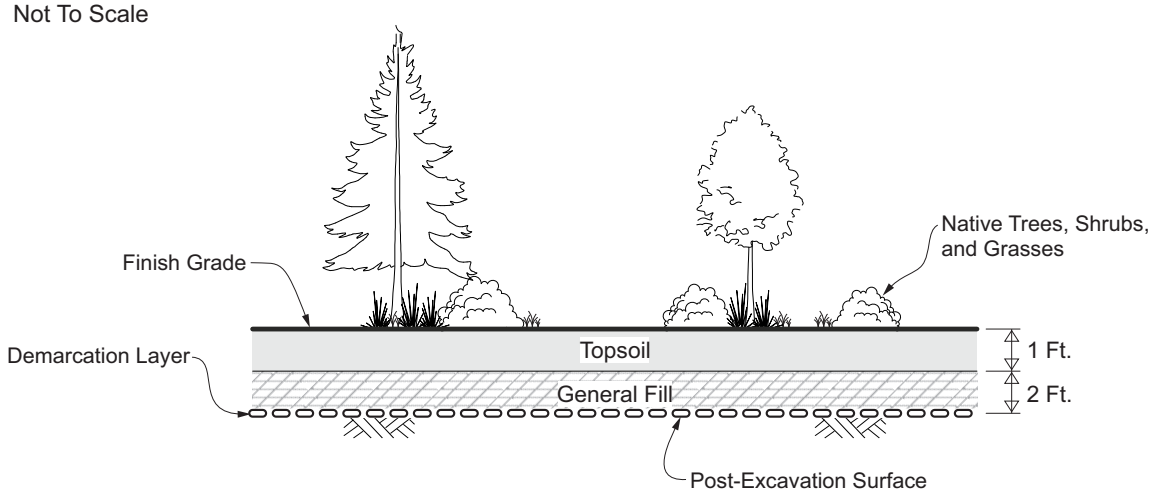
A No Cap - Residual Ecological Hazard Index Less Than One

Not To Scale



B Standard Cap - Residual Ecological Hazard Index Greater Than One; Residual Ecological Hazard Quotient Less Than Ten

Not To Scale



C Enhanced Cap - Residual Ecological Hazard Quotient Greater Than Ten

Not To Scale

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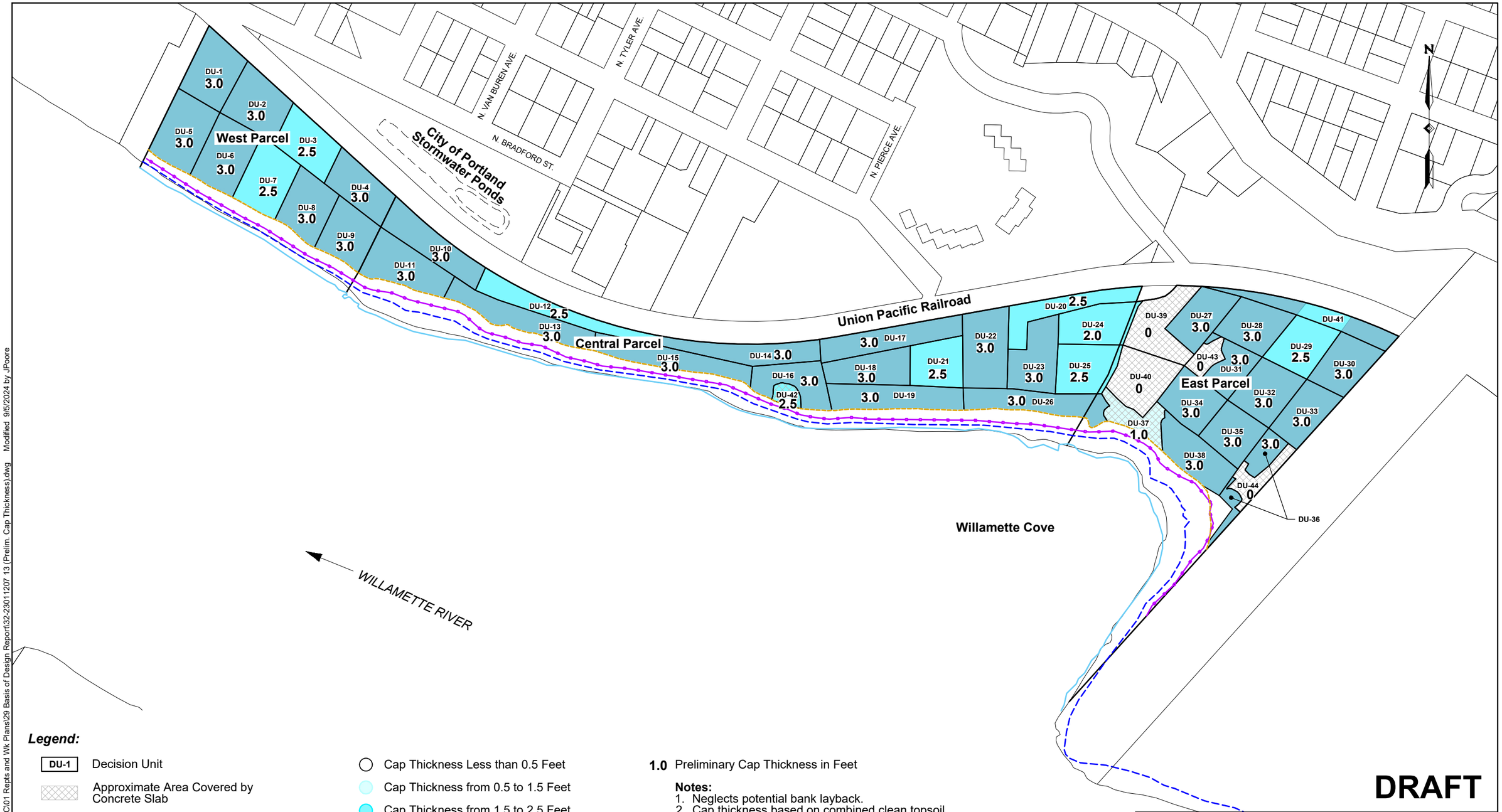
Site Restoration and CAP Details

Basis of Design Report
Willamette Cove Project Area
Portland Harbor Superfund Site

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number: 32-23011207	Drawn: JP	Approved: HFC	Figure 12
September 2024			



Legend:

- DU-1 — Decision Unit
- Approximate Area Covered by Concrete Slab
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)
- Cap Thickness Less than 0.5 Feet
- Cap Thickness from 0.5 to 1.5 Feet
- Cap Thickness from 1.5 to 2.5 Feet
- Cap Thickness Greater than 2.5 Feet

1.0 Preliminary Cap Thickness in Feet

Notes:
1. Neglects potential bank layback.
2. Cap thickness based on combined clean topsoil and clean general fill.
3. Cap thickness preliminary and may be adjusted during remedial design.

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

0 250 500
Scale in Feet

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Preliminary Cap Thickness

Basis of Design Report
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Portland, Oregon

Apex Companies, LLC
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Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	13
September 2024			

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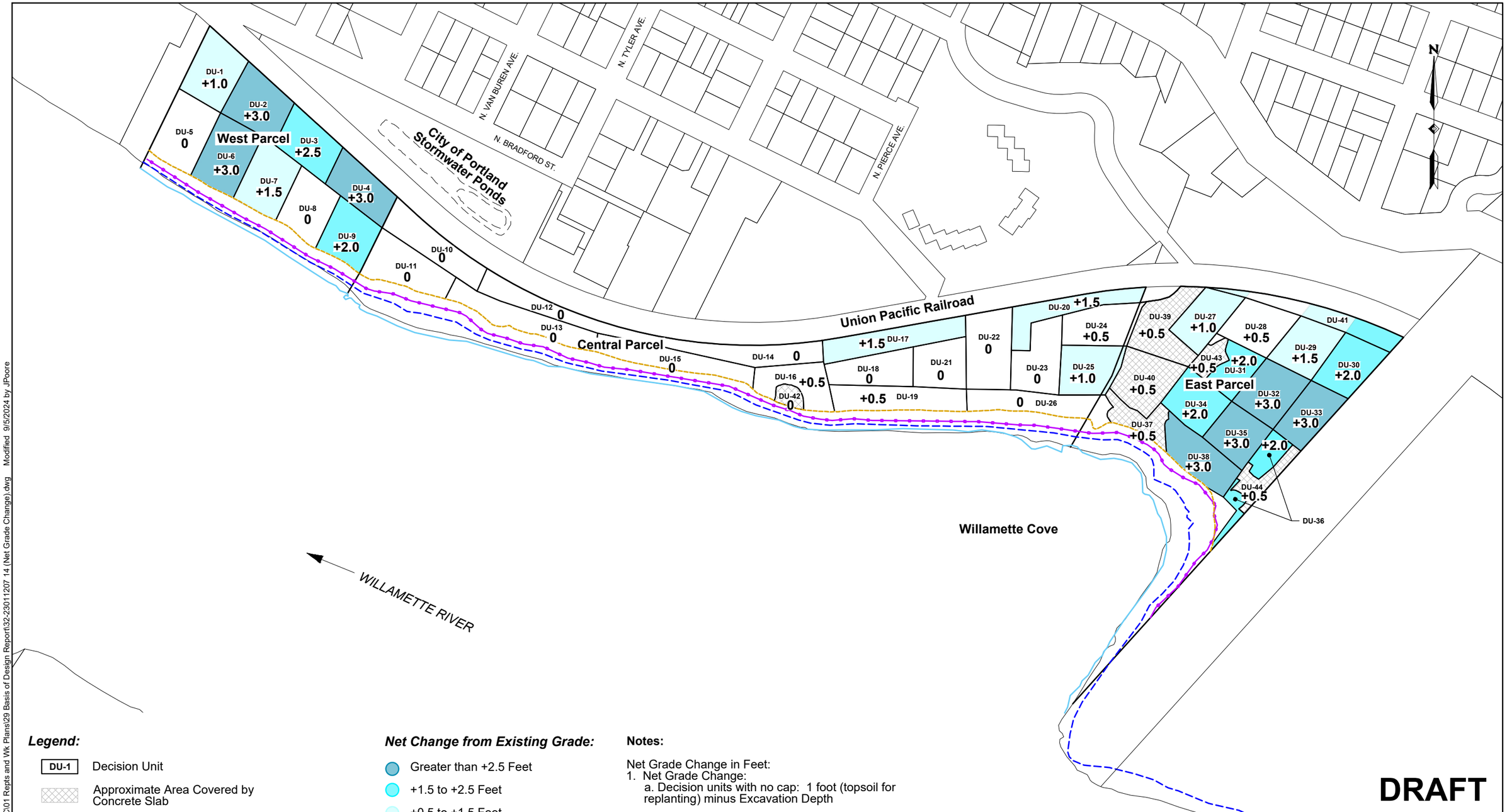

Legend:

- DU-1 — Decision Unit
- Approximate Area Covered by Concrete Slab
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

Net Change from Existing Grade:

- Greater than +2.5 Feet
- +1.5 to +2.5 Feet
- +0.5 to +1.5 Feet
- +0.5 to -0.5

Notes:

Net Grade Change in Feet:

1. Net Grade Change:
   a. Decision units with no cap: 1 foot (topsoil for replanting) minus Excavation Depth

   b. Decision units with a cap: Cap Thickness minus Excavation Depth

2. Neglects potential bank layback.

3. Preliminary pending adjustments for constructability, habitat, or drainage considerations.

0 250 500

Scale in Feet

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

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Net Grade Change

Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	14

September 2024

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Appendix A

Preliminary Evaluation of Excavation to Address Human Health Risk

This appendix provides an example of the design process to define the additional excavation needed (following hot spot excavation) to address excess human health risks.

Step 1: Determine if there are any Human Health Cleanup Level (CUL) Exceedances. Table A-1 presents human health risk screening of the residual data following hot spot excavation (i.e., data for layers that are proposed for hot spot excavation are excluded from the screening). Only arsenic, D/F TEQ, and cPAHs were detected at least once above CULs, summarized below.

	West Parcel	Central Parcel	East Parcel
Number of Residual Samples	17	6	38
Arsenic	<Background	<Background	3 samples >CUL Maximum Hazard Quotient (HQ) = 11
D/F TEQ	4 samples >CUL Maximum HQ = 1.8	<CUL	20 samples >CUL Maximum HQ = 4.0
cPAHs	2 samples >CUL Maximum HQ = 3.2	<CUL	1 sample >CUL Maximum HQ = 1.03

Much of the Central Parcel will be excavated to 3 feet for hot spot removal, so data are limited. The uncertainty in residual risk associated with the Central Parcel was assessed by screening the Layer 3 samples from the Central Parcel. The results of that screening are summarized below.

	Central Parcel, Incl. Layer 3 Samples
Number of Residual Samples	19
Arsenic	<Background
D/F TEQ	5 samples >CUL Maximum HQ = 10
cPAHs	2 samples >CUL Maximum HQ = 9.3

Given these CUL exceedances, arsenic on the East Parcel and D/F TEQ and cPAHs on all three parcels will be evaluated in Step 2.

Step 2: Evaluate the Residual Parcel Exposure Point Concentration. Using methods consistent with the baseline human health risk assessment, residual exposure point concentrations were estimated for arsenic on the East Parcel and D/F TEQ and cPAHs on each parcel. The exposure point concentrations for each COC/parcel were calculated as follows:

- The base data set consisted of the following:
    - The residual data representing layers not excavated;
    - For layers that are partially excavated, the data representing the full layer was used (this likely overestimates the residual concentration for that layer);
    - Layers that are excavated were represented by replacement values corresponding to the clean fill expected to be used (no replacement values were used for cap soil overlying the replaced layers);
    - No data were excluded in anticipation of bank layback because the layback design is not yet known (this likely overestimates residual concentrations as bank layback will remove soil to deeper levels where soil concentrations are likely lower);
    - Composite data were used as if representative of the concentrations in the corresponding layers; and
    - Smaller DUs (DU-42, DU-43, and DU-44) were neglected (this likely overestimates the risk as the concentrations in these DUs are generally less than the adjacent DUs).

Table A-2 lists the input data for Step 2. Backup 90 percent upper confidence limit on the mean (90 UCL) calculations are included as an attachment to this appendix. Residual exposure point concentrations are summarized below.

COC	Human Health CUL	90 UCL in mg/kg		
		West Parcel	Central Parcel	East Parcel
Arsenic	8.8 mg/kg (background)	NA	NA	5.4
D/F TEQ	1.5E-05 mg/kg	1.0E-05	5.9E-06	2.4E-05
cPAHs	0.55 mg/kg	0.39	0.03	0.12

These results show that only the D/F TEQ exposure point concentration on the East Parcel exceeded the CUL after hot spot excavation. The extent of additional excavation needed on the East Parcel is evaluated for D/F TEQ in Step 3.

Step 3: Define Additional Excavation Needed to Address Excess Human Health. Table A-3 lists the D/F TEQ residual data for the East Parcel. The first column lists the data following hot spot excavation (same as the data for the East Parcel in Table A-2). Subsequent columns list the prior column of data with the greatest exposed D/F TEQ concentration removed and the replacement concentration inserted. The corresponding

90 UCL concentration is listed at the bottom of each column. Backup 90 UCL calculations are included as an attachment to this appendix. The 90 UCL falls below the CUL after removal of the six greatest D/F TEQ samples. Therefore, to address human health risk on the East Parcel, the following additional excavation is needed (following hot spot excavation):

Decision Unit	Depth Range Targeted for Additional Excavation
DU-27	1.5 – 2.0 feet
DU-29, DU-30, DU-31, DU-34, and DU-36	0 – 1.0 feet

Step 4: Define Additional Excavation Needed to Address Localized Excess Human Health Risk. To evaluate potential localized risk, Figures A-1 through A-3 summarize residual human health risk following excavation of hot spots and additional excavation to address human health risk. No additional excavation was identified because of potential localized risk, as discussed below.

- Arsenic – Residual arsenic concentrations exceeded background and the CUL in three DUs, all on the East Parcel (Figure A-1). Since these DUs are all on the East Parcel, the risk evaluation of the East Parcel adequately captured the potential risk associated with these DUs. Additionally, future use of the Site as a nature park is not likely to focus site use exclusively to these DUs, so the exposure point concentrations calculated for the East Parcel are representative of expected future exposures. Half of the DUs on the Central Parcel have proposed excavation depths of 3 feet, so there are no residual data to evaluate risk for those DUs. To assess the potential uncertainty associated with the limited data, hazard quotients for Layer 3 are shown on Figure A-1. Arsenic concentrations are below background for these data, so the data set is adequate to evaluate arsenic residual risk.

- cPAHs – Residual cPAH concentrations exceeded the CUL in two DUs, one each on the West and East Parcels (Figure A-2). Given that these two DUs are widely separated, no localized cPAH risk is identified. However, DU-4 is adjacent to DU-10 and DU-11 on the Central Parcel that are also impacted by cPAHs. Those Central Parcel DUs are proposed for 3 feet of excavation so there are no residual data to evaluate a potential localized impact. Verification sampling will be conducted during remedial action and a potential localized cPAH impact will be re-evaluated at that time. Except for DU-10 and DU-11, cPAH concentrations in the Layer 3 data are below CULs, so the data set is otherwise adequate to evaluate cPAH residual risk.

- D/F TEQ – Figure A-3 summarizes the residual human health risk screening for D/F TEQ. Fourteen DUs exceed the CUL (four on the West Parcel, one on the Central Parcel, and nine on the East Parcel). The CUL exceedances range from 1.0 to 2.7, and the DUs that exceed the CUL on the West and East Parcels are scattered within the Parcels, so the CUL exceedances do not represent a localized risk and the parcel exposure concentrations are representative of the potential human health risk. Except for DU-15, hazard quotients in Layer 3 on the Central Parcel range from 0.3 to 1.8. These relatively low hazard quotients support the conclusion that there are no localized risk concerns on the Central Parcel. DU-15, with a hazard quotient of 10, is located along the top of bank

and is expected to be further excavated as part of the in-water remediation bank layback. The bank layback will be evaluated further during remedial design.

Step 5: Define Additional Excavation Needed to Address Shallow Surface Soil (0 to 1 foot) Excess Risk. To evaluate the need for additional excavation to address shallow contamination, the residual data associated with the top 1 foot (from the bottom of the proposed excavation) was compared to the full residual data set. Results are discussed separately for each COC.

- Arsenic – Arsenic exceeded background and the CUL only on the East Parcel. The average concentrations of the two data sets differed by approximately 10 percent (4.5 mg/kg for the full data set; 5.1 mg/kg for the 1-foot data set). These two data sets do not substantively differ, so no additional excavation is needed to address arsenic surface contamination.
- cPAHs – cPAHs exceeded the CUL on the West and East Parcels. In both cases, the maximum detected concentration was not in the 1-foot data set. For the West Parcel, the average concentration of the full data set was higher than the 1-foot data set. For the East Parcel, the average concentrations of the two data sets differed by approximately 10 percent (0.070 mg/kg for the full data set; 0.078 mg/kg for the 1-foot data set). These data sets do not substantively differ, so no additional excavation is needed to address cPAH surface contamination.
- D/F TEQ – D/F TEQ exceeded the CUL on each Parcel. For the West and Central Parcels, average concentrations of the two data sets differed by less than 20 and 10 percent, respectively. These data sets do not substantively differ, so no additional excavation is needed to address D/F TEQ surface contamination on the West and Central Parcels. On the East Parcel, the average concentration of the 1-foot data set (1.95E-05 mg/kg) is 50 percent greater than the full data set (1.29E-05 mg/kg). To assess the practicability of further risk reduction on the East Parcel, the 1-foot data set was adjusted by removing the highest remaining D/F TEQ concentration (Layer 2 of DU-36) and substituting the concentration for the underlying layer (Layer 3 of DU-36). With this substitution, the average concentration (1.89E-05 mg/kg) was essentially unchanged. Therefore, the marginal effort of additional excavation is disproportionate to the marginal risk reduction, so additional excavation is not warranted.

Table A-1
Human Health Residual Risk Screening
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Antimony	Arsenic	Copper	Lead	Dioxin/Furan TEQ	cPAHs	Total PCBs
					Constituent (mg/kg)						
				Human Health RBC	24.3	1.4	11000	400	1.50E-05	0.55	0.75
				ISM Bkgd	0.29	8.8	24	27			
				Composite Bkgd	0.56	8.8	34	79			
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)	0.801	6.24	180	74.8	2.21E-05	0.4460	0.4270
			1-2	DU-1 (1-2)	0.712	5.41	64.6	321	2.56E-05	0.4000	2.7500
			2-3	DU-1 (2-3)	0.529	5.79	69.5	57.5	1.07E-05	0.3280	0.1100
	DU-2	ISM	0-1	DU-2 (0-1)	0.603	5.41	119	96.2	6.95E-06	0.1650	0.1860
			1-2	DU-2 (1-2)	0.515	5.36	170	118	3.44E-06	0.1080	0.5580
			2-3	DU-2 (2-3)	0.495	5.21	41.9	24.4	2.42E-06	0.0319	0.0299
	DU-3	ISM	0-1	DU-3 (0-1)	0.547	6.87	26.8	20.1	2.63E-05	0.1530	0.0250
			1-2	DU-3 (1-2)	0.497	6.65	25.8	15.8	7.82E-06	0.1290	0.0050
			2-3	DU-3 (2-3)	0.536	6.65	21.6	13.5	4.57E-06	0.1030	0.0048
	DU-4	ISM	0-1	DU-4 (0-1)	0.565	6.57	29.1	23.7	2.09E-05	0.4280	0.0317
			1-2	DU-4 (1-2)	0.515	6.87	26.6	23.9	1.66E-05	1.7500	0.0245
			2-3	DU-4 (2-3)	0.502	7.63	34	45.1	1.47E-05	0.7670	0.0351
	DU-5	ISM	0-1	DU-5 (0-1)	0.992	8.98	344	62.1	1.71E-05	0.2420	0.1770
			1-2	DU-5 (1-2)	0.832	8.09	237	70.5	1.53E-05	0.1990	0.1430
			2-3	DU-5 (2-3)	0.596	6.73	214	118	2.33E-05	0.4080	0.3870
	DU-6	ISM	0-1	DU-6 (0-1)	0.539	4.93	67.6	28.2	1.04E-05	0.1880	0.0625
			1-2	DU-6 (1-2)	0.56	4.89	91.6	40	2.51E-05	0.2040	0.1110
			2-3	DU-6 (2-3)	0.526	4.67	100	37.8	1.14E-05	0.2260	0.1670
	DU-7	ISM	0-1	DU-7 (0-1)	0.537	4.37	36	23.3	1.74E-05	0.1270	0.0527
			1-2	DU-7 (1-2)	0.547	3.98	30.1	18.7	1.24E-05	0.0711	0.0567
			2-3	DU-7 (2-3)	0.536	3.07	24.2	14.9	8.17E-06	0.0478	0.0502
	DU-8	ISM	0-1	DU-8 (0-1)	0.56	4.33	32.5	39.1	2.36E-05	0.1210	0.0989
			1-2	DU-8 (1-2)	0.501	4.13	32.9	31.4	2.46E-05	0.0731	0.0678
			2-3	DU-8 (2-3)	0.545	4.13	32	31	2.34E-05	0.0847	0.0984
	DU-9	ISM	0-1	DU-9 (0-1)	0.623	5.25	40.6	28.2	1.78E-05	0.1890	0.0640
			1-2	DU-9 (1-2)	0.555	4.81	34.6	40.7	1.28E-05	0.0771	0.0353
			2-3	DU-9 (2-3)	0.512	5.12	37.4	21.5	1.23E-05	0.1800	0.0478
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)	0.541	4.5	33.3	86.5	1.73E-05	5.1900	0.0337
			1-2	DU-10 (1-2)	0.531	5.56	33.6	54.8	5.46E-06	4.7000	0.0262
			2-3	DU-10 (2-3)	0.514	5.16	32.2	73.3	4.52E-06	2.6000	0.0051
	DU-11	ISM	0-1	DU-11 (0-1)	0.545	4.6	38.5	56.1	1.17E-05	5.4000	0.0369
			1-2	DU-11 (1-2)	0.535	4.15	37.3	49	5.21E-06	2.6500	0.0372
			2-3	DU-11 (2-3)	0.526	4.23	35.2	43.3	5.89E-06	5.1300	0.0389
	DU-12	ISM	0-1	DU-12 (0-1)	0.83	4.95	78.9	165	2.54E-05	0.3930	0.0532
			1-2	DU-12 (1-2)	0.493	4.26	55.7	131	4.21E-06	0.1430	0.0317
			2-3	DU-12 (2-3)	0.551	3.62	41	70.8	2.60E-06	0.0900	0.0050
	DU-13	ISM	0-1	DU-13 (0-1)	0.923	6.04	94.3	241	2.77E-04	1.1700	0.0701
			1-2	DU-13 (1-2)	0.54	4.79	53	154	3.62E-05	0.4500	0.0272
			2-3	DU-13 (2-3)	0.562	4.04	54.2	175	2.66E-05	0.2630	0.0330
	DU-14	ISM	0-1	DU-14 (0-1)	2.81	6.14	73.5	134	7.87E-05	0.1490	0.0283
			1-2	DU-14 (1-2)	7.38	6.87	122	240	3.43E-05	0.2570	0.0048
			2-3	DU-14 (2-3)	3.04	5.66	185	162	1.43E-05	0.1950	0.0048
	DU-15	ISM	0-1	DU-15 (0-1)	2.81	5.04	95.4	131	3.96E-04	0.1380	0.0268
			1-2	DU-15 (1-2)	0.576	3.75	57.7	68.6	2.00E-04	0.0499	0.0048
			2-3	DU-15 (2-3)	0.492	2.91	36.2	63.6	1.50E-04	0.1010	0.0048
	DU-16	ISM	0-1	DU-16 (0-1)	4.29	8.31	131	306	2.44E-04	0.4960	0.0346
			1-2	DU-16 (1-2)	2.29	6.92	71.8	151	1.75E-05	0.2460	0.0049
			2-3	DU-16 (2-3)	0.499	3.6	16	4	6.00E-06	0.0200	0.0050
	DU-17	ISM	0-1	DU-17 (0-1)	1.06	4.95	59.2	81.4	4.04E-05	0.0634	0.0257
			1-2	DU-17 (1-2)	0.511	3.72	34.3	62.5	3.43E-06	0.0513	0.0050
			2-3	DU-17 (2-3)	0.504	3.16	26.8	35.1	7.81E-06	0.0309	0.0049
	DU-18	ISM	0-1	DU-18 (0-1)	1.41	10.9	111	280	6.68E-05	0.2710	0.0584
			1-2	DU-18 (1-2)	0.495	6.22	79.5	179	2.16E-05	0.1380	0.0336
			2-3	DU-18 (2-3)	0.502	5.63	59.9	92.3	1.29E-05	0.0862	0.0316
	DU-19	ISM	0-1	DU-19 (0-1)	1.39	7.67	107	257	1.34E-04	0.4030	0.1440
			1-2	DU-19 (1-2)	0.957	11.2	110	161	8.48E-05	0.2700	0.0311
			2-3	DU-19 (2-3)	0.926	5.68	44.9	51	4.00E-05	0.0560	0.0568
	DU-20	ISM	0-1	DU-20 (0-1)	1.69	5.69	58.4	76.2	3.49E-05	0.1450	0.0390
			1-2	DU-20 (1-2)	0.536	4.08	25.8	17.7	4.30E-06	0.0132	0.0050
			2-3	DU-20 (2-3)	0.511	3.68	23	14.3	3.97E-06	0.0193	0.0050
	DU-21	ISM	0-1	DU-21 (0-1)	2.73	10.5	128	295	7.03E-05	0.3140	0.0492
			1-2	DU-21 (1-2)	1.01	4.93	56.2	116	2.06E-05	0.1640	0.0364
			2-3	DU-21 (2-3)	0.497	4.48	45.9	89.7	1.01E-05	0.0879	0.0050
	DU-22	ISM	0-1	DU-22 (0-1)	2.89	6.48	96.6	190	3.25E-05	0.1310	0.0438
			1-2	DU-22 (1-2)	2.63	4.53	47.4	72.3	1.23E-05	0.0289	0.0258
			2-3	DU-22 (2-3)	1.09	4.45	54	57.5	7.93E-06	0.0292	0.0050
	DU-23	ISM	0-1	DU-23 (0-1)	1.62	5.99	150	276	4.00E-05	0.1060	0.0591
			1-2	DU-23 (1-2)	0.61	4.63	69.5	70.9	1.05E-05	0.1040	0.0265
			2-3	DU-23 (2-3)	0.498	3.82	41.9	82.2	5.92E-06	0.0362	0.0050
	DU-24	ISM	0-1	DU-24 (0-1)	0.546	4.16	39.9	48.8	2.33E-05	0.0907	0.0326
			1-2	DU-24 (1-2)	0.496	3.56	28.4	23.2	6.44E-06	0.0680	0.0049
			2-3	DU-24 (2-3)	0.501	2.84	17.6	13.8	8.88E-06	0.0145	0.0048

Please see notes at the end of the table.

