

Appendix B

Design Considerations for cPAH RAL Exceedance Areas Relative to 2014 ROD RALs

1 Introduction

As described in the *Pre-Design Investigation Report for the Lower Duwamish Waterway Upper Reach* (DER) for the upper reach of the Lower Duwamish Waterway (LDW; Anchor QEA and Windward 2022a), remedial action level (RAL) exceedance areas were developed by comparing data in the design dataset with RALs, as defined in the U.S. Environmental Protection Agency's (EPA's) November 2014 LDW *Record of Decision* (ROD; EPA 2014) for all contaminants of concern (COCs) except carcinogenic polycyclic aromatic hydrocarbons (cPAHs). RAL exceedance areas for cPAHs presented in the DER were based on RALs presented in the LDW *Explanation of Significant Differences* (ESD; EPA 2021). The ESD for cPAHs was prepared by EPA to re-calculate the cPAH RALs, cleanup levels, and target tissue levels to reflect the latest scientific understanding of cPAH toxicity. The ESD provides the RALs that require remedial action in the LDW for cPAHs, which have higher concentrations than those presented in the ROD.

Appendix B of the DER evaluated whether additional areas with RAL exceedances would be identified if the areas were based on the 2014 ROD RALs for cPAHs. Appendix B of the DER identified two areas where this would be the case (Figure B-1).

The Lower Duwamish Waterway Group is voluntarily preparing a design that addresses additional RAL exceedance areas identified using the 2014 ROD RALs for cPAHs (pre-ESD). The purpose of this appendix is to describe the basis of design for these areas. In general, the remedy elements discussed in the main Intermediate (60%) Remedial Design (RD) *Basis of Design Report* (BODR) are applicable to these areas, so this appendix focuses on considerations specific to each area.

This appendix presents the following:

- An overview of the two areas that exceed the 2014 ROD RALs (referred to as cPAH-only areas)
- Technology assignment for the cPAH-only areas identified using 2014 ROD RALs
- A discussion of the cPAH-only remedial action area (RAA) boundary and sediment management area (SMA) boundary development
- Design drawing, quantities, and opinion of probable cost of the additional cPAH-only remediation
- A discussion of anticipated Phase III pre-design investigation (PDI) data gaps associated with the cPAH-only areas identified using 2014 ROD RALs

2 Technology Assignments for Areas with 2014 ROD RAL Exceedances for cPAHs

Appendix B of the DER identified two areas that exceed the 2014 ROD RALs for cPAHs but do not exceed the ESD RALs and are not already included within a RAL exceedance area delineated by other COCs at those locations. Both areas (shown in Figure B-1) are based on surface sediment exceedances; one includes a small area immediately adjacent to Area 18 (river mile [RM] 3.8 East), and the other is an area west of the Turning Basin (RM 4.7 West).

The technology assignments for the areas are as follows:

- Area adjacent to Area 18 (RM 3.8 East): Similar to the adjacent intertidal portion of Area 18, dredge and backfill is the remedial technology that will be applied at this location consistent with the design details in the BODR.
- Area west of Turning Basin (RM 4.7 West): There are no structural limitations, the area is Recovery Category 3, and the cPAH concentrations are less than the enhanced natural recovery (ENR) upper limit (ROD Table 28). Therefore, ENR is the selected technology for this area.

3 Remedial Action Area and Sediment Management Area Development

3.1 Remedial Action Area Development

The horizontal extents of contamination for non-PCB exceedances are defined using the Thiessen polygon method, as described in Section 4 of the BODR and Appendix K of the DER. Therefore, the starting point to define the RAA for the cPAH-only areas (based on 2014 ROD RALs) is simply the RAL exceedance area. The RAA development process for each area, described in detail in Section 6 of the BODR, is as follows:

- Area adjacent to Area 18 (RM 3.8 East): Through the RAA development process for Area 18, the cPAH-only portion that exceeds the 2014 ROD RALs for cPAHs was fully encompassed within the RAA. Therefore, further RAA development to address this area is not required. In other words, this area is already being addressed as part of the base design after engineering factors were applied to Area 18, even though the initial RAL exceedance area delineation did not include the cPAH-only Thiessen polygon.
- New area in Turning Basin (RM 4.7 West): A 10-foot placement buffer was added to the ROD cPAH RAL exceedance area, consistent with other locations where ENR is the selected remedy. ENR placement will be carefully controlled and monitored during construction to prevent disturbance of the adjacent habitat.

