60% Remedial Design Engineering Design Report

Willamette Cove Upland
Portland, Oregon

Prepared for:
Port of Portland
and
Metro

Prepared by:
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Acronyms and Abbreviations

Apex	Apex Companies, LLC
bgs	below ground surface
BMP	best management practice
BNSF	Burlington Northern Santa Fe
BODR	Basis of Design Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
City	City of Portland
CMMP	Contaminated Media Management Plan
COC	contaminant of concern
COP	City of Portland
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CQA/QC	Construction Quality Assurance/Quality Control
cy	cubic yard
D/F TEQ	dioxin/furans toxic equivalent
DEQ	Oregon Department of Environmental Quality
DU	decision unit
ECSI	Environmental Cleanup Site Information
EIS	Environmental Impact Statement
EPA	US Environmental Protection Agency
ERP	Emergency Response Plan
ESCP	erosion and sediment control plan
Facility	Willamette Cove Upland Facility
FEMA	Federal Emergency Management Agency
FS	feasibility study
HASP	Health and Safety Plan
HI	Hazard index
HQ	Hazard quotient
ICIAP	Institutional Control Implementation and Assurance Plan
Metro	Regional government in greater Portland Oregon
mg/kg	milligram per kilogram
MHW	mean high water
NAD88	North American Vertical Datum 1988
NOAA	National Oceanic and Atmospheric Administration
OLW	ordinary low water
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PFAS	per- and polyfluoroalkyl substances
PHSS	Portland Harbor Superfund Site
Port	Port of Portland
PRG	preliminary remediation goal
RA	remedial action
RAO	Remedial Action Objective
RBC	risk-based concentration
RD	Remedial Design
RDI	Remedial Design Investigation

RG	remediation goal
ROD	Record of Decision
SAP	Sampling and Analysis Plan
Sf	square feet
SRDI	Supplemental Remedial Design Investigation
SVOCs	Semi-volatile organic compounds
TOB	top of bank
TODP	Transportation and Off-Site Disposal Plan
TPH	Total petroleum hydrocarbons
UCL	upper confidence limit
UPRR	Union Pacific Railroad
VCP	Voluntary Cleanup Program
VOCs	Volatile organic compounds
WG	Willamette Greenway

Signatures

DRAFT

Herb Clough Date

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1 Introduction

Apex Companies, LLC (Apex) prepared this 60% Remedial Design (RD) Engineering Design Report for the Willamette Cove Upland Facility (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 RD, 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 US Environmental Protection Agency (EPA) (referred to in this report as the "In-Water Action" being conducted by the "In-Water Team").

The DEQ selected a final soil remedial action (RA) for the Site in the Record of Decision (ROD) (DEQ, 2021). In summary, the selected RA 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;
- 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[2] 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 caps and soil covers. A Cap Inspection and Maintenance Plan, a Contaminated Media Management Plan (CMMP), and a Community 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 RD 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.

The purpose of the 60% RD Engineering Report is to present the engineering analysis supporting the RD drawings and specifications and provide the supporting plans for implementing the RA. The RD Engineering Report scope includes:

[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.

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

- Design criteria and standards;
- Engineering evaluations;
- Construction schedule;
- Description of the RA;
- Permitting requirements;
- Disposal requirements;
- Construction quality assurance and quality control; and
- Community outreach and long-term planning.

Supporting information includes 60% RD drawings and specifications (Appendix A and B, respectively), engineering analysis (Appendix C through H), and project work plans that include the following:

- Transportation and Off-Site Disposal Plan (TODP, Appendix I)
- Inadvertent Discovery Plan (Appendix J)
- Construction Quality Assurance/Quality Control (CQA/QC) Plan (Appendix K)
- Sampling and Analysis Plan (SAP, Appendix L)
- Health and Safety Plan (HASP, Appendix M)
- Emergency Response Plan (ERP, Appendix N)
- Community Outreach Plan (Appendix O)
- Institutional Control Implementation and Assurance Plan (ICIAP, Appendix P)
- Cap Inspection and Maintenance Plan (Appendix Q)
- CMMP (Appendix R)

Prior work that serves as the primary basis for the RD Engineering Report includes the following.

- *Draft Remedial Design Investigation Evaluation Report, Willamette Cove Upland Facility* (RDI; Apex 2023a). This report discusses the field investigations and sampling results for soil in the upper 3 feet across the site.
- *Response to Oregon Department of Environmental Quality Comments on the Remedial Design Investigation Evaluation Report, Willamette Cove Upland Facility* (Apex 2023b). This letter responds to DEQ comments on the RDI report (a revised RDI report was not required by DEQ).
- *Basis of Design Report, Willamette Cove Upland Facility* (BODR; Apex, 2025). The BODR presents the following: preliminary design criteria, data gaps, preliminary excavation and capping plans, preliminary residual risks, future monitoring and maintenance requirements, design studies needed, and a conceptual design and construction schedule.
- *Remedial Design/Remedial Action Work Plan, Willamette Cove Upland Facility* (RD/RA Work Plan; Apex, 2026). The RD/RA Work Plan presents planned RD/RA tasks, updated residual risks, a proposed design and construction schedule, project team, summary of the proposed remedy, performance standards and design criteria, permitting and other requirements, potential disposal facilities, proposed additional investigation/studies, design/implementation special issues, institutional controls, construction means/methods, and documentation requirements.

In addition, a Supplemental RDI (SRDI) is underway. The data from the SRDI will be incorporated into the 90% RD as the data are received. The SRDI will be documented in a future report.

2 Project Area Description

2.1 Location and General Description

The Site is located along the northeastern bank of the Willamette River in the St. Johns area of Portland, Oregon. Figure 1 shows the location of the Site. It is situated 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. Figure 2 provides a current plan of the Facility and the surrounding area. For describing the Site, it has been divided into the Richmond, West, Central, and East Parcels as shown in Figure 2.

The Site is approximately 3,300 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 historically created primarily because 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 of upland area that is inland from the line of ordinary low water (OLW). 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 1988 [NAVD88]) to the property line with the Union Pacific Railroad (UPRR). DEQ and EPA have agreed that the riverbank at the Facility (defined as the area from the waterline to the top of bank [TOB]) will be addressed separately as part of the In-Water Action. Although the feasibility study (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.[3] The Site for the RD/RA, therefore, is that portion of the Facility from the TOB to the inland property line and covers an area of approximately 19.3 acres, divided as follows: Richmond Parcel (0.58 acres), West Parcel (4.27 acres), Central Parcel (8.09 acres), and East Parcel (6.31 acres).

The Site is bordered on the northeast by the UPRR property and rail 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 vacant industrial property (Crawford Street site, DEQ ECSI #2363). 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). Toward the river, the Site is bordered by the riverbank and the surface water of the cove and Willamette River. The Fund Lead 11 Project Area is adjacent to the southeast corner of the Site, between the BNSF property and the existing McCormick & Baxter cap.

2.2 Existing Conditions

2.2.1 Ownership and Access

This section discusses the Site and adjacent properties. Relevant parcels are shown in Figure 2 and discussed below.

Project Site. The Site has been owned by Metro since 1996. On the river side, the Site boundary is the top of the riverbank, but Metro ownership extends down to OLW. No special access requirements are needed along the riverside, but construction work will be conducted by the In-Water Team on the riverbank and in the

[3] The Willamette Cove riverbanks were excluded from consideration in the selected cleanup for the upland site in DEQ's 2021 Record of Decision with the understanding that the In-Water Action would meet or exceed the upland cleanup criteria. More recently, EPA clarifications indicate that the In-Water Action may not achieve the upland cleanup requirements. Clarification of the residual risks on the riverbank will be addressed in future work.

adjacent river. The In-Water Team will also use the upland property for staging/access during the In-Water Action. Coordination of upland RA and the In-Water Action will be required.

BNSF Railroad Embankment. BNSF Railway owns and operates rail lines adjacent to and southeast of the Site. No excavation or capping are planned on the BNSF property. However, excavation and capping are planned up to the property line shared with the Site. Excavation to the property line may impact soil on the BNSF property up to approximately 5 feet from the property line (debris may cross the property line, disturbing off-site soil when removed; the side slope of an excavation to the property line could extend over the line). Feathering of slopes related to excavation or capping would be facilitated by smooth transitions several feet beyond the property line. In addition, to facilitate excavation/capping to the property line, it is desirable to place temporary facilities (erosion control, temporary perimeter fencing) several feet onto the BNSF side of the property line. Therefore, an access agreement will be requested with BNSF for a narrow strip along the property line to address the above needs.

UPRR Railroad. UPRR operates a rail line adjacent to and north of the Site. No excavation or capping are planned on the UPRR property. However, for the reasons stated above for the BNSF property, an access agreement will be requested with UPRR for a narrow strip along the property line. In addition, access to the Site must cross the UPRR railroad at an uncontrolled crossing.

Crawford Street. The Crawford Street property, located northwest of the Site, is owned by Steel Hammer Properties, LLC. No excavation or capping are planned on the Crawford Street property. However, for the reasons stated above for the BNSF property, an access agreement will be requested with Steel Hammer Properties, LLC, for a narrow strip along the property line.

2.2.2 Topography

Figure 3 shows the Site and nearby topography. Overall, the topography of the Site 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 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 southeastern 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.

2.2.3 Vegetation and Site Improvements

The Site is currently vacant, covered with invasive and native vegetation, and it provides habitat for opportunistic use by wildlife. Nine monitoring wells are present along the TOB. Remnants of previous structures include a large concrete slab foundation and a paved roadway in the eastern portion of the Site, pavement on the Richmond Parcel, as well as several smaller concrete slabs or foundations. The site is not managed for any human use and is posted to prohibit trespassing. However, trespassers do come on the site (e.g., homeless persons and joggers/walkers).

In 2015, Metro conducted a vegetation survey of the Facility that identified approximately 1,000 native trees on the Site and riverbank. Native species identified on the Site include Pacific Madrone, Bigleaf Maple, Oregon Ash, Black Cottonwood, Oregon White Oak, Pacific Willow, and Scouler's Willow.

2.2.4 Soil, Surface Water, and Groundwater

The Site is situated on a terrace created by historical filling. Based on historical maps and photographs, the fill was placed on lowlands and outward into the Willamette River prior to and concurrent with development (early 1900s). The thickness of the fill across the Site is generally in the range of 20 to 30 feet; however, in places, the fill thickness 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).

There is no surface water on the Site. The Willamette River is adjacent to the Site with the following river levels: OLW of 6.9 feet, MHW of 13.3 feet, and ordinary high water of 20.1 feet (NAVD88). The Site is composed of permeable sandy soils, so rainfall typically infiltrates without surface runoff or sheet flow. Therefore, there are no defined stormwater ditches or infrastructure draining on or leading from the Site. No significant rills in the riverbank related to stormwater runoff have been observed.

Groundwater levels were measured in Site monitoring wells over multiple events between 2002 and 2025, including continuous water level monitoring for several years in four monitoring wells. Depth to groundwater at the Site has ranged from 21 to 37 feet below the ground surface (bgs), corresponding to groundwater elevations ranging from 7.1 to 21.7 feet (NAVD88).