Table A-1
Human Health Residual Risk Screening
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Antimony	Arsenic	Copper	Lead	Dioxin/Furan TEQ	cPAHs	Total PCBs
					Constituent (mg/kg)						
				Human Health RBC	24.3	1.4	11000	400	1.50E-05	0.55	0.75
				ISM Bkgd	0.29	8.8	24	27			
				Composite Bkgd	0.56	8.8	34	79			
Central Parcel	DU-25	ISM	0-1	DU-25 (0-1)	0.822	5.24	226	144	4.69E-05	0.3860	0.0653
			1-2	DU-25 (1-2)	0.493	3.29	43	92	2.60E-06	0.0905	0.0050
			2-3	DU-25 (2-3)	0.496	3.17	30	43.2	1.94E-06	0.0873	0.0050
	DU-26	ISM	0-1	DU-26 (0-1)	4.79	9.5	152	330	9.33E-05	0.7230	0.1850
			1-2	DU-26 (1-2)	1.4	11.6	80.7	151	4.27E-05	0.2810	0.0705
			2-3	DU-26 (2-3)	0.529	4.75	41.6	76.1	2.36E-05	0.1480	0.1890
Central Parcel Concrete Slab	DU-42 (Within DU-16)	Composite	0-1	DU-42 (0-1)	0.512	4.38	36.3	53.3	6.07E-05	0.0507	0.0050
			1-2	DU-42 (1-2)	0.6	4.05	25	29.3	2.10E-05	0.0300	0.0050
			2-3	DU-42 (2-3)	0.531	3.76	21.1	20.1	8.27E-06	0.0229	0.0049
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)	1.3	14.5	204	46.1	1.03E-04	0.2130	0.1860
			1-2	DU-27 (1-2)	0.488	8.72	81.2	39.1	6.99E-05	0.2420	0.1680
			2-3	DU-27 (2-3)	1.15	15.8	45.6	55.4	2.40E-05	0.0973	0.1780
	DU-28	ISM	0-1	DU-28 (0-1)	2.32	10.5	184	78.1	1.91E-05	0.4330	0.1000
			1-2	DU-28 (1-2)	2.87	13.3	327	74.1	3.27E-05	0.5280	0.0718
			2-3	DU-28 (2-3)	4.79	7.4	229	113	1.49E-05	0.3530	0.0370
	DU-29	ISM	0-1	DU-29 (0-1)	1.08	6.95	69.3	103	4.97E-05	0.1540	0.0250
			1-2	DU-29 (1-2)	1.02	5.08	44.3	41.1	1.53E-05	0.0697	0.0047
			2-3	DU-29 (2-3)	0.511	3.6	27.8	45.7	1.53E-05	0.0588	0.0049
	DU-30	ISM	0-1	DU-30 (0-1)	1.66	4.22	63.4	131	5.05E-05	0.3980	0.0325
			1-2	DU-30 (1-2)	2.09	3.72	79.8	202	2.24E-05	0.1690	0.0050
			2-3	DU-30 (2-3)	6.81	4.14	86.6	220	1.44E-05	0.0709	0.0456
	DU-31	ISM	0-1	DU-31 (0-1)	1.85	6.09	35.4	44.8	5.84E-05	0.1240	0.0257
			1-2	DU-31 (1-2)	0.743	4.98	49.2	34.1	1.90E-05	0.1190	0.0298
			2-3	DU-31 (2-3)	0.735	5.96	68.2	25	1.09E-05	0.0919	0.0270
	DU-32	ISM	0-1	DU-32 (0-1)	0.879	8.99	31.6	28.9	3.48E-05	0.1150	0.0048
			1-2	DU-32 (1-2)	0.535	7.1	23.4	20.9	7.54E-06	0.0754	0.0048
			2-3	DU-32 (2-3)	0.492	3.56	20.1	34.1	7.59E-06	0.5660	0.0047
	DU-33	ISM	0-1	DU-33 (0-1)	2.31	6.62	79.8	88.8	3.69E-05	0.0542	0.0852
			1-2	DU-33 (1-2)	1.84	9.6	96.6	66.2	1.67E-05	0.0519	0.0501
			2-3	DU-33 (2-3)	0.666	5.35	52.6	42.8	1.21E-05	0.0555	0.0579
	DU-34	ISM	0-1	DU-34 (0-1)	1.05	5.13	32.6	41.4	6.03E-05	0.2530	0.0330
			1-2	DU-34 (1-2)	0.557	4.95	33.2	31.9	2.82E-05	0.1840	0.0476
			2-3	DU-34 (2-3)	0.537	3.69	33.1	25.9	3.02E-05	0.0973	0.0050
	DU-35	ISM	0-1	DU-35 (0-1)	0.512	4.4	52.9	22.6	4.05E-05	0.0931	0.0284
			1-2	DU-35 (1-2)	0.531	3.81	29.1	19	1.31E-05	0.1190	0.0396
			2-3	DU-35 (2-3)	0.524	3.37	27.8	12.4	1.02E-05	0.0355	0.0050
	DU-36	ISM	0-1	DU-36 (0-1)	3.77	5.03	57.9	73.2	4.21E-05	0.0823	0.0279
			1-2	DU-36 (1-2)	3.44	4.23	56.7	130	3.70E-05	0.1030	0.0050
			2-3	DU-36 (2-3)	3.62	4.12	46.3	63.3	2.80E-05	0.0379	0.0284
	DU-38	ISM	0-1	DU-38 (0-1)	1.31	3.71	27.7	30.5	2.94E-05	0.0828	0.0412
			1-2	DU-38 (1-2)	4.88	3.76	56	76.7	1.90E-05	0.0635	0.0444
			2-3	DU-38 (2-3)	3.71	4.06	51.4	51.3	1.05E-05	0.0442	0.0300
East Parcel Concrete Slabs	DU-37	Composite	0-1	DU-37 (0-1)	0.495	3.72	26.1	39.3	6.78E-07	0.0124	0.0049
			1-2	DU-37 (1-2)	0.495	3	21.4	12.6	6.32E-07	0.0114	0.0050
			2-3	DU-37 (2-3)	0.513	2.85	16.9	8.96	5.69E-07	0.0970	0.0051
	DU-39	Composite	0-1	DU-39 (0-1)	0.534	2.69	21.3	6.09	3.68E-06	0.0057	0.0049
			1-2	DU-39 (1-2)	0.56	3.24	17.9	5.11	1.38E-06	0.0057	0.0049
			2-3	DU-39 (2-3)	0.525	3.44	18.4	6.88	1.36E-06	0.0124	0.0049
	DU-40	Composite	0-1	DU-40 (0-1)	0.509	2.88	16.2	3.75	7.34E-07	0.0057	0.0049
			1-2	DU-40 (1-2)	0.513	3.4	15.4	3.47	5.18E-07	0.0061	0.0050
			2-3	DU-40 (2-3)	0.525	3.13	16.6	3.1	5.52E-07	0.0061	0.0050
	DU-43 (Within DU-31)	Composite	0-1	DU-43 (0-1)	0.503	2.92	18.8	5.42	3.00E-06	0.0163	0.0051
			1-2	DU-43 (1-2)	0.536	2.89	18.7	9.65	1.26E-06	0.0106	0.0051
			2-3	DU-43 (2-3)	0.523	3.06	16.3	4.35	6.63E-07	0.0097	0.0050
	DU-44 (Within DU-36)	Composite	0-1	DU-44 (0-1)	0.619	3.12	17.9	13	1.38E-06	0.0180	0.0049
			1-2	DU-44 (1-2)	0.486	3.24	15.7	6.23	8.37E-07	0.0127	0.0049
			2-3	DU-44 (2-3)	0.505	3.06	15	5.94	7.25E-07	0.0129	0.0048
East Parcel Soil Berms	DU-41	ISM	0-1	DU-41 (0-1)	2.81	50.1	78.6	83.8	2.55E-04	0.3360	0.0691
			1-2	DU-41 (1-2)	2.39	14.1	71.1	129	2.42E-04	0.2760	0.0926
			2-3	DU-41 (2-3)	1.69	19.6	45.2	109	1.55E-04	0.1490	0.0438

Notes:
1. Definition of table shading:
   - Layer Removed
   - Layer Partially Removed
   - Non-Detect
   - Layer not excavated for hot spots and exceeds detection limit, background, and human health risk-based concentration
2. mg/kg = milligrams per kilogram

Table A-2
Residual Human Health Risk Data - Step 2
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg		
					Arsenic	Dioxin/Furan TEQ	cPAHs
West Parcel	DU-1	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	DU-1 (2-3)		1.07E-05	0.3280
	DU-2	ISM	0-1	DU-2 (0-1)		6.95E-06	0.1650
			1-2	DU-2 (1-2)		3.44E-06	0.1080
			2-3	DU-2 (2-3)		2.42E-06	0.0319
	DU-3	ISM	0-1	DU-3 (0-1)		2.63E-05	0.1530
			1-2	DU-3 (1-2)		7.82E-06	0.1290
			2-3	DU-3 (2-3)		4.57E-06	0.1030
	DU-4	ISM	0-1	DU-4 (0-1)		2.09E-05	0.4280
			1-2	DU-4 (1-2)		1.66E-05	1.7500
			2-3	DU-4 (2-3)		1.47E-05	0.7670
	DU-5	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	Replace		1.40E-06	0.0100
	DU-6	ISM	0-1	DU-6 (0-1)		1.04E-05	0.1880
			1-2	DU-6 (1-2)		2.51E-05	0.2040
			2-3	DU-6 (2-3)		1.14E-05	0.2260
	DU-7	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	DU-7 (1-2)		1.24E-05	0.0711
			2-3	DU-7 (2-3)		8.17E-06	0.0478
	DU-8	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	Replace		1.40E-06	0.0100
	DU-9	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	DU-9 (1-2)		1.28E-05	0.0771
			2-3	DU-9 (2-3)		1.23E-05	0.1800

Please see notes at the end of the table.

Table A-2
Residual Human Health Risk Data - Step 2
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg		
					Arsenic	Dioxin/Furan TEQ	cPAHs
Central Parcel	DU-10	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	Replace		1.40E-06	0.0100
	DU-11	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	Replace		1.40E-06	0.0100
	DU-12	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	DU-12 (2-3)		2.60E-06	0.0900
	DU-13	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	Replace		1.40E-06	0.0100
	DU-14	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	Replace		1.40E-06	0.0100
	DU-15	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	Replace		1.40E-06	0.0100
	DU-16	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	DU-16 (2-3)		7.62E-06	0.0569
	DU-17	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	DU-17 (1-2)		3.43E-06	0.0513
			2-3	DU-17 (2-3)		7.81E-06	0.0309
	DU-18	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	Replace		1.40E-06	0.0100
	DU-19	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	DU-19 (2-3)		4.66E-05	0.0790
	DU-20	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	DU-20 (1-2)		4.30E-06	0.0132
			2-3	DU-20 (2-3)		3.97E-06	0.0193
	DU-21	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	DU-21 (2-3)		1.01E-05	0.0879

Please see notes at the end of the table.

Table A-2
Residual Human Health Risk Data - Step 2
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg		
					Arsenic	Dioxin/Furan TEQ	cPAHs
Central Parcel	DU-22	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	Replace		1.40E-06	0.0100
	DU-23	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	Replace		1.40E-06	0.0100
	DU-24	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	DU-24 (1-2)		6.44E-06	0.0740
			2-3	DU-24 (2-3)		8.88E-06	0.0145
	DU-25	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	DU-25 (1-2)		2.60E-06	0.0905
			2-3	DU-25 (2-3)		1.94E-06	0.0873
	DU-26	ISM	0-1	Replace		1.40E-06	0.0100
			1-2	Replace		1.40E-06	0.0100
			2-3	Replace		1.40E-06	0.0100
	DU-42	Composite	0-1	DU-42 (0-1)	Not Used - Small Area		
			1-2	DU-42 (1-2)			
			2-3	DU-42 (2-3)			
East Parcel	DU-27	ISM	0-1	Replace	3.1	1.40E-06	0.0100
			1-2	DU-27 (1-2)	8.72	6.99E-05	0.2420
			2-3	DU-27 (2-3)	15.8	2.40E-05	0.0973
	DU-28	ISM	0-1	Replace	3.1	1.40E-06	0.0100
			1-2	Replace	3.1	1.40E-06	0.0100
			2-3	DU-28 (2-3)	7.4	1.49E-05	0.3530
	DU-29	ISM	0-1	DU-29 (0-1)	6.95	4.97E-05	0.1540
			1-2	DU-29 (1-2)	5.08	1.53E-05	0.0697
			2-3	DU-29 (2-3)	3.6	1.53E-05	0.0588
	DU-30	ISM	0-1	DU-30 (0-1)	4.22	5.05E-05	0.3980
			1-2	DU-30 (1-2)	3.72	2.24E-05	0.1690
			2-3	DU-30 (2-3)	4.14	1.44E-05	0.0709
	DU-31	ISM	0-1	DU-31 (0-1)	6.09	5.84E-05	0.1240
			1-2	DU-31 (1-2)	4.98	1.90E-05	0.1190
			2-3	DU-31 (2-3)	5.96	1.09E-05	0.0919
	DU-32	ISM	0-1	DU-32 (0-1)	8.99	3.48E-05	0.1150
			1-2	DU-32 (1-2)	7.1	7.54E-06	0.0754
			2-3	DU-32 (2-3)	3.56	7.59E-06	0.5660

Please see notes at the end of the table.

Table A-2
Residual Human Health Risk Data - Step 2
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg		
					Arsenic	Dioxin/Furan TEQ	cPAHs
East Parcel	DU-33	ISM	0-1	DU-33 (0-1)	6.62	3.69E-05	0.0542
			1-2	DU-33 (1-2)	9.6	1.67E-05	0.0519
			2-3	DU-33 (2-3)	5.35	1.21E-05	0.0555
	DU-34	ISM	0-1	DU-34 (0-1)	5.13	6.03E-05	0.2530
			1-2	DU-34 (1-2)	4.95	2.82E-05	0.1840
			2-3	DU-34 (2-3)	3.69	3.02E-05	0.0973
	DU-35	ISM	0-1	DU-35 (0-1)	4.4	4.05E-05	0.0931
			1-2	DU-35 (1-2)	3.81	1.31E-05	0.1190
			2-3	DU-35 (2-3)	3.37	1.02E-05	0.0355
	DU-36	ISM	0-1	DU-36 (0-1)	5.03	4.21E-05	0.0823
			1-2	DU-36 (1-2)	4.23	3.70E-05	0.1030
			2-3	DU-36 (2-3)	4.12	2.80E-05	0.0379
	DU-38	ISM	0-1	DU-38 (0-1)	3.71	2.94E-05	0.0828
			1-2	DU-38 (1-2)	3.76	1.90E-05	0.0635
			2-3	DU-38 (2-3)	4.06	1.05E-05	0.0442
	DU-37	Composite	0-1	DU-37 (0-1)	3.72	6.78E-07	0.0124
			1-2	DU-37 (1-2)	3.00	6.32E-07	0.0114
			2-3	DU-37 (2-3)	2.85	5.69E-07	0.0970
	DU-39	Composite	0-1	DU-39 (0-1)	2.69	3.68E-06	0.0057
			1-2	DU-39 (1-2)	3.24	1.38E-06	0.0057
			2-3	DU-39 (2-3)	3.44	1.36E-06	0.0124
	DU-40	Composite	0-1	DU-40 (0-1)	2.88	7.34E-07	0.0057
			1-2	DU-40 (1-2)	3.4	5.18E-07	0.0061
			2-3	DU-40 (2-3)	3.13	5.52E-07	0.0061
	DU-43	Composite	0-1	DU-43 (0-1)	Not Used - Small Area		
			1-2	DU-43 (1-2)			
			2-3	DU-43 (2-3)			
	DU-44	Composite	0-1	DU-44 (0-1)	Not Used - Small Area		
			1-2	DU-44 (1-2)			
			2-3	DU-44 (2-3)			
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)	Not Used - Soil Berm		
			1-2	DU-41 (1-2)			
			2-3	DU-41 (2-3)			

Notes:

1. Definition of table shading:

Proposed for removal for hot spot excavation.

Upper 0.5 feet proposed for removal for hot spot excavation. Conservatively use full layer concentration.

Replacement value (based on concentrations beneath concrete pads on East Parcel).

As	3.1 mg/kg
D/F	1.40E-06 mg/kg
cPAHs	0.01 mg/kg

Table A-3
Additional Human Health Risk Excavation - Step 3 Data and Results
Willamette Cove Upland Facility

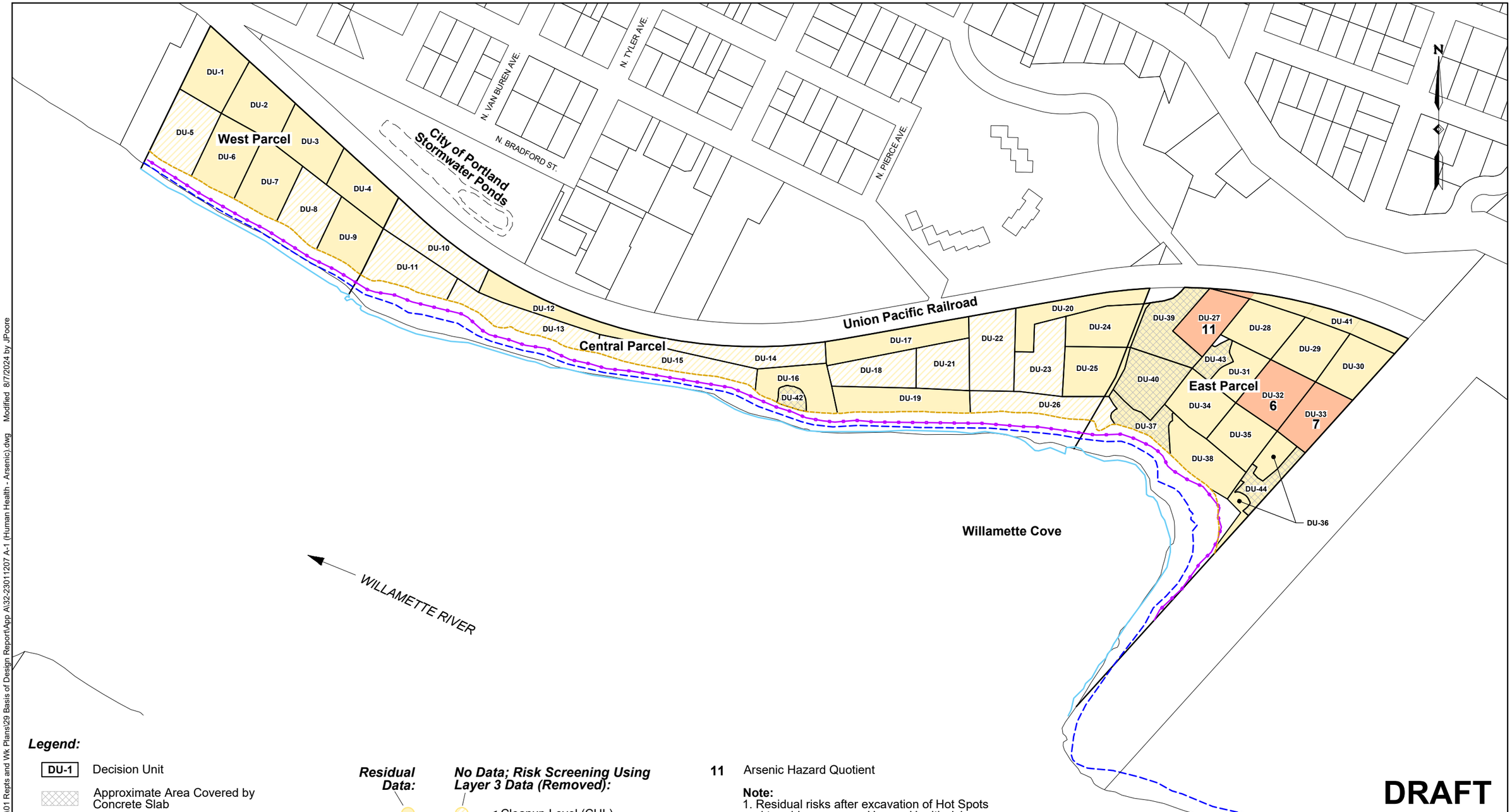
Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Dioxin/Furan TEQ Concentration in mg/kg						
					Post Hot Spot Removal	Remove 1 Cell	Remove 2 Cells	Remove 3 Cells	Remove 4 Cells	Remove 5 Cells	Remove 6 Cells
East Parcel	DU-27	ISM	0-1	Replace	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06
			1-2	DU-27 (1-2)	6.99E-05	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06
			2-3	DU-27 (2-3)	2.40E-05	2.40E-05	2.40E-05	2.40E-05	2.40E-05	2.40E-05	2.40E-05
	DU-28	ISM	0-1	Replace	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06
			1-2	Replace	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06
			2-3	DU-28 (2-3)	1.49E-05	1.49E-05	1.49E-05	1.49E-05	1.49E-05	1.49E-05	1.49E-05
	DU-29	ISM	0-1	DU-29 (0-1)	4.97E-05	4.97E-05	4.97E-05	4.97E-05	4.97E-05	1.40E-06	1.40E-06
			1-2	DU-29 (1-2)	1.53E-05	1.53E-05	1.53E-05	1.53E-05	1.53E-05	1.53E-05	1.53E-05
			2-3	DU-29 (2-3)	1.53E-05	1.53E-05	1.53E-05	1.53E-05	1.53E-05	1.53E-05	1.53E-05
	DU-30	ISM	0-1	DU-30 (0-1)	5.05E-05	5.05E-05	5.05E-05	5.05E-05	1.40E-06	1.40E-06	1.40E-06
			1-2	DU-30 (1-2)	2.24E-05	2.24E-05	2.24E-05	2.24E-05	2.24E-05	2.24E-05	2.24E-05
			2-3	DU-30 (2-3)	1.44E-05	1.44E-05	1.44E-05	1.44E-05	1.44E-05	1.44E-05	1.44E-05
	DU-31	ISM	0-1	DU-31 (0-1)	5.84E-05	5.84E-05	5.84E-05	1.40E-06	1.40E-06	1.40E-06	1.40E-06
			1-2	DU-31 (1-2)	1.90E-05	1.90E-05	1.90E-05	1.90E-05	1.90E-05	1.90E-05	1.90E-05
			2-3	DU-31 (2-3)	1.09E-05	1.09E-05	1.09E-05	1.09E-05	1.09E-05	1.09E-05	1.09E-05
	DU-32	ISM	0-1	DU-32 (0-1)	3.48E-05	3.48E-05	3.48E-05	3.48E-05	3.48E-05	3.48E-05	3.48E-05
			1-2	DU-32 (1-2)	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06
			2-3	DU-32 (2-3)	7.59E-06	7.59E-06	7.59E-06	7.59E-06	7.59E-06	7.59E-06	7.59E-06
	DU-33	ISM	0-1	DU-33 (0-1)	3.69E-05	3.69E-05	3.69E-05	3.69E-05	3.69E-05	3.69E-05	3.69E-05
			1-2	DU-33 (1-2)	1.67E-05	1.67E-05	1.67E-05	1.67E-05	1.67E-05	1.67E-05	1.67E-05
			2-3	DU-33 (2-3)	1.21E-05	1.21E-05	1.21E-05	1.21E-05	1.21E-05	1.21E-05	1.21E-05
	DU-34	ISM	0-1	DU-34 (0-1)	6.03E-05	6.03E-05	1.40E-06	1.40E-06	1.40E-06	1.40E-06	1.40E-06
			1-2	DU-34 (1-2)	2.82E-05	2.82E-05	2.82E-05	2.82E-05	2.82E-05	2.82E-05	2.82E-05
			2-3	DU-34 (2-3)	3.02E-05	3.02E-05	3.02E-05	3.02E-05	3.02E-05	3.02E-05	3.02E-05
	DU-35	ISM	0-1	DU-35 (0-1)	4.05E-05	4.05E-05	4.05E-05	4.05E-05	4.05E-05	4.05E-05	4.05E-05
			1-2	DU-35 (1-2)	1.31E-05	1.31E-05	1.31E-05	1.31E-05	1.31E-05	1.31E-05	1.31E-05
			2-3	DU-35 (2-3)	1.02E-05	1.02E-05	1.02E-05	1.02E-05	1.02E-05	1.02E-05	1.02E-05
	DU-36	ISM	0-1	DU-36 (0-1)	4.21E-05	4.21E-05	4.21E-05	4.21E-05	4.21E-05	4.21E-05	1.40E-06
			1-2	DU-36 (1-2)	3.70E-05	3.70E-05	3.70E-05	3.70E-05	3.70E-05	3.70E-05	3.70E-05
			2-3	DU-36 (2-3)	2.80E-05	2.80E-05	2.80E-05	2.80E-05	2.80E-05	2.80E-05	2.80E-05
	DU-38	ISM	0-1	DU-38 (0-1)	2.94E-05	2.94E-05	2.94E-05	2.94E-05	2.94E-05	2.94E-05	2.94E-05
			1-2	DU-38 (1-2)	1.90E-05	1.90E-05	1.90E-05	1.90E-05	1.90E-05	1.90E-05	1.90E-05
			2-3	DU-38 (2-3)	1.05E-05	1.05E-05	1.05E-05	1.05E-05	1.05E-05	1.05E-05	1.05E-05
	DU-37	Composite	0-1	DU-37 (0-1)	6.78E-07	6.78E-07	6.78E-07	6.78E-07	6.78E-07	6.78E-07	6.78E-07
			1-2	DU-37 (1-2)	6.32E-07	6.32E-07	6.32E-07	6.32E-07	6.32E-07	6.32E-07	6.32E-07
			2-3	DU-37 (2-3)	5.69E-07	5.69E-07	5.69E-07	5.69E-07	5.69E-07	5.69E-07	5.69E-07
	DU-39	Composite	0-1	DU-39 (0-1)	3.68E-06	3.68E-06	3.68E-06	3.68E-06	3.68E-06	3.68E-06	3.68E-06
			1-2	DU-39 (1-2)	1.38E-06	1.38E-06	1.38E-06	1.38E-06	1.38E-06	1.38E-06	1.38E-06
			2-3	DU-39 (2-3)	1.36E-06	1.36E-06	1.36E-06	1.36E-06	1.36E-06	1.36E-06	1.36E-06
	DU-40	Composite	0-1	DU-40 (0-1)	7.34E-07	7.34E-07	7.34E-07	7.34E-07	7.34E-07	7.34E-07	7.34E-07
			1-2	DU-40 (1-2)	5.18E-07	5.18E-07	5.18E-07	5.18E-07	5.18E-07	5.18E-07	5.18E-07
			2-3	DU-40 (2-3)	5.52E-07	5.52E-07	5.52E-07	5.52E-07	5.52E-07	5.52E-07	5.52E-07
	DU-43	Composite	0-1	DU-43 (0-1)	Not Used - Small Area						
			1-2	DU-43 (1-2)							
			2-3	DU-43 (2-3)							
	DU-44	Composite	0-1	DU-44 (0-1)	Not Used - Small Area						
			1-2	DU-44 (1-2)							
			2-3	DU-44 (2-3)							
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)	Not Used - Soil Berm						
			1-2	DU-41 (1-2)							
			2-3	DU-41 (2-3)							
90 UCL Concentration					2.4E-05	2.19E-05	2.03E-05	1.87E-05	1.73E-05	1.60E-05	1.49E-05

Notes:

1. Definition of table shading:

Proposed for removal for hot spot excavation or to adddress excess human health risk. Replacement value (based on concentrations beneath concrete pads on East Parcel).