3.2 Sediment Management Area Development

The SMA development process is described in detail in Section 7 of the BODR. For the cPAH-only area in the Turning Basin, an independent SMA has been defined based on its distance from other RAAs, technology assignment, and site access considerations. The SMA is numbered separately from the remaining site and is called "SMA-c1."

4 cPAH-Only Area Quantity and Opinion of Probable Cost Summary

This section presents the quantities and costs associated with the cPAH-only RAA. A variation of Sheet C161 of the Intermediate Drawings (Appendix D of the BODR) that shows the cPAH-only RAA is included as Attachment B-1.

As noted previously, ENR is the selected remedial technology for this area. The RAA (including the 10-foot buffer around the planned ENR placement area) is 7,500 square feet. Assuming ENR material (medium-to-coarse grained sand) is applied over the ENR placement area at a minimum 6-inch thickness (with a 6-inch maximum overplacement allowance), the total ENR placement volume is 280 cubic yards.

The Intermediate (60%) RD Opinion of Probable Cost to implement the remediation of this cPAH-only area is summarized in Table B-1. This work would likely be integrated with other remedial actions described in the BODR; therefore, some efficiencies and cost savings would be realized.

The total project cost includes costs for direct construction tasks (i.e., all construction activities anticipated to be conducted by the contractor), indirect construction tasks (i.e., additional activities to provide quality assurance that are necessary to the project but are performed by parties other than the contractor), and additional construction oversight tasks (by the Owner and EPA). The total Intermediate (60%) RD Opinion of Probable (most likely) Cost for LDW upper reach implementation at the Intermediate (60%) RD is \$212,100 (with a range of costs varying from a lower probable cost of \$191,200 to a higher probable cost of \$260,900).

Table B-1
Opinion of Probable Cost for Implementation of cPAH-Only Area

Task ID	Task Description	Lower Probable Total Cost (\$)	Probable Total Cost (\$)	Upper Probable Total Cost (\$)
Direct Construction Costs				
1	Mobilization/Demobilization	\$13,500	\$15,000	\$18,000
2	Surveys	\$17,400	\$19,300	\$28,200
3	Material Placement	\$55,100	\$61,000	\$72,700
Direct Construction Costs Subtotal		\$86,000	\$95,300	\$118,900
4	Direct Construction Contingency (30.0%)	\$25,800	\$28,590	\$35,670
Direct Construction Costs Subtotal with Contingency		\$111,800	\$123,890	\$154,570
5	Sales Tax (10.1%)	\$11,290	\$12,510	\$15,610
Total Direct Construction Costs (with Contingency and Sales Tax)		\$123,090	\$136,400	\$170,180
Indirect Construction Costs				
6	Other Indirect Construction Costs	\$22,200	\$24,700	\$29,600
Indirect Construction Costs Subtotal		\$22,200	\$24,700	\$29,600
7	Indirect Construction Contingency (30.0%)	\$6,660	\$7,410	\$8,880
Total Indirect Construction Costs (with Contingency)		\$28,860	\$32,110	\$38,480
Additional Construction Oversight Costs				
8	Additional Construction Oversight Costs	\$30,200	\$33,500	\$40,200
Additional Construction Oversight Costs Subtotal		\$30,200	\$33,500	\$40,200
9	Additional Construction Oversight Contingency (30.0%)	\$9,060	\$10,050	\$12,060
Additional Construction Oversight Costs Subtotal with Contingency		\$39,260	\$43,550	\$52,260
Total Additional Construction Oversight Costs (with Contingency)		\$39,260	\$43,550	\$52,260
10	Total cPAH-Only Area Project Costs	\$191,200	\$212,100	\$260,900

Notes:

Costs are presented in present-day (i.e., 2022) U.S. dollars.