2.2.5 Cultural and Historical Resources

A cultural/historical resource survey of the Site was conducted in 2003 (Archaeological Investigations Northwest, Inc., 2003) with the conclusion that there are no significant archaeological or historical resources identified. In addition, during removal action excavation activities in 2015/2016, an archaeologist was on site to observe debris encountered in one area of the Central Parcel. The conclusion of the archaeologist was that the brick and other debris encountered should not be recorded as an archaeological site.

2.2.6 Nature and Extent of Contamination

Contaminants of concern (COCs) were evaluated in the RDI and SRDI. COCs detected at least once above remediation goals (RGs)[4] include the following:

- Metals (antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc);
- Dioxin/furans toxic equivalent (D/F TEQ);
- Dibenzofuran;
- Polycyclic aromatic hydrocarbons (PAHs); and
- Polychlorinated biphenyls (PCBs).

Figures 4 through 6 summarize the lateral extent of COCs exceeding RGs and hot spot levels. The extent of COCs at the Site is summarized as follows.

- COCs exceeding RGs in soil extend laterally throughout most of the Site.
- In most areas, COCs exceeding RGs in soil extend at least to the depth of the design investigation sampling (3 feet bgs).
- COC concentrations in soil beneath the concrete slabs on the East Parcel are below RGs.

[4] RGs are risk-based concentrations that are protective of ecological and human receptors based on current and reasonably like future Site uses—see Section 3.2.

- Primary ecological risk drivers are D/F TEQ, mercury, and lead on all parcels and PCBs on the West Parcel. 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.
- Primary human health risk drivers are D/F TEQ on all parcels and carcinogenic PAHs (cPAHs) on the Central Parcel. There are no human health hot spots remaining on the Site.

2.2.7 Utilities

Utility locate requests were completed for site investigation activities that covered the entire Site through the Oregon Utility Notification Center 811 system to identify the presence of underground utilities. In addition, City of Portland (City) records were reviewed for utilities on or adjacent to the site. The following underground utilities were identified.

- City storm sewer line (City Stormwater Outfall 49) that crosses the Central Parcel (shown in Figure 2). Except for two manholes extending above the ground surface, the stormwater line is below a depth of 10 feet bgs.
- City records[5] show two water lines entering the Site—one near the northwestern corner of the West Parcel and one on the east side of the Central Parcel. Utility locating will be conducted during the SRDI and updates will be provided.
- A fiberoptic line is located in the UPRR railroad right-of-way adjacent to the Site.

3 Design Criteria and Standards

3.1 Remedial Action Objectives

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 individual and cumulative acceptable risk;
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 Remediation Goals

The RG 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 RG values and the use of RGs 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 FS (Apex, 2019). The lowest RBC (or the background concentration, whichever is greater) for each COC was selected as the preliminary remediation goal (PRG) for that COC. PRGs are conservative screening levels used during the RD investigation to ensure that data collected adequately

[5] See Portland Maps at www.portlandmaps.com/detail/water/SEC-RICHMOND-N-BRADFORD-ST/R324112_did/ and www.portlandmaps.com/detail/water/S-N-PIERCE-AVE/R324110_did/.

characterized the nature and extent of contamination for use in RD. The PRGs correspond to the lowest RBC for ecological receptors and the lowest RBC for human receptors. The RBCs and PRGs are presented in Tables 1 and 2 (adopted from the BODR) for human and ecological receptors, respectively. RGs were developed from the PRGs and are listed in Table 3. RGs were used in RD as follows.

- Ecological receptors: For ecological receptors, soil concentrations representing decision units (DUs) of approximately 0.5 acres were compared to RGs. RD defines removal or risk management actions in each DU where a COC concentration equals or exceeds an RG for ecological receptors. The RG for each COC for ecological receptors is the lower of the plant, invertebrate, bird, or mammal RBC (or the background concentration if greater than the RBC) for that COC.
- Human health: For human health, soil concentrations representing DUs of approximately 0.5 acres will be screened against RGs. If concentrations are lower than RGs, then the risks are acceptable. If any COC concentrations exceed RGs, soil concentrations representing exposure areas (exposure point concentrations) will be estimated for those COCs and compared to RGs. The exposure areas to be evaluated are the West, Central, and East Parcels, corresponding to the primary exposure areas used in the baseline risk calculations (Formation Environmental, 2013 and 2014). The exposure point concentration for a parcel will be calculated as the 90% upper confidence limit of the mean (90 UCL) of the applicable data from the DUs within that parcel. As a result, for human health, it is possible for an individual DU COC concentration to exceed the RG but the exposure point concentration for the parcel to be less than the RG. In that event, no risk management would be required for human health for that COC on that parcel. RD will address removal or risk management actions on each parcel where a COC exposure point concentration equals or exceeds an RG for human health (generally focusing on addressing the DUs with higher COC concentrations until the risk at the parcel is acceptable). The RG for human health is the lowest of the human receptor RBCs (or the background concentration if greater than the RBC) for that COC (i.e., the RBCs for the park user receptor were adopted as the human health RGs).
- Risk uncertainty related to exposure point concentrations for human health will be evaluated by considering exposure to smaller areas (i.e., individual DUs) and exposure to just the upper 1 foot of soil (as opposed to the default exposure depth of 3 feet for the park user receptor).

In January 2024, after development of the RGs for the Site, the EPA updated the evaluation of lead risk from soil. For residential areas, acceptable lead concentrations in soil were set at 200 milligrams per kilogram (mg/kg) unless other sources of lead were present (e.g., indoor dust from lead-based paint) in which case the acceptable lead concentration in soil was set at 100 mg/kg. In October 2025, the EPA further revised the guidance for lead. The screening level for residential soil was maintained at 200 mg/kg, but the "removal management level" was increased to 600 mg/kg. The excavation evaluation for this RD includes further evaluation of residual concentrations of lead to verify the remedy is protective for lead in consideration of the updated EPA screening levels.

3.3 Hot Spot Levels

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 FS (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 were compared to hot spot levels. The RD specifies removal of human health hot spots and ecological non-dioxin/furan hot spots. Dioxin/furan hot spots for ecological receptors are removed to the extent practicable but may be managed

with a minimum 3-foot cap. 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.

3.4 Remedial Design Dataset

The excavation and cap designs use the data collected during the RDI and SRDI (the "remedial design dataset"). The remedial design dataset is defined and discussed in Appendix C.

3.5 Other Design Criteria

Additional design criteria to be used in RD are discussed below.

3.5.1 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 preserve native trees. These special techniques, implemented within the driplines of the trees and intended to preserve tree roots, limited excavation depths and residual soil cover thicknesses to approximately 6 inches. Therefore, given the widespread presence of COCs exceeding RGs and/or hot spot levels to depths greater than 6 inches, tree preservation would result in a corresponding increase in residual risk. Because of that increased residual risk, native tree preservation was evaluated only in DUs where the ecological hazard quotient (HQ) is less than 5 and the hazard index (HI) is less than 10 (limited to DU-3, DU-37, DU-38, DU-39, DU-40, DU-43, and DU-44).

3.5.2 Site Clearing

Invasive Species Removal. Invasive species (as defined by the City of Portland Nuisance Plant List[6]), including roots, will be cleared from the entire Site and composted (if soil can be removed) or disposed of off the Site. In areas targeted for excavation, root removal may be conducted in conjunction with excavation.

Woody Debris Salvage. The design evaluated potential for salvage of large trees cleared from the Site for reuse in habitat enhancement or other site features. In consultation with Metro and the In-Water Team, the number of trees will be identified that may be used in upland restoration or as large woody debris for the In-Water Action. If it is desired to salvage trees with intact root balls, all contaminated soil must be removed from the root ball.

3.5.3 Excavation Criteria

The following excavation criteria, developed from the RAOs and feedback from the DEQ during development of the Basis of Design Report (Apex, 2025), were used to design the planned excavation.

- Minimum Excavation
    - **Hot Spots.** The minimum excavation is based on removing soil exceeding hot spot levels for any receptor using the Baseline dataset defined in Appendix C. The lateral extent of excavation will be the full areal extent of a DU targeted for excavation. Vertically, each DU was divided into layers (with each layer 1 foot thick) and the full depth of each layer was sampled. For each layer targeted for removal, the full layer thickness will be removed if a concentration exceeds a hot spot level.

[6] www.portland.gov/bps/planning/environ-planning/documents/portland-plant-list/download

    - **Small Soil Piles.** Discrete soil piles that are small compared to the size of a DU may not have been adequately characterized by the sampling conducted in the DU. These soil piles will be removed for off-site disposal prior to conducting the planned excavation or capping in the DU.

- **Buried Hot Spots.** Layers with COC concentrations that exceed hot spot levels but are overlain by soil that does not exceed hot spot levels will be removed for off-site disposal. However, the overlying soil that does not exceed hot spot levels will be replaced in the DU.
- **Additional Excavation for Human Health Risk.** Human health risk will be evaluated using the residual data set following removal of hot spots. Risks will be calculated for exposure areas corresponding to the Richmond (to be conducted following the SRDI), West, Central, and East Parcels. If risks based on these exposure areas meet acceptable risk levels, no further excavation is needed. Where risks are unacceptable, additional excavation would be conducted until exposure area risks are acceptable.
- **Additional Excavation to Address Higher Relative Residual Risks.** The next step in the excavation evaluation is consideration of the practicability of removal of higher remaining residual risks. The practicability evaluation considers the relative risk reduction compared to the additional effort. Higher ecological risks were defined as an HQ greater than 5 or an HI greater than 10. The additional excavation needed to achieve these criteria and the associated risk reduction will be estimated. These will be compared to the risk reduction/soil volumes associated with the hot spot removals to assess the practicability of additional excavation.
- **Considerations of Risk Uncertainty.** The final step in the excavation evaluation will consider uncertainties in the risk assessments used to evaluate excavation requirements.
    - Additional potential hot spots and human health risks will be identified by evaluating baseline data adjusted for uncertainty based on replicate soil data. The associated soil volumes and risks will be estimated to assess if additional excavation would result in a proportionate risk reduction.
    - Human Health Risk for Smaller Exposure Areas. Human health risk will be estimated for both small areas (individual DUs) and for exposure to only shallow soil (top 1 foot within each parcel exposure area). The associated soil volumes and risks will be estimated to assess if additional excavation would result in a proportionate risk reduction.

3.5.4 Cap Criteria

Cap Thickness. Soil caps will be installed at locations that have post-excavation unacceptable residual risk. In general, caps will consist of soil with a thickness of 1 or 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). Cap thickness will be established as follows:

- Residual HI less than 1: No cap.
- Residual HQ equal to or less than 5 and residual HI equal to or less than 10: 1-foot-thick cap.
- Residual HQ greater than 5 or residual HI greater than 10: 3-foot-thick cap with demarcation layer defining the boundary between residual soil and the cap.
- If adjusted residual soil data (based on replicate data) exceeds hot spot levels or human health risk levels (on a DU basis), the cap thickness will be 3 feet and include a demarcation layer.