Upper 0.5 feet proposed for removal for hot spot excavation. Conservatively use full layer concentration.



Legend:

- DU-1 — Decision Unit
- Approximate Area Covered by Concrete Slab
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

Residual Data:

No Data; Risk Screening Using Layer 3 Data (Removed):

- < Cleanup Level (CUL)
- > CUL; <Hot Spot
- ≥ Hot Spot

11 Arsenic Hazard Quotient

Note:
1. Residual risks after excavation of Hot Spots and to address excess Human Health risk.

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

0 250 500
Scale in Feet

DRAFT

Residual Human Health Risk Screening - Arsenic

Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

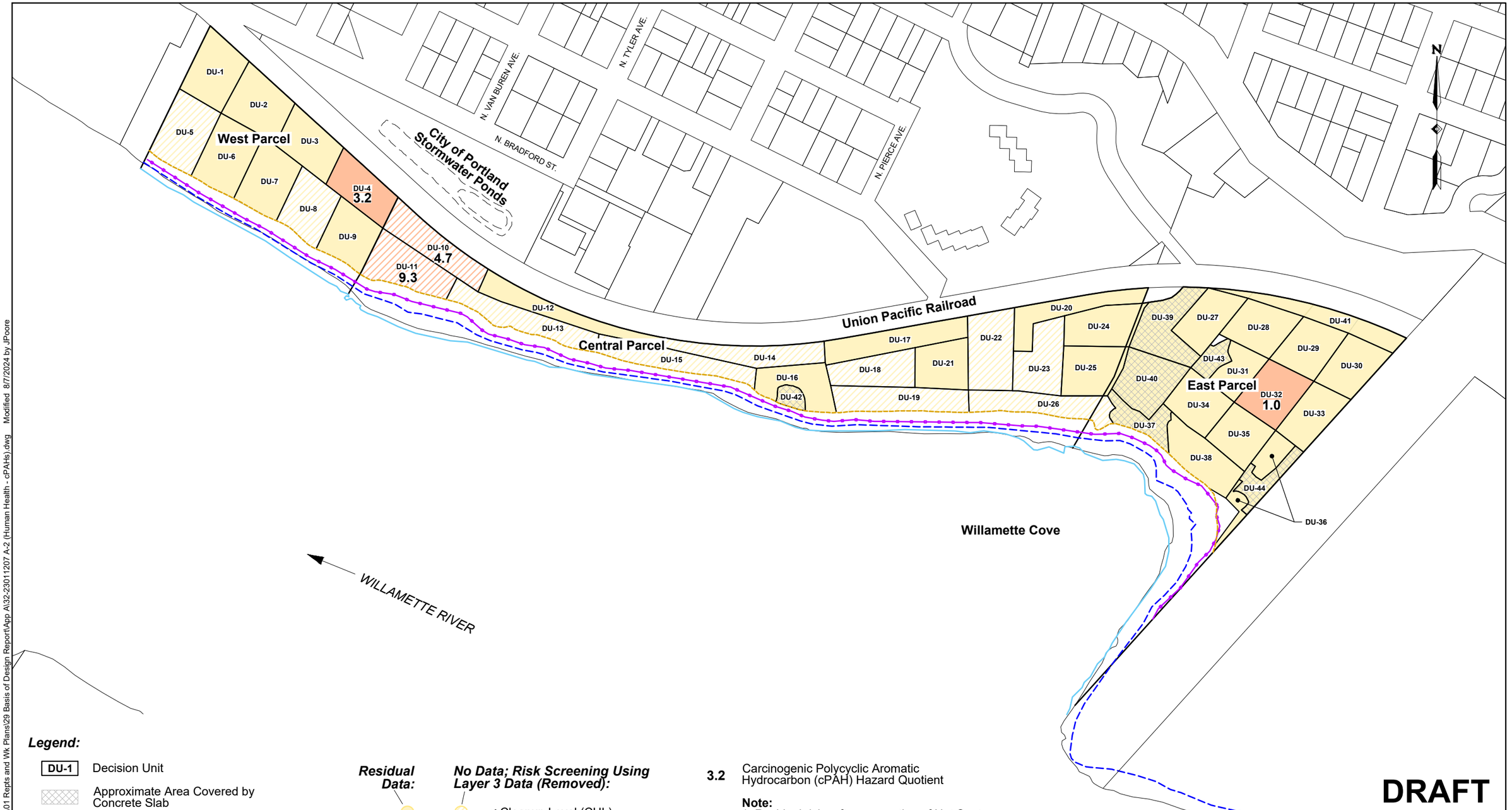
Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:
32-23011207	JP	HFC

September 2024

Figure **A-1**

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\29 Basis of Design Report\App A\32-23011207 A-1 (Human Health - Arsenic).dwg Modified 8/7/2024 by JPoore



Legend:

- DU-1 — Decision Unit
- Approximate Area Covered by Concrete Slab
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

Residual Data:

No Data; Risk Screening Using Layer 3 Data (Removed):

- < Cleanup Level (CUL)
- > CUL; <Hot Spot
- ≥ Hot Spot

3.2 Carcinogenic Polycyclic Aromatic Hydrocarbon (cPAH) Hazard Quotient

Note:
1. Residual risks after excavation of Hot Spots and to address excess Human Health risk.

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

0 250 500
Scale in Feet

DRAFT

Residual Human Health Risk Screening - cPAHs

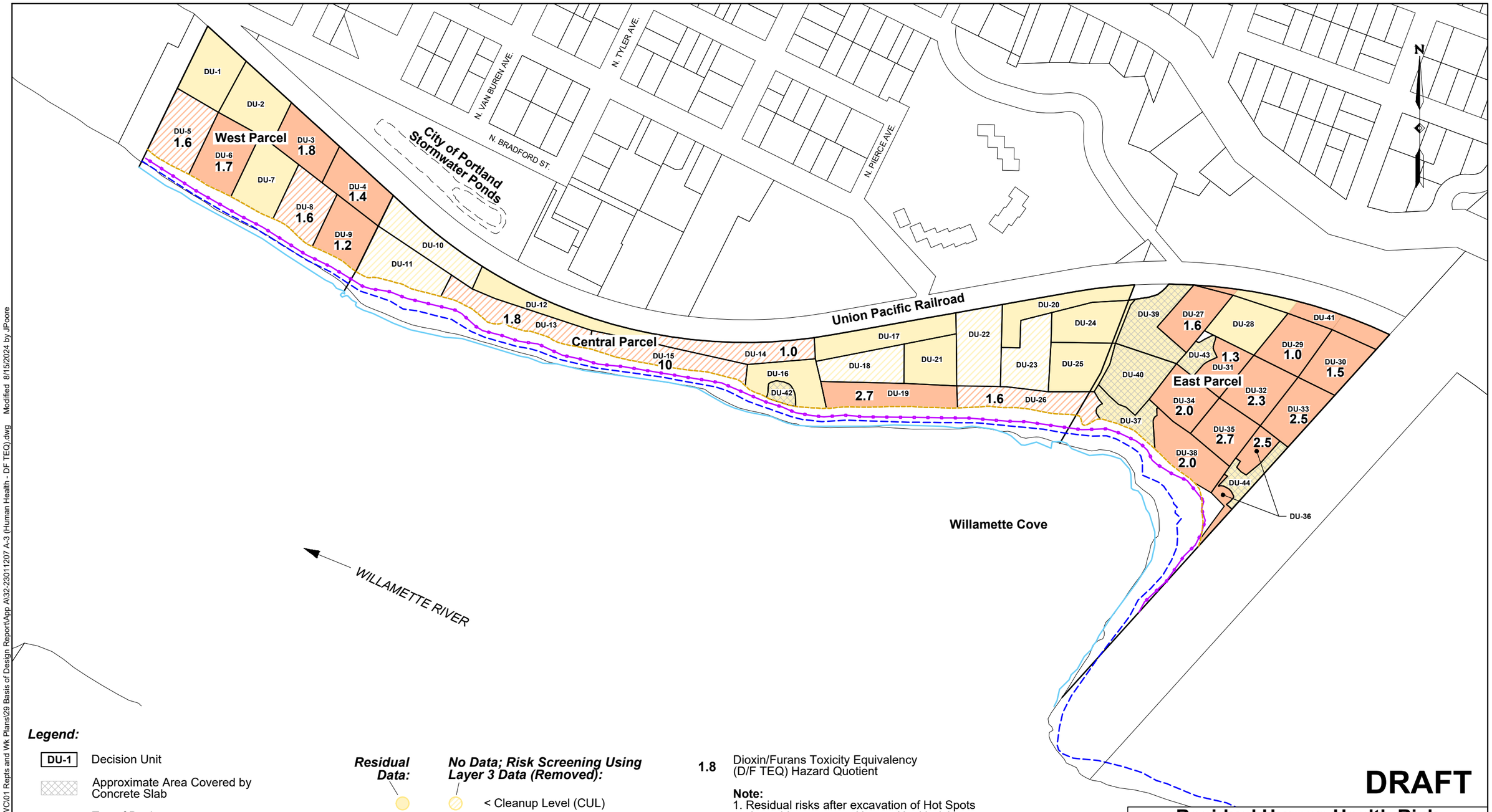
Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	A-2

September 2024

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\29 Basis of Design Report\App A\32-23011207 A-2 (Human Health - cPAHs).dwg Modified 8/7/2024 by JPoore



Legend:

- DU-1 — Decision Unit
- Approximate Area Covered by Concrete Slab
- Top of Bank
- Ordinary High Water Line (20.1NAVD88)
- Mean High Water Line (13.3NAVD88)
- Ordinary Low Water Line (6.9NAVD88)

Residual Data:

- ***No Data; Risk Screening Using Layer 3 Data (Removed):***
  - < Cleanup Level (CUL)
  - > CUL; <Hot Spot
  - ≥ Hot Spot

1.8 Dioxin/Furans Toxicity Equivalency (D/F TEQ) Hazard Quotient

Note:
1. Residual risks after excavation of Hot Spots and to address excess Human Health risk.

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2023). Historical base layer information from an electronic file provided by Hart Crowser.

0 250 500
Scale in Feet

DRAFT

Residual Human Health Risk Screening - D/F TEQ

Basis of Design Report
Willamette Cove Upland Facility
Portland, Oregon

Apex Companies, LLC
15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	A-3

September 2024

I:\Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\29 Basis of Design Report\App A\32-23011207 A-3 (Human Health - DF TEQ).dwg Modified 8/15/2024 by JPoore

Appendix A Attachment

90 Percent Upper Confidence Limit Calculation Input and Output

Parcel	Sample ID	Result	D_Result
West Parcel - D/F TEQ [µg/kg]	DU-1 (0-1)	1.40	1
West Parcel - D/F TEQ [µg/kg]	DU-1 (1-2)	1.40	1
West Parcel - D/F TEQ [µg/kg]	DU-1 (2-3)	10.74	1
West Parcel - D/F TEQ [µg/kg]	DU-2 (0-1)	6.95	1
West Parcel - D/F TEQ [µg/kg]	DU-2 (1-2)	3.44	1
West Parcel - D/F TEQ [µg/kg]	DU-2 (2-3)	2.42	1
West Parcel - D/F TEQ [µg/kg]	DU-3 (0-1)	26.29	1
West Parcel - D/F TEQ [µg/kg]	DU-3 (1-2)	7.82	1
West Parcel - D/F TEQ [µg/kg]	DU-3 (2-3)	4.57	1
West Parcel - D/F TEQ [µg/kg]	DU-4 (0-1)	20.88	1
West Parcel - D/F TEQ [µg/kg]	DU-4 (1-2)	16.59	1
West Parcel - D/F TEQ [µg/kg]	DU-4 (2-3)	14.66	1
West Parcel - D/F TEQ [µg/kg]	DU-5 (0-1)	1.40	1
West Parcel - D/F TEQ [µg/kg]	DU-5 (1-2)	1.40	1
West Parcel - D/F TEQ [µg/kg]	DU-5 (2-3)	1.40	1
West Parcel - D/F TEQ [µg/kg]	DU-6 (0-1)	10.36	1
West Parcel - D/F TEQ [µg/kg]	DU-6 (1-2)	25.14	1
West Parcel - D/F TEQ [µg/kg]	DU-6 (2-3)	11.45	1
West Parcel - D/F TEQ [µg/kg]	DU-7 (0-1)	1.40	1
West Parcel - D/F TEQ [µg/kg]	DU-7 (1-2)	12.38	1
West Parcel - D/F TEQ [µg/kg]	DU-7 (2-3)	8.17	1
West Parcel - D/F TEQ [µg/kg]	DU-8 (0-1)	1.40	1
West Parcel - D/F TEQ [µg/kg]	DU-8 (1-2)	1.40	1
West Parcel - D/F TEQ [µg/kg]	DU-8 (2-3)	1.40	1
West Parcel - D/F TEQ [µg/kg]	DU-9 (0-1)	1.40	1
West Parcel - D/F TEQ [µg/kg]	DU-9 (1-2)	12.79	1
West Parcel - D/F TEQ [µg/kg]	DU-9 (2-3)	12.34	1
Central Parcel - D/F TEQ [µg/kg]	DU-10 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-10 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-10 (2-3)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-11 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-11 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-11 (2-3)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-12 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-12 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-12 (2-3)	2.60	1
Central Parcel - D/F TEQ [µg/kg]	DU-13 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-13 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-13 (2-3)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-14 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-14 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-14 (2-3)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-15 (0-1)	1.40	1

Central Parcel - D/F TEQ [µg/kg]	DU-15 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-15 (2-3)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-16 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-16 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-16 (2-3)	7.62	1
Central Parcel - D/F TEQ [µg/kg]	DU-17 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-17 (1-2)	3.43	1
Central Parcel - D/F TEQ [µg/kg]	DU-17 (2-3)	7.81	1
Central Parcel - D/F TEQ [µg/kg]	DU-18 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-18 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-18 (2-3)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-19 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-19 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-19 (2-3)	46.63	1
Central Parcel - D/F TEQ [µg/kg]	DU-20 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-20 (1-2)	4.30	1
Central Parcel - D/F TEQ [µg/kg]	DU-20 (2-3)	3.97	1
Central Parcel - D/F TEQ [µg/kg]	DU-21 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-21 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-21 (2-3)	10.05	1
Central Parcel - D/F TEQ [µg/kg]	DU-22 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-22 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-22 (2-3)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-23 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-23 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-23 (2-3)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-24 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-24 (1-2)	6.44	1
Central Parcel - D/F TEQ [µg/kg]	DU-24 (2-3)	8.88	1
Central Parcel - D/F TEQ [µg/kg]	DU-25 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-25 (1-2)	2.60	1
Central Parcel - D/F TEQ [µg/kg]	DU-25 (2-3)	1.94	1
Central Parcel - D/F TEQ [µg/kg]	DU-26 (0-1)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-26 (1-2)	1.40	1
Central Parcel - D/F TEQ [µg/kg]	DU-26 (2-3)	1.40	1
East Parcel - D/F TEQ [µg/kg]	DU-27 (0-1)	1.40	1
East Parcel - D/F TEQ [µg/kg]	DU-27 (1-2)	69.91	1
East Parcel - D/F TEQ [µg/kg]	DU-27 (2-3)	23.98	1
East Parcel - D/F TEQ [µg/kg]	DU-28 (0-1)	1.40	1
East Parcel - D/F TEQ [µg/kg]	DU-28 (1-2)	1.40	1
East Parcel - D/F TEQ [µg/kg]	DU-28 (2-3)	14.94	1
East Parcel - D/F TEQ [µg/kg]	DU-29 (0-1)	49.73	1
East Parcel - D/F TEQ [µg/kg]	DU-29 (1-2)	15.27	1
East Parcel - D/F TEQ [µg/kg]	DU-29 (2-3)	15.26	1

East Parcel - D/F TEQ [µg/kg]	DU-30 (0-1)	50.48	1
East Parcel - D/F TEQ [µg/kg]	DU-30 (1-2)	22.41	1
East Parcel - D/F TEQ [µg/kg]	DU-30 (2-3)	14.36	1
East Parcel - D/F TEQ [µg/kg]	DU-31 (0-1)	58.37	1
East Parcel - D/F TEQ [µg/kg]	DU-31 (1-2)	19.00	1
East Parcel - D/F TEQ [µg/kg]	DU-31 (2-3)	10.94	1
East Parcel - D/F TEQ [µg/kg]	DU-32 (0-1)	34.80	1
East Parcel - D/F TEQ [µg/kg]	DU-32 (1-2)	7.54	1
East Parcel - D/F TEQ [µg/kg]	DU-32 (2-3)	7.59	1
East Parcel - D/F TEQ [µg/kg]	DU-33 (0-1)	36.92	1
East Parcel - D/F TEQ [µg/kg]	DU-33 (1-2)	16.74	1
East Parcel - D/F TEQ [µg/kg]	DU-33 (2-3)	12.15	1
East Parcel - D/F TEQ [µg/kg]	DU-34 (0-1)	60.26	1
East Parcel - D/F TEQ [µg/kg]	DU-34 (1-2)	28.23	1
East Parcel - D/F TEQ [µg/kg]	DU-34 (2-3)	30.17	1
East Parcel - D/F TEQ [µg/kg]	DU-35 (0-1)	40.47	1
East Parcel - D/F TEQ [µg/kg]	DU-35 (1-2)	13.11	1
East Parcel - D/F TEQ [µg/kg]	DU-35 (2-3)	10.16	1
East Parcel - D/F TEQ [µg/kg]	DU-36 (0-1)	42.14	1
East Parcel - D/F TEQ [µg/kg]	DU-36 (1-2)	36.98	1
East Parcel - D/F TEQ [µg/kg]	DU-36 (2-3)	27.98	1
East Parcel - D/F TEQ [µg/kg]	DU-38 (0-1)	29.41	1
East Parcel - D/F TEQ [µg/kg]	DU-38 (1-2)	19.03	1
East Parcel - D/F TEQ [µg/kg]	DU-38 (2-3)	10.49	1
East Parcel - D/F TEQ [µg/kg]	DU-37 (0-1)	0.68	1
East Parcel - D/F TEQ [µg/kg]	DU-37 (1-2)	0.63	1
East Parcel - D/F TEQ [µg/kg]	DU-37 (2-3)	0.57	1
East Parcel - D/F TEQ [µg/kg]	DU-39 (0-1)	3.68	1
East Parcel - D/F TEQ [µg/kg]	DU-39 (1-2)	1.38	1
East Parcel - D/F TEQ [µg/kg]	DU-39 (2-3)	1.36	1
East Parcel - D/F TEQ [µg/kg]	DU-40 (0-1)	0.73	1
East Parcel - D/F TEQ [µg/kg]	DU-40 (1-2)	0.52	1
East Parcel - D/F TEQ [µg/kg]	DU-40 (2-3)	0.55	1
West Parcel - cPAHs [mg/kg]	DU-1 (0-1)	0.0100	1
West Parcel - cPAHs [mg/kg]	DU-1 (1-2)	0.0100	1
West Parcel - cPAHs [mg/kg]	DU-1 (2-3)	0.3280	1
West Parcel - cPAHs [mg/kg]	DU-2 (0-1)	0.1650	1
West Parcel - cPAHs [mg/kg]	DU-2 (1-2)	0.1080	1
West Parcel - cPAHs [mg/kg]	DU-2 (2-3)	0.0319	1
West Parcel - cPAHs [mg/kg]	DU-3 (0-1)	0.1530	1
West Parcel - cPAHs [mg/kg]	DU-3 (1-2)	0.1290	1
West Parcel - cPAHs [mg/kg]	DU-3 (2-3)	0.1030	1
West Parcel - cPAHs [mg/kg]	DU-4 (0-1)	0.4280	1
West Parcel - cPAHs [mg/kg]	DU-4 (1-2)	1.7500	1

West Parcel - cPAHs [mg/kg]	DU-4 (2-3)	0.7670	1
West Parcel - cPAHs [mg/kg]	DU-5 (0-1)	0.0100	1
West Parcel - cPAHs [mg/kg]	DU-5 (1-2)	0.0100	1
West Parcel - cPAHs [mg/kg]	DU-5 (2-3)	0.0100	1
West Parcel - cPAHs [mg/kg]	DU-6 (0-1)	0.1880	1
West Parcel - cPAHs [mg/kg]	DU-6 (1-2)	0.2040	1
West Parcel - cPAHs [mg/kg]	DU-6 (2-3)	0.2260	1
West Parcel - cPAHs [mg/kg]	DU-7 (0-1)	0.0100	1
West Parcel - cPAHs [mg/kg]	DU-7 (1-2)	0.0711	1
West Parcel - cPAHs [mg/kg]	DU-7 (2-3)	0.0478	1
West Parcel - cPAHs [mg/kg]	DU-8 (0-1)	0.0100	1
West Parcel - cPAHs [mg/kg]	DU-8 (1-2)	0.0100	1
West Parcel - cPAHs [mg/kg]	DU-8 (2-3)	0.0100	1
West Parcel - cPAHs [mg/kg]	DU-9 (0-1)	0.0100	1
West Parcel - cPAHs [mg/kg]	DU-9 (1-2)	0.0771	1
West Parcel - cPAHs [mg/kg]	DU-9 (2-3)	0.1800	1
Central Parcel - cPAHs [mg/kg]	DU-10 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-10 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-10 (2-3)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-11 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-11 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-11 (2-3)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-12 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-12 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-12 (2-3)	0.0900	1
Central Parcel - cPAHs [mg/kg]	DU-13 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-13 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-13 (2-3)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-14 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-14 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-14 (2-3)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-15 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-15 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-15 (2-3)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-16 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-16 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-16 (2-3)	0.0569	1
Central Parcel - cPAHs [mg/kg]	DU-17 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-17 (1-2)	0.0513	1
Central Parcel - cPAHs [mg/kg]	DU-17 (2-3)	0.0309	1
Central Parcel - cPAHs [mg/kg]	DU-18 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-18 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-18 (2-3)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-19 (0-1)	0.0100	1