Sales tax is included at 10.1% to account for Washington State (6.5%) and the City of Tukwila (3.6%) taxes.

A 30% contingency is applied to total direct construction, total indirect construction costs, and additional construction oversight costs, based on consideration of potential cost uncertainty associated with the level of information currently available and engineering best professional judgment. Due to the nature of the construction activity (i.e., environmental sediment remediation), additional factors that cannot be forecasted at this time—such as scope unknowns (i.e., significant changes in site conditions or quantities), price uncertainty (i.e., varying market conditions, increasing inflation, and fuel and labor changes), or any other unforeseen circumstances (i.e., additional design requirements)—may influence contractor bidding prices and impact the final project costs outside, in excess, or below this contingency.

Long-term monitoring costs for the cPAH-only area are not included in this opinion of probable cost as assumptions for these activities will be developed consistent with the Long-Term Maintenance and Monitoring Plan in subsequent RD phases.

cPAH: carcinogenic polycyclic aromatic hydrocarbon

RD: remedial design

5 Summary of Phase III PDI Data Gaps

This section summarizes the data gaps filled in the Phase III PDI to address data needed for RD related to the additional cPAH-only RAL exceedance areas (Table B-2). Discussion of the surface samples collected to address the data gaps are documented in the Phase III quality assurance project plan addendum (Anchor QEA and Windward 2022b). The Phase III PDI data will be incorporated into the Pre-Final (90%) RD.

Table B-2
Evaluation of Data Gaps for cPAH 2014 ROD RAL Areas

DQO	Phase III PDI Data Gaps
Further horizontal delineation (DQOs 9 and 10)	Surface samples to bound the horizontal footprint and avoid disturbing habitat
Further vertical delineation (DQO 12)	None
Other engineering data (DQO 14)	None

Notes:

cPAH: carcinogenic polycyclic aromatic hydrocarbon

DQO: data quality objective

PDI: pre-design investigation

RAL: remedial action level

ROD: *Record of Decision*

6 References

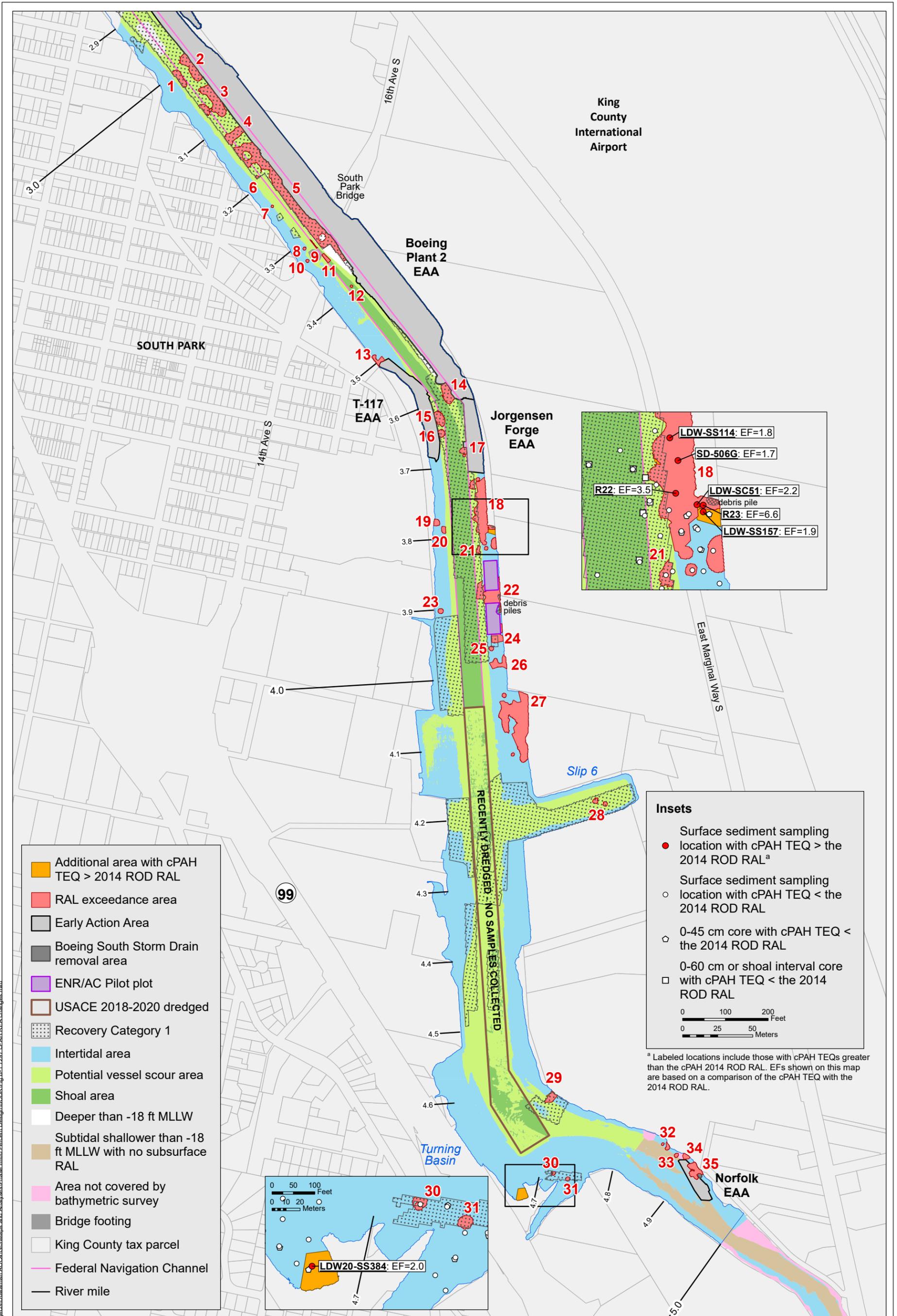
Anchor QEA and Windward (Anchor QEA, LLC, and Windward Environmental), 2022a. *Pre-Design Investigation Report for the Lower Duwamish Waterway Upper Reach*. Draft. For submittal to U.S. Environmental Protection Agency, February 21, 2022.

Anchor QEA and Windward, 2022b. *Quality Assurance Project Plan Addendum for the Lower Duwamish Waterway Upper Reach: Pre-Design Investigation Phase III*. Final. Submitted to U.S. Environmental Protection Agency, November 17, 2022.

EPA (U.S. Environmental Protection Agency), 2014. *Record of Decision*. Lower Duwamish Waterway Superfund Site. U.S. Environmental Protection Agency Region 10. November 2014.

EPA, 2021. *Proposed Explanation of Differences*. Draft for Comment. Lower Duwamish Waterway Superfund Site. U.S. Environmental Protection Agency, Region 10

Figures



- Additional area with cPAH TEQ > 2014 ROD RAL
- RAL exceedance area
- Early Action Area
- Boeing South Storm Drain removal area
- ENR/AC Pilot plot
- USACE 2018-2020 dredged
- Recovery Category 1
- Intertidal area
- Potential vessel scour area
- Shoal area
- Deeper than -18 ft MLLW
- Subtidal shallower than -18 ft MLLW with no subsurface RAL
- Area not covered by bathymetric survey
- Bridge footing
- King County tax parcel
- Federal Navigation Channel
- River mile

- Insets**
- Surface sediment sampling location with cPAH TEQ > the 2014 ROD RAL^a
 - Surface sediment sampling location with cPAH TEQ < the 2014 ROD RAL
 - 0-45 cm core with cPAH TEQ < the 2014 ROD RAL
 - 0-60 cm or shoal interval core with cPAH TEQ < the 2014 ROD RAL
- 0 100 200 Feet
0 25 50 Meters

^a Labeled locations include those with cPAH TEQs greater than the cPAH 2014 ROD RAL. EFs shown on this map are based on a comparison of the cPAH TEQ with the 2014 ROD RAL.