Cap and Other Fill Soil. Cap soils will generally consist of topsoil and general fill (e.g., silty sand). These materials will be obtained from on-site borrow or imported from off-site sources. In either case, unless

otherwise approved by the DEQ, these soils will have concentrations of Site COCs below the RGs or below DEQ Clean Fill Levels for chemicals without RGs. Prior to use, the soil will be evaluated for compliance with these criteria. Samples of borrow or imported soil will be collected for laboratory analysis and analyzed for metals (antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc), dioxin/furans, PAHs (including dibenzofuran), PCBs, total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), organochlorine pesticides, and per- and polyfluoroalkyl substances (PFAS).

Soil may be imported from off site for use as temporary roadways and staging pads, general fill, or topsoil. General fill may also be obtained from on-site borrow areas if it meets the criteria discussed above. Gravel (soil with particle sizes greater than No. 4 sieve size) from a virgin commercial source will be sampled for metals analysis only. The method and frequency of sampling imported fill or on-site borrow are discussed in Section 11.

3.5.5 Surface Drainage

Currently, the Site is relatively flat with no clear drainage channels. Most rainfall infiltrates into the ground surface. Post-remediation finish grades (after excavation/capping) will maintain these characteristics, emphasizing infiltration of rainfall. Finish grades may vary by several feet from current grades, but overall existing surface drainage will be maintained (i.e., the before and after surface gradients will be within the same range and the overall average gradients will be similar). If borrow materials are obtained from an on-site area, finish grade could be 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 mounded areas to accommodate variable habitats and/or program elements within the park.

3.5.6 Site Restoration

Site restoration will consist of planting finish grade with native trees, shrubs, and groundcover to establish vegetation that will prevent surface erosion and support native species. The top 1 foot of the caps will consist of topsoil to support the native vegetation. Areas that will not be capped will still receive 1 foot of topsoil.

Site restoration for the RA will be in accordance with City code requirements for vegetation replacement and mitigation. The City's Planning and Zoning Code, Title 33 overlays (e.g., Environmental Overlay, Heritage Overlay) impose enhanced tree protection requirements on development which includes the general Title 11 Tree Code. These standards are designed to preserve large, mature, and heritage trees that are ecologically or culturally significant. In accordance with Section 11.40.050, Table 40.3 Summary of Permit Requirements for Private Trees, a remediation site or development impact area must be planted with trees.

Sites with more than 24 required trees must have species diversity such that no more than 24% of required trees can be a single species. This does not apply to existing trees. Any trees required to be planted in the greenway overlay zone must be native species. At the time of planting, any broadleaf native trees within a remediation site must have a minimum planting size of 1/2" caliper. Coniferous trees must be installed at a minimum of 5 feet in height.

In accordance with Title 33, Section 33.440.230, Greenway Overlay Zones, there are several additional landscaping standards that apply. Required greenway landscaping must provide a minimum of one tree for every 20 lineal feet of river frontage, and a minimum of one shrub for every 2 lineal feet of river frontage.

To the extent feasible, restoration will be consistent with Metro's planned final use and Site Conservation Plan (riparian forest; Oregon white oak/madrone woodland; invasive species removal), but it is not intended to fully implement Metro's park master plan.

3.5.7 *Applicable or Relevant and Appropriate Requirements*

The RD will address the following requirements.

- Protection of Surface Water, Wetland, and Drinking Water. Earthwork activities could impact wetlands or water quality. See the temporary erosion control measures in the drawings and specifications (Appendix A and Appendix B). Construction stormwater permitting is discussed in Section 9.
- Air Emissions. Potential air emissions include fugitive dusts and engine exhausts. See Section 6.9.
- Waste Designation, Handling, Transport, and Disposal. The primary protective component of the RA is off-site disposal of contaminated soil. See Section 10.
- Impacts to Endangered or Protected Species or Migratory Birds. The RA activities will include impacts to upland habitat. The Site will be restored by planting with native species. See Section 8.6.
- Protection of Trees. RD will include actions to address local rules for protection of existing trees if possible, or replacement of existing trees if not. Tree preservation is discussed in Section 6.3; replacement of trees is discussed in Section 8.6.
- Protection of Archeological or Historically Sensitive Areas. Archeological and historically sensitive resources have been assessed (Archaeological Investigations Northwest, Inc., 2003). Remaining remnant structures are not historically significant and archeological resources are not expected to be encountered within the planned excavation. However, potential archeological resources are discussed in Section 8.8.
- Floodplain Impacts. 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. Planned changes to finish grade will be incorporated into the flood-rise analysis being conducted by the In-Water Team to verify the RA will not cause a rise in future floods. See Section 6.7.

4 Drawings

The 60% RD drawings are presented in Appendix A.

5 Specifications

The 60% RD specifications are presented in Appendix B.

6 Engineering Evaluations

6.1 Excavation Depths

Based on the criteria in Section 3.5.3, excavation depths were evaluated for each DU. The excavation depth analysis is presented in Appendix C (with supporting calculations in Appendix D). Design excavation depths are summarized in Table C-13.

6.2 Cap Design

Based on the criteria in Section 3.5.4, cap design was evaluated for each DU. The cap design analysis is presented in Appendix E. Cap design elements (layer types and thicknesses, demarcation layer requirements, material quantities) are summarized in Table E-1.

6.3 Tree Preservation

Appendix F presents an evaluation of trees that may be preserved during RA. Table F-1 identifies the trees that may be preserved, and the drawings and specifications identify the protection requirements to assure survival of these trees.

6.4 Woody Debris Salvage

The Site is covered with over 700 trees including over 600 native trees. Virtually all these trees will be removed to accommodate the RA (except as noted above in Section 6.3). Some of these trees may be used as large woody debris in the In-Water Action and the upland restoration, but the trees salvaged from the Site are not yet known. Appendix F provides a tree inventory summary (Table F-2) and evaluates storage area requirements. An area approximately 100 feet by 100 feet (0.25 acre) is adequate to store salvaged logs (maximum 100 feet in length, stacked four logs high).

6.5 Surface Drainage

In Appendix G, proposed finish grades were evaluated to compare post-RA surface drainage to existing conditions. Average surface slopes and drainage pathways before and after RA are similar. Potential for surface ponding is greater on the UPRR property, the east end of the Central Parcel, and the north side of the East Parcel. Finish grades and impacts on surface drainage will be further evaluated during 90% RD.

6.6 Geotechnical Considerations

In general, the work consists of shallow excavations (3 feet or less) and modest fills (3 feet or less) on a site where the current ground surface is generally flat. Therefore, there are no substantive geotechnical issues to be addressed during design. However, the work will include net fills that could induce settlement, fills at the top of the riverbank that could impact slope stability, and excavation near the toe of the BNSF railroad embankment that could impact slope stability of the embankment, and earthquakes could induce liquefaction-based settlement. These issues are evaluated below.

6.6.1 Settlement

Settlement resulting from net loading (cap soil less excavation) is evaluated in Appendix F. Expected settlement is summarized as follows.

West and Richmond Parcels: Up to ½ inch in the center of the parcel with at least half of the settlement occurring as the load is applied.

Central Parcel: ¼ inch or less with most of the settlement occurring as the load is applied.

East Parcel: 1 to 2 inches with up to half of the settlement occurring as the load is applied.

The predicted settlement is not expected to have an adverse effect on construction or long-term performance of the RA. Because a portion of this settlement will occur as the work progresses, potential settlement will be considered when specifying quality assurance activities (e.g., use of survey data to verify cap thickness).

6.6.2 Slope Stability

Potential effects of net fill at the top of the riverbank or excavation near the BNSF Railroad embankment are evaluated in Appendix F. The conclusions of these evaluations are summarized below.

Up to 3 feet of fill may be placed adjacent to the top of the riverbank. However, this material will be placed at the same slope as the proposed riverbank (ranging from 2H:1V to 3H:1V). For the granular materials composing the majority of the riverbank, the fill will not reduce the overall stability of the riverbank.

One DU adjacent to the property line with BNSF will require temporary excavation to a depth of 3 feet (DU-30). The edge of the excavation is approximately 30 feet from the toe of the railroad embankment, a distance greater than the height of the slope (25 feet). The proposed excavation will have no impact on the stability of the railroad embankment.

6.6.3 Seismic Considerations

The Site is flat, and there are no structures associated with the RA. The nature park will have limited structures including a restroom and picnic shelter. The primary seismic risk to the RA is liquefaction and associated ground deformations compromising the integrity of the cap. Potential liquefaction was evaluated by the In-Water Design Team (see Appendix F), and they concluded that the riverbank is susceptible to liquefaction during a design level earthquake that could result in lateral spreading and ground damage with deformations more than 5 feet. The ground movement associated with liquefaction could result in exposure of contaminated soil beneath the cap. It is not practicable to mitigate this potential damage. Rather, the Cap Inspection and Maintenance Plan includes contingency planning for repair of damage associated with an earthquake.

6.7 Flood Rise

FEMA floodplain maps show that the 100-year floodplain encroaches on portions of the Site.[7] Table F-3 shows that the net fill along the riverbank ranges up to 2 feet on the West Parcel (average 1.2 feet) and up to 3 feet on the East Parcel (average 2.3 feet). There is no net change on the Central Parcel. Net grade changes for 60% RD were provided to the In-Water Team design team to include in the flood-rise analysis conducted for the In-Water Action. The results of that analysis showed that the combined In-Water Action and upland RA will result in no rise in the base flood elevation (Maul Foster & Alongi, 2026).

6.8 Climate Change

Climate change is expected to result in increased temperatures and changes to 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 the Portland Harbor remedy design (EPA, 2021).

Survival of upland vegetation may be impacted by temperature increases. The planting plans include mixed specifies for grasses, shrubs, and trees, providing resiliency if certain species are affected by temperature shifts. The effects of climate change on peak flows in the lower Willamette have been studied with regional hydrodynamic models (RMJOC, 2018; Wherry et al., 2018). Peak river levels in the Portland area could exceed 1996 flood levels by up to 5.4 feet by 2100. These river levels could result in flooding of 1 to 5 feet in much of the Central and East Parcels. However, these areas are in the protected cove area, and flood velocities would not expect to negatively impact well-vegetated upland caps.

6.9 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

[7] See FEMA floodplain maps for the Portland metro region at: https://databasin.org/maps/new/#datasets=f55b00a6502c4e6ab971e0e89bc4ba3c

consistent with DEQ and EPA policy and guidance to promote, support, and implement sustainable practices that lessen the overall environmental impact of the cleanup. Green remediation best management practices (BMPs) are evaluated in Appendix F.

7 Construction Schedule

The proposed project schedule accounts for construction of the elements of the RA considering the expected coordination needed with the In-Water Action. The RA schedule is highly dependent on the In-Water Action schedule. The parties are conducting overlapping excavation (upland parties are excavating surface soil up to the existing TOB whereas the In-Water Action includes excavating the riverbank, moving the TOB inland). In addition, the In-Water Action will use the upland area for staging and access. Final installation of the upland cap and site restoration will be conducted in these areas only after the In-Water Team has vacated the upland site. Figure 7 presents the proposed construction schedule. Major work periods are summarized as follows.

