Appendix C
Response to Comments

Appendix C-1
Combined BOD-PDR Response to Comments

Table C-1
Combined BODR-PDR Response to Comments

Comment No.	Section/Topic	Comment	Comment Response
EPA General Comments			
1	General	**Removal of PTW-NAPL:**	
		a. The design concept presented in the BOD-PDR does not meet the Gasco ASAOC Remedial Action Objective (RAO) #1 which requires that "substantial product shall be removed unless it can be shown that the costs of such removal are clearly disproportionate to the degree of risk reduction to be attained through physical removal as compared to other remedial options for the same material. If substantial product will not be removed, it should be shown that alternative approaches are substantially less costly as well as equally if not more effective at meeting all of the other RAOs, particularly those that relate to creating acceptable sediment risk and preventing downstream migration of contaminants." For the purpose of these comments and to be consistent with terminology in the ROD, 'substantial product' includes PTW-NAPL. Instead of incorporating a preference for removal of PTW-NAPL, the BOD-PDR recommends capping PTW-NAPL after minimal or no dredging in areas outside of the Navigation Channel without demonstrating that removal of sediments impacted with PTW-NAPL would result in disproportionate costs relative to risk reduction compared to capping. The remedy concept presented in the BOD-PDR must be reworked to incorporate a preference for removal of PTW-NAPL to the greatest extent feasible. Justification for leaving PTW-NAPL must be supported by an engineering analysis that **defines the maximum feasible removal depths** and footprint at the Gasco Sediments Site and should include a **comparative analysis of contaminant mass removed by dredging versus contaminant mass left in place** to be capped. EPA expects that the evaluation to justify leaving PTW-NAPL in place will focus more on defining **at what extents and/or depths the cost of removing PTW-NAPL becomes disproportionate to risk reduction** and not a general comparison of dredging versus capping. In addition, as noted in EPA's comments on Appendix G regarding seepage rates, cap design modeling should be conducted with and the without the HC&C system in operation for the design period of 100-years. Without this evaluation it is not clear if the reliance on the hydraulic control and containment (HC&C) system to achieve long-term goals is appropriate or not which should be taken into consideration for capping PTW-NAPL.	Comment is no longer applicable as the Full Dredge and ISS Design includes full removal to the DOC in the Navigation Channel and fully addresses DOC in the remaining areas through ISS. The detailed rationale documenting that the Full Dredge and ISS Design fully achieves all of EPA's design objectives and prevents sediment recontamination is presented in the *Preferred Alternative Report* (PAR) prepared by Anchor QEA and dated October 31, 2022.
		b. The BOD-PDR must provide rationale for not achieving complete removal of PTW-NAPL in the navigation channel and/or other areas deeper than 15 feet below the mudline. The rationale should include creation of stable side slopes to support removal without the need for structural reinforcement, where possible. The BOD-PDR should evaluate the use of engineering measures to access deeper inventory of PTW-NAPL near structures or in circumstances where creation of stable side slopes is more limited. According to the January 24, 2014 response to NW Natural's *Proposed Methods for Substantial Product Accessibility Analysis* , EPA indicated that temporary engineering measures, such as but not limited to sheet piles, could potentially be implemented to allow PTW-NAPL removal to proceed near structures. Furthermore, the BOD-PDR does not consider lessons learned during the 2005 early action, which involved removal of sediments containing PTW-NAPL immediately adjacent to functional structures (i.e., the Gasco dock and south access ramp). The 2005 early action work demonstrates that removal immediately adjacent to functional structures is feasible. In general, EPA considers dredging depths greater than 15 feet below mudline to be feasible. Dredging to these depths has been done at other Superfund sites like the Lower Fox River (Green Bay, WI). If 15 feet was selected based on reference to the ROD or Portland Harbor feasibility study (FS), it should be understood in context, as stated in ROD Section 10.1.1.3: *"Actual dredge depths will be based on data collected during remedial design and the RALs. A maximum dredge depth of 15-19 ft was assumed in the intermediate and Nav/FMD Regions and in the shallow regions where* ***PTW that is NAPL or not*** *reliably contained* ***(emphasis added)*** *is present since deeper dredge depths would require special design and side slope stabilization considerations"* . Additionally, EPA notes that the 2012 Engineering Evaluation/Cost Analysis (EE/CA) (Anchor QEA, 2012) assumed that dredging up to 20 feet of sediment was considered feasible. The revised BOD-PDR should present engineering evaluations and/or lines of evidence to support determination of the feasible limits and depths of dredging.	See response to General Comment 1a and the detailed rationale presented in the PAR (Anchor QEA 2022).
		c. Regarding engineering measures to access deeper inventory of PTW-NAPL, the BOD-PDR does not provide any discussion on the use of earth support structures (such as coffer dams) to provide access for deeper dredging of NAPL impacted sediments in the shallow and intermediate zones. The BOD-PDR lacks an assessment of construction sequencing (i.e., slot dredging) for the removal of PTW-NAPL impacted sediments where earth support structures may not be needed.	See response to Comment 1a and the detailed rationale presented in the PAR (Anchor QEA 2022).
2	General	**Capping on grade:** The BOD-PDR does not provide sufficient justification and/or supporting engineering analysis for constructing a cap on grade to the extent proposed. EPA expects that the design concept presented in the BOD-PDR will be reworked to resolve General comment 1 above. The revised BOD-PDR must provide engineering analysis to justify capping on grade in areas where removal of PTW-NAPL is not feasible or where conditions might otherwise allow for capping (i.e., where PTW is not present). Consistent with the General Capping requirements outlined in the Portland Harbor Superfund Site (PHSS) Record of Decision (ROD) Section 14.2.9.1, in habitat areas, currently defined by National Marine Fisheries Service (NMFS) as those areas above -15 ft Columbia River Datum (CRD), post-remedy surfaces will be maintained at their current depth and backfilled or capped with suitable habitat materials. Capping on grade in areas above -15ft CRD is not consistent with the ROD. Capping on grade may be allowed if flood rise and habitat impacts are adequately evaluated and addressed in design. For example, by creating new shallow water habitat to offset any loss. Because these evaluations are not yet complete (see EPA comments on Sections 13 and 14), capping on grade cannot be approved.	Comment is no longer applicable. ISS allows full control of post-construction mudline elevations, and the net mudline elevation increases in shallow areas can be eliminated or managed as needed based on habitat and flood rise objectives.