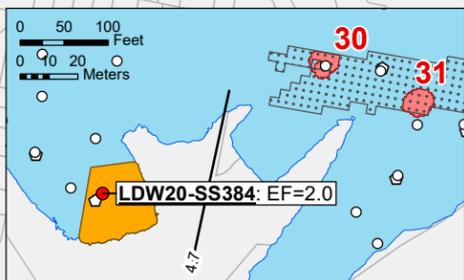
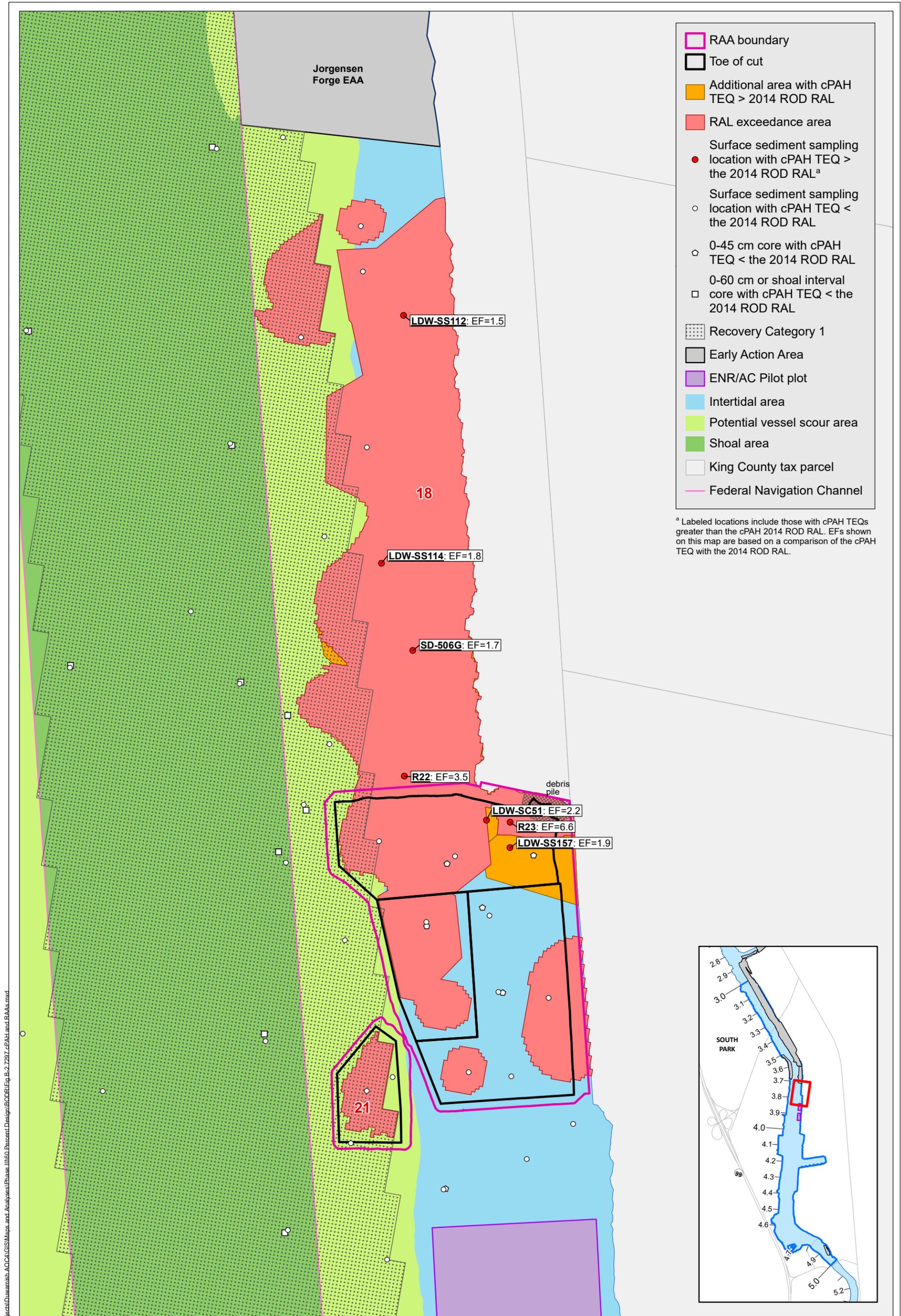