Central Parcel - cPAHs [mg/kg]	DU-19 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-19 (2-3)	0.0790	1
Central Parcel - cPAHs [mg/kg]	DU-20 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-20 (1-2)	0.0132	1
Central Parcel - cPAHs [mg/kg]	DU-20 (2-3)	0.0193	1
Central Parcel - cPAHs [mg/kg]	DU-21 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-21 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-21 (2-3)	0.0879	1
Central Parcel - cPAHs [mg/kg]	DU-22 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-22 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-22 (2-3)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-23 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-23 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-23 (2-3)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-24 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-24 (1-2)	0.0740	1
Central Parcel - cPAHs [mg/kg]	DU-24 (2-3)	0.0145	1
Central Parcel - cPAHs [mg/kg]	DU-25 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-25 (1-2)	0.0905	1
Central Parcel - cPAHs [mg/kg]	DU-25 (2-3)	0.0873	1
Central Parcel - cPAHs [mg/kg]	DU-26 (0-1)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-26 (1-2)	0.0100	1
Central Parcel - cPAHs [mg/kg]	DU-26 (2-3)	0.0100	1
East Parcel - cPAHs [mg/kg]	DU-27 (0-1)	0.0100	1
East Parcel - cPAHs [mg/kg]	DU-27 (1-2)	0.2420	1
East Parcel - cPAHs [mg/kg]	DU-27 (2-3)	0.0973	1
East Parcel - cPAHs [mg/kg]	DU-28 (0-1)	0.0100	1
East Parcel - cPAHs [mg/kg]	DU-28 (1-2)	0.0100	1
East Parcel - cPAHs [mg/kg]	DU-28 (2-3)	0.3530	1
East Parcel - cPAHs [mg/kg]	DU-29 (0-1)	0.1540	1
East Parcel - cPAHs [mg/kg]	DU-29 (1-2)	0.0697	1
East Parcel - cPAHs [mg/kg]	DU-29 (2-3)	0.0588	1
East Parcel - cPAHs [mg/kg]	DU-30 (0-1)	0.3980	1
East Parcel - cPAHs [mg/kg]	DU-30 (1-2)	0.1690	1
East Parcel - cPAHs [mg/kg]	DU-30 (2-3)	0.0709	1
East Parcel - cPAHs [mg/kg]	DU-31 (0-1)	0.1240	1
East Parcel - cPAHs [mg/kg]	DU-31 (1-2)	0.1190	1
East Parcel - cPAHs [mg/kg]	DU-31 (2-3)	0.0919	1
East Parcel - cPAHs [mg/kg]	DU-32 (0-1)	0.1150	1
East Parcel - cPAHs [mg/kg]	DU-32 (1-2)	0.0754	1
East Parcel - cPAHs [mg/kg]	DU-32 (2-3)	0.5660	1
East Parcel - cPAHs [mg/kg]	DU-33 (0-1)	0.0542	1
East Parcel - cPAHs [mg/kg]	DU-33 (1-2)	0.0519	1
East Parcel - cPAHs [mg/kg]	DU-33 (2-3)	0.0555	1

East Parcel - cPAHs [mg/kg]	DU-34 (0-1)	0.2530	1
East Parcel - cPAHs [mg/kg]	DU-34 (1-2)	0.1840	1
East Parcel - cPAHs [mg/kg]	DU-34 (2-3)	0.0973	1
East Parcel - cPAHs [mg/kg]	DU-35 (0-1)	0.0931	1
East Parcel - cPAHs [mg/kg]	DU-35 (1-2)	0.1190	1
East Parcel - cPAHs [mg/kg]	DU-35 (2-3)	0.0355	1
East Parcel - cPAHs [mg/kg]	DU-36 (0-1)	0.0823	1
East Parcel - cPAHs [mg/kg]	DU-36 (1-2)	0.1030	1
East Parcel - cPAHs [mg/kg]	DU-36 (2-3)	0.0379	1
East Parcel - cPAHs [mg/kg]	DU-38 (0-1)	0.0828	1
East Parcel - cPAHs [mg/kg]	DU-38 (1-2)	0.0635	1
East Parcel - cPAHs [mg/kg]	DU-38 (2-3)	0.0442	1
East Parcel - cPAHs [mg/kg]	DU-37 (0-1)	0.0124	1
East Parcel - cPAHs [mg/kg]	DU-37 (1-2)	0.0114	1
East Parcel - cPAHs [mg/kg]	DU-37 (2-3)	0.0970	1
East Parcel - cPAHs [mg/kg]	DU-39 (0-1)	0.0057	1
East Parcel - cPAHs [mg/kg]	DU-39 (1-2)	0.0057	1
East Parcel - cPAHs [mg/kg]	DU-39 (2-3)	0.0124	1
East Parcel - cPAHs [mg/kg]	DU-40 (0-1)	0.0057	1
East Parcel - cPAHs [mg/kg]	DU-40 (1-2)	0.0061	1
East Parcel - cPAHs [mg/kg]	DU-40 (2-3)	0.0061	1
East Parcel - Arsenic [mg/kg]	DU-27 (0-1)	3.1	1
East Parcel - Arsenic [mg/kg]	DU-27 (1-2)	8.72	1
East Parcel - Arsenic [mg/kg]	DU-27 (2-3)	15.8	1
East Parcel - Arsenic [mg/kg]	DU-28 (0-1)	3.1	1
East Parcel - Arsenic [mg/kg]	DU-28 (1-2)	3.1	1
East Parcel - Arsenic [mg/kg]	DU-28 (2-3)	7.4	1
East Parcel - Arsenic [mg/kg]	DU-29 (0-1)	6.95	1
East Parcel - Arsenic [mg/kg]	DU-29 (1-2)	5.08	1
East Parcel - Arsenic [mg/kg]	DU-29 (2-3)	3.6	1
East Parcel - Arsenic [mg/kg]	DU-30 (0-1)	4.22	1
East Parcel - Arsenic [mg/kg]	DU-30 (1-2)	3.72	1
East Parcel - Arsenic [mg/kg]	DU-30 (2-3)	4.14	1
East Parcel - Arsenic [mg/kg]	DU-31 (0-1)	6.09	1
East Parcel - Arsenic [mg/kg]	DU-31 (1-2)	4.98	1
East Parcel - Arsenic [mg/kg]	DU-31 (2-3)	5.96	1
East Parcel - Arsenic [mg/kg]	DU-32 (0-1)	8.99	1
East Parcel - Arsenic [mg/kg]	DU-32 (1-2)	7.1	1
East Parcel - Arsenic [mg/kg]	DU-32 (2-3)	3.56	1
East Parcel - Arsenic [mg/kg]	DU-33 (0-1)	6.62	1
East Parcel - Arsenic [mg/kg]	DU-33 (1-2)	9.6	1
East Parcel - Arsenic [mg/kg]	DU-33 (2-3)	5.35	1
East Parcel - Arsenic [mg/kg]	DU-34 (0-1)	5.13	1
East Parcel - Arsenic [mg/kg]	DU-34 (1-2)	4.95	1

East Parcel - Arsenic [mg/kg]	DU-34 (2-3)	3.69	1
East Parcel - Arsenic [mg/kg]	DU-35 (0-1)	4.4	1
East Parcel - Arsenic [mg/kg]	DU-35 (1-2)	3.81	1
East Parcel - Arsenic [mg/kg]	DU-35 (2-3)	3.37	1
East Parcel - Arsenic [mg/kg]	DU-36 (0-1)	5.03	1
East Parcel - Arsenic [mg/kg]	DU-36 (1-2)	4.23	1
East Parcel - Arsenic [mg/kg]	DU-36 (2-3)	4.12	1
East Parcel - Arsenic [mg/kg]	DU-38 (0-1)	3.71	1
East Parcel - Arsenic [mg/kg]	DU-38 (1-2)	3.76	1
East Parcel - Arsenic [mg/kg]	DU-38 (2-3)	4.06	1
East Parcel - Arsenic [mg/kg]	DU-37 (0-1)	3.72	1
East Parcel - Arsenic [mg/kg]	DU-37 (1-2)	3.00	1
East Parcel - Arsenic [mg/kg]	DU-37 (2-3)	2.85	1
East Parcel - Arsenic [mg/kg]	DU-39 (0-1)	2.69	1
East Parcel - Arsenic [mg/kg]	DU-39 (1-2)	3.24	1
East Parcel - Arsenic [mg/kg]	DU-39 (2-3)	3.44	1
East Parcel - Arsenic [mg/kg]	DU-40 (0-1)	2.88	1
East Parcel - Arsenic [mg/kg]	DU-40 (1-2)	3.4	1
East Parcel - Arsenic [mg/kg]	DU-40 (2-3)	3.13	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-27 (0-1)	1.40	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-27 (1-2)	1.40	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-27 (2-3)	23.98	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-28 (0-1)	1.40	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-28 (1-2)	1.40	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-28 (2-3)	14.94	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-29 (0-1)	49.73	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-29 (1-2)	15.27	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-29 (2-3)	15.26	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-30 (0-1)	50.48	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-30 (1-2)	22.41	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-30 (2-3)	14.36	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-31 (0-1)	58.37	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-31 (1-2)	19.00	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-31 (2-3)	10.94	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-32 (0-1)	34.80	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-32 (1-2)	7.54	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-32 (2-3)	7.59	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-33 (0-1)	36.92	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-33 (1-2)	16.74	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-33 (2-3)	12.15	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-34 (0-1)	60.26	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-34 (1-2)	28.23	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-34 (2-3)	30.17	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-35 (0-1)	40.47	1

East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-35 (1-2)	13.11	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-35 (2-3)	10.16	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-36 (0-1)	42.14	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-36 (1-2)	36.98	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-36 (2-3)	27.98	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-38 (0-1)	29.41	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-38 (1-2)	19.03	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-38 (2-3)	10.49	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-37 (0-1)	0.68	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-37 (1-2)	0.63	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-37 (2-3)	0.57	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-39 (0-1)	3.68	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-39 (1-2)	1.38	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-39 (2-3)	1.36	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-40 (0-1)	0.73	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-40 (1-2)	0.52	1
East Parcel D/F TEQ - 1 Additional Samples Removed [µg/kg]	DU-40 (2-3)	0.55	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-27 (0-1)	1.40	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-27 (1-2)	1.40	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-27 (2-3)	23.98	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-28 (0-1)	1.40	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-28 (1-2)	1.40	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-28 (2-3)	14.94	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-29 (0-1)	49.73	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-29 (1-2)	15.27	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-29 (2-3)	15.26	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-30 (0-1)	50.48	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-30 (1-2)	22.41	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-30 (2-3)	14.36	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-31 (0-1)	58.37	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-31 (1-2)	19.00	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-31 (2-3)	10.94	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-32 (0-1)	34.80	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-32 (1-2)	7.54	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-32 (2-3)	7.59	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-33 (0-1)	36.92	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-33 (1-2)	16.74	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-33 (2-3)	12.15	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-34 (0-1)	1.40	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-34 (1-2)	28.23	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-34 (2-3)	30.17	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-35 (0-1)	40.47	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-35 (1-2)	13.11	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-35 (2-3)	10.16	1

East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-36 (0-1)	42.14	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-36 (1-2)	36.98	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-36 (2-3)	27.98	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-38 (0-1)	29.41	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-38 (1-2)	19.03	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-38 (2-3)	10.49	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-37 (0-1)	0.68	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-37 (1-2)	0.63	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-37 (2-3)	0.57	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-39 (0-1)	3.68	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-39 (1-2)	1.38	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-39 (2-3)	1.36	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-40 (0-1)	0.73	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-40 (1-2)	0.52	1
East Parcel D/F TEQ - 2 Additional Samples Removed [µg/kg]	DU-40 (2-3)	0.55	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-27 (0-1)	1.40	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-27 (1-2)	1.40	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-27 (2-3)	23.98	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-28 (0-1)	1.40	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-28 (1-2)	1.40	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-28 (2-3)	14.94	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-29 (0-1)	49.73	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-29 (1-2)	15.27	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-29 (2-3)	15.26	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-30 (0-1)	50.48	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-30 (1-2)	22.41	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-30 (2-3)	14.36	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-31 (0-1)	1.40	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-31 (1-2)	19.00	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-31 (2-3)	10.94	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-32 (0-1)	34.80	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-32 (1-2)	7.54	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-32 (2-3)	7.59	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-33 (0-1)	36.92	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-33 (1-2)	16.74	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-33 (2-3)	12.15	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-34 (0-1)	1.40	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-34 (1-2)	28.23	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-34 (2-3)	30.17	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-35 (0-1)	40.47	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-35 (1-2)	13.11	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-35 (2-3)	10.16	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-36 (0-1)	42.14	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-36 (1-2)	36.98	1

East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-36 (2-3)	27.98	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-38 (0-1)	29.41	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-38 (1-2)	19.03	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-38 (2-3)	10.49	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-37 (0-1)	0.68	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-37 (1-2)	0.63	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-37 (2-3)	0.57	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-39 (0-1)	3.68	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-39 (1-2)	1.38	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-39 (2-3)	1.36	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-40 (0-1)	0.73	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-40 (1-2)	0.52	1
East Parcel D/F TEQ - 3 Additional Samples Removed [µg/kg]	DU-40 (2-3)	0.55	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-27 (0-1)	1.40	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-27 (1-2)	1.40	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-27 (2-3)	23.98	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-28 (0-1)	1.40	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-28 (1-2)	1.40	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-28 (2-3)	14.94	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-29 (0-1)	49.73	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-29 (1-2)	15.27	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-29 (2-3)	15.26	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-30 (0-1)	1.40	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-30 (1-2)	22.41	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-30 (2-3)	14.36	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-31 (0-1)	1.40	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-31 (1-2)	19.00	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-31 (2-3)	10.94	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-32 (0-1)	34.80	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-32 (1-2)	7.54	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-32 (2-3)	7.59	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-33 (0-1)	36.92	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-33 (1-2)	16.74	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-33 (2-3)	12.15	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-34 (0-1)	1.40	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-34 (1-2)	28.23	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-34 (2-3)	30.17	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-35 (0-1)	40.47	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-35 (1-2)	13.11	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-35 (2-3)	10.16	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-36 (0-1)	42.14	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-36 (1-2)	36.98	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-36 (2-3)	27.98	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-38 (0-1)	29.41	1

East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-38 (1-2)	19.03	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-38 (2-3)	10.49	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-37 (0-1)	0.68	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-37 (1-2)	0.63	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-37 (2-3)	0.57	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-39 (0-1)	3.68	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-39 (1-2)	1.38	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-39 (2-3)	1.36	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-40 (0-1)	0.73	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-40 (1-2)	0.52	1
East Parcel D/F TEQ - 4 Additional Samples Removed [µg/kg]	DU-40 (2-3)	0.55	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-27 (0-1)	1.40	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-27 (1-2)	1.40	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-27 (2-3)	23.98	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-28 (0-1)	1.40	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-28 (1-2)	1.40	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-28 (2-3)	14.94	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-29 (0-1)	1.40	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-29 (1-2)	15.27	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-29 (2-3)	15.26	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-30 (0-1)	1.40	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-30 (1-2)	22.41	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-30 (2-3)	14.36	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-31 (0-1)	1.40	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-31 (1-2)	19.00	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-31 (2-3)	10.94	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-32 (0-1)	34.80	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-32 (1-2)	7.54	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-32 (2-3)	7.59	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-33 (0-1)	36.92	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-33 (1-2)	16.74	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-33 (2-3)	12.15	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-34 (0-1)	1.40	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-34 (1-2)	28.23	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-34 (2-3)	30.17	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-35 (0-1)	40.47	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-35 (1-2)	13.11	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-35 (2-3)	10.16	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-36 (0-1)	42.14	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-36 (1-2)	36.98	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-36 (2-3)	27.98	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-38 (0-1)	29.41	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-38 (1-2)	19.03	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-38 (2-3)	10.49	1

East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-37 (0-1)	0.68	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-37 (1-2)	0.63	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-37 (2-3)	0.57	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-39 (0-1)	3.68	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-39 (1-2)	1.38	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-39 (2-3)	1.36	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-40 (0-1)	0.73	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-40 (1-2)	0.52	1
East Parcel D/F TEQ - 5 Additional Samples Removed [µg/kg]	DU-40 (2-3)	0.55	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-27 (0-1)	1.40	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-27 (1-2)	1.40	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-27 (2-3)	23.98	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-28 (0-1)	1.40	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-28 (1-2)	1.40	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-28 (2-3)	14.94	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-29 (0-1)	1.40	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-29 (1-2)	15.27	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-29 (2-3)	15.26	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-30 (0-1)	1.40	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-30 (1-2)	22.41	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-30 (2-3)	14.36	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-31 (0-1)	1.40	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-31 (1-2)	19.00	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-31 (2-3)	10.94	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-32 (0-1)	34.80	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-32 (1-2)	7.54	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-32 (2-3)	7.59	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-33 (0-1)	36.92	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-33 (1-2)	16.74	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-33 (2-3)	12.15	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-34 (0-1)	1.40	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-34 (1-2)	28.23	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-34 (2-3)	30.17	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-35 (0-1)	40.47	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-35 (1-2)	13.11	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-35 (2-3)	10.16	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-36 (0-1)	1.40	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-36 (1-2)	36.98	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-36 (2-3)	27.98	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-38 (0-1)	29.41	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-38 (1-2)	19.03	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-38 (2-3)	10.49	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-37 (0-1)	0.68	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-37 (1-2)	0.63	1

East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-37 (2-3)	0.57	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-39 (0-1)	3.68	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-39 (1-2)	1.38	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-39 (2-3)	1.36	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-40 (0-1)	0.73	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-40 (1-2)	0.52	1
East Parcel D/F TEQ - 6 Additional Samples Removed [µg/kg]	DU-40 (2-3)	0.55	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-27 (0-1)	1.40	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-27 (1-2)	1.40	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-27 (2-3)	23.98	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-28 (0-1)	1.40	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-28 (1-2)	1.40	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-28 (2-3)	14.94	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-29 (0-1)	1.40	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-29 (1-2)	15.27	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-29 (2-3)	15.26	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-30 (0-1)	1.40	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-30 (1-2)	22.41	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-30 (2-3)	14.36	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-31 (0-1)	1.40	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-31 (1-2)	19.00	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-31 (2-3)	10.94	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-32 (0-1)	34.80	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-32 (1-2)	7.54	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-32 (2-3)	7.59	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-33 (0-1)	36.92	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-33 (1-2)	16.74	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-33 (2-3)	12.15	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-34 (0-1)	1.40	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-34 (1-2)	28.23	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-34 (2-3)	30.17	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-35 (0-1)	1.40	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-35 (1-2)	13.11	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-35 (2-3)	10.16	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-36 (0-1)	1.40	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-36 (1-2)	36.98	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-36 (2-3)	27.98	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-38 (0-1)	29.41	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-38 (1-2)	19.03	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-38 (2-3)	10.49	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-37 (0-1)	0.68	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-37 (1-2)	0.63	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-37 (2-3)	0.57	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-39 (0-1)	3.68	1

East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-39 (1-2)	1.38	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-39 (2-3)	1.36	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-40 (0-1)	0.73	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-40 (1-2)	0.52	1
East Parcel D/F TEQ - 7 Additional Samples Removed [µg/kg]	DU-40 (2-3)	0.55	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-27 (0-1)	1.40	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-27 (1-2)	1.40	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-27 (2-3)	23.98	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-28 (0-1)	1.40	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-28 (1-2)	1.40	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-28 (2-3)	14.94	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-29 (0-1)	1.40	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-29 (1-2)	15.27	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-29 (2-3)	15.26	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-30 (0-1)	1.40	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-30 (1-2)	22.41	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-30 (2-3)	14.36	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-31 (0-1)	1.40	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-31 (1-2)	19.00	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-31 (2-3)	10.94	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-32 (0-1)	34.80	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-32 (1-2)	7.54	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-32 (2-3)	7.59	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-33 (0-1)	1.40	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-33 (1-2)	16.74	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-33 (2-3)	12.15	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-34 (0-1)	1.40	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-34 (1-2)	28.23	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-34 (2-3)	30.17	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-35 (0-1)	1.40	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-35 (1-2)	13.11	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-35 (2-3)	10.16	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-36 (0-1)	1.40	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-36 (1-2)	36.98	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-36 (2-3)	27.98	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-38 (0-1)	29.41	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-38 (1-2)	19.03	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-38 (2-3)	10.49	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-37 (0-1)	0.68	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-37 (1-2)	0.63	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-37 (2-3)	0.57	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-39 (0-1)	3.68	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-39 (1-2)	1.38	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-39 (2-3)	1.36	1

East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-40 (0-1)	0.73	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-40 (1-2)	0.52	1
East Parcel D/F TEQ - 8 Additional Samples Removed [µg/kg]	DU-40 (2-3)	0.55	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-27 (0-1)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-27 (1-2)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-27 (2-3)	23.98	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-28 (0-1)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-28 (1-2)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-28 (2-3)	14.94	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-29 (0-1)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-29 (1-2)	15.27	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-29 (2-3)	15.26	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-30 (0-1)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-30 (1-2)	22.41	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-30 (2-3)	14.36	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-31 (0-1)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-31 (1-2)	19.00	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-31 (2-3)	10.94	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-32 (0-1)	34.80	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-32 (1-2)	7.54	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-32 (2-3)	7.59	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-33 (0-1)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-33 (1-2)	16.74	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-33 (2-3)	12.15	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-34 (0-1)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-34 (1-2)	28.23	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-34 (2-3)	30.17	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-35 (0-1)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-35 (1-2)	13.11	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-35 (2-3)	10.16	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-36 (0-1)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-36 (1-2)	1.40	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-36 (2-3)	27.98	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-38 (0-1)	29.41	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-38 (1-2)	19.03	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-38 (2-3)	10.49	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-37 (0-1)	0.68	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-37 (1-2)	0.63	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-37 (2-3)	0.57	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-39 (0-1)	3.68	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-39 (1-2)	1.38	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-39 (2-3)	1.36	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-40 (0-1)	0.73	1
East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-40 (1-2)	0.52	1

East Parcel D/F TEQ - 9 Additional Samples Removed [µg/kg]	DU-40 (2-3)	0.55	1

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 8/14/2024 10:09:37 AM
From File	UCL Input.xls
Full Precision	OFF
Confidence Coefficient	90%
Number of Bootstrap Operations	2000

Result (central parcel - cpahs [mg/kg])

General Statistics

Total Number of Observations	51	Number of Distinct Observations	13
		Number of Missing Observations	0
Minimum	0.01	Mean	0.0213
Maximum	0.0905	Median	0.01
SD	0.0252	Std. Error of Mean	0.00353
Coefficient of Variation	1.185	Skewness	2.075

Normal GOF Test

Shapiro Wilk Test Statistic	0.493	**Shapiro Wilk GOF Test**
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.437	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.143	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

90% Normal UCL		**90% UCLs (Adjusted for Skewness)**	
90% Student's-t UCL	0.0259	90% Adjusted-CLT UCL (Chen-1995)	0.0265
		90% Modified-t UCL (Johnson-1978)	0.026

Gamma GOF Test

A-D Test Statistic	12.31	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.769	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.458	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.127	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.427	k star (bias corrected MLE)	1.356
Theta hat (MLE)	0.0149	Theta star (bias corrected MLE)	0.0157
nu hat (MLE)	145.5	nu star (bias corrected)	138.3
MLE Mean (bias corrected)	0.0213	MLE Sd (bias corrected)	0.0183
		Approximate Chi Square Value (0.1)	117.5
Adjusted Level of Significance	0.0948	Adjusted Chi Square Value	117

Assuming Gamma Distribution

90% Approximate Gamma UCL	0.025	90% Adjusted Gamma UCL	0.0251

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.522	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk P Value	0	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.451	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.113	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.605	Mean of logged Data	-4.24
Maximum of Logged Data	-2.402	SD of logged Data	0.751

Assuming Lognormal Distribution

90% H-UCL	0.0226	90% Chebyshev (MVUE) UCL	0.0256
95% Chebyshev (MVUE) UCL	0.0286	97.5% Chebyshev (MVUE) UCL	0.0328
99% Chebyshev (MVUE) UCL	0.0409		

67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data do not follow a Discernible Distribution**											
69												
70	**Nonparametric Distribution Free UCLs**											
71	90% CLT UCL				0.0258		90% BCA Bootstrap UCL				0.0268	
72	90% Standard Bootstrap UCL				0.0259		90% Bootstrap-t UCL				0.0271	
73	90% Hall's Bootstrap UCL				0.0264		90% Percentile Bootstrap UCL				0.026	
74	90% Chebyshev(Mean, Sd) UCL				0.0319		95% Chebyshev(Mean, Sd) UCL				0.0367	
75	97.5% Chebyshev(Mean, Sd) UCL				0.0433		99% Chebyshev(Mean, Sd) UCL				0.0564	
76												
77	**Suggested UCL to Use**											
78	ecommendation Provided only for 95% Confidence Coefficient											
79												
80	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
81	**Please verify the data were collected from random locations.**											
82	**If the data were collected using judgmental or other non-random methods,**											
83	**then contact a statistician to correctly calculate UCLs.**											
84												
85												
86	**Result (central parcel - d/f teq [µg/kg])**											
87												
88	**General Statistics**											
89	Total Number of Observations				51		Number of Distinct Observations				13	
90							Number of Missing Observations				0	
91	Minimum				1.4		Mean				3.154	
92	Maximum				46.63		Median				1.4	
93	SD				6.553		Std. Error of Mean				0.918	
94	Coefficient of Variation				2.077		Skewness				6.118	
95												
96	**Normal GOF Test**											
97	Shapiro Wilk Test Statistic				0.303		**Shapiro Wilk GOF Test**					
98	1% Shapiro Wilk P Value				0		Data Not Normal at 1% Significance Level					
99	Lilliefors Test Statistic				0.394		**Lilliefors GOF Test**					
100	1% Lilliefors Critical Value				0.143		Data Not Normal at 1% Significance Level					
101	**Data Not Normal at 1% Significance Level**											
102												
103	**Assuming Normal Distribution**											
104	**90% Normal UCL**						**90% UCLs (Adjusted for Skewness)**					
105	90% Student's-t UCL				4.346		90% Adjusted-CLT UCL (Chen-1995)				4.892	
106							90% Modified-t UCL (Johnson-1978)				4.477	
107												
108	**Gamma GOF Test**											
109	A-D Test Statistic				11.19		**Anderson-Darling Gamma GOF Test**					
110	5% A-D Critical Value				0.775		Data Not Gamma Distributed at 5% Significance Level					
111	K-S Test Statistic				0.439		**Kolmogorov-Smirnov Gamma GOF Test**					
112	5% K-S Critical Value				0.127		Data Not Gamma Distributed at 5% Significance Level					
113	**Data Not Gamma Distributed at 5% Significance Level**											
114												
115	**Gamma Statistics**											
116	k hat (MLE)				1.178		k star (bias corrected MLE)				1.122	
117	Theta hat (MLE)				2.678		Theta star (bias corrected MLE)				2.812	
118	nu hat (MLE)				120.1		nu star (bias corrected)				114.4	
119	MLE Mean (bias corrected)				3.154		MLE Sd (bias corrected)				2.979	
120							Approximate Chi Square Value (0.1)				95.5	
121	Adjusted Level of Significance				0.0948		Adjusted Chi Square Value				95.09	
122												
123	**Assuming Gamma Distribution**											
124	90% Approximate Gamma UCL				3.779		90% Adjusted Gamma UCL				3.795	
125												
126	**Lognormal GOF Test**											
127	Shapiro Wilk Test Statistic				0.542		**Shapiro Wilk Lognormal GOF Test**					
128	10% Shapiro Wilk P Value				0		Data Not Lognormal at 10% Significance Level					
129	Lilliefors Test Statistic				0.441		**Lilliefors Lognormal GOF Test**					
130	10% Lilliefors Critical Value				0.113		Data Not Lognormal at 10% Significance Level					
131	**Data Not Lognormal at 10% Significance Level**											
132												