- Phase 1: Excavation and Preliminary Cap (Year 1 Q3 and Q4). The In-Water Action 60% RD shows use of nearly the entire Site for equipment staging, stockpiling, potential treatment facilities, and worker offices/facilities. Use of the Site for the In-Water Action after upland RA would destroy the new vegetation and impact the integrity of the Site cap. Use of the Site prior to excavation would also create extra costs associated with addressing contaminated soil impacting removal of the In-Water Action support facilities. Therefore, Phase 1 of the upland RA will include excavation and disposal of contaminated soil and preliminary capping of residual soils. Temporary barge transloading infrastructure would be constructed to facilitate barge export of contaminated soil and import of cap soil. However, the barge transloading infrastructure would be removed prior to installation of the cap by the In-Water team. Furthermore, transport of materials by barge may be infeasible after layback of the riverbank. Therefore, upland import materials would be brought to the Site in Phase 1. The lower portion of the cap (general fill, excluding topsoil) would be placed during Phase 1. This reduces the area needed for stockpiling fill material and creates an uncontaminated working surface for the In-Water Action contractor. Topsoil would be imported to the Site and stockpiled in Phase 1. Any portions of the Site not used by the In-Water Action contractor would be temporarily stabilized against potential erosion.
- Hiatus: Inspect/Maintain Topsoil Stockpile and Temporarily Stabilized Areas (Year 2, Year 3, and Year 4 Q1). Based on the current understanding of the In-Water Action schedule, the Site would be used by the In-Water Action contractor for equipment staging, stockpiling, potential treatment facilities, and worker offices/facilities. Note that the actual start date for the In-Water Action is dependent on the sequencing of the other Portland Harbor sediment cleanup projects, so the In-Water Action schedule may change, resulting in a change to the upland schedule. Upland RA activities during the hiatus would be limited to inspection and maintenance of the topsoil stockpile and any temporarily stabilized areas not used by the In-Water Action contractor. Management of all other areas of the Site would be the responsibility of the In-Water Action contractor.
- Phase 2: Final Cap and Site Restoration (Q2/Q3 Year 4). The In-Water Action contractor will remove all support facilities from the Site and restore any general fill cap material disturbed by their actions. The stockpiled topsoil would be placed, and planting and irrigation installation would be completed.
- Construction Completion Report (Q3/Q4 Year 4).

8 Description of Remedial Action

The drawings and specifications in Appendix A and Appendix B present a detailed description of RA. This section presents a narrative description of the proposed work.

8.1 Mobilization

Mobilization will include setup of the project office and sanitary facilities, connection to utilities, preparation of worker parking and equipment staging areas, and transport of construction equipment to the project Site. Mobilization means and methods will be dictated by the contractor but are expected to be generally in accordance with the following.

- It is expected that the Richmond Parcel will be used for the project office, sanitary facilities, and worker parking. That parcel can accommodate a 40-foot roadway the full length, leaving a parcel 30 feet by 240 feet—sufficient space for two 60-foot office/breakroom/bathroom structures and 12 parking spaces.
- The contractor will provide temporary utilities through temporary connections (e.g., power) or portable facilities (e.g., drinking water, sanitary facilities).
- Overflow parking, equipment staging, and storage areas can be constructed on DUs 2 through 4. These DUs have no planned excavation. There is an area approximately 100 feet by 450 feet with only one or two trees. The area can be cleared and graded to approximate finish subgrade and covered with a temporary gravel pad to accommodate vehicle and equipment parking and material storage.

8.2 Site Preparation

Site preparation will include utility locates, setup of temporary site fencing, installation of erosion control facilities, and preparation of a barge loading facility.

The contractor will locate and protect all utilities. Known utilities are discussed in Section 2.2.7.

Temporary fencing and erosion control facilities (e.g., silt fence, construction entrance) will be per the drawings.

A temporary barge loading facility will be near the eastern end of the Central Parcel to support loading of contaminated soil and import of fill soil. The conceptual facility shown in Drawing Sheet GI-1.06 consists of up to four temporary piles installed during the in-water work window to secure barges during loading and off-loading activities. The contractor will identify loading methods, spill prevention, and barge anchoring details within the Construction Work Plan. Barges may be tied off to piles or dolphins at the loading location or may use other temporary anchoring methods, such as spuds to maintain the barge position during soil loading and off-loading activities. The barge loading facilities will also be used and removed by the In-Water Team.

8.3 Demolition and Clearing, Hauling, and Disposal

Demolition. Surface and subsurface debris will impact the ability to perform excavation and place cap materials effectively. Debris will be removed wherever practicable. The remnant structures and debris are defined on the drawings (see Drawing Sheets GI-2.05 through GI-3.02) and generally consist of remnant foundations, concrete building slabs, pavement, concrete debris (barriers, blocks, remnant piling), boulders, logs and poles, and miscellaneous trash.

Debris will be removed and sized using an excavator with a hammer attachment and/or a bucket with an articulating thumb. Soil will be removed from debris by shaking, brooming, or water spraying. Water will infiltrate and generated soil will be disposed of with contaminated soil.

To the extent feasible, debris will be separated for recycling. Potential recycling streams include concrete, asphalt pavement, wood, and metal (rebar, miscellaneous metal). Debris will only be recycled if soil can be removed (broom clean). Debris that is not recycled will be disposed of in a landfill.

Monitoring Wells. There are nine monitoring wells on the Site (see Figure 2). Seven of the monitoring wells are located within the planned bank layback (MW-1 through MW-6, MW-8). Protection of monitoring wells during construction projects involving significant earthwork is not practicable. The monitoring wells will be abandoned in accordance with Oregon Water Resources Department requirements (Oregon Administrative Rule 690-240-0510) prior to beginning the upland RA.

Clearing. Vegetation will be cleared using a combination of tractor mounted brush mowers, chain saws, excavators, and dozers with rake attachments. Trees targeted for salvage will be removed (without root balls) and stockpiled separately. Other vegetation will be mowed or dozed. Trash rakes will be used to consolidate vegetation without soil for removal. Vegetation without soil will be recycled at a green waste facility. Vegetation containing soil will be removed to be disposed of with contaminated soil.

Debris and vegetation removed from the site will be transported by truck or barge at the discretion of the contractor. See further discussions in Appendix H (Waste Designation Analysis) and Appendix I (Transportation and Off-Site Disposal Plan).

Debris and vegetation quantities to be removed are estimated as follows.

Material	Volume (Truck Cubic Yards)	Weight (Tons)	Truck Loads
Concrete	2,100	2,800	100
Asphalt Concrete	430	600	20
Other	420	300	14
Vegetation	5,000	300	167
Total	7,950	4,000	308

8.4 Excavation, Hauling, and Disposal

Excavation will be conducted to the depths indicated on the drawings, generally up to 3 feet bgs. The excavation evaluation is presented in Appendix C and Appendix D. The proposed excavation is summarized in Drawing Sheet C-2.00 in Appendix A. Excavation will be conducted using earthmovers, dozers, excavators, and/or front-end loaders. Subgrade and finish grading may be conducted using a grader. The machines may use a GPS grading system for real-time elevation control.

Contaminated soil excavation will be conducted to neat line planned depths using vertical cuts. Following receipt of verification sample results, the excavated areas will be shaped to create smooth transitions between adjacent DUs. Soil will be graded from higher points to lower, but soil will not be moved farther than half the distance across an immediately adjacent DU.

Appendix H and Appendix I discuss contaminated soil transport and disposal in greater detail. In general, contaminated soil will be loaded onto dry bulk barges for transport up the Columbia River to a transload facility located near the disposal facility. The disposal facility will be selected by the contractor from a list of acceptable disposal facilities.

Typical inland dry bulk barges are 195 feet by 35 feet, have a loaded draft up to 10 feet, and carry 1,500 to 2,000 tons. A draft of 10 feet corresponds to elevation -7 feet at OLW. The former dry dock area adjacent to the Central Parcel (between Stations 9+00 and 13+00) is a basin at least 350 feet long with a typical mudline elevation of -20 feet. In this basin, the -7-foot contour is approximately 80 feet from and parallel to the TOB. A mobile barge loading conveyor (reach up to 100 feet) would be staged at the TOB to load the barges.

At the transload facility near the landfill, contaminated soil would be off-loaded to trucks for the final transport segment to the landfill. Typical truck/trailer combinations carry 30 tons.

Table C-13 summarizes the final excavation depths and volumes. The estimated quantity of contaminated soil to be excavated is 50,100 cubic yards (cy; in-place). Based on the density of Site soil derived from the 2015 removal action (1.59 ton/cy), that volume corresponds to 79,700 tons. That corresponds to 45 barge loads or 2,600 truckloads.

8.5 Verification Sampling

Verification sampling is discussed in detail in the SAP in Appendix L. In summary, verification sampling will be conducted as follows.

- Where RDI or SRDI data are available after excavation (i.e., excavation depth is less than the depth of RDI or SRDI sampling—2 feet or less), the RDI/SRDI sample results will be used for verification, and no further sampling will be conducted.
- For DUs that are entirely within the planned bank layback, the soil below the excavation depth will be removed during bank layback, so no verification sampling will be conducted. [8]
- For DUs that are excavated to a depth of 3 feet, verification samples will be collected following excavation. Verification samples will be used for residual risks analysis. No further excavation is planned based on results. For DUs that are partially within the bank layback, the verification sample will be collected only from that portion of the DU that is outside of the bank layback.

Table C-13 identifies DUs targeted for verification sampling.

8.6 Capping

Capping will be conducted to the lines and grades indicated on the drawings. Most areas will be capped with 3 feet of soil, but some areas will have a 1-foot cap and some areas will have no cap.[9] The cap evaluation is presented in Appendix E. Figure 8 shows the extent of the proposed cap. Cap soil placement will be conducted

[8] The riverbank layback area will be sampled by the in-water construction team (either using previously collected leave surface sampling or by collecting samples following riverbank construction).

[9] Areas without a cap will receive 1 foot of topsoil to support new vegetation, identical to the planned design for the 1-foot-thick cap. To avoid confusing the contractor, the construction drawings refer to all areas with 1 foot of topsoil as receiving a 1-foot cap. The areas are distinguished only by more rigorous requirements for future inspection/maintenance in areas that are capped to address residual contamination.

primarily using dozers and graders. The machines may use a GPS grading system for real-time elevation control.

The 3-foot cap will consist of 2 feet of general fill (consisting of sand with gradation similar to existing Site soil) underlying 1 foot of topsoil. A demarcation layer consisting of brightly colored plastic mesh will be placed between the contaminated soil and the cap. The demarcation layer is intended to act as a visual indicator of a breach in the cap.

The 1-foot cap will consist of topsoil and will not have a demarcation layer. Because the area of 1-foot caps is limited, installation of the demarcation layer may be more efficient by including the demarcation layer in all locations. However, the demarcation layer will interfere with excavations for trees and shrubs on the 1-foot cap, more than offsetting any efficiencies gained in installing the demarcation layer.