Figure B-1. Additional RAL exceedance areas in the upper reach based on the use of the 2014 ROD RAL for cPAHs

60% BASIS OF DESIGN REPORT FOR THE LDW UPPER REACH FEBRUARY 20, 2023

Prepared by: ChitraC_21/15/2023: W:\Projects\Duwamish\AC\GIS\MapInfo\Phase 1\17297_cPAH_RAL_changes.mxd



^a Labeled locations include those with cPAH TEQs greater than the cPAH 2014 ROD RAL. EFs shown on this map are based on a comparison of the cPAH TEQ with the 2014 ROD RAL.

Prepared by: Citrac, 2/15/2023, W:\Projects\Duwamish\AOC\GIS\Mapas and Analysis\Phase III\60_Percent Design\ODR\Eig.B-2_7297_cPAH and RAAs.mxd

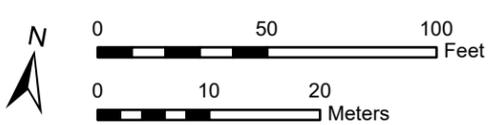
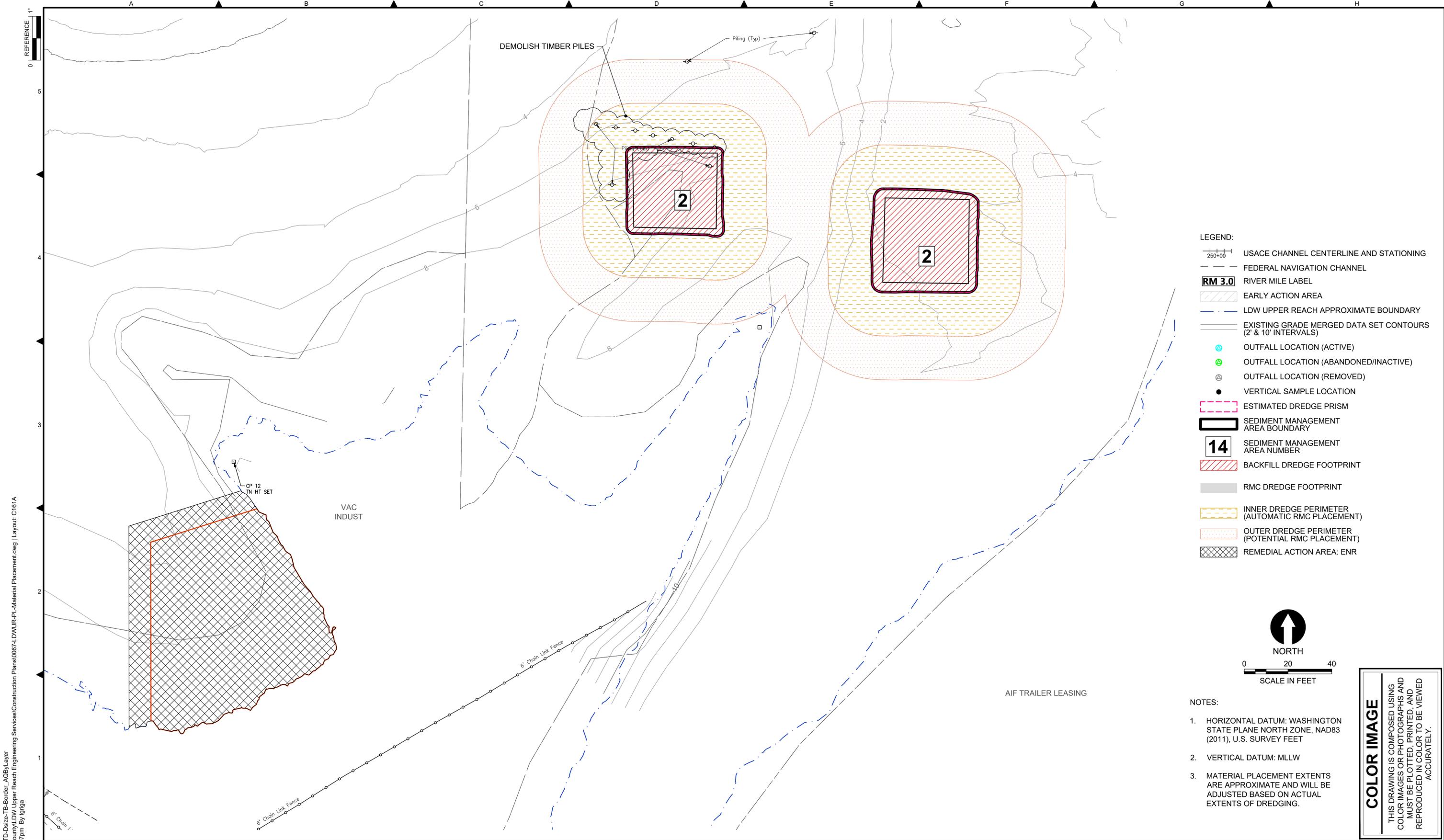