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3	General	**Integration with Upland Source Control Measures:** The sediment remedy concept presented in the BOD-PDR includes consideration of the existing groundwater source control measure for the alluvium water bearing zones (WBZs); i.e., the HC&C system and acknowledges that additional groundwater source control measures for the Fill WBZ are required. However, the BOD-PDR does not adequately integrate the uplands source control measures into the in-water remedy design basis. The comments provided below identify concerns with the integration of source control measures into the design and construction sequence that must be addressed.	
		a. The revised BOD-PDR should include construction impacts to the HC&C system which should be evaluated in a reworked remedy concept that includes the preference for removal of PTW-NAPL and PTW-NRC, as required by the ASAOC and ROD. Section 5.1.6.2 (Functional Structures Determination Findings) of the BOD-PDR identifies the existing HC&C system (including extraction wells and piping) along with other site structures and features as functional structures that restrict the removal of impacted sediments and riverbank soils. The inclusion of the HC&C system as functional infrastructure for the purposes of defining the removal footprint is inconsistent with the intent of the functional structures determination (i.e., identify permanent functional site structures involved in and necessary for operations) and expectations based on previous evaluations and agreements, which include the potential for short-term impacts to the HC&C system. Expectations regarding potential impacts to the HC&C system are based on the following:	Comment is no longer applicable. Consistent with this comment, the Full Dredge and ISS Design maintains the use of the existing HC&C system. Section 6.5.5 of the Revised BODR summarizes impacts to the HC&C system.
		i. The 2012 EE/CA identifies and evaluates