Table E-1 lists the material quantities required for the cap. Total fill required is 43,400 cy of general fill (65,100 tons) and 24,200 cy of topsoil (32,700 tons) for a total of 67,600 cy of fill. Approximately 7,500 cy of general fill may be obtained from on-site borrow excavated from DU-37, DU-39, and DU-40, depending on evaluation during RA. The remainder of the fill will be imported from off-site sources. Imported fill for the caps will be transported to the Site by barge as described above for export of contaminated soil. Approximately 98,000 tons of import soil will be required, corresponding to approximately 55 barge loads.

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.

8.7 Planting

A total new landscape area of approximately 14.8 acres (644,630 square feet) will be restored with trees, shrubs and groundcover that meet the criteria in Section 3.5.6.[10] Drawing sheets L-1.00 through L-1.07 summarize the proposed planting. Tree and shrub quantities will be determined in 90% RD. Plant species have been selected from the Native Plants Restoration List (Appendix C) of the Portland Harbor Programmatic EIS and Restoration Plan.

A native mix of shrubs and groundcover will be planted with the new trees and will be planted generally within and riverward of the greenway setback. Areas outside of the tree, shrub, and groundcover planting zones will receive compost blanket as a measure for general slope stabilization. The compost blanket will be comprised of medium compost and a tackifier and will be installed via pneumatic blower or mechanical spreader to a depth of 2 inches for general slope stabilization. The compost blanket depth can be increased to 3 inches at steeper slopes or more erosive areas.

[10] The proposed plantings will be in accordance with Metro nature park design and City code requirements.

8.8 Erosion and Dust Control

BMPs applicable to demolition, clearing, excavation, capping, and restoration are described in the drawings (EC-1.01 through EC-1.07 in Appendix A). BMPs will be implemented to control erosion, stabilize exposed soils, and minimize sediment transport to the river during both during construction and between work phases. Erosion and dust control will generally include the following.

- Rock construction entrance
- Perimeter controls (e.g., silt fences, fiber rolls, or equivalent measures; construction entrance) to prevent sediment from leaving the Site or entering the river
- Wheel cleaning to include inspection and cleaning of wheels and evaluating need for wheel wash
- Temporary stabilization measures (e.g., hydromulch with sterile seeding, erosion control blankets, compost blankets, plastic sheeting) to protect disturbed areas prior to final stabilization
- Sequencing of excavation, stabilization, and restoration to support progressive stabilization of completed work areas
- Dust control BMPs including:
    - Water application to exposed soils, stockpiles, temporary access roads, and other surfaces as needed to prevent visible fugitive dust
    - Covering loads leaving the Site
    - Sweeping roadways
- Spill/dust control such as shields or shrouds during barge transfer activities
- Permanent vegetation for final restoration

Detailed performance criteria, monitoring requirements, and adaptive management responses are provided in the drawings and specifications.

During periods of inactivity between construction phases, erosion control measures will focus on stabilizing disturbed areas. Exposed areas not used by the In-Water Team will be fully stabilized at the completion of Phase 1. Stabilization measures will include application of hydromulching, compost blanket, or erosion control matting. Perimeter controls (e.g., silt fence) will be maintained throughout the inter-phase period. These controls will be inspected on a regular basis and after significant precipitation events, with accumulated sediment removed and damaged controls repaired or replaced as needed to maintain functionality. Inspection of inter-phase measures will be conducted at least monthly, with additional inspections performed following major storm events (e.g., approximately 1 inch or greater of rainfall within a 24-hour period, subject to refinement during final design).

8.9 Archeological Resources

As discussed in Section 2.2.5, no significant archaeological or historical resources have been identified on the Site. However, it is possible that significant resources may be encountered during site excavation, especially if excavations disturb the original floodplain surface underlying fill soils (planned excavations are not expected to penetrate below the fill soil). To address the potential for encountering significant resources, Appendix J contains an Inadvertent Discovery Plan prepared by Metro to cover Metro-owned park properties. The plan in Appendix J will be followed during the RA.

9 Permitting

RAs conducted under Oregon cleanup rules must obtain 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). It is anticipated that the work will not be conducted under permit exemptions, and required permits will be obtained.

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 1 acre. Required permits include a site development permit from the City 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 CMMP. The ESCP is included in the drawings and specifications (Appendix A and Appendix B), and the CMMP is included in Appendix R. No other permits are anticipated associated with the earthwork activities. The site development permit will address requirements for tree preservation and/or replacement under city code Title 11. The Site lies within the greenway overlay zone (including both River General and River Water Quality overlays), triggering a 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.

Permitting for the barge mooring facility will be addressed in the 90% RD.

10 Off-Site Disposal Facilities and Disposal Requirements

10.1 Waste Designation

Appendix H presents a waste designation analysis of contaminated soil. Based on the waste designation screening in Appendix H, excavated soil will not be designated as hazardous waste under federal or Oregon state regulations.

Other materials to be removed from the Site include vegetation and debris. Any of these materials containing soil will be disposed of with the contaminated soil. Remaining materials will be solid wastes that will be recycled to the extent practicable.

10.2 Disposal Facilities

Potential disposal facilities are discussed in Appendix I. Final selection of the disposal facilities will be made by the contractor. Approved disposal facilities for contaminated soil (assuming nonhazardous disposal) include the following:

- Waste Connections, Wasco County Landfill in The Dalles, Oregon
- Waste Management, Columbia Ridge Landfill in Arlington, Oregon
- Republic Services, Roosevelt Regional Landfill in Bickleton, Washington

Recycling/disposal facilities for other materials will be submitted by the contractor for approval.

10.3 Transportation and Disposal

Transportation and ultimate disposition of waste materials are discussed in Appendix I and Section 8.4. The following summarizes planned transportation and disposal.

Material	Quantity	Primary Transportation Mode
Demolition Debris	3,000 cy	Truck
Vegetation	5,000 cy	Truck
Contaminated Soil	50,000 cy	Barge

11 Construction Quality Assurance/Quality Control

The overall quality of the RA will be controlled by following the drawings, specifications, and work plans for the project, and compliance with these plans will be assured through a program of inspections, approvals, and documentation. The CQA/QC Plan in Appendix K describes the QA/QC program and includes:

- Comprehensive submittal requirements to verify that planned activities comply with the drawings and specifications;
- Verification of materials and layouts prior to implementation of a task;
- Full-time inspections of all aspects of construction;
- Verification of installed elements of the RA through observation, direct measurements, and surveying;
- Verifying load tracking, manifests, bills of lading, and disposal documentation;
- Compliance testing to verify material qualities and installation;
- Process for identifying and correcting nonconforming elements; and
- Comprehensive documentation of the RA construction including:
    - Photographs of the work;
    - Daily construction reports;
    - Weekly construction reports;
    - Element specific reports such as material sampling, as-built surveys, compliance inspections; and
    - Construction completion report.

Soil sampling and chemical analysis will be conducted during RA to verify quality of import materials and residual concentrations following soil excavation. Protocols for soil sampling are presented in the SAP in Appendix L. Safety protocols for soil sampling are addressed in the HASP in Appendix M. The contractor will be required to develop an updated HASP that addresses all aspects of safety related to the RA.

Environmental controls to prevent releases of hazardous substances, control runoff, and prevent dust are discussed in the drawings (EC-1.01 through EC-1.07 in Appendix A) and specifications,[11] Section 8.7, and the ERP in Appendix N.

[11] See specification sections 013529, 015000, 015713, 015719, 015720, and 025100.

12 Community Outreach and Long-Term Planning

12.1 General Impacts

The Site is in the Cathedral Park neighborhood. Residential areas are present overlooking the Site on the bluff to the north. Vehicle access to the Site is via surface streets through the residential areas (N Richmond Avenue off N Lombard Street). Potential impacts to the community from the upland RA are discussed in the Community Outreach Plan (Appendix O) with primary impacts including noise, truck traffic, construction lights, ambient dust, and vehicle emissions.

12.2 Houseless Communities

Unsheltered houseless residents may live in public spaces, abandoned buildings, vehicles, and other areas not intended for human habitation and may be particularly vulnerable and disproportionately affected by disturbances related to the RA activities. Because of the COCs present in surface soil, the Site is currently closed to the public, reducing the likelihood of houseless communities on the Site. Impacts to houseless communities will be mitigated through outreach as discussed in the Community Outreach Plan (Appendix O).

12.3 Tribal Rights and Presence

Tribes with interests in the Willamette River watershed and the Site include the Confederated Tribes of Grand Ronde, Confederated Tribes of Siletz Indians, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, Nez Perce Tribe (collectively, the Five Tribes), and the Confederated Tribes and Bands of the Yakama Nation. Working through Metro's outreach in developing the future park design, the RD incorporates consideration of Tribal significance of the land and integration of plants of Tribal significance into planting. This includes restoring native riparian habitat and avoiding/minimizing disturbance to cultural resources. The Tribes are provided with the opportunity to review RD documents. Tribal feedback that is compatible with remedy protectiveness, habitat objectives, and long-term maintenance requirements will be incorporated into RD.

12.4 Long-Term Planning

The final RA includes capping residual contaminated soils on the Site. Therefore, the Site will require long-term inspection and maintenance and controls to assure that the remedy remains protective and that future site work accounts for the presence of residual contaminated soil. To address these long-term needs, the following plans were prepared.

- Institutional Control Implementation and Assurance Plan (ICIAP), Appendix P. The ICIAP presents the institutional control planning, maintenance, enforcement, modification, and termination requirements for the Willamette Cove Upland. Institutional controls will be implemented at Willamette Cove to limit future Site use, inform future owners of the presence of contamination and the engineered cap, limit exposure to contamination left in place, and protect the long-term integrity of the Site cap. The planned institutional controls include hazard notice on the deed; Easement and Equitable Servitude between Metro and the DEQ; registration of the Site cap with the Oregon 811 One-Call System, and informational signs.
- Cap Inspection and Maintenance Plan (CIMP), Appendix Q. The CIMP describes the required long-term inspection scope and schedule; operation requirements; repairs; and notification and reporting requirements.

- Contaminated Media Management Plan (CMMP), Appendix R. The CMMP identifies engineering and other controls to be used during future soil-disturbing activities at the Site to manage potential risk associated with chemicals that may be encountered in soil or groundwater.