Figure B-2. Area 18 cPAH-only area

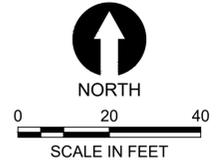
60% BASIS OF DESIGN REPORT FOR THE LDW UPPER REACH FEBRUARY 20, 2023

Attachment B-1

Material Placement Plan (RMs 4.64 to
4.76) with cPAH-Only Area



- LEGEND:**
- USACE CHANNEL CENTERLINE AND STATIONING
 - FEDERAL NAVIGATION CHANNEL
 - RM 3.0** RIVER MILE LABEL
 - EARLY ACTION AREA
 - LDW UPPER REACH APPROXIMATE BOUNDARY
 - EXISTING GRADE MERGED DATA SET CONTOURS (2' & 10' INTERVALS)
 - OUTFALL LOCATION (ACTIVE)
 - OUTFALL LOCATION (ABANDONED/INACTIVE)
 - OUTFALL LOCATION (REMOVED)
 - VERTICAL SAMPLE LOCATION
 - ESTIMATED DREDGE PRISM
 - SEDIMENT MANAGEMENT AREA BOUNDARY
 - 14** SEDIMENT MANAGEMENT AREA NUMBER
 - BACKFILL DREDGE FOOTPRINT
 - RMC DREDGE FOOTPRINT
 - INNER DREDGE PERIMETER (AUTOMATIC RMC PLACEMENT)
 - OUTER DREDGE PERIMETER (POTENTIAL RMC PLACEMENT)
 - REMEDIAL ACTION AREA: ENR



- NOTES:**
1. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD83 (2011), U.S. SURVEY FEET
 2. VERTICAL DATUM: MLLW
 3. MATERIAL PLACEMENT EXTENTS ARE APPROXIMATE AND WILL BE ADJUSTED BASED ON ACTUAL EXTENTS OF DREDGING.

COLOR IMAGE

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BORDER FILE EDITION: \\KOV\TD-Size-TB-Border_AQB\Layer_Vgala\CAD\Projects\0067-King County\LDW Upper Reach Engineering Services\Construction Plans\0067-LDWUR-PL-Material Placement.dwg | Layout: C161A
PLOTTED: Feb 20, 2023 02:54:07pm By tgriga

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INTERMEDIATE ISSUE DRAWING
INFORMATION ONLY

60% REVIEW

FEBRUARY 2023

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DESIGN APPROVAL: T. WANG	PROJECT FILE NO: E00559E18
PROJECT ACCEPTANCE: PRJCT MNGR	CONTRACT NO: C0XXXXCX



DEPARTMENT OF NATURAL RESOURCES & PARKS
WASTEWATER TREATMENT DIVISION
LOWER DUWAMISH WATERWAY UPPER REACH
ENGINEERING SERVICES AND SEDIMENT CLEANUP

MATERIAL PLACEMENT PLAN
(RM 4.64 TO 4.76)

DATE: FEBRUARY 2023
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