133	**Lognormal Statistics**											
134					Minimum of Logged Data	0.336			Mean of logged Data	0.668		
135					Maximum of Logged Data	3.842			SD of logged Data	0.724		
136												
137	**Assuming Lognormal Distribution**											
138					90% H-UCL	2.97			90% Chebyshev (MVUE) UCL	3.359		
139					95% Chebyshev (MVUE) UCL	3.74			97.5% Chebyshev (MVUE) UCL	4.269		
140					99% Chebyshev (MVUE) UCL	5.309						
141												
142	**Nonparametric Distribution Free UCL Statistics**											
143	**Data do not follow a Discernible Distribution**											
144												
145	**Nonparametric Distribution Free UCLs**											
146					90% CLT UCL	4.33			90% BCA Bootstrap UCL	5.128		
147					90% Standard Bootstrap UCL	4.335			90% Bootstrap-t UCL	7.048		
148					90% Hall's Bootstrap UCL	9.457			90% Percentile Bootstrap UCL	4.38		
149					90% Chebyshev(Mean, Sd) UCL	5.907			95% Chebyshev(Mean, Sd) UCL	7.154		
150					97.5% Chebyshev(Mean, Sd) UCL	8.885			99% Chebyshev(Mean, Sd) UCL	12.28		
151												
152	**Suggested UCL to Use**											
153	ecommendation Provided only for 95% Confidence Coefficient											
154												
155	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
156	**Please verify the data were collected from random locations.**											
157	**If the data were collected using judgmental or other non-random methods,**											
158	**then contact a statistician to correctly calculate UCLs.**											
159												
160												
161	**Result (east parcel - arsenic [mg/kg])**											
162												
163	**General Statistics**											
164					Total Number of Observations	42			Number of Distinct Observations	39		
165									Number of Missing Observations	0		
166					Minimum	2.69			Mean	4.9		
167					Maximum	15.8			Median	4.09		
168					SD	2.455			Std. Error of Mean	0.379		
169					Coefficient of Variation	0.501			Skewness	2.557		
170												
171	**Normal GOF Test**											
172					Shapiro Wilk Test Statistic	0.721			**Shapiro Wilk GOF Test**			
173					1% Shapiro Wilk Critical Value	0.922			Data Not Normal at 1% Significance Level			
174					Lilliefors Test Statistic	0.203			**Lilliefors GOF Test**			
175					1% Lilliefors Critical Value	0.157			Data Not Normal at 1% Significance Level			
176	**Data Not Normal at 1% Significance Level**											
177												
178	**Assuming Normal Distribution**											
179	**90% Normal UCL**								**90% UCLs (Adjusted for Skewness)**			
180					90% Student's-t UCL	5.393			90% Adjusted-CLT UCL (Chen-1995)	5.492		
181									90% Modified-t UCL (Johnson-1978)	5.418		
182												
183	**Gamma GOF Test**											
184					A-D Test Statistic	1.712			**Anderson-Darling Gamma GOF Test**			
185					5% A-D Critical Value	0.751			Data Not Gamma Distributed at 5% Significance Level			
186					K-S Test Statistic	0.18			**Kolmogorov-Smirnov Gamma GOF Test**			
187					5% K-S Critical Value	0.137			Data Not Gamma Distributed at 5% Significance Level			
188	**Data Not Gamma Distributed at 5% Significance Level**											
189												
190	**Gamma Statistics**											
191					k hat (MLE)	6.018			k star (bias corrected MLE)	5.604		
192					Theta hat (MLE)	0.814			Theta star (bias corrected MLE)	0.874		
193					nu hat (MLE)	505.5			nu star (bias corrected)	470.7		
194					MLE Mean (bias corrected)	4.9			MLE Sd (bias corrected)	2.07		
195									Approximate Chi Square Value (0.1)	431.9		
196					Adjusted Level of Significance	0.0937			Adjusted Chi Square Value	430.8		
197												
198	**Assuming Gamma Distribution**											

199				90% Approximate Gamma UCL		5.341				90% Adjusted Gamma UCL		5.354
200												
201						**Lognormal GOF Test**						
202				Shapiro Wilk Test Statistic		0.867				**Shapiro Wilk Lognormal GOF Test**		
203				10% Shapiro Wilk Critical Value		0.951				Data Not Lognormal at 10% Significance Level		
204				Lilliefors Test Statistic		0.158				**Lilliefors Lognormal GOF Test**		
205				10% Lilliefors Critical Value		0.124				Data Not Lognormal at 10% Significance Level		
206						**Data Not Lognormal at 10% Significance Level**						
207												
208						**Lognormal Statistics**						
209				Minimum of Logged Data		0.99				Mean of logged Data		1.504
210				Maximum of Logged Data		2.76				SD of logged Data		0.389
211												
212						**Assuming Lognormal Distribution**						
213				90% H-UCL		5.281				90% Chebyshev (MVUE) UCL		5.741
214				95% Chebyshev (MVUE) UCL		6.147				97.5% Chebyshev (MVUE) UCL		6.712
215				99% Chebyshev (MVUE) UCL		7.821						
216												
217						**Nonparametric Distribution Free UCL Statistics**						
218						**Data do not follow a Discernible Distribution**						
219												
220						**Nonparametric Distribution Free UCLs**						
221				90% CLT UCL		5.385				90% BCA Bootstrap UCL		5.48
222				90% Standard Bootstrap UCL		5.375				90% Bootstrap-t UCL		5.564
223				90% Hall's Bootstrap UCL		5.672				90% Percentile Bootstrap UCL		5.374
224				90% Chebyshev(Mean, Sd) UCL		6.036				95% Chebyshev(Mean, Sd) UCL		6.551
225				97.5% Chebyshev(Mean, Sd) UCL		7.266				99% Chebyshev(Mean, Sd) UCL		8.669
226												
227						**Suggested UCL to Use**						
228	ecommendation Provided only for 95% Confidence Coefficient											
229												
230												
231	**Result (east parcel - cpahs [mg/kg])**											
232												
233						**General Statistics**						
234				Total Number of Observations		42				Number of Distinct Observations		37
235										Number of Missing Observations		0
236				Minimum		0.00566				Mean		0.101
237				Maximum		0.566				Median		0.0732
238				SD		0.115				Std. Error of Mean		0.0178
239				Coefficient of Variation		1.139				Skewness		2.334
240												
241						**Normal GOF Test**						
242				Shapiro Wilk Test Statistic		0.724				**Shapiro Wilk GOF Test**		
243				1% Shapiro Wilk Critical Value		0.922				Data Not Normal at 1% Significance Level		
244				Lilliefors Test Statistic		0.231				**Lilliefors GOF Test**		
245				1% Lilliefors Critical Value		0.157				Data Not Normal at 1% Significance Level		
246						**Data Not Normal at 1% Significance Level**						
247												
248						**Assuming Normal Distribution**						
249				**90% Normal UCL**						**90% UCLs (Adjusted for Skewness)**		
250				90% Student's-t UCL		0.124				90% Adjusted-CLT UCL (Chen-1995)		0.129
251										90% Modified-t UCL (Johnson-1978)		0.126
252												
253						**Gamma GOF Test**						
254				A-D Test Statistic		0.705				**Anderson-Darling Gamma GOF Test**		
255				5% A-D Critical Value		0.782				Detected data appear Gamma Distributed at 5% Significance Level		
256				K-S Test Statistic		0.13				**Kolmogorov-Smirnov Gamma GOF Test**		
257				5% K-S Critical Value		0.141				Detected data appear Gamma Distributed at 5% Significance Level		
258						**Detected data appear Gamma Distributed at 5% Significance Level**						
259												
260						**Gamma Statistics**						
261				k hat (MLE)		0.915				k star (bias corrected MLE)		0.866
262				Theta hat (MLE)		0.111				Theta star (bias corrected MLE)		0.117
263				nu hat (MLE)		76.89				nu star (bias corrected)		72.73
264				MLE Mean (bias corrected)		0.101				MLE Sd (bias corrected)		0.109

265							Approximate Chi Square Value (0.1)					57.77
266				Adjusted Level of Significance		0.0937				Adjusted Chi Square Value		57.39
267												
268						Assuming Gamma Distribution						
269				90% Approximate Gamma UCL		0.128				90% Adjusted Gamma UCL		0.128
270												
271						Lognormal GOF Test						
272				Shapiro Wilk Test Statistic		0.875				Shapiro Wilk Lognormal GOF Test		
273				10% Shapiro Wilk Critical Value		0.951				Data Not Lognormal at 10% Significance Level		
274				Lilliefors Test Statistic		0.157				Lilliefors Lognormal GOF Test		
275				10% Lilliefors Critical Value		0.124				Data Not Lognormal at 10% Significance Level		
276						Data Not Lognormal at 10% Significance Level						
277												
278						Lognormal Statistics						
279				Minimum of Logged Data		-5.174				Mean of logged Data		-2.927
280				Maximum of Logged Data		-0.569				SD of logged Data		1.279
281												
282						Assuming Lognormal Distribution						
283				90% H-UCL		0.181				90% Chebyshev (MVUE) UCL		0.204
284				95% Chebyshev (MVUE) UCL		0.243				97.5% Chebyshev (MVUE) UCL		0.298
285				99% Chebyshev (MVUE) UCL		0.404						
286												
287						Nonparametric Distribution Free UCL Statistics						
288						Data appear to follow a Discernible Distribution						
289												
290						Nonparametric Distribution Free UCLs						
291				90% CLT UCL		0.124				90% BCA Bootstrap UCL		0.13
292				90% Standard Bootstrap UCL		0.124				90% Bootstrap-t UCL		0.13
293				90% Hall's Bootstrap UCL		0.131				90% Percentile Bootstrap UCL		0.125
294				90% Chebyshev(Mean, Sd) UCL		0.155				95% Chebyshev(Mean, Sd) UCL		0.179
295				97.5% Chebyshev(Mean, Sd) UCL		0.212				99% Chebyshev(Mean, Sd) UCL		0.278
296												
297						Suggested UCL to Use						
298	ecommendation Provided only for 95% Confidence Coefficient											
299												
300						The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.						
301						Please verify the data were collected from random locations.						
302						If the data were collected using judgmental or other non-random methods,						
303						then contact a statistician to correctly calculate UCLs.						
304												
305												
306	Result (east parcel - d/f teq [µg/kg])											
307												
308						General Statistics						
309				Total Number of Observations		42				Number of Distinct Observations		40
310										Number of Missing Observations		0
311				Minimum		0.518				Mean		20.07
312				Maximum		69.91				Median		15.1
313				SD		18.81				Std. Error of Mean		2.902
314				Coefficient of Variation		0.937				Skewness		0.943
315												
316						Normal GOF Test						
317				Shapiro Wilk Test Statistic		0.841				Shapiro Wilk GOF Test		
318				1% Shapiro Wilk Critical Value		0.922				Data Not Normal at 1% Significance Level		
319				Lilliefors Test Statistic		0.149				Lilliefors GOF Test		
320				1% Lilliefors Critical Value		0.157				Data appear Normal at 1% Significance Level		
321						Data appear Approximate Normal at 1% Significance Level						
322												
323						Assuming Normal Distribution						
324				90% Normal UCL						90% UCLs (Adjusted for Skewness)		
325				90% Student's-t UCL		23.85				90% Adjusted-CLT UCL (Chen-1995)		24.09
326										90% Modified-t UCL (Johnson-1978)		23.92
327												
328						Gamma GOF Test						
329				A-D Test Statistic		0.979				Anderson-Darling Gamma GOF Test		
330				5% A-D Critical Value		0.788				Data Not Gamma Distributed at 5% Significance Level		

331				K-S Test Statistic		0.153	**Kolmogorov-Smirnov Gamma GOF Test**					
332				5% K-S Critical Value		0.142	Data Not Gamma Distributed at 5% Significance Level					
333	**Data Not Gamma Distributed at 5% Significance Level**											
334												
335	**Gamma Statistics**											
336				k hat (MLE)		0.779				k star (bias corrected MLE)		0.739
337				Theta hat (MLE)		25.76				Theta star (bias corrected MLE)		27.15
338				nu hat (MLE)		65.45				nu star (bias corrected)		62.11
339				MLE Mean (bias corrected)		20.07				MLE Sd (bias corrected)		23.35
340										Approximate Chi Square Value (0.1)		48.32
341				Adjusted Level of Significance		0.0937				Adjusted Chi Square Value		47.98
342												
343	**Assuming Gamma Distribution**											
344				90% Approximate Gamma UCL		25.8				90% Adjusted Gamma UCL		25.99
345												
346	**Lognormal GOF Test**											
347				Shapiro Wilk Test Statistic		0.82	**Shapiro Wilk Lognormal GOF Test**					
348				10% Shapiro Wilk Critical Value		0.951	Data Not Lognormal at 10% Significance Level					
349				Lilliefors Test Statistic		0.188	**Lilliefors Lognormal GOF Test**					
350				10% Lilliefors Critical Value		0.124	Data Not Lognormal at 10% Significance Level					
351	**Data Not Lognormal at 10% Significance Level**											
352												
353	**Lognormal Statistics**											
354				Minimum of Logged Data		-0.659				Mean of logged Data		2.235
355				Maximum of Logged Data		4.247				SD of logged Data		1.559
356												
357	**Assuming Lognormal Distribution**											
358				90% H-UCL		54.78				90% Chebyshev (MVUE) UCL		58.02
359				95% Chebyshev (MVUE) UCL		70.85				97.5% Chebyshev (MVUE) UCL		88.66
360				99% Chebyshev (MVUE) UCL		123.7						
361												
362	**Nonparametric Distribution Free UCL Statistics**											
363	**Data appear to follow a Discernible Distribution**											
364												
365	**Nonparametric Distribution Free UCLs**											
366				90% CLT UCL		23.79				90% BCA Bootstrap UCL		24.16
367				90% Standard Bootstrap UCL		23.79				90% Bootstrap-t UCL		24.27
368				90% Hall's Bootstrap UCL		24.22				90% Percentile Bootstrap UCL		23.85
369				90% Chebyshev(Mean, Sd) UCL		28.78				95% Chebyshev(Mean, Sd) UCL		32.72
370				97.5% Chebyshev(Mean, Sd) UCL		38.2				99% Chebyshev(Mean, Sd) UCL		48.95
371												
372	**Suggested UCL to Use**											
373	ecommendation Provided only for 95% Confidence Coefficient											
374												
375												
376	**Result (east parcel d/f teq - 1 additional samples removed [µg/kg])**											
377												
378	**General Statistics**											
379				Total Number of Observations		42				Number of Distinct Observations		39
380										Number of Missing Observations		0
381				Minimum		0.518				Mean		18.44
382				Maximum		60.26				Median		14.65
383				SD		17.29				Std. Error of Mean		2.668
384				Coefficient of Variation		0.937				Skewness		0.866
385												
386	**Normal GOF Test**											
387				Shapiro Wilk Test Statistic		0.834	**Shapiro Wilk GOF Test**					
388				1% Shapiro Wilk Critical Value		0.922	Data Not Normal at 1% Significance Level					
389				Lilliefors Test Statistic		0.15	**Lilliefors GOF Test**					
390				1% Lilliefors Critical Value		0.157	Data appear Normal at 1% Significance Level					
391	**Data appear Approximate Normal at 1% Significance Level**											
392												
393	**Assuming Normal Distribution**											
394	**90% Normal UCL**						**90% UCLs (Adjusted for Skewness)**					
395				90% Student's-t UCL		21.92				90% Adjusted-CLT UCL (Chen-1995)		22.12
396										90% Modified-t UCL (Johnson-1978)		21.98

397												
398	**Gamma GOF Test**											
399				A-D Test Statistic		1.103	**Anderson-Darling Gamma GOF Test**					
400				5% A-D Critical Value		0.788	Data Not Gamma Distributed at 5% Significance Level					
401				K-S Test Statistic		0.168	**Kolmogorov-Smirnov Gamma GOF Test**					
402				5% K-S Critical Value		0.142	Data Not Gamma Distributed at 5% Significance Level					
403	**Data Not Gamma Distributed at 5% Significance Level**											
404												
405	**Gamma Statistics**											
406				k hat (MLE)		0.772	k star (bias corrected MLE)					0.733
407				Theta hat (MLE)		23.9	Theta star (bias corrected MLE)					25.18
408				nu hat (MLE)		64.83	nu star (bias corrected)					61.53
409				MLE Mean (bias corrected)		18.44	MLE Sd (bias corrected)					21.55
410							Approximate Chi Square Value (0.1)					47.81
411				Adjusted Level of Significance		0.0937	Adjusted Chi Square Value					47.47
412												
413	**Assuming Gamma Distribution**											
414				90% Approximate Gamma UCL		23.74	90% Adjusted Gamma UCL					23.91
415												
416	**Lognormal GOF Test**											
417				Shapiro Wilk Test Statistic		0.816	**Shapiro Wilk Lognormal GOF Test**					
418				10% Shapiro Wilk Critical Value		0.951	Data Not Lognormal at 10% Significance Level					
419				Lilliefors Test Statistic		0.188	**Lilliefors Lognormal GOF Test**					
420				10% Lilliefors Critical Value		0.124	Data Not Lognormal at 10% Significance Level					
421	**Data Not Lognormal at 10% Significance Level**											
422												
423	**Lognormal Statistics**											
424				Minimum of Logged Data		-0.659	Mean of logged Data					2.142
425				Maximum of Logged Data		4.099	SD of logged Data					1.553
426												
427	**Assuming Lognormal Distribution**											
428				90% H-UCL		49.24	90% Chebyshev (MVUE) UCL					52.24
429				95% Chebyshev (MVUE) UCL		63.77	97.5% Chebyshev (MVUE) UCL					79.76
430				99% Chebyshev (MVUE) UCL		111.2						
431												
432	**Nonparametric Distribution Free UCL Statistics**											
433	**Data appear to follow a Discernible Distribution**											
434												
435	**Nonparametric Distribution Free UCLs**											
436				90% CLT UCL		21.86	90% BCA Bootstrap UCL					22.13
437				90% Standard Bootstrap UCL		21.82	90% Bootstrap-t UCL					22.16
438				90% Hall's Bootstrap UCL		22.07	90% Percentile Bootstrap UCL					21.97
439				90% Chebyshev(Mean, Sd) UCL		26.45	95% Chebyshev(Mean, Sd) UCL					30.07
440				97.5% Chebyshev(Mean, Sd) UCL		35.1	99% Chebyshev(Mean, Sd) UCL					44.99
441												
442	**Suggested UCL to Use**											
443	ecommendation Provided only for 95% Confidence Coefficient											
444												
445												
446	**Result (east parcel d/f teq - 2 additional samples removed [µg/kg])**											
447												
448	**General Statistics**											
449				Total Number of Observations		42	Number of Distinct Observations					38
450							Number of Missing Observations					0
451				Minimum		0.518	Mean					17.04
452				Maximum		58.37	Median					13.73
453				SD		16.16	Std. Error of Mean					2.494
454				Coefficient of Variation		0.949	Skewness					0.859
455												
456	**Normal GOF Test**											
457				Shapiro Wilk Test Statistic		0.833	**Shapiro Wilk GOF Test**					
458				1% Shapiro Wilk Critical Value		0.922	Data Not Normal at 1% Significance Level					
459				Lilliefors Test Statistic		0.153	**Lilliefors GOF Test**					
460				1% Lilliefors Critical Value		0.157	Data appear Normal at 1% Significance Level					
461	**Data appear Approximate Normal at 1% Significance Level**											
462												

463	**Assuming Normal Distribution**											
464	**90% Normal UCL**						**90% UCLs (Adjusted for Skewness)**					
465				90% Student's-t UCL		20.29				90% Adjusted-CLT UCL (Chen-1995)		20.47
466										90% Modified-t UCL (Johnson-1978)		20.35
467												
468	**Gamma GOF Test**											
469				A-D Test Statistic		1.209	**Anderson-Darling Gamma GOF Test**					
470				5% A-D Critical Value		0.789	Data Not Gamma Distributed at 5% Significance Level					
471				K-S Test Statistic		0.182	**Kolmogorov-Smirnov Gamma GOF Test**					
472				5% K-S Critical Value		0.142	Data Not Gamma Distributed at 5% Significance Level					
473	**Data Not Gamma Distributed at 5% Significance Level**											
474												
475	**Gamma Statistics**											
476				k hat (MLE)		0.763				k star (bias corrected MLE)		0.724
477				Theta hat (MLE)		22.35				Theta star (bias corrected MLE)		23.54
478				nu hat (MLE)		64.06				nu star (bias corrected)		60.81
479				MLE Mean (bias corrected)		17.04				MLE Sd (bias corrected)		20.03
480										Approximate Chi Square Value (0.1)		47.18
481				Adjusted Level of Significance		0.0937				Adjusted Chi Square Value		46.84
482												
483	**Assuming Gamma Distribution**											
484				90% Approximate Gamma UCL		21.97				90% Adjusted Gamma UCL		22.13
485												
486	**Lognormal GOF Test**											
487				Shapiro Wilk Test Statistic		0.815	**Shapiro Wilk Lognormal GOF Test**					
488				10% Shapiro Wilk Critical Value		0.951	Data Not Lognormal at 10% Significance Level					
489				Lilliefors Test Statistic		0.187	**Lilliefors Lognormal GOF Test**					
490				10% Lilliefors Critical Value		0.124	Data Not Lognormal at 10% Significance Level					
491	**Data Not Lognormal at 10% Significance Level**											
492												
493	**Lognormal Statistics**											
494				Minimum of Logged Data		-0.659				Mean of logged Data		2.052
495				Maximum of Logged Data		4.067				SD of logged Data		1.545
496												
497	**Assuming Lognormal Distribution**											
498				90% H-UCL		44.34				90% Chebyshev (MVUE) UCL		47.14
499				95% Chebyshev (MVUE) UCL		57.51				97.5% Chebyshev (MVUE) UCL		71.9
500				99% Chebyshev (MVUE) UCL		100.2						
501												
502	**Nonparametric Distribution Free UCL Statistics**											
503	**Data appear to follow a Discernible Distribution**											
504												
505	**Nonparametric Distribution Free UCLs**											
506				90% CLT UCL		20.24				90% BCA Bootstrap UCL		20.43
507				90% Standard Bootstrap UCL		20.2				90% Bootstrap-t UCL		20.52
508				90% Hall's Bootstrap UCL		20.47				90% Percentile Bootstrap UCL		20.34
509				90% Chebyshev(Mean, Sd) UCL		24.52				95% Chebyshev(Mean, Sd) UCL		27.91
510				97.5% Chebyshev(Mean, Sd) UCL		32.62				99% Chebyshev(Mean, Sd) UCL		41.86
511												
512	**Suggested UCL to Use**											
513	ecommendation Provided only for 95% Confidence Coefficient											
514												
515												
516	**Result (east parcel d/f teq - 3 additional samples removed [µg/kg])**											
517												
518	**General Statistics**											
519				Total Number of Observations		42				Number of Distinct Observations		37
520										Number of Missing Observations		0
521				Minimum		0.518				Mean		15.69
522				Maximum		50.48				Median		12.63
523				SD		14.96				Std. Error of Mean		2.308
524				Coefficient of Variation		0.954				Skewness		0.802
525												
526	**Normal GOF Test**											
527				Shapiro Wilk Test Statistic		0.823	**Shapiro Wilk GOF Test**					
528				1% Shapiro Wilk Critical Value		0.922	Data Not Normal at 1% Significance Level					

529				Lilliefors Test Statistic		0.164	**Lilliefors GOF Test**					
530				1% Lilliefors Critical Value		0.157	Data Not Normal at 1% Significance Level					
531	**Data Not Normal at 1% Significance Level**											
532												
533	**Assuming Normal Distribution**											
534	**90% Normal UCL**						**90% UCLs (Adjusted for Skewness)**					
535				90% Student's-t UCL		18.69	90% Adjusted-CLT UCL (Chen-1995)					18.85
536							90% Modified-t UCL (Johnson-1978)					18.74
537												
538	**Gamma GOF Test**											
539				A-D Test Statistic		1.354	**Anderson-Darling Gamma GOF Test**					
540				5% A-D Critical Value		0.789	Data Not Gamma Distributed at 5% Significance Level					
541				K-S Test Statistic		0.196	**Kolmogorov-Smirnov Gamma GOF Test**					
542				5% K-S Critical Value		0.142	Data Not Gamma Distributed at 5% Significance Level					
543	**Data Not Gamma Distributed at 5% Significance Level**											
544												
545	**Gamma Statistics**											
546				k hat (MLE)		0.758	k star (bias corrected MLE)					0.719
547				Theta hat (MLE)		20.7	Theta star (bias corrected MLE)					21.81
548				nu hat (MLE)		63.64	nu star (bias corrected)					60.42
549				MLE Mean (bias corrected)		15.69	MLE Sd (bias corrected)					18.49
550							Approximate Chi Square Value (0.1)					46.83
551				Adjusted Level of Significance		0.0937	Adjusted Chi Square Value					46.49
552												
553	**Assuming Gamma Distribution**											
554				90% Approximate Gamma UCL		20.24	90% Adjusted Gamma UCL					20.38
555												
556	**Lognormal GOF Test**											
557				Shapiro Wilk Test Statistic		0.811	**Shapiro Wilk Lognormal GOF Test**					
558				10% Shapiro Wilk Critical Value		0.951	Data Not Lognormal at 10% Significance Level					
559				Lilliefors Test Statistic		0.189	**Lilliefors Lognormal GOF Test**					
560				10% Lilliefors Critical Value		0.124	Data Not Lognormal at 10% Significance Level					
561	**Data Not Lognormal at 10% Significance Level**											
562												
563	**Lognormal Statistics**											
564				Minimum of Logged Data		-0.659	Mean of logged Data					1.964
565				Maximum of Logged Data		3.922	SD of logged Data					1.534
566												
567	**Assuming Lognormal Distribution**											
568				90% H-UCL		39.6	90% Chebyshev (MVUE) UCL					42.23
569				95% Chebyshev (MVUE) UCL		51.48	97.5% Chebyshev (MVUE) UCL					64.3
570				99% Chebyshev (MVUE) UCL		89.5						
571												
572	**Nonparametric Distribution Free UCL Statistics**											
573	**Data do not follow a Discernible Distribution**											
574												
575	**Nonparametric Distribution Free UCLs**											
576				90% CLT UCL		18.64	90% BCA Bootstrap UCL					18.74
577				90% Standard Bootstrap UCL		18.63	90% Bootstrap-t UCL					18.88
578				90% Hall's Bootstrap UCL		18.84	90% Percentile Bootstrap UCL					18.79
579				90% Chebyshev(Mean, Sd) UCL		22.61	95% Chebyshev(Mean, Sd) UCL					25.75
580				97.5% Chebyshev(Mean, Sd) UCL		30.1	99% Chebyshev(Mean, Sd) UCL					38.65
581												
582	**Suggested UCL to Use**											
583	ecommendation Provided only for 95% Confidence Coefficient											
584												
585												
586	**Result (east parcel d/f teq - 4 additional samples removed [µg/kg])**											
587												
588	**General Statistics**											
589				Total Number of Observations		42	Number of Distinct Observations					36
590							Number of Missing Observations					0
591				Minimum		0.518	Mean					14.52
592				Maximum		49.73	Median					11.55
593				SD		14.06	Std. Error of Mean					2.17
594				Coefficient of Variation		0.969	Skewness					0.812

595												
596	**Normal GOF Test**											
597					Shapiro Wilk Test Statistic	0.819	**Shapiro Wilk GOF Test**					
598					1% Shapiro Wilk Critical Value	0.922	Data Not Normal at 1% Significance Level					
599					Lilliefors Test Statistic	0.182	**Lilliefors GOF Test**					
600					1% Lilliefors Critical Value	0.157	Data Not Normal at 1% Significance Level					
601	**Data Not Normal at 1% Significance Level**											
602												
603	**Assuming Normal Distribution**											
604	**90% Normal UCL**						**90% UCLs (Adjusted for Skewness)**					
605					90% Student's-t UCL	17.34	90% Adjusted-CLT UCL (Chen-1995)	17.49				
606							90% Modified-t UCL (Johnson-1978)	17.39				
607												
608	**Gamma GOF Test**											
609					A-D Test Statistic	1.478	**Anderson-Darling Gamma GOF Test**					
610					5% A-D Critical Value	0.789	Data Not Gamma Distributed at 5% Significance Level					
611					K-S Test Statistic	0.21	**Kolmogorov-Smirnov Gamma GOF Test**					
612					5% K-S Critical Value	0.142	Data Not Gamma Distributed at 5% Significance Level					
613	**Data Not Gamma Distributed at 5% Significance Level**											
614												
615	**Gamma Statistics**											
616					k hat (MLE)	0.751	k star (bias corrected MLE)	0.713				
617					Theta hat (MLE)	19.33	Theta star (bias corrected MLE)	20.36				
618					nu hat (MLE)	63.08	nu star (bias corrected)	59.91				
619					MLE Mean (bias corrected)	14.52	MLE Sd (bias corrected)	17.19				
620							Approximate Chi Square Value (0.1)	46.38				
621					Adjusted Level of Significance	0.0937	Adjusted Chi Square Value	46.04				
622												
623	**Assuming Gamma Distribution**											
624					90% Approximate Gamma UCL	18.75	90% Adjusted Gamma UCL	18.89				
625												
626	**Lognormal GOF Test**											
627					Shapiro Wilk Test Statistic	0.809	**Shapiro Wilk Lognormal GOF Test**					
628					10% Shapiro Wilk Critical Value	0.951	Data Not Lognormal at 10% Significance Level					
629					Lilliefors Test Statistic	0.202	**Lilliefors Lognormal GOF Test**					
630					10% Lilliefors Critical Value	0.124	Data Not Lognormal at 10% Significance Level					
631	**Data Not Lognormal at 10% Significance Level**											
632												
633	**Lognormal Statistics**											
634					Minimum of Logged Data	-0.659	Mean of logged Data	1.878				
635					Maximum of Logged Data	3.907	SD of logged Data	1.522				
636												
637	**Assuming Lognormal Distribution**											
638					90% H-UCL	35.45	90% Chebyshev (MVUE) UCL	37.94				
639					95% Chebyshev (MVUE) UCL	46.2	97.5% Chebyshev (MVUE) UCL	57.66				
640					99% Chebyshev (MVUE) UCL	80.18						
641												
642	**Nonparametric Distribution Free UCL Statistics**											
643	**Data do not follow a Discernible Distribution**											
644												
645	**Nonparametric Distribution Free UCLs**											
646					90% CLT UCL	17.3	90% BCA Bootstrap UCL	17.36				
647					90% Standard Bootstrap UCL	17.27	90% Bootstrap-t UCL	17.4				
648					90% Hall's Bootstrap UCL	17.34	90% Percentile Bootstrap UCL	17.43				
649					90% Chebyshev(Mean, Sd) UCL	21.03	95% Chebyshev(Mean, Sd) UCL	23.98				
650					97.5% Chebyshev(Mean, Sd) UCL	28.07	99% Chebyshev(Mean, Sd) UCL	36.11				
651												
652	**Suggested UCL to Use**											
653	ecommendation Provided only for 95% Confidence Coefficient											
654												
655												
656	**Result (east parcel d/f teq - 5 additional samples removed [µg/kg])**											
657												
658	**General Statistics**											
659					Total Number of Observations	42	Number of Distinct Observations	35				
660							Number of Missing Observations	0				

661					Minimum	0.518				Mean		13.37
662					Maximum	42.14				Median		10.72
663					SD	13.05				Std. Error of Mean		2.014
664					Coefficient of Variation	0.977				Skewness		0.765
665												
666					**Normal GOF Test**							
667					Shapiro Wilk Test Statistic	0.804				**Shapiro Wilk GOF Test**		
668					1% Shapiro Wilk Critical Value	0.922				Data Not Normal at 1% Significance Level		
669					Lilliefors Test Statistic	0.201				**Lilliefors GOF Test**		
670					1% Lilliefors Critical Value	0.157				Data Not Normal at 1% Significance Level		
671					**Data Not Normal at 1% Significance Level**							
672												
673					**Assuming Normal Distribution**							
674					**90% Normal UCL**					**90% UCLs (Adjusted for Skewness)**		
675					90% Student's-t UCL	15.99				90% Adjusted-CLT UCL (Chen-1995)		16.12
676										90% Modified-t UCL (Johnson-1978)		16.03
677												
678					**Gamma GOF Test**							
679					A-D Test Statistic	1.65				**Anderson-Darling Gamma GOF Test**		
680					5% A-D Critical Value	0.789				Data Not Gamma Distributed at 5% Significance Level		
681					K-S Test Statistic	0.224				**Kolmogorov-Smirnov Gamma GOF Test**		
682					5% K-S Critical Value	0.142				Data Not Gamma Distributed at 5% Significance Level		
683					**Data Not Gamma Distributed at 5% Significance Level**							
684												
685					**Gamma Statistics**							
686					k hat (MLE)	0.749				k star (bias corrected MLE)		0.711
687					Theta hat (MLE)	17.85				Theta star (bias corrected MLE)		18.79
688					nu hat (MLE)	62.91				nu star (bias corrected)		59.75
689					MLE Mean (bias corrected)	13.37				MLE Sd (bias corrected)		15.85
690										Approximate Chi Square Value (0.1)		46.24
691					Adjusted Level of Significance	0.0937				Adjusted Chi Square Value		45.9
692												
693					**Assuming Gamma Distribution**							
694					90% Approximate Gamma UCL	17.27				90% Adjusted Gamma UCL		17.4
695												
696					**Lognormal GOF Test**							
697					Shapiro Wilk Test Statistic	0.803				**Shapiro Wilk Lognormal GOF Test**		
698					10% Shapiro Wilk Critical Value	0.951				Data Not Lognormal at 10% Significance Level		
699					Lilliefors Test Statistic	0.214				**Lilliefors Lognormal GOF Test**		
700					10% Lilliefors Critical Value	0.124				Data Not Lognormal at 10% Significance Level		
701					**Data Not Lognormal at 10% Significance Level**							
702												
703					**Lognormal Statistics**							
704					Minimum of Logged Data	-0.659				Mean of logged Data		1.793
705					Maximum of Logged Data	3.741				SD of logged Data		1.506
706												
707					**Assuming Lognormal Distribution**							
708					90% H-UCL	31.47				90% Chebyshev (MVUE) UCL		33.82
709					95% Chebyshev (MVUE) UCL	41.13				97.5% Chebyshev (MVUE) UCL		51.27
710					99% Chebyshev (MVUE) UCL	71.2						
711												
712					**Nonparametric Distribution Free UCL Statistics**							
713					**Data do not follow a Discernible Distribution**							
714												
715					**Nonparametric Distribution Free UCLs**							
716					90% CLT UCL	15.95				90% BCA Bootstrap UCL		16.07
717					90% Standard Bootstrap UCL	15.97				90% Bootstrap-t UCL		16.13
718					90% Hall's Bootstrap UCL	16.03				90% Percentile Bootstrap UCL		16.12
719					90% Chebyshev(Mean, Sd) UCL	19.41				95% Chebyshev(Mean, Sd) UCL		22.15
720					97.5% Chebyshev(Mean, Sd) UCL	25.94				99% Chebyshev(Mean, Sd) UCL		33.41
721												
722					**Suggested UCL to Use**							
723	ecommendation Provided only for 95% Confidence Coefficient											
724												
725												
726	**Result (east parcel d/f teq - 6 additional samples removed [µg/kg])**											

727												
728	**General Statistics**											
729					Total Number of Observations	42			Number of Distinct Observations	34		
730									Number of Missing Observations	0		
731					Minimum	0.518			Mean	12.4		
732					Maximum	40.47			Median	10.33		
733					SD	12.36			Std. Error of Mean	1.907		
734					Coefficient of Variation	0.997			Skewness	0.803		
735												
736	**Normal GOF Test**											
737					Shapiro Wilk Test Statistic	0.796			**Shapiro Wilk GOF Test**			
738					1% Shapiro Wilk Critical Value	0.922			Data Not Normal at 1% Significance Level			
739					Lilliefors Test Statistic	0.218			**Lilliefors GOF Test**			
740					1% Lilliefors Critical Value	0.157			Data Not Normal at 1% Significance Level			
741	**Data Not Normal at 1% Significance Level**											
742												
743	**Assuming Normal Distribution**											
744					**90% Normal UCL**				**90% UCLs (Adjusted for Skewness)**			
745					90% Student's-t UCL	14.88			90% Adjusted-CLT UCL (Chen-1995)	15.01		
746									90% Modified-t UCL (Johnson-1978)	14.92		
747												
748	**Gamma GOF Test**											
749					A-D Test Statistic	1.787			**Anderson-Darling Gamma GOF Test**			
750					5% A-D Critical Value	0.79			Data Not Gamma Distributed at 5% Significance Level			
751					K-S Test Statistic	0.238			**Kolmogorov-Smirnov Gamma GOF Test**			
752					5% K-S Critical Value	0.142			Data Not Gamma Distributed at 5% Significance Level			
753	**Data Not Gamma Distributed at 5% Significance Level**											
754												
755	**Gamma Statistics**											
756					k hat (MLE)	0.744			k star (bias corrected MLE)	0.707		
757					Theta hat (MLE)	16.66			Theta star (bias corrected MLE)	17.53		
758					nu hat (MLE)	62.52			nu star (bias corrected)	59.38		
759					MLE Mean (bias corrected)	12.4			MLE Sd (bias corrected)	14.74		
760									Approximate Chi Square Value (0.1)	45.92		
761					Adjusted Level of Significance	0.0937			Adjusted Chi Square Value	45.58		
762												
763	**Assuming Gamma Distribution**											
764					90% Approximate Gamma UCL	16.03			90% Adjusted Gamma UCL	16.15		
765												
766	**Lognormal GOF Test**											
767					Shapiro Wilk Test Statistic	0.801			**Shapiro Wilk Lognormal GOF Test**			
768					10% Shapiro Wilk Critical Value	0.951			Data Not Lognormal at 10% Significance Level			
769					Lilliefors Test Statistic	0.227			**Lilliefors Lognormal GOF Test**			
770					10% Lilliefors Critical Value	0.124			Data Not Lognormal at 10% Significance Level			
771	**Data Not Lognormal at 10% Significance Level**											
772												
773	**Lognormal Statistics**											
774					Minimum of Logged Data	-0.659			Mean of logged Data	1.712		
775					Maximum of Logged Data	3.701			SD of logged Data	1.49		
776												
777	**Assuming Lognormal Distribution**											
778					90% H-UCL	28.08			90% Chebyshev (MVUE) UCL	30.31		
779					95% Chebyshev (MVUE) UCL	36.81			97.5% Chebyshev (MVUE) UCL	45.83		
780					99% Chebyshev (MVUE) UCL	63.56						
781												
782	**Nonparametric Distribution Free UCL Statistics**											
783	**Data do not follow a Discernible Distribution**											
784												
785	**Nonparametric Distribution Free UCLs**											
786					90% CLT UCL	14.84			90% BCA Bootstrap UCL	14.88		
787					90% Standard Bootstrap UCL	14.83			90% Bootstrap-t UCL	15.05		
788					90% Hall's Bootstrap UCL	14.95			90% Percentile Bootstrap UCL	14.92		
789					90% Chebyshev(Mean, Sd) UCL	18.12			95% Chebyshev(Mean, Sd) UCL	20.71		
790					97.5% Chebyshev(Mean, Sd) UCL	24.3			99% Chebyshev(Mean, Sd) UCL	31.37		
791												
792	**Suggested UCL to Use**											

	A	B	C	D	E	F	G	H	I	J	K	L
793	ecommendation Provided only for 95% Confidence Coefficient											
794												
795												
796	**Result (east parcel d/f teq - 7 additional samples removed [µg/kg])**											
797												
798	**General Statistics**											
799	Total Number of Observations					42	Number of Distinct Observations					33
800							Number of Missing Observations					0
801	Minimum					0.518	Mean					11.47
802	Maximum					36.98	Median					8.873
803	SD					11.64	Std. Error of Mean					1.796
804	Coefficient of Variation					1.015	Skewness					0.832
805												
806	**Normal GOF Test**											
807	Shapiro Wilk Test Statistic					0.785	**Shapiro Wilk GOF Test**					
808	1% Shapiro Wilk Critical Value					0.922	Data Not Normal at 1% Significance Level					
809	Lilliefors Test Statistic					0.235	**Lilliefors GOF Test**					
810	1% Lilliefors Critical Value					0.157	Data Not Normal at 1% Significance Level					
811	**Data Not Normal at 1% Significance Level**											
812												
813	**Assuming Normal Distribution**											
814	**90% Normal UCL**						**90% UCLs (Adjusted for Skewness)**					
815	90% Student's-t UCL					13.81	90% Adjusted-CLT UCL (Chen-1995)					13.93
816							90% Modified-t UCL (Johnson-1978)					13.84
817												
818	**Gamma GOF Test**											
819	A-D Test Statistic					1.953	**Anderson-Darling Gamma GOF Test**					
820	5% A-D Critical Value					0.79	Data Not Gamma Distributed at 5% Significance Level					
821	K-S Test Statistic					0.252	**Kolmogorov-Smirnov Gamma GOF Test**					
822	5% K-S Critical Value					0.142	Data Not Gamma Distributed at 5% Significance Level					
823	**Data Not Gamma Distributed at 5% Significance Level**											
824												
825	**Gamma Statistics**											
826	k hat (MLE)					0.743	k star (bias corrected MLE)					0.705
827	Theta hat (MLE)					15.44	Theta star (bias corrected MLE)					16.26
828	nu hat (MLE)					62.37	nu star (bias corrected)					59.25
829	MLE Mean (bias corrected)					11.47	MLE Sd (bias corrected)					13.65
830							Approximate Chi Square Value (0.1)					45.8
831	Adjusted Level of Significance					0.0937	Adjusted Chi Square Value					45.46
832												
833	**Assuming Gamma Distribution**											
834	90% Approximate Gamma UCL					14.83	90% Adjusted Gamma UCL					14.94
835												
836	**Lognormal GOF Test**											
837	Shapiro Wilk Test Statistic					0.797	**Shapiro Wilk Lognormal GOF Test**					
838	10% Shapiro Wilk Critical Value					0.951	Data Not Lognormal at 10% Significance Level					
839	Lilliefors Test Statistic					0.239	**Lilliefors Lognormal GOF Test**					
840	10% Lilliefors Critical Value					0.124	Data Not Lognormal at 10% Significance Level					
841	**Data Not Lognormal at 10% Significance Level**											
842												
843	**Lognormal Statistics**											
844	Minimum of Logged Data					-0.659	Mean of logged Data					1.632
845	Maximum of Logged Data					3.61	SD of logged Data					1.471
846												
847	**Assuming Lognormal Distribution**											
848	90% H-UCL					24.92	90% Chebyshev (MVUE) UCL					27.03
849	95% Chebyshev (MVUE) UCL					32.77	97.5% Chebyshev (MVUE) UCL					40.75
850	99% Chebyshev (MVUE) UCL					56.41						
851												
852	**Nonparametric Distribution Free UCL Statistics**											
853	**Data do not follow a Discernible Distribution**											
854												
855	**Nonparametric Distribution Free UCLs**											
856	90% CLT UCL					13.77	90% BCA Bootstrap UCL					13.84
857	90% Standard Bootstrap UCL					13.75	90% Bootstrap-t UCL					14
858	90% Hall's Bootstrap UCL					13.91	90% Percentile Bootstrap UCL					13.81

859					90% Chebyshev(Mean, Sd) UCL	16.86				95% Chebyshev(Mean, Sd) UCL		19.3
860					97.5% Chebyshev(Mean, Sd) UCL	22.69				99% Chebyshev(Mean, Sd) UCL		29.34
861												
862						**Suggested UCL to Use**							
863	ecommendation Provided only for 95% Confidence Coefficient											
864												
865						**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**							
866						**Please verify the data were collected from random locations.**							
867						**If the data were collected using judgmental or other non-random methods,**							
868						**then contact a statistician to correctly calculate UCLs.**							
869												
870												
871	**Result (east parcel d/f teq - 8 additional samples removed [µg/kg])**											
872												
873						**General Statistics**							
874					Total Number of Observations	42				Number of Distinct Observations		32
875										Number of Missing Observations		0
876					Minimum	0.518				Mean		10.62
877					Maximum	36.98				Median		7.562
878					SD	11.02				Std. Error of Mean		1.701
879					Coefficient of Variation	1.038				Skewness		0.888
880												
881						**Normal GOF Test**						
882					Shapiro Wilk Test Statistic	0.78				**Shapiro Wilk GOF Test**		
883					1% Shapiro Wilk Critical Value	0.922				Data Not Normal at 1% Significance Level		
884					Lilliefors Test Statistic	0.251				**Lilliefors GOF Test**		
885					1% Lilliefors Critical Value	0.157				Data Not Normal at 1% Significance Level		
886						**Data Not Normal at 1% Significance Level**						
887												
888						**Assuming Normal Distribution**						
889						**90% Normal UCL**					**90% UCLs (Adjusted for Skewness)**	
890					90% Student's-t UCL	12.84				90% Adjusted-CLT UCL (Chen-1995)		12.97
891										90% Modified-t UCL (Johnson-1978)		12.87
892												
893						**Gamma GOF Test**						
894					A-D Test Statistic	2.12				**Anderson-Darling Gamma GOF Test**		
895					5% A-D Critical Value	0.79				Data Not Gamma Distributed at 5% Significance Level		
896					K-S Test Statistic	0.266				**Kolmogorov-Smirnov Gamma GOF Test**		
897					5% K-S Critical Value	0.142				Data Not Gamma Distributed at 5% Significance Level		
898						**Data Not Gamma Distributed at 5% Significance Level**						
899												
900						**Gamma Statistics**						
901					k hat (MLE)	0.741				k star (bias corrected MLE)		0.704
902					Theta hat (MLE)	14.32				Theta star (bias corrected MLE)		15.08
903					nu hat (MLE)	62.29				nu star (bias corrected)		59.17
904					MLE Mean (bias corrected)	10.62				MLE Sd (bias corrected)		12.65
905										Approximate Chi Square Value (0.1)		45.73
906					Adjusted Level of Significance	0.0937				Adjusted Chi Square Value		45.39
907												
908						**Assuming Gamma Distribution**						
909					90% Approximate Gamma UCL	13.74				90% Adjusted Gamma UCL		13.84
910												
911						**Lognormal GOF Test**						
912					Shapiro Wilk Test Statistic	0.795				**Shapiro Wilk Lognormal GOF Test**		
913					10% Shapiro Wilk Critical Value	0.951				Data Not Lognormal at 10% Significance Level		
914					Lilliefors Test Statistic	0.252				**Lilliefors Lognormal GOF Test**		
915					10% Lilliefors Critical Value	0.124				Data Not Lognormal at 10% Significance Level		
916						**Data Not Lognormal at 10% Significance Level**						
917												
918						**Lognormal Statistics**						
919					Minimum of Logged Data	-0.659				Mean of logged Data		1.554
920					Maximum of Logged Data	3.61				SD of logged Data		1.45
921												
922						**Assuming Lognormal Distribution**						
923					90% H-UCL	22.11				90% Chebyshev (MVUE) UCL		24.1
924					95% Chebyshev (MVUE) UCL	29.17				97.5% Chebyshev (MVUE) UCL		36.21

925				99% Chebyshev (MVUE) UCL		50.04						
926												
927	**Nonparametric Distribution Free UCL Statistics**											
928	**Data do not follow a Discernible Distribution**											
929												
930	**Nonparametric Distribution Free UCLs**											
931				90% CLT UCL		12.8				90% BCA Bootstrap UCL		13
932				90% Standard Bootstrap UCL		12.79				90% Bootstrap-t UCL		12.97
933				90% Hall's Bootstrap UCL		12.92				90% Percentile Bootstrap UCL		12.83
934				90% Chebyshev(Mean, Sd) UCL		15.72				95% Chebyshev(Mean, Sd) UCL		18.03
935				97.5% Chebyshev(Mean, Sd) UCL		21.24				99% Chebyshev(Mean, Sd) UCL		27.54
936												
937	**Suggested UCL to Use**											
938	ecommendation Provided only for 95% Confidence Coefficient											
939												
940	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
941	**Please verify the data were collected from random locations.**											
942	**If the data were collected using judgmental or other non-random methods,**											
943	**then contact a statistician to correctly calculate UCLs.**											
944												
945												
946	**Result (east parcel d/f teq - 9 additional samples removed [µg/kg])**											
947												
948	**General Statistics**											
949				Total Number of Observations		42				Number of Distinct Observations		31
950										Number of Missing Observations		0
951				Minimum		0.518				Mean		9.773
952				Maximum		34.8				Median		5.609
953				SD		10.29				Std. Error of Mean		1.588
954				Coefficient of Variation		1.053				Skewness		0.903
955												
956	**Normal GOF Test**											
957				Shapiro Wilk Test Statistic		0.77				**Shapiro Wilk GOF Test**		
958				1% Shapiro Wilk Critical Value		0.922				Data Not Normal at 1% Significance Level		
959				Lilliefors Test Statistic		0.268				**Lilliefors GOF Test**		
960				1% Lilliefors Critical Value		0.157				Data Not Normal at 1% Significance Level		
961	**Data Not Normal at 1% Significance Level**											
962												
963	**Assuming Normal Distribution**											
964	**90% Normal UCL**									**90% UCLs (Adjusted for Skewness)**		
965				90% Student's-t UCL		11.84				90% Adjusted-CLT UCL (Chen-1995)		11.97
966										90% Modified-t UCL (Johnson-1978)		11.88
967												
968	**Gamma GOF Test**											
969				A-D Test Statistic		2.342				**Anderson-Darling Gamma GOF Test**		
970				5% A-D Critical Value		0.79				Data Not Gamma Distributed at 5% Significance Level		
971				K-S Test Statistic		0.28				**Kolmogorov-Smirnov Gamma GOF Test**		
972				5% K-S Critical Value		0.142				Data Not Gamma Distributed at 5% Significance Level		
973	**Data Not Gamma Distributed at 5% Significance Level**											
974												
975	**Gamma Statistics**											
976				k hat (MLE)		0.746				k star (bias corrected MLE)		0.708
977				Theta hat (MLE)		13.11				Theta star (bias corrected MLE)		13.8
978				nu hat (MLE)		62.64				nu star (bias corrected)		59.5
979				MLE Mean (bias corrected)		9.773				MLE Sd (bias corrected)		11.61
980										Approximate Chi Square Value (0.1)		46.02
981				Adjusted Level of Significance		0.0937				Adjusted Chi Square Value		45.68
982												
983	**Assuming Gamma Distribution**											
984				90% Approximate Gamma UCL		12.64				90% Adjusted Gamma UCL		12.73
985												
986	**Lognormal GOF Test**											
987				Shapiro Wilk Test Statistic		0.79				**Shapiro Wilk Lognormal GOF Test**		
988				10% Shapiro Wilk Critical Value		0.951				Data Not Lognormal at 10% Significance Level		
989				Lilliefors Test Statistic		0.264				**Lilliefors Lognormal GOF Test**		
990				10% Lilliefors Critical Value		0.124				Data Not Lognormal at 10% Significance Level		

991	**Data Not Lognormal at 10% Significance Level**											
992												
993	**Lognormal Statistics**											
994					Minimum of Logged Data	-0.659			Mean of logged Data	1.476		
995					Maximum of Logged Data	3.55			SD of logged Data	1.424		
996												
997	**Assuming Lognormal Distribution**											
998					90% H-UCL	19.44			90% Chebyshev (MVUE) UCL	21.31		
999					95% Chebyshev (MVUE) UCL	25.74			97.5% Chebyshev (MVUE) UCL	31.89		
1000					99% Chebyshev (MVUE) UCL	43.97						
1001												
1002	**Nonparametric Distribution Free UCL Statistics**											
1003	**Data do not follow a Discernible Distribution**											
1004												
1005	**Nonparametric Distribution Free UCLs**											
1006					90% CLT UCL	11.81			90% BCA Bootstrap UCL	11.92		
1007					90% Standard Bootstrap UCL	11.8			90% Bootstrap-t UCL	11.96		
1008					90% Hall's Bootstrap UCL	11.89			90% Percentile Bootstrap UCL	11.82		
1009					90% Chebyshev(Mean, Sd) UCL	14.54			95% Chebyshev(Mean, Sd) UCL	16.69		
1010					97.5% Chebyshev(Mean, Sd) UCL	19.69			99% Chebyshev(Mean, Sd) UCL	25.57		
1011												
1012	**Suggested UCL to Use**											
1013	ecommendation Provided only for 95% Confidence Coefficient											
1014												
1015	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
1016	**Please verify the data were collected from random locations.**											
1017	**If the data were collected using judgmental or other non-random methods,**											
1018	**then contact a statistician to correctly calculate UCLs.**											
1019												
1020												
1021	**Result (west parcel - cpahs [mg/kg])**											
1022												
1023	**General Statistics**											
1024					Total Number of Observations	27			Number of Distinct Observations	18		
1025									Number of Missing Observations	0		
1026					Minimum	0.01			Mean	0.187		
1027					Maximum	1.75			Median	0.0771		
1028					SD	0.354			Std. Error of Mean	0.0681		
1029					Coefficient of Variation	1.891			Skewness	3.707		
1030												
1031	**Normal GOF Test**											
1032					Shapiro Wilk Test Statistic	0.525			**Shapiro Wilk GOF Test**			
1033					1% Shapiro Wilk Critical Value	0.894			Data Not Normal at 1% Significance Level			
1034					Lilliefors Test Statistic	0.308			**Lilliefors GOF Test**			
1035					1% Lilliefors Critical Value	0.194			Data Not Normal at 1% Significance Level			
1036	**Data Not Normal at 1% Significance Level**											
1037												
1038	**Assuming Normal Distribution**											
1039	**90% Normal UCL**								**90% UCLs (Adjusted for Skewness)**			
1040					90% Student's-t UCL	0.277			90% Adjusted-CLT UCL (Chen-1995)	0.309		
1041									90% Modified-t UCL (Johnson-1978)	0.285		
1042												
1043	**Gamma GOF Test**											
1044					A-D Test Statistic	1.262			**Anderson-Darling Gamma GOF Test**			
1045					5% A-D Critical Value	0.803			Data Not Gamma Distributed at 5% Significance Level			
1046					K-S Test Statistic	0.209			**Kolmogorov-Smirnov Gamma GOF Test**			
1047					5% K-S Critical Value	0.177			Data Not Gamma Distributed at 5% Significance Level			
1048	**Data Not Gamma Distributed at 5% Significance Level**											
1049												
1050	**Gamma Statistics**											
1051					k hat (MLE)	0.548			k star (bias corrected MLE)	0.512		
1052					Theta hat (MLE)	0.342			Theta star (bias corrected MLE)	0.366		
1053					nu hat (MLE)	29.58			nu star (bias corrected)	27.63		
1054					MLE Mean (bias corrected)	0.187			MLE Sd (bias corrected)	0.262		
1055									Approximate Chi Square Value (0.1)	18.63		
1056					Adjusted Level of Significance	0.089			Adjusted Chi Square Value	18.26		

1057											
1058	**Assuming Gamma Distribution**										
1059				90% Approximate Gamma UCL		0.278		90% Adjusted Gamma UCL			0.283
1060											
1061	**Lognormal GOF Test**										
1062				Shapiro Wilk Test Statistic		0.875		**Shapiro Wilk Lognormal GOF Test**			
1063				10% Shapiro Wilk Critical Value		0.935		Data Not Lognormal at 10% Significance Level			
1064				Lilliefors Test Statistic		0.239		**Lilliefors Lognormal GOF Test**			
1065				10% Lilliefors Critical Value		0.153		Data Not Lognormal at 10% Significance Level			
1066	**Data Not Lognormal at 10% Significance Level**										
1067											
1068	**Lognormal Statistics**										
1069				Minimum of Logged Data		-4.605		Mean of logged Data			-2.819
1070				Maximum of Logged Data		0.56		SD of logged Data			1.595
1071											
1072	**Assuming Lognormal Distribution**										
1073				90% H-UCL		0.463		90% Chebyshev (MVUE) UCL			0.419
1074				95% Chebyshev (MVUE) UCL		0.521		97.5% Chebyshev (MVUE) UCL			0.662
1075				99% Chebyshev (MVUE) UCL		0.94					
1076											
1077	**Nonparametric Distribution Free UCL Statistics**										
1078	**Data do not follow a Discernible Distribution**										
1079											
1080	**Nonparametric Distribution Free UCLs**										
1081				90% CLT UCL		0.275		90% BCA Bootstrap UCL			0.328
1082				90% Standard Bootstrap UCL		0.273		90% Bootstrap-t UCL			0.389
1083				90% Hall's Bootstrap UCL		0.708		90% Percentile Bootstrap UCL			0.278
1084				90% Chebyshev(Mean, Sd) UCL		0.392		95% Chebyshev(Mean, Sd) UCL			0.484
1085				97.5% Chebyshev(Mean, Sd) UCL		0.613		99% Chebyshev(Mean, Sd) UCL			0.865
1086											
1087	**Suggested UCL to Use**										
1088	ecommendation Provided only for 95% Confidence Coefficient										
1089											
1090	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**										
1091	**Please verify the data were collected from random locations.**										
1092	**If the data were collected using judgmental or other non-random methods,**										
1093	**then contact a statistician to correctly calculate UCLs.**										
1094											
1095											
1096	**Result (west parcel - d/f teq [µg/kg])**										
1097											
1098	**General Statistics**										
1099				Total Number of Observations		27		Number of Distinct Observations			18
1100								Number of Missing Observations			0
1101				Minimum		1.4		Mean			8.185
1102				Maximum		26.29		Median			6.954
1103				SD		7.59		Std. Error of Mean			1.461
1104				Coefficient of Variation		0.927		Skewness			1.003
1105											
1106	**Normal GOF Test**										
1107				Shapiro Wilk Test Statistic		0.839		**Shapiro Wilk GOF Test**			
1108				1% Shapiro Wilk Critical Value		0.894		Data Not Normal at 1% Significance Level			
1109				Lilliefors Test Statistic		0.186		**Lilliefors GOF Test**			
1110				1% Lilliefors Critical Value		0.194		Data appear Normal at 1% Significance Level			
1111	**Data appear Approximate Normal at 1% Significance Level**										
1112											
1113	**Assuming Normal Distribution**										
1114	**90% Normal UCL**							**90% UCLs (Adjusted for Skewness)**			
1115				90% Student's-t UCL		10.11		90% Adjusted-CLT UCL (Chen-1995)			10.26
1116								90% Modified-t UCL (Johnson-1978)			10.15
1117											
1118	**Gamma GOF Test**										
1119				A-D Test Statistic		1.433		**Anderson-Darling Gamma GOF Test**			
1120				5% A-D Critical Value		0.771		Data Not Gamma Distributed at 5% Significance Level			
1121				K-S Test Statistic		0.234		**Kolmogorov-Smirnov Gamma GOF Test**			
1122				5% K-S Critical Value		0.173		Data Not Gamma Distributed at 5% Significance Level			

1123	**Data Not Gamma Distributed at 5% Significance Level**											
1124												
1125	**Gamma Statistics**											
1126					k hat (MLE)	1.108			k star (bias corrected MLE)	1.009		
1127					Theta hat (MLE)	7.39			Theta star (bias corrected MLE)	8.11		
1128					nu hat (MLE)	59.81			nu star (bias corrected)	54.5		
1129					MLE Mean (bias corrected)	8.185			MLE Sd (bias corrected)	8.147		
1130									Approximate Chi Square Value (0.1)	41.62		
1131					Adjusted Level of Significance	0.089			Adjusted Chi Square Value	41.05		
1132												
1133	**Assuming Gamma Distribution**											
1134					90% Approximate Gamma UCL	10.72			90% Adjusted Gamma UCL	10.87		
1135												
1136	**Lognormal GOF Test**											
1137					Shapiro Wilk Test Statistic	0.836			**Shapiro Wilk Lognormal GOF Test**			
1138					10% Shapiro Wilk Critical Value	0.935			Data Not Lognormal at 10% Significance Level			
1139					Lilliefors Test Statistic	0.242			**Lilliefors Lognormal GOF Test**			
1140					10% Lilliefors Critical Value	0.153			Data Not Lognormal at 10% Significance Level			
1141	**Data Not Lognormal at 10% Significance Level**											
1142												
1143	**Lognormal Statistics**											
1144					Minimum of Logged Data	0.336			Mean of logged Data	1.587		
1145					Maximum of Logged Data	3.269			SD of logged Data	1.105		
1146												
1147	**Assuming Lognormal Distribution**											
1148					90% H-UCL	13.78			90% Chebyshev (MVUE) UCL	15.16		
1149					95% Chebyshev (MVUE) UCL	18.09			97.5% Chebyshev (MVUE) UCL	22.16		
1150					99% Chebyshev (MVUE) UCL	30.14						
1151												
1152	**Nonparametric Distribution Free UCL Statistics**											
1153	**Data appear to follow a Discernible Distribution**											
1154												
1155	**Nonparametric Distribution Free UCLs**											
1156					90% CLT UCL	10.06			90% BCA Bootstrap UCL	9.99		
1157					90% Standard Bootstrap UCL	9.959			90% Bootstrap-t UCL	10.24		
1158					90% Hall's Bootstrap UCL	10.18			90% Percentile Bootstrap UCL	10.01		
1159					90% Chebyshev(Mean, Sd) UCL	12.57			95% Chebyshev(Mean, Sd) UCL	14.55		
1160					97.5% Chebyshev(Mean, Sd) UCL	17.31			99% Chebyshev(Mean, Sd) UCL	22.72		
1161												
1162	**Suggested UCL to Use**											
1163	ecommendation Provided only for 95% Confidence Coefficient											
1164												

Appendix B

Preliminary Evaluation of Cap Requirements

This appendix presents the preliminary development of the cap thicknesses needed to address residual ecological risk.

Step 1: Identify DUs with Residual Hazard Index Less Than One. Table B-1 presents residual COC concentrations following the proposed excavation to address hot spots and human health risk. CULs for each ecological receptor are listed in the table. Table B-2 summarizes the screening of residual COC data against ecological CULs, listing the maximum residual hazard quotient (HQ) and the residual hazard index (HI). The following DUs have residual HI values of less than 1 and require no cap.

Decision Units with No Cap Requirements
DU-39
DU-40
DU-43
DU-44

These DUs will be restored as shown on Detail A of Figure 12. There are no long-term inspection or maintenance requirements for remedial action of these DUs.

Step 2: Identify DUs with a Residual Hazard Quotient Equal to or Greater Than Ten. Table B-2 lists the maximum residual HQ for each DU. The following DUs have residual HQ values of 10 or greater and require an enhanced cap.

Decision Units with Enhanced Cap Requirements
DU-6
DU-30

In addition, eleven decision units have a proposed excavation depth of 3 feet so have no residual data. The hazard quotient in Layer 3 of these DUs was greater than 10.

The initial cap design for these 13 DUs is shown on Detail C of Figure 12. These DUs will require long-term inspection and maintenance.

Step 3: Determine Cap Thicknesses for Residual Hazard Index Greater Than One and a Maximum Residual Hazard Quotient Less Than Ten. Standard cap thickness will be established such that, if the top 3 feet of soil is thoroughly mixed, the resulting COC concentrations will result in an HI of less than 1 for each ecological receptor. Preliminary cap thicknesses were determined using the residual data in Table B-1 and the following procedure.

- Assuming 1 foot of soil cap, calculate the final COC concentrations after mixing with the underlying soil to a total depth of 3 feet. Input concentrations for the clean soil cap were estimated from the

COC concentrations for soil beneath the East Parcel concrete pads. Input concentrations for the underlying soil were obtained from the residual RDI data. For DUs where the planned excavation is 3 feet, Layer 3 residual concentrations were used for the input data.

- Calculate the hazard index for each ecological receptor.
- Repeat for soil cap thicknesses of 1.5, 2.0, and 2.5 feet.
- For each DU, select the soil cap thickness that results in the HI less than 1 for each receptor.

Table B-3 summarizes the resultant HIs for the range of potential cap thicknesses for DUs targeted for a standard cap (Detail B on Figure 12). The table identifies the proposed cap thicknesses based on the thinnest cap that results in the HIs less than 1. Except for DU-24 (2 feet) and DU-37 (1 foot), proposed cap thicknesses range from 2.5 to 3.0 feet.

Table B-1
Residual Soil Data
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg														
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
Reference Concentrations				ISM Background	0.29	8.8	39	24	27	0.073	23.4	0.33	105						
				Composite Background	0.56	8.8	76	34	79	0.23	47	0.71	180						
				Plant RBC	5	18	1.0	70	120	0.30	38	0.52	160						40
				Invertebrate RBC	78		0.4	80	1700	0.10	280	4.10	120			18	29		
				Bird RBC		575	87.0	88	33	0.015	139	3.42	673	8.90E-05					0.734
				Mammal RBC	2.70	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100		0.098
				Cap Material[1]	0.53	3.1	14	18	5	0.042	18	0.54	55	1.40E-06	0.005	0.1	0.08	0.01	0.005
West Parcel	DU-1	ISM	0-1	DU-1 (0-1)	0.801	6.24	37.4	180	74.8	0.0696	27.1	0.514	151	2.21E-05	0.0078	2.6600	0.3370	0.4460	0.4270
			1-2	DU-1 (1-2)	0.712	5.41	41.3	64.6	321	0.0863	30.9	0.516	140	2.56E-05	0.0102	2.6200	0.4240	0.4000	2.7500
			2-3	DU-1 (2-3)	0.529	5.79	29.5	69.5	57.5	0.0813	25.0	0.529	179	1.07E-05	0.0048	2.1100	0.2860	0.3280	0.1100
	DU-2	ISM	0-1	DU-2 (0-1)	0.603	5.41	21.5	119	96.2	0.0731	18.9	0.505	99.4	6.95E-06	0.0051	1.0200	0.1270	0.1650	0.1860
			1-2	DU-2 (1-2)	0.515	5.36	22	170	118	0.124	16.4	0.515	88.8	3.44E-06	0.0047	0.7920	0.1230	0.1080	0.5580
			2-3	DU-2 (2-3)	0.495	5.21	15.5	41.9	24.4	0.0607	14.7	0.495	78	2.42E-06	0.0050	0.2230	0.0275	0.0319	0.0299
	DU-3	ISM	0-1	DU-3 (0-1)	0.547	6.87	16.2	26.8	20.1	0.0438	16.3	0.547	80.4	2.63E-05	0.0048	0.9760	0.1210	0.1530	0.0250
			1-2	DU-3 (1-2)	0.497	6.65	16.5	25.8	15.8	0.0455	17.1	0.497	72.2	7.82E-06	0.0051	0.9840	0.1210	0.1290	0.0050
			2-3	DU-3 (2-3)	0.536	6.65	15.7	21.6	13.5	0.0497	16.0	0.536	64.7	4.57E-06	0.0050	0.7450	0.1140	0.1030	0.0048
	DU-4	ISM	0-1	DU-4 (0-1)	0.565	6.57	16.3	29.1	23.7	0.0746	23.9	0.565	89.4	2.09E-05	0.0057	2.5200	0.3290	0.4280	0.0317
			1-2	DU-4 (1-2)	0.515	6.87	16.3	26.6	23.9	0.0596	24.6	0.515	79.4	1.66E-05	0.0334	11.9000	3.5400	1.7500	0.0245
			2-3	DU-4 (2-3)	0.502	7.63	18.4	34	45.1	0.076	22.4	0.502	115	1.47E-05	0.0094	4.6500	0.6340	0.7670	0.0351
	DU-5	ISM	0-1	DU-5 (0-1)	0.992	8.98	52.3	344	62.1	0.352	32.6	0.369	211	1.71E-05	0.0073	1.4000	0.1860	0.2420	0.1770
			1-2	DU-5 (1-2)	0.832	8.09	42.9	237	70.5	0.369	58.9	0.335	179	1.53E-05	0.0061	1.1600	0.1550	0.1990	0.1430
			2-3	DU-5 (2-3)	0.596	6.73	47.1	214	118	0.273	31.3	0.309	224	2.33E-05	0.0099	2.8800	0.5470	0.4080	0.3870
	DU-6	ISM	0-1	DU-6 (0-1)	0.539	4.93	22.1	67.6	28.2	0.128	19.6	0.539	135	1.04E-05	0.0052	1.1000	0.1200	0.1880	0.0625
			1-2	DU-6 (1-2)	0.56	4.89	25.2	91.6	40	0.156	21.8	0.56	124	2.51E-05	0.0090	1.2900	0.1910	0.2040	0.1110
			2-3	DU-6 (2-3)	0.526	4.67	23.2	100	37.8	0.141	22.0	0.526	112	1.14E-05	0.0110	1.4300	0.2160	0.2260	0.1670
	DU-7	ISM	0-1	DU-7 (0-1)	0.537	4.37	19.2	36	23.3	0.304	19.3	0.537	126	1.74E-05	0.0051	0.7510	0.0885	0.1270	0.0527
			1-2	DU-7 (1-2)	0.547	3.98	18.6	30.1	18.7	0.13	19.7	0.547	92.7	1.24E-05	0.0050	0.4400	0.0705	0.0711	0.0567
			2-3	DU-7 (2-3)	0.536	3.07	16.2	24.2	14.9	0.0927	19.1	0.536	75.1	8.17E-06	0.0050	0.3160	0.0497	0.0478	0.0502
	DU-8	ISM	0-1	DU-8 (0-1)	0.56	4.33	21.7	32.5	39.1	0.154	19.6	0.56	144	2.36E-05	0.0055	0.7550	0.1140	0.1210	0.0989
			1-2	DU-8 (1-2)	0.501	4.13	24.6	32.9	31.4	0.164	19.7	0.501	130	2.46E-05	0.0055	0.4940	0.1010	0.0731	0.0678
			2-3	DU-8 (2-3)	0.545	4.13	21.9	32	31	0.156	20.7	0.545	126	2.34E-05	0.0062	0.5890	0.1200	0.0847	0.0984
	DU-9	ISM	0-1	DU-9 (0-1)	0.623	5.25	30.6	40.6	28.2	0.16	26.5	0.506	154	1.78E-05	0.0057	1.1200	0.1600	0.1890	0.0640
			1-2	DU-9 (1-2)	0.555	4.81	27.8	34.6	40.7	0.141	24.4	0.555	115	1.28E-05	0.0048	0.4770	0.0753	0.0771	0.0353
			2-3	DU-9 (2-3)	0.512	5.12	31	37.4	21.5	0.141	26.2	0.512	122	1.23E-05	0.0080	1.1600	0.1990	0.1800	0.0478

Please see notes at the end of the table.

Table B-1
Residual Soil Data
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg														
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
Reference Concentrations				ISM Background	0.29	8.8	39	24	27	0.073	23.4	0.33	105						
				Composite Background	0.56	8.8	76	34	79	0.23	47	0.71	180						
				Plant RBC	5	18	1.0	70	120	0.30	38	0.52	160						40
				Invertebrate RBC	78		0.4	80	1700	0.10	280	4.10	120			18	29		
				Bird RBC		575	87.0	88	33	0.015	139	3.42	673	8.90E-05					0.734
				Mammal RBC	2.70	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100		0.098
				Cap Material[1]	0.53	3.1	14	18	5	0.042	18	0.54	55	1.40E-06	0.005	0.1	0.08	0.01	0.005
Central Parcel	DU-10	ISM	0-1	DU-10 (0-1)	0.541	4.5	14.8	33.3	86.5	1.07	29.9	0.541	106	1.73E-05	0.0235	29.4000	3.8500	5.1900	0.0337
			1-2	DU-10 (1-2)	0.531	5.56	15.3	33.6	54.8	0.829	27.5	0.513	94.9	5.46E-06	0.0494	28.3000	6.5900	4.7000	0.0262
			2-3	DU-10 (2-3)	0.514	5.16	14.5	32.2	73.3	0.609	22.6	0.491	117	4.52E-06	0.0244	16.9000	3.3700	2.6000	0.0051
	DU-11	ISM	0-1	DU-11 (0-1)	0.545	4.6	23.6	38.5	56.1	0.726	29.3	0.545	116	1.17E-05	0.0819	31.3000	9.3600	5.4000	0.0369
			1-2	DU-11 (1-2)	0.535	4.15	22	37.3	49	0.633	28.2	0.535	99.5	5.21E-06	0.0486	15.1000	2.9800	2.6500	0.0372
			2-3	DU-11 (2-3)	0.526	4.23	22	35.2	43.3	0.604	26.4	0.526	95	5.89E-06	0.0613	30.2000	7.3500	5.1300	0.0389
	DU-12	ISM	0-1	DU-12 (0-1)	0.83	4.95	14.8	78.9	165	0.292	19.8	0.504	166	2.54E-05	0.0070	2.4700	0.3520	0.3930	0.0532
			1-2	DU-12 (1-2)	0.493	4.26	14	55.7	131	0.275	19	0.493	104	4.21E-06	0.0059	0.9970	0.1900	0.1430	0.0317
			2-3	DU-12 (2-3)	0.551	3.62	13.7	41	70.8	0.207	17.8	0.551	79.7	2.60E-06	0.0050	0.5840	0.1030	0.0900	0.0050
	DU-13	ISM	0-1	DU-13 (0-1)	0.923	6.04	14.2	94.3	241	1.15	21.4	0.563	204	2.77E-04	0.0084	7.9300	0.4760	1.1700	0.0701
			1-2	DU-13 (1-2)	0.54	4.79	13.8	53	154	0.785	18.6	0.54	128	3.62E-05	0.0155	3.0600	0.6760	0.4500	0.0272
			2-3	DU-13 (2-3)	0.562	4.04	12.6	54.2	175	0.769	18.4	0.562	127	2.66E-05	0.0052	1.6700	0.2480	0.2630	0.0330
	DU-14	ISM	0-1	DU-14 (0-1)	2.81	6.14	22.9	73.5	134	1.33	24.3	0.514	147	7.87E-05	0.0229	0.9920	0.3010	0.1490	0.0283
			1-2	DU-14 (1-2)	7.38	6.87	21.6	122	240	3.1	23.7	0.519	204	3.43E-05	0.0224	1.7000	0.4070	0.2570	0.0048
			2-3	DU-14 (2-3)	3.04	5.66	20.6	185	162	2.5	24.8	0.493	164	1.43E-05	0.0143	1.3200	0.2860	0.1950	0.0048
	DU-15	ISM	0-1	DU-15 (0-1)	2.81	5.04	16	95.4	131	0.75	21.7	0.506	131	3.96E-04	0.0081	0.9590	0.1440	0.1380	0.0268
			1-2	DU-15 (1-2)	0.576	3.75	14	57.7	68.6	1.28	19.3	0.517	120	2.00E-04	0.0049	0.3280	0.0668	0.0499	0.0048
			2-3	DU-15 (2-3)	0.492	2.91	11.2	36.2	63.6	0.563	17.6	0.492	76.8	1.50E-04	0.0049	0.6910	0.0868	0.1010	0.0048
	DU-16	ISM	0-1	DU-16 (0-1)	4.29	8.31	26.6	131	306	5.12	28.1	0.543	371	2.44E-04	0.0776	3.2200	0.9680	0.4960	0.0346
			1-2	DU-16 (1-2)	2.29	6.92	13.6	71.8	151	1.69	18.5	0.521	139	1.75E-05	0.0075	1.6300	0.2070	0.2460	0.0049
			2-3	DU-16 (2-3)	0.499	3.72	12.9	29.1	37.5	0.429	16.8	0.539	71.3	7.62E-06	0.0050	0.4170	0.0624	0.0569	0.0050
	DU-17	ISM	0-1	DU-17 (0-1)	1.06	4.95	12.4	59.2	81.4	0.575	16.4	0.499	156	4.04E-05	0.0050	0.4280	0.0851	0.0634	0.0257
			1-2	DU-17 (1-2)	0.511	3.72	11.8	34.3	62.5	0.356	16.3	0.511	70.6	3.43E-06	0.0050	0.3630	0.0859	0.0513	0.0050
			2-3	DU-17 (2-3)	0.504	3.16	11.1	26.8	35.1	0.121	14.6	0.504	58.4	7.81E-06	0.0050	0.2220	0.0348	0.0309	0.0049
	DU-18	ISM	0-1	DU-18 (0-1)	1.41	10.9	22.8	111	280	1.72	23.5	0.531	204	6.68E-05	0.0069	1.8100	0.2630	0.2710	0.0435
			1-2	DU-18 (1-2)	0.495	6.22	15.3	79.5	179	1.06	21.8	0.495	158	2.16E-05	0.0050	0.8940	0.1380	0.1380	0.0217
			2-3	DU-18 (2-3)	0.502	5.63	13.9	59.9	92.3	0.681	18.3	0.502	118	1.29E-05	0.0051	0.5870	0.0841	0.0862	0.0290

Please see notes at the end of the table.

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Residual Soil Data
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg														
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
Reference Concentrations				ISM Background	0.29	8.8	39	24	27	0.073	23.4	0.33	105						
				Composite Background	0.56	8.8	76	34	79	0.23	47	0.71	180						
				Plant RBC	5	18	1.0	70	120	0.30	38	0.52	160						40
				Invertebrate RBC	78		0.4	80	1700	0.10	280	4.10	120			18	29		
				Bird RBC		575	87.0	88	33	0.015	139	3.42	673	8.90E-05					0.734
				Mammal RBC	2.70	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100		0.098
				Cap Material[1]	0.53	3.1	14	18	5	0.042	18	0.54	55	1.40E-06	0.005	0.1	0.08	0.01	0.005
Central Parcel	DU-19	ISM	0-1	DU-19 (0-1)	1.39	7.67	13.2	107	257	0.666	16.5	0.541	215	1.34E-04	0.0121	2.3700	0.3430	0.4030	0.1440
			1-2	DU-19 (1-2)	0.957	11.2	12	110	161	1.08	15.5	0.555	198	8.48E-05	0.0174	1.8200	0.3840	0.2700	0.0311
			2-3	DU-19 (2-3)	0.926	5.68	11.2	44.9	70.8	0.327	15.5	0.497	113	4.66E-05	0.0051	0.5140	0.0627	0.0790	0.0568
	DU-20	ISM	0-1	DU-20 (0-1)	1.69	5.69	19.6	58.4	76.2	0.314	22.7	0.517	117	3.49E-05	0.0048	0.8920	0.0970	0.1450	0.0390
			1-2	DU-20 (1-2)	0.536	4.08	19.5	25.8	17.7	0.136	28.4	0.536	87.3	4.30E-06	0.0049	0.0881	0.0236	0.0132	0.0050
			2-3	DU-20 (2-3)	0.511	3.68	16.7	23	14.3	0.101	21.1	0.511	90.4	3.97E-06	0.0047	0.1350	0.0247	0.0193	0.0050
	DU-21	ISM	0-1	DU-21 (0-1)	2.73	10.5	14.8	128	295	0.776	20.3	0.493	242	0.000070304	0.0187	2.0900	0.4640	0.3140	0.0492
			1-2	DU-21 (1-2)	1.01	4.93	11.8	56.2	116	0.276	17.7	0.5	180	2.05915E-05	0.0074	1.0500	0.1510	0.1640	0.0364
			2-3	DU-21 (2-3)	0.497	4.48	11.6	45.9	89.7	0.154	18	0.5	109	1.00546E-05	0.0052	0.6240	0.1480	0.0879	0.0050
	DU-22	ISM	0-1	DU-22 (0-1)	2.89	6.48	19.6	96.6	190	0.602	23.2	0.538	178	3.25E-05	0.1120	2.6500	1.9500	0.1310	0.0438
			1-2	DU-22 (1-2)	2.63	4.53	18.8	47.4	72.3	0.349	22.6	0.512	164	1.23E-05	0.0051	0.2350	0.0463	0.0289	0.0258
			2-3	DU-22 (2-3)	1.09	4.45	18	54	57.5	0.376	21.4	0.557	123	7.93E-06	0.0051	0.2250	0.0652	0.0292	0.0050
	DU-23	ISM	0-1	DU-23 (0-1)	1.62	5.99	22.1	150	276	1.02	22.9	0.497	184	4.00E-05	0.0061	0.7550	0.1410	0.1060	0.0591
			1-2	DU-23 (1-2)	0.61	4.63	18.4	69.5	70.9	0.545	20.5	0.518	127	1.05E-05	0.0050	0.5370	0.0638	0.1040	0.0265
			2-3	DU-23 (2-3)	0.498	3.82	15.6	41.9	82.2	0.426	18.8	0.488	99	5.92E-06	0.0051	0.2310	0.0313	0.0362	0.0050
	DU-24	ISM	0-1	DU-24 (0-1)	0.546	4.16	15.5	39.9	48.8	0.276	19.2	0.546	117	2.33E-05	0.0050	0.6300	0.0812	0.0907	0.0326
			1-2	DU-24 (1-2)	0.496	3.56	15	31.1	23.2	0.175	20.6	0.496	124	6.44E-06	0.0050	0.5000	0.0548	0.0740	0.0049
			2-3	DU-24 (2-3)	0.501	2.84	10.9	17.6	13.8	0.0928	18.5	0.501	83.1	8.88E-06	0.0050	0.0883	0.0202	0.0145	0.0048
	DU-25	ISM	0-1	DU-25 (0-1)	0.822	5.24	20.2	226	144	0.762	21.3	0.491	242	4.69E-05	0.0123	2.7700	0.4270	0.3860	0.0653
			1-2	DU-25 (1-2)	0.493	3.29	14.5	48.5	113	0.213	19.6	0.493	202	2.60E-06	0.0050	0.6430	0.1010	0.0905	0.0050
			2-3	DU-25 (2-3)	0.496	3.17	12.6	30	43.2	0.116	18.7	0.496	138	1.94E-06	0.0048	0.6130	0.0873	0.0873	0.0050
	DU-26	ISM	0-1	DU-26 (0-1)	4.79	9.5	19.1	152	330	1.95	20.7	0.605	260	9.33E-05	0.0246	4.8900	0.7790	0.7230	0.1850
			1-2	DU-26 (1-2)	1.4	11.6	15.5	80.7	151	1.25	19.9	0.558	206	4.27E-05	0.0050	1.6600	0.1580	0.2810	0.0705
			2-3	DU-26 (2-3)	0.529	4.75	14.6	41.6	76.1	0.82	18.3	0.521	138	2.36E-05	0.0050	0.9930	0.1240	0.1480	0.1890
	DU-42	Composite	0-1	DU-42 (0-1)	0.512	4.38	17.8	36.3	53.3	0.226	23.3	0.531	126	6.07E-05	0.0050	0.3470	0.0678	0.0507	0.0050
			1-2	DU-42 (1-2)	0.667	4.11	18.4	25.4	30.3	0.186	22.6	0.549	109	2.27E-05	0.0048	0.2200	0.0429	0.0309	0.0050
			2-3	DU-42 (2-3)	0.531	3.76	17.4	21.1	20.1	0.125	20.7	0.531	87	8.27E-06	0.0050	0.1580	0.0297	0.0229	0.0049

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Residual Soil Data
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg														
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
Reference Concentrations				ISM Background	0.29	8.8	39	24	27	0.073	23.4	0.33	105						
				Composite Background	0.56	8.8	76	34	79	0.23	47	0.71	180						
				Plant RBC	5	18	1.0	70	120	0.30	38	0.52	160						40
				Invertebrate RBC	78		0.4	80	1700	0.10	280	4.10	120			18	29		
				Bird RBC		575	87.0	88	33	0.015	139	3.42	673	8.90E-05					0.734
				Mammal RBC	2.70	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100		0.098
				Cap Material[1]	0.53	3.1	14	18	5	0.042	18	0.54	55	1.40E-06	0.005	0.1	0.08	0.01	0.005
East Parcel	DU-27	ISM	0-1	DU-27 (0-1)	1.3	14.5	19.8	204	46.1	0.184	21.1	0.583	173	1.03E-04	0.0050	1.4000	0.1590	0.2130	0.1860
			1-2	DU-27 (1-2)	0.488	8.72	16.9	81.2	39.1	0.0555	21.3	0.488	130	6.99E-05	0.0101	1.7800	0.3630	0.2420	0.1680
			2-3	DU-27 (2-3)	1.15	15.8	15.5	45.6	55.4	0.0643	18.4	0.512	139	2.40E-05	0.0050	0.6570	0.1030	0.0973	0.1780
	DU-28	ISM	0-1	DU-28 (0-1)	2.32	10.5	16.4	184	78.1	0.649	17.9	0.513	267	1.91E-05	0.0070	2.3600	0.2610	0.4330	0.1000
			1-2	DU-28 (1-2)	2.87	13.3	17.3	327	74.1	0.706	17.2	0.493	231	3.27E-05	0.0085	3.1400	0.3090	0.5280	0.0718
			2-3	DU-28 (2-3)	4.79	7.4	16.9	229	113	0.207	19.6	0.522	275	1.49E-05	0.0084	1.8900	0.2380	0.3530	0.0370
	DU-29	ISM	0-1	DU-29 (0-1)	1.08	6.95	12.1	69.3	103	0.0595	18.1	0.518	164	4.97E-05	0.0085	0.9880	0.1570	0.1540	0.0250
			1-2	DU-29 (1-2)	1.02	5.08	10.4	44.3	41.1	0.0436	15.3	0.545	100	1.53E-05	0.0051	0.4780	0.0641	0.0697	0.0047
			2-3	DU-29 (2-3)	0.511	3.6	10	27.8	45.7	0.0409	15.2	0.511	92.7	1.53E-05	0.0050	0.3800	0.0562	0.0588	0.0049
	DU-30	ISM	0-1	DU-30 (0-1)	1.66	4.22	14.5	63.4	131	0.0829	18.3	0.5	179	5.05E-05	0.0072	2.1500	0.2030	0.3980	0.0325
			1-2	DU-30 (1-2)	2.09	3.72	13.9	79.8	202	0.05	17.7	0.512	228	2.24E-05	0.0050	1.0000	0.1200	0.1690	0.0050
			2-3	DU-30 (2-3)	6.81	4.14	11.6	86.6	220	0.159	15.7	0.501	152	1.44E-05	0.0050	0.4650	0.0681	0.0709	0.0456
	DU-31	ISM	0-1	DU-31 (0-1)	1.85	6.09	14.5	35.4	44.8	0.0479	16.5	0.491	116	5.84E-05	0.0050	0.8540	0.1160	0.1240	0.0257
			1-2	DU-31 (1-2)	0.743	4.98	12.6	49.2	34.1	0.067	17	0.516	140	1.90E-05	0.0054	0.7680	0.1270	0.1190	0.0298
			2-3	DU-31 (2-3)	0.735	5.96	12.9	68.2	25	0.0415	16.7	0.519	109	1.09E-05	0.0050	0.6490	0.1100	0.0919	0.0270
	DU-32	ISM	0-1	DU-32 (0-1)	0.879	8.99	12.4	31.6	28.9	0.0428	15.7	0.535	118	3.48E-05	0.0063	0.7760	0.1220	0.1150	0.0048
			1-2	DU-32 (1-2)	0.535	7.1	11.1	23.4	20.9	0.0428	15.3	0.535	104	7.54E-06	0.0047	0.4910	0.0684	0.0754	0.0048
			2-3	DU-32 (2-3)	0.492	3.56	9.91	20.1	34.1	0.0394	14.2	0.492	90.2	7.59E-06	0.0405	3.5300	0.7460	0.5660	0.0047
	DU-33	ISM	0-1	DU-33 (0-1)	2.31	6.62	9.85	79.8	88.8	0.0435	14.9	0.491	290	3.69E-05	0.0081	0.4140	0.1040	0.0542	0.0852
			1-2	DU-33 (1-2)	1.84	9.6	12.3	96.6	66.2	0.0413	17.8	0.516	354	1.67E-05	0.0066	0.4510	0.1280	0.0519	0.0501
			2-3	DU-33 (2-3)	0.666	5.35	10.3	52.6	42.8	0.0423	16.4	0.529	234	1.21E-05	0.0049	0.4010	0.0650	0.0555	0.0579
	DU-34	ISM	0-1	DU-34 (0-1)	1.05	5.13	14	32.6	41.4	0.044	22	0.523	182	6.03E-05	0.0178	1.7200	0.3960	0.2530	0.0330
			1-2	DU-34 (1-2)	0.557	4.95	14.6	33.2	31.9	0.0447	24.3	0.498	177	2.82E-05	0.0098	1.1900	0.2100	0.1840	0.0476
			2-3	DU-34 (2-3)	0.537	3.69	12.1	33.1	25.9	0.043	20.1	0.537	222	3.02E-05	0.0051	0.6510	0.1160	0.0973	0.0050
	DU-35	ISM	0-1	DU-35 (0-1)	0.512	4.4	14.5	52.9	22.6	0.0415	17.8	0.512	174	4.05E-05	0.0053	0.6160	0.1040	0.0931	0.0284
			1-2	DU-35 (1-2)	0.531	3.81	12.3	29.1	19	0.0425	15.3	0.531	168	1.31E-05	0.0050	0.7040	0.1060	0.1190	0.0396
			2-3	DU-35 (2-3)	0.524	3.37	9.45	27.8	12.4	0.042	14.2	0.524	141	1.02E-05	0.0049	0.2500	0.0334	0.0355	0.0050

Please see notes at the end of the table.

Table B-1
Residual Soil Data
Willamette Cove Upland Facility

Sample Location	Decision Unit	Sample Type	Sample Depth (feet bgs)	Sample ID	Concentration in mg/kg														
					Antimony	Arsenic	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Dioxin/Furan TEQ	Dibenzofuran	Total HPAH	Total LPAH	cPAHs	Total PCBs
Reference Concentrations				ISM Background	0.29	8.8	39	24	27	0.073	23.4	0.33	105						
				Composite Background	0.56	8.8	76	34	79	0.23	47	0.71	180						
				Plant RBC	5	18	1.0	70	120	0.30	38	0.52	160						40
				Invertebrate RBC	78		0.4	80	1700	0.10	280	4.10	120			18	29		
				Bird RBC		575	87.0	88	33	0.015	139	3.42	673	8.90E-05					0.734
				Mammal RBC	2.70	83	342	82	122	3.53	20	1.1	201	6.10E-06	0.01	5.6	100		0.098
				Cap Material[1]	0.53	3.1	14	18	5	0.042	18	0.54	55	1.40E-06	0.005	0.1	0.08	0.01	0.005
East Parcel	DU-36	ISM	0-1	DU-36 (0-1)	3.77	5.03	20.1	57.9	73.2	0.0398	22.6	0.498	266	4.21E-05	0.0060	0.6170	0.0892	0.0823	0.0279
			1-2	DU-36 (1-2)	3.44	4.23	17.3	56.7	130	0.0606	19	0.52	222	3.70E-05	0.0082	0.7770	0.1290	0.1030	0.0050
			2-3	DU-36 (2-3)	3.62	4.12	14.4	46.3	63.3	0.0449	18.3	0.526	190	2.80E-05	0.0050	0.2950	0.0564	0.0379	0.0284
	DU-38	ISM	0-1	DU-38 (0-1)	1.31	3.71	13.1	27.7	30.5	0.0454	16.5	0.536	110	2.94E-05	0.0056	0.5940	0.0920	0.0828	0.0412
			1-2	DU-38 (1-2)	4.88	3.76	12.3	56	76.7	0.0415	16	0.519	102	1.90E-05	0.0051	0.4550	0.0853	0.0635	0.0444
			2-3	DU-38 (2-3)	3.71	4.06	13.6	51.4	51.3	0.0421	17.1	0.527	108	1.05E-05	0.0051	0.5190	0.0738	0.0442	0.0300
	DU-37	Composite	0-1	DU-37 (0-1)	0.495	3.72	17.4	26.1	39.3	0.0396	18.6	0.572	74.4	6.78E-07	0.0050	0.0834	0.0210	0.0124	0.0049
			1-2	DU-37 (1-2)	0.495	3.00	14.9	21.4	12.6	0.043	18.8	0.537	61.5	6.32E-07	0.0050	0.1050	0.0213	0.0114	0.0050
			2-3	DU-37 (2-3)	0.513	2.85	13.4	16.9	8.96	0.0411	17.1	0.513	52.2	5.69E-07	0.0115	0.8510	0.2540	0.0970	0.0051
	DU-39	Composite	0-1	DU-39 (0-1)	0.534	2.69	13.4	21.3	6.09	0.0427	16	0.534	62.8	3.68E-06	0.0049	0.0270	0.0172	0.0057	0.0049
			1-2	DU-39 (1-2)	0.56	3.24	15.1	17.9	5.11	0.0448	18.3	0.615	57.4	1.38E-06	0.0049	0.0247	0.1750	0.0057	0.0049
			2-3	DU-39 (2-3)	0.525	3.44	16	18.4	6.88	0.042	19.2	0.525	54.3	1.36E-06	0.0049	0.0955	0.1290	0.0124	0.0049
	DU-40	Composite	0-1	DU-40 (0-1)	0.509	2.88	12.9	16.2	3.75	0.0407	16.3	0.509	44.3	7.34E-07	0.0050	0.0249	0.0174	0.0057	0.0049
			1-2	DU-40 (1-2)	0.513	3.4	13.4	15.4	3.47	0.0411	17.7	0.513	44.7	5.18E-07	0.0050	0.0281	0.0175	0.0061	0.0050
			2-3	DU-40 (2-3)	0.525	3.13	13.7	16.6	3.1	0.042	18.2	0.525	45.1	5.52E-07	0.0051	0.0279	0.0177	0.0061	0.0050
	DU-43	Composite	0-1	DU-43 (0-1)	0.503	2.92	13.8	18.8	5.42	0.0402	16.9	0.522	53.9	3.00E-06	0.0049	0.1200	0.0236	0.0163	0.0051
			1-2	DU-43 (1-2)	0.536	2.89	14	18.7	9.65	0.0429	18.5	0.536	56.4	1.26E-06	0.0051	0.1220	0.0813	0.0106	0.0051
			2-3	DU-43 (2-3)	0.523	3.06	13.8	16.3	4.35	0.0418	18.4	0.523	46	6.63E-07	0.0050	0.0616	0.0174	0.0097	0.0050
	DU-44	Composite	0-1	DU-44 (0-1)	0.619	3.12	14	17.9	13	0.0394	17.7	0.492	83.7	1.38E-06	0.0050	0.1430	0.0294	0.0180	0.0049
			1-2	DU-44 (1-2)	0.486	3.24	14.3	15.7	6.23	0.0389	17.2	0.486	51.3	8.37E-07	0.0050	0.0910	0.0206	0.0127	0.0049
			2-3	DU-44 (2-3)	0.505	3.06	13.2	15	5.94	0.0404	16.0	0.505	45.9	7.25E-07	0.0049	0.0840	0.0171	0.0129	0.0048
	DU-41	ISM (Berm Sample)	0-1	DU-41 (0-1)	2.81	50.1	16.9	78.6	83.8	0.262	16.5	0.531	139	2.55E-04	0.0184	2.1100	0.3120	0.3360	0.0691
			1-2	DU-41 (1-2)	2.39	14.1	20.7	71.1	129	0.108	18.4	0.514	165	2.42E-04	0.0427	1.9400	0.5590	0.2760	0.0926
			2-3	DU-41 (2-3)	1.69	19.6	21.7	45.2	109	0.0732	21.7	0.511	182	1.55E-04	0.0129	1.0800	0.2310	0.1490	0.0438

Notes:

1. Generally equal to the average concentration in DU-39 and DU-40.
2. Definition of table shading:
   - Proposed for removal for hot spot excavation or to adddress excess human health risk.
   - Upper 0.5 feet proposed for removal for hot spot excavation.
   - COC was not detected. Value shown is the detection limit.

Table B-2
Ecological Residual Risk Screening
Willamette Cove Upland Facility

Location	Decision Unit	Maximum HQ	HI	Primary COC	Controlling Receptor
West Parcel	DU-1	5.4	8.7	Hg	Bird
	DU-2	8.3	15	Hg	Bird
	DU-3	4.3	5.1	D/F	Mammal
	DU-4	5.1	10	Hg, D/F	Bird, Mammal
	DU-5	--	--	Cr	Invertebrate
	DU-6	10	13	Hg	Bird
	DU-7	8.7	9.1	Hg	Bird
	DU-8	--	--	Hg	Bird
	DU-9	9.4	12	Hg	Bird
Central Parcel	DU-10	--	--	Hg	Bird
	DU-11	--	--	Hg	Bird
	DU-12	--	--	Hg	Bird
	DU-13	--	--	Hg	Bird
	DU-14	--	--	Hg	Bird
	DU-15	--	--	Hg	Bird
	DU-16	--	--	Hg	Bird
	DU-17	8.1	9.4	Hg	Bird
	DU-18	--	--	Hg	Bird
	DU-19	--	--	Hg	Bird
	DU-20	9.1	9.6	Hg	Bird
	DU-21	--	--	Hg	Bird
	DU-22	--	--	Hg	Bird
	DU-23	--	--	Hg	Bird
	DU-24	6.2	6.2	Hg	Bird
	DU-25	7.7	9.6	Hg	Bird
	DU-26	--	--	Hg	Bird
	DU-42	1.4	1.4	D/F	Mammal

Please see notes at the end of the table.

Table B-2
Ecological Residual Risk Screening
Willamette Cove Upland Facility

Location	Decision Unit	Maximum HQ	HI	Primary COC	Controlling Receptor
East Parcel	DU-27	3.9	8.2	D/F	Mammal
	DU-28	--	--	Hg	Bird
	DU-29	2.5	3.8	D/F	Mammal
	DU-30	11	19	Hg	Bird
	DU-31	3.1	5.9	D/F	Mammal
	DU-32	5.7	8.1	DbF	Mammal
	DU-33	6.1	12	D/F	Mammal
	DU-34	4.9	9.3	D/F	Mammal
	DU-35	2.1	3.9	D/F	Mammal
	DU-36	6.1	11	D/F	Mammal
	DU-37	1.2	1.3	DbF	Mammal
	DU-38	4.8	7.5	D/F	Mammal
	DU-39	0.6	0.6	D/F	Mammal
	DU-40	0.1	0.1	D/F	Mammal
	DU-41	42	49	D/F	Mammal
	DU-43	0.5	0.5	D/F	Mammal
	DU-44	0.2	0.5	D/F	Mammal

Notes:
1. Definition of Shading

Proposed excavation to 3 feet so no residual data. The HQ in Layer 3 is greater than 10.

Proposed excavation to 2.5 so residual data uncertain. Excavation expected to reduce residual HQ to less than 10.

Soil berm to be removed. Pending verification sampling, cap design based on adjacent DU.

2. HQ = Hazard Quotient
3. HI = Hazard Index
4. Cr = Chromium
5. DbF = Dibenzofuran
6. D/F = Dioxin/furan
7. Hg = Mercury

Table B-3
Standard Cap Design Evaluation
Willamette Cove Upland Facility

Location	Decision Unit	Hazard Index Assuming Complete Mixing in Upper 3 Feet																			
		Cap Thickness = 1 Foot				Cap Thickness = 1.5 Feet				Cap Thickness = 2 Feet				Cap Thickness = 2.5 Feet				Cap Thickness = 3 Feet			
		Plant	Invert	Bird	Mammal	Plant	Invert	Bird	Mammal	Plant	Invert	Bird	Mammal	Plant	Invert	Bird	Mammal	Plant	Invert	Bird	Mammal
West Parcel	DU-1	2	2	2	4	2	2	2	3	0.5	0.4	0.4	2	0.4	0.3	0.3	1.0	<1	<1	<1	<1
	DU-2	3	2	9	6	2	1.0	3	4	1.1	0.6	2	3	0.6	0.4	0.4	2	<1	<1	<1	<1
	DU-3	0.3	0	0.1	2	0.3	0	0.1	2	0	0	0.1	2	0	0	0	0.9	<1	<1	<1	<1
	DU-4	0.7	0.6	0.4	5	0.3	0.2	0.1	3	0	0	0	2	0	0	0	1.3	<1	<1	<1	<1
	DU-5	na																			
	DU-6	na																			
	DU-7	0.6	1.2	6	2	0.3	0.8	5	1.3	0	0	0	1.1	0	0	0	0.7	<1	<1	<1	<1
	DU-8	na																			
	DU-9	0.8	1.5	8	3	0.7	1.2	6	2	0.3	0.8	5	1.5	0	0	0	1.1	<1	<1	<1	<1
Central Parcel	DU-10	na																			
	DU-11	na																			
	DU-12	1.4	2	12	1.2	1.2	2	10	1.0	0.7	1.3	7	0.6	0	0	0	0.3	<1	<1	<1	<1
	DU-13	na																			
	DU-14	na																			
	DU-15	na																			
	DU-16	2	3	20	2	2	2	16	1.2	2	2	12	1.1	1.4	1.2	7	0.9	<1	<1	<1	<1
	DU-17	1.1	2	10	1.4	0.4	1.2	8	0.6	0.4	1.1	7	0.5	0.3	0.9	6	0.3	<1	<1	<1	<1
	DU-18	na																			
	DU-19	3	3	18	7	3	2	14	6	2	2	10	4	1.4	1.0	6	2	<1	<1	<1	<1
	DU-20	0.3	0.9	6	0.5	0.3	0.8	6	0.5	0.2	0.7	5	0.4	0	0	0	0.3	<1	<1	<1	<1
	DU-21	1.4	2	10	3	1.2	1.4	8	2	0.9	1.1	7	2	0	0	0	1.0	<1	<1	<1	<1
	DU-22	na																			
	DU-23	na																			
	DU-24	0.3	0.9	6	1.0	0.3	0.8	5	0.8	0	0	0	0.6	0	0	0	0.4	<1	<1	<1	<1
	DU-25	2	2	9	2	2	2	8	1.4	0.9	1.1	7	0.8	0	0	0	0.3	<1	<1	<1	<1
	DU-26	na																			
	DU-42	0	1.1	7	1.4	0	0.9	6	1.2	0	0.8	5	1.0	0	0	0	0.8	<1	<1	<1	<1
East Parcel	DU-27	2	2	2	6	1.2	0.5	2	5	0.8	0.5	0.4	3	0.3	0.1	0	2	<1	<1	<1	<1
	DU-28	6	5	15	8	5	4	12	6	3	3	9	5	1.0	0.7	0.6	2	<1	<1	<1	<1
	DU-29	0.8	0.4	1.4	3	0.5	0.4	0.3	2	0.5	0.3	0.3	2	0.1	0	0	0.8	<1	<1	<1	<1
	DU-30	na																			
	DU-31	1.0	0.6	0.6	3	0.7	0.5	0.4	3	0.5	0.4	0.3	2	0.1	0	0	1.4	<1	<1	<1	<1
	DU-32	0.8	0.3	0.4	3	0.4	0	0.2	3	0.4	0	0.1	3	0.1	0	0	2	<1	<1	<1	<1
	DU-33	3	3	3	7	3	2	2	6	2	2	2	5	0.6	0.4	0.3	3	<1	<1	<1	<1
	DU-34	1.5	2	0.8	6	1.2	1.3	0.6	4	0.1	0	0.1	3	0.1	0	0	2	<1	<1	<1	<1
	DU-35	1.3	1.5	0.8	5	1.2	1.3	0.7	4	0	0	0	3.4	0	0	0	1.8	<1	<1	<1	<1

Table B-3
Standard Cap Design Evaluation
Willamette Cove Upland Facility

Location	Decision Unit	Hazard Index Assuming Complete Mixing in Upper 3 Feet																			
		Cap Thickness = 1 Foot				Cap Thickness = 1.5 Feet				Cap Thickness = 2 Feet				Cap Thickness = 2.5 Feet				Cap Thickness = 3 Feet			
		Plant	Invert	Bird	Mammal	Plant	Invert	Bird	Mammal	Plant	Invert	Bird	Mammal	Plant	Invert	Bird	Mammal	Plant	Invert	Bird	Mammal
	DU-36	3	2	3	7	2	2	3	6	2	1.3	2	5	0.6	0.3	0.3	2	<1	<1	<1	<1
	DU-37	0	0	0	0.6	0	0	0	0.7	0	0	0	0.7	0	0	0	0.7	<1	<1	<1	<1
	DU-38	1.2	0.4	2	5	0.7	0.3	0.5	4	0.2	0	0.1	3	0.1	0	0	2	<1	<1	<1	<1
	DU-39	na																			
	DU-40	na																			
	DU-41	na																			
	DU-43	na																			
	DU-44	na																			

Notes:

1. Definition of Shading
   - Proposed excavation to 3 feet so no residual data. The HQ in Layer 3 is greater than 10 so assume enhanced cap.
   - Residual HQ greater than 10; enhanced cap.
   - Soil berm to be removed. Pending verification sampling, cap design based on adjacent DU.
   - Residual HI less than 1. No cap required.
   - Selected cap thickness
2. HQ = Hazard Quotient
3. HI = Hazard Index