13 References

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Tables

Table 1
Human Health Remediation Goals and Hot Spot Levels
60% Remedial Design
Willamette Cove Upland Facility

Analyte	Background Concentration in mg/kg		Remediation Goal in mg/kg	Hot Spot Level in mg/kg
	Mean	95% UPL		
Antimony	0.29	0.56	24	240
Arsenic	4.4	8.8	8.8	140
Copper	24	34	11,000	110,000
Lead	27	79	400	4,000
Dioxin/Furan TEQ	--	--	1.5E-05	1.5E-03
cPAHs	--	--	0.55	55
Total PCBs	--	--	0.74	40

Notes:

Background concentrations from *Development of Oregon Background Metals Concentrations in Soil,* Oregon DEQ, March 2013 (Portland Basin)

Values from Basis of Design Report (Apex, 2025)
95% UPL = Upper Prediction Limit (95% confidence)
cPAHs= carcinogenic polycyclic aromatic hydrocarbons
Dioxin/Furan TEQ = 2,3,7,8-TCDD toxicity equivalent
mg/kg = milligrams per kilogram
PCBs = polychlorinated biphenyls

Table 2
Ecological Remediation Goals and Hot Spot Levels
60% Remedial Design
Willamette Cove Upland Facility

Analyte	Background Concentration in mg/kg*		Remediation Goal in mg/kg				Hot Spot Level in mg/kg
	Mean	95% UPL	Plants	Invertebrates	Birds	Mammals	
Antimony	0.29	0.56	5	78	--	2.7	27
Arsenic	4.4	8.8	18	--	575	83	180
Chromium	39	76	39	39	87	342	39
Copper	24	34	70	80	87.7	82	700
Lead	27	79	120	1,700	33	122	330
Mercury	0.073	0.23	0.30	0.10	0.073	3.53	0.15
Nickel	23	47	38	280	139	20	200
Selenium	0.33	0.71	0.52	4.1	3.42	1.1	5.2
Zinc	105	180	160	120	673	201	1,200
Dioxin/Furan TEQ	--	--	--	--	8.9E-05	6.1E-06	6.1E-05
Dibenzofuran	--	--	--	--	--	0.010	0.10
Total HPAH	--	--	--	18	--	5.6	56
Total LPAH	--	--	--	29	--	100	290
Total PCBs	--	--	40	--	0.734	0.098	0.98

Notes:

Background concentrations from *Development of Oregon Background Metals Concentrations in Soil,* Oregon DEQ, March 2013 (Portland Basin)

Values from Basis of Design Report (Apex, 2025)

*Two background levels are shown: mean and UPL. Per DEQ direction, the mean value was used to define background for incremental sampling methodology (ISM) and the UPL was used for composite sampling. Since most samples collected at the Site used ISM sampling, the UPL value is used as the lower bound for remediation goals and hot spot levels (except arsenic where per DEQ direction, the UPL value was used).

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

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

HPAH = high molecular weight polycyclic aromatic hydrocarbons

LPAH = low molecular weight polycyclic aromatic hydrocarbons

mg/kg = milligrams per kilogram

PCBs = polychlorinated biphenyls

Table 3
Remediation Goals and Hot Spot Levels
60% Remedial Design
Willamette Cove Upland Facility

Analyte	Remediation Goal in mg/kg	Hot Spot Level in mg/kg
Antimony	2.7	27
Arsenic	8.8	140
Chromium	39	39
Copper	70	700
Lead	33	330
Mercury	0.073	0.15
Nickel	23	200
Selenium	0.52	5.2
Zinc	120	1,200
Dioxin/Furan TEQ	6.1E-06	6.1E-05
Dibenzofuran	0.01	0.10
Total HPAH	5.6	56
Total LPAH	29	290
cPAHs	0.55	55
Total PCBs	0.098	0.98

Notes:

Values are minimum from Tables 1 and 2

cPAHs= carcinogenic polycyclic aromatic hydrocarbons

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

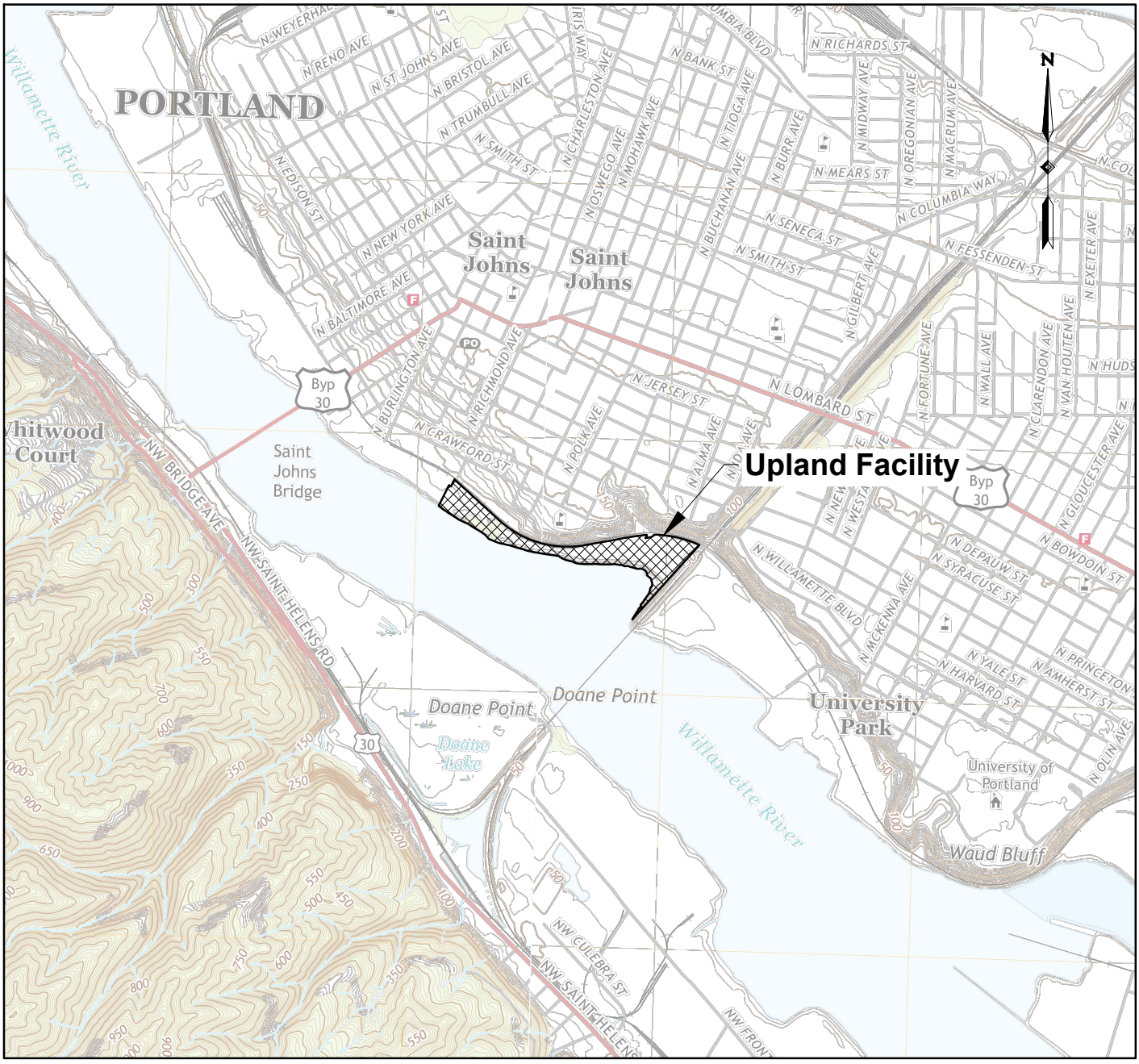
HPAH = high molecular weight polycyclic aromatic hydrocarbons

LPAH = low molecular weight polycyclic aromatic hydrocarbons

mg/kg = milligrams per kilogram

PCBs = polychlorinated biphenyls

Figures



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

0 2,000 4,000
Scale in Feet



OREGON

Site Location Map

Willamette Cove Upland 60% Remedial 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
	August 2026			

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Crawford Parcel
Richmond Parcel
West Parcel
Central Parcel
East Parcel
Willamette Cove
BNSF Parcel
Union Pacific Railroad
City of Portland Stormwater Ponds
N. VAN BUREN AVE.
N. TYLER AVE.
N. BRADFORD ST.
N. PIERCE AVE.
CITY STORMWATER OUTFALL
WILLAMETTE RIVER
N

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-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-42 DU-43 DU-44 DU-45 DU-46

MW-1 MW-2 MW-3 MW-4 MW-5 MW-6 MW-7 MW-8 MW-9 OF49

Legend:

- MW-4 — Monitoring Well Location
- 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

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Site Plan

Willamette Cove Upland 60% Remedial 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
August 2026			

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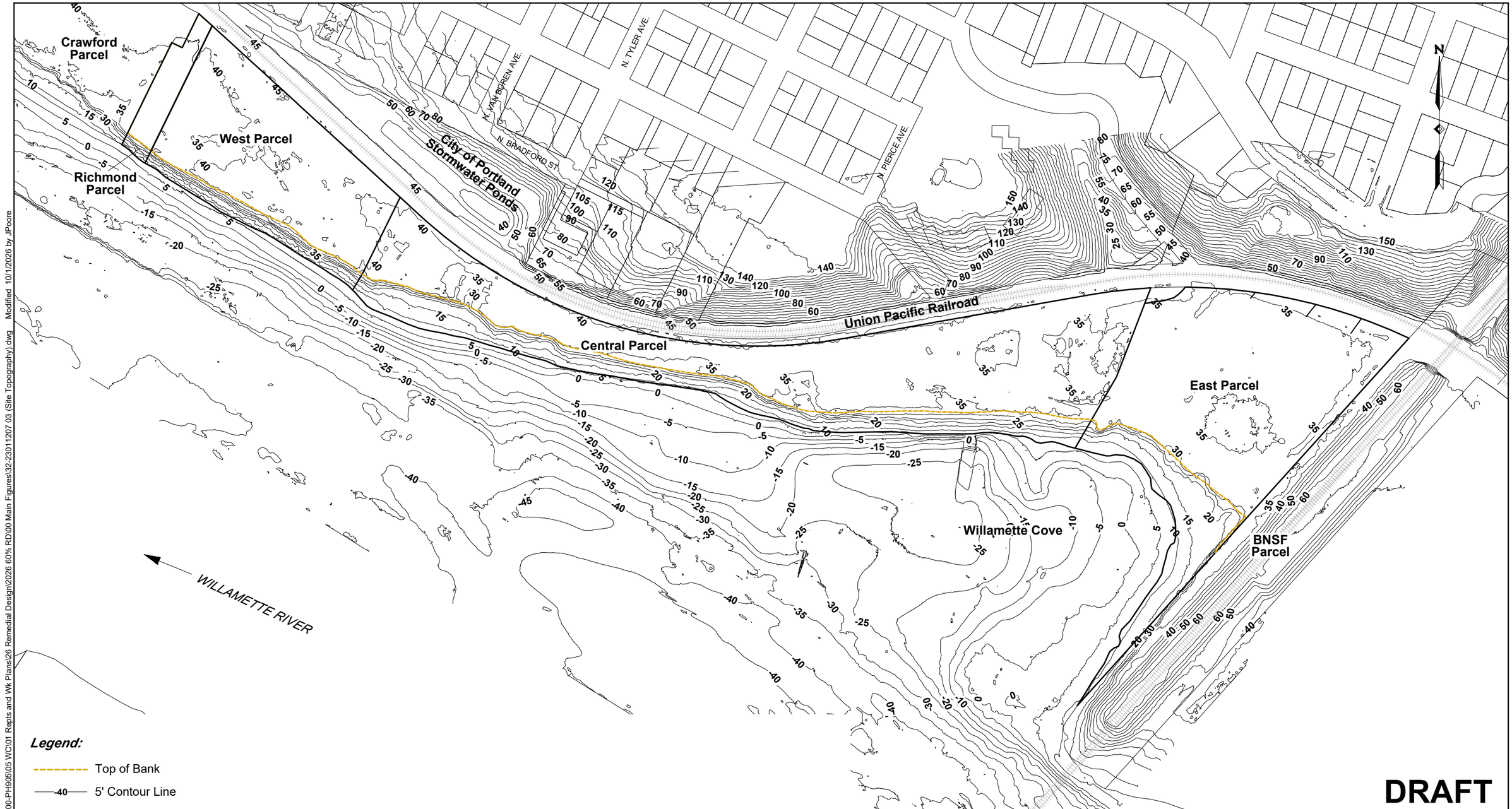

Legend:

Top of Bank

-40 5' Contour Line

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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.

Site Topography

Willamette Cove Upland 60% Remedial 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
August 2026			

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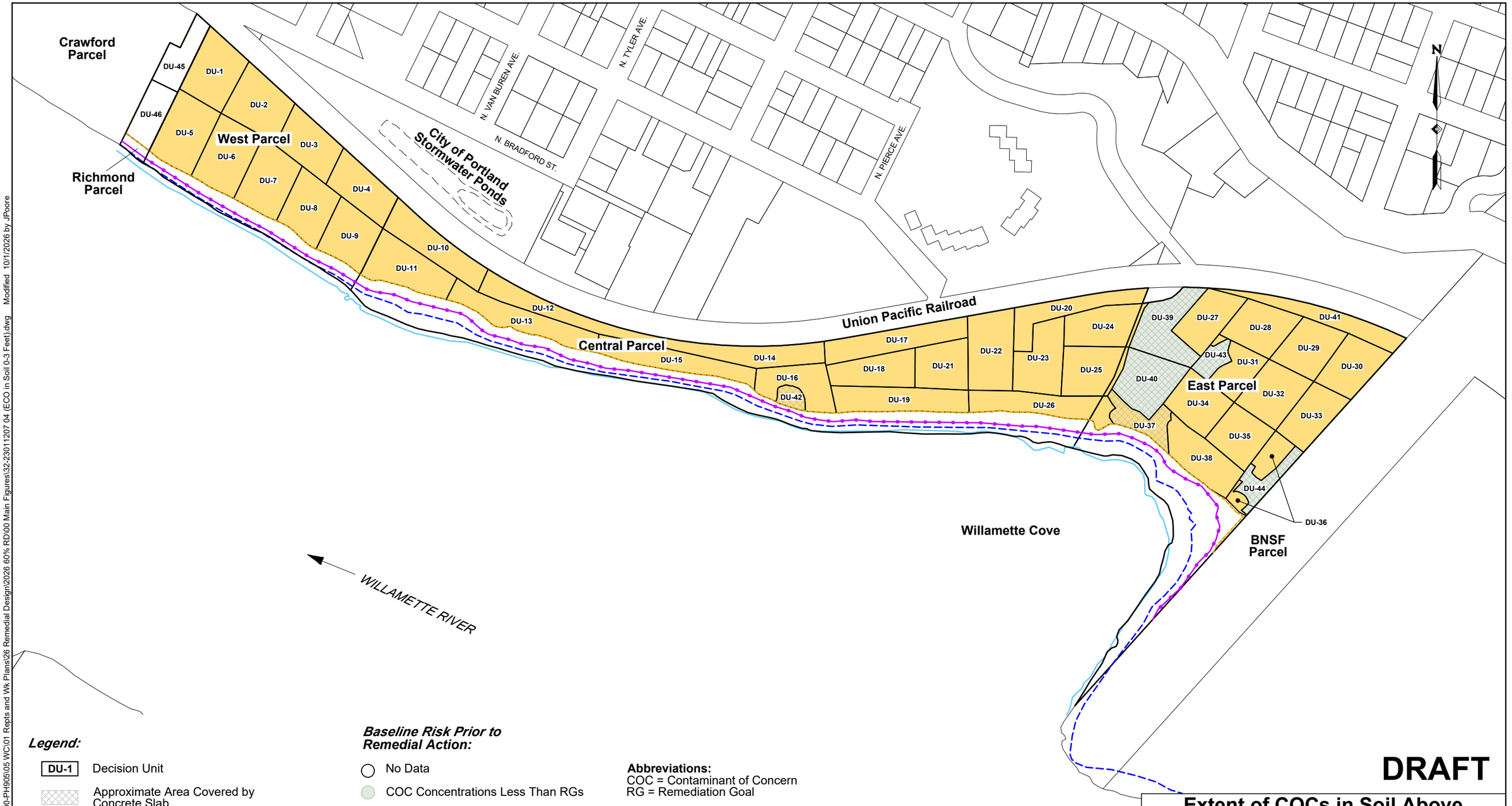

Legend:

- 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)

Baseline Risk Prior to Remedial Action:

- No Data
- COC Concentrations Less Than RGs
- COC Concentrations Greater Than RGs

Abbreviations:
COC = Contaminant of Concern
RG = Remediation Goal

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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Extent of COCs in Soil Above Ecological Remediation Goals (0-3 Feet)

Willamette Cove Upland 60% Remedial 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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August 2026			

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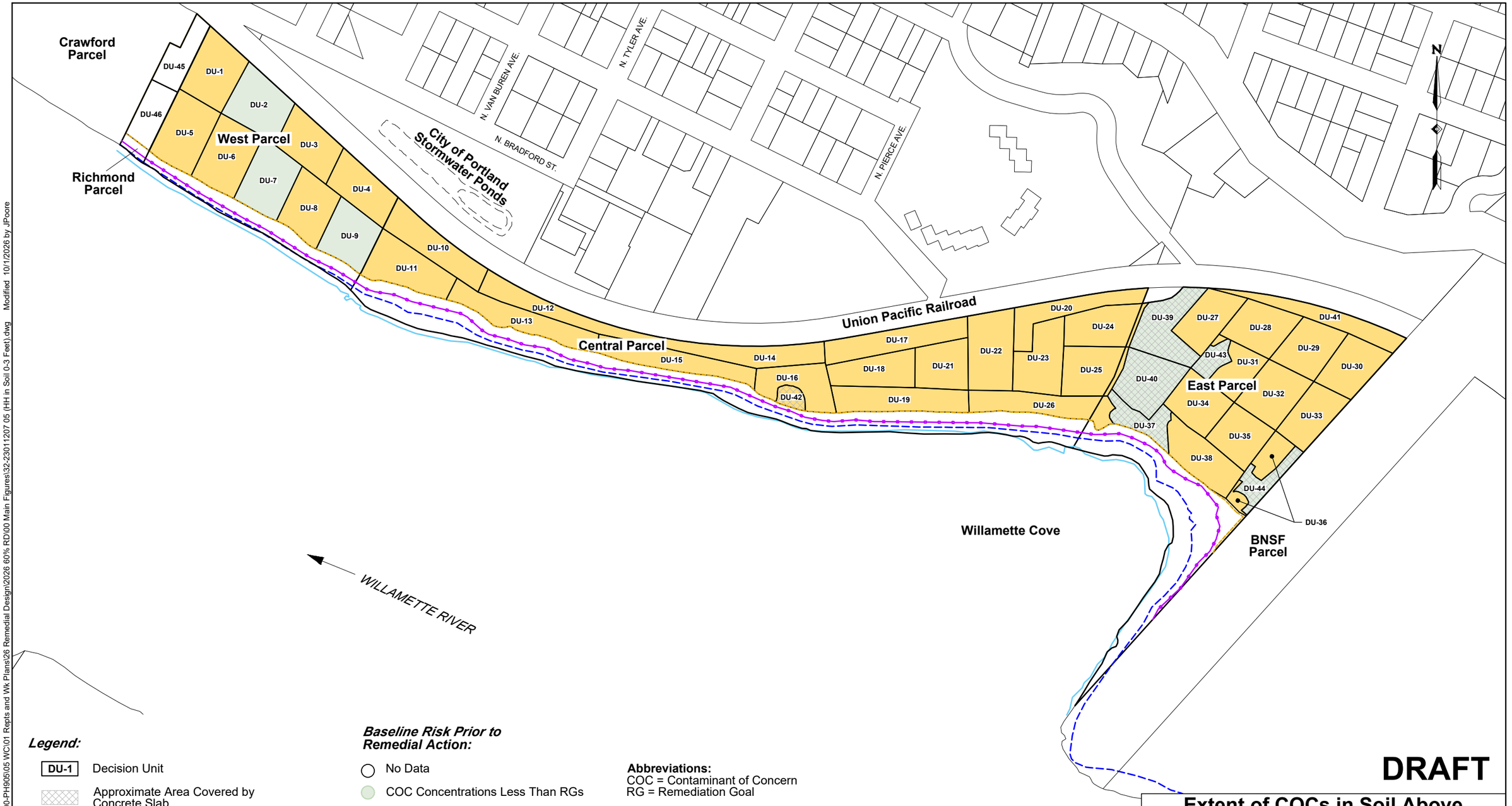

Legend:

- 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)

Baseline Risk Prior to Remedial Action:

- No Data
- COC Concentrations Less Than RGs
- COC Concentrations Greater Than RGs

Abbreviations:
COC = Contaminant of Concern
RG = Remediation Goal

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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Extent of COCs in Soil Above Human Health Remediation Goals (0-3 Feet)

Willamette Cove Upland 60% Remedial 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	5

August 2026

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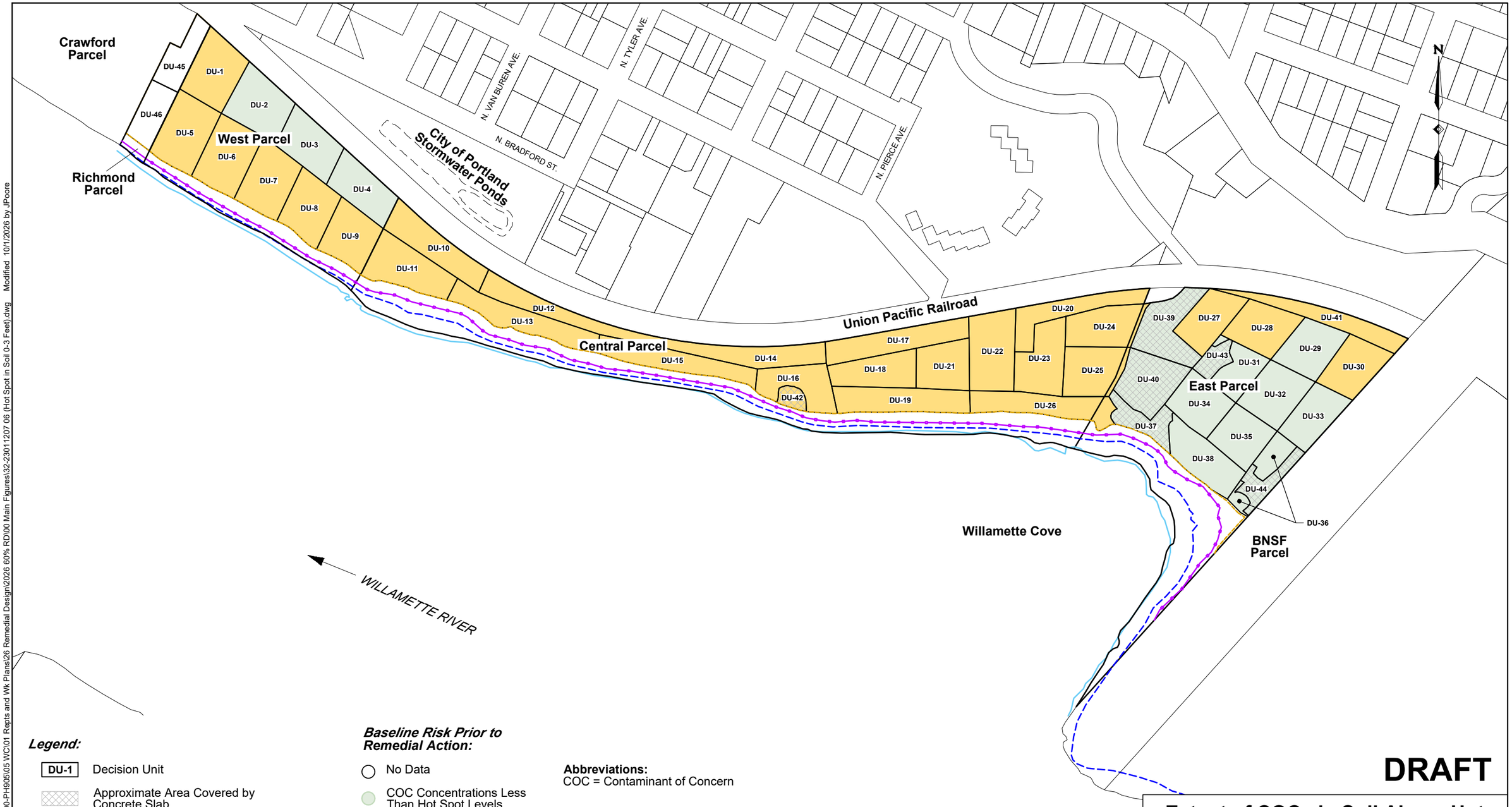

Legend:

- 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)

Baseline Risk Prior to Remedial Action:

- No Data
- COC Concentrations Less Than Hot Spot Levels
- COC Concentrations Greater Than Hot Spot Levels

Abbreviations:
COC = Contaminant of Concern

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

Extent of COCs in Soil Above Hot Spot Levels (0-3 Feet)

Willamette Cove Upland 60% Remedial 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	6
August 2026			

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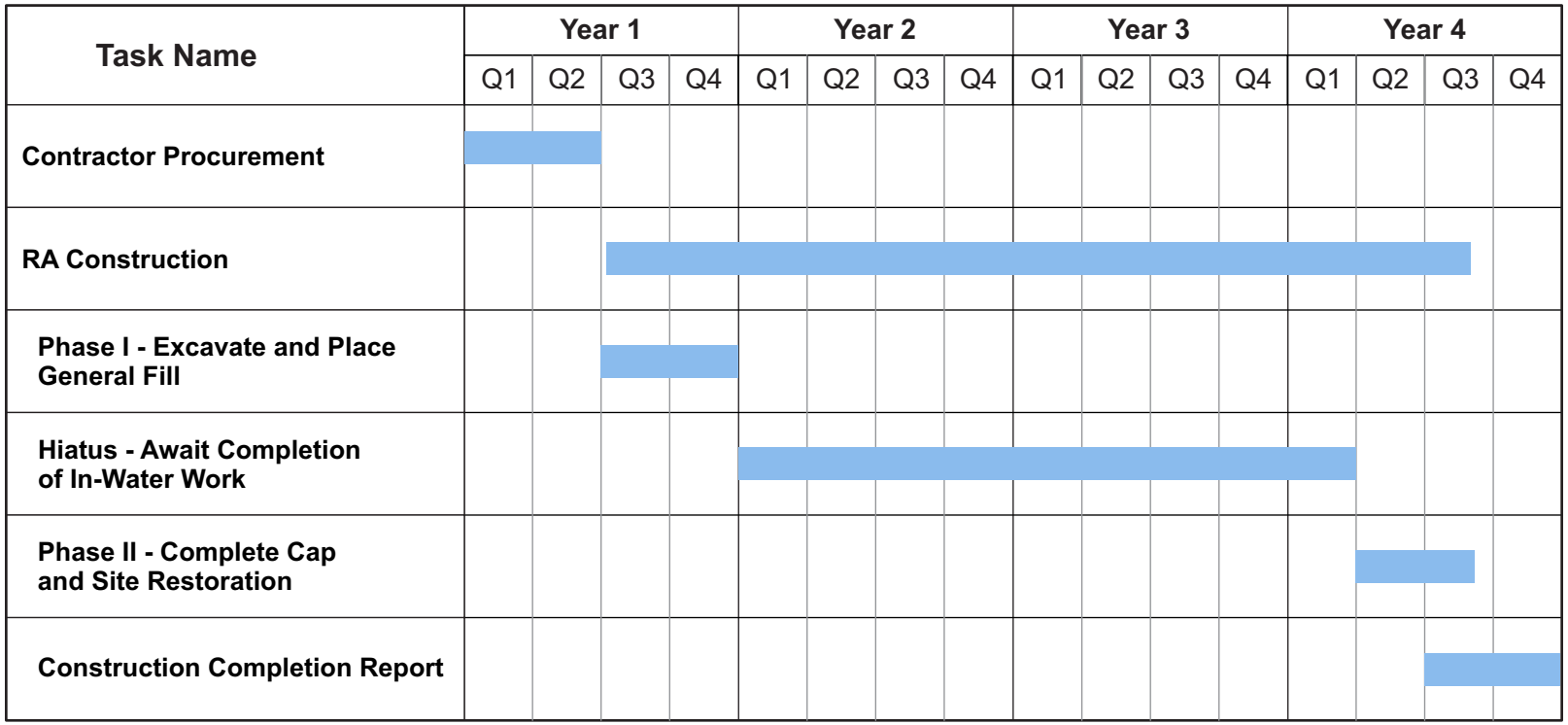


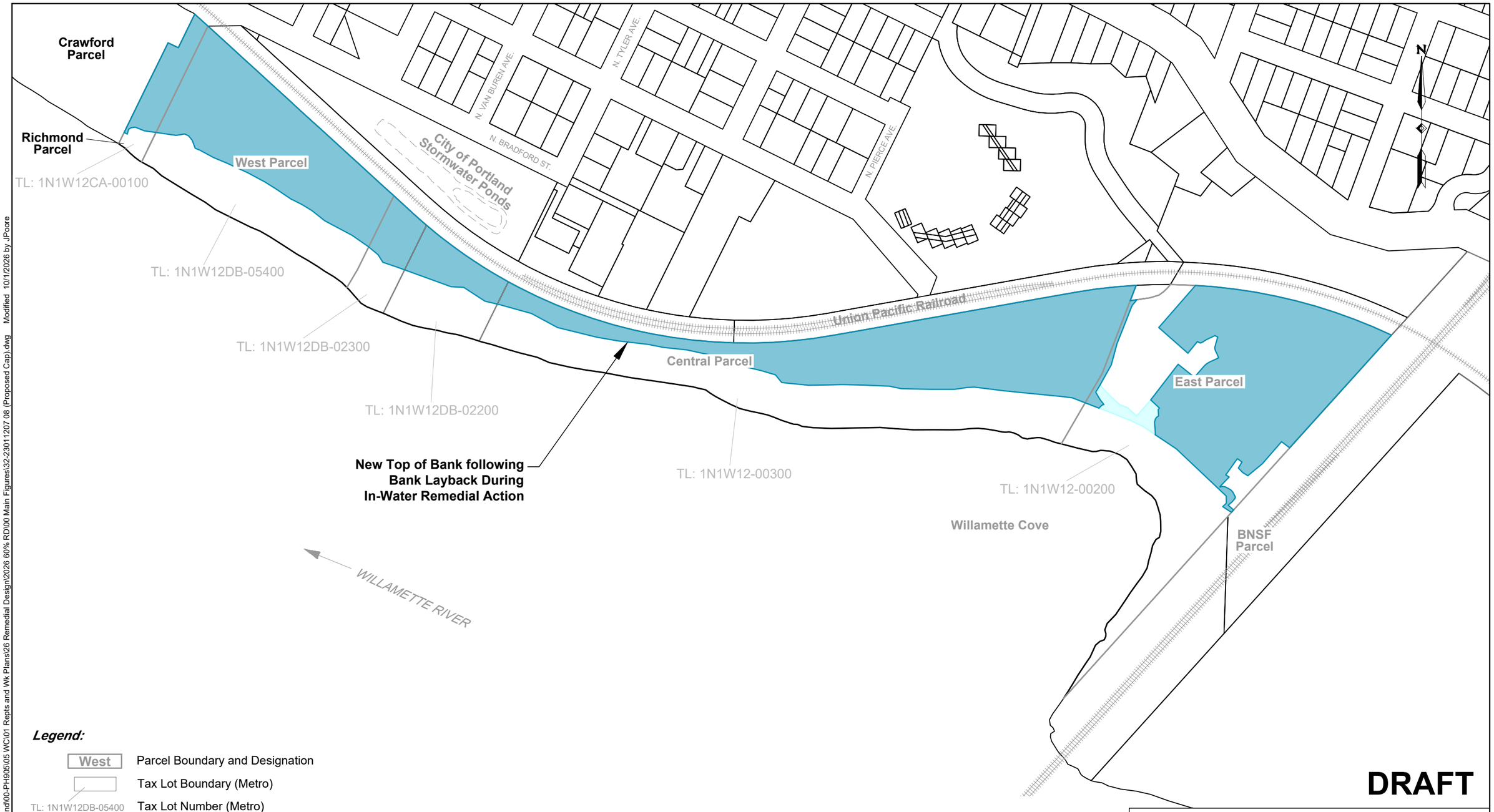
Note: Schedule highly dependent on In-Water RA schedule.

Remedial Action Project Schedule

Willamette Cove Upland 60% Remedial Design Report
Willamette Cove Upland Facility
Portland, Oregon

APEX Apex Companies, LLC 15618 SW 72nd Avenue Tigard, Oregon 97224	Project Number: 32-23011207	Drawn: JP	Approved: HFC	Figure 7
	August 2026			

Client\Port of Portland\00-PH905\05 WC\01 Repts and Wk Plans\26 Remedial Design\2026 60% RD\00 Main Figures\32-23011207 07 (Project Schedule).des Modified 11/05/2026



Legend:

- West — Parcel Boundary and Designation
- Tax Lot Boundary (Metro)
- TL: 1N1W12DB-05400 — Tax Lot Number (Metro)
- Proposed 1-Foot-Thick Cap
- Proposed 3-Foot-Thick Cap with Demarcation Layer

NOTE: Base map prepared from Bing Imagery. Tax lot information from ©Oregon Metro www.oregonmetro.gov/rlis (2026). Historical base layer information from an electronic file provided by Hart Crowser.

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Proposed Cap

Willamette Cove Upland 60% Remedial Design Report
Willamette Cove Upland Facility
Portland, Oregon

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15618 SW 72nd Avenue
Tigard, Oregon 97224

Project Number:	Drawn:	Approved:	Figure
32-23011207	JP	HFC	8
August 2026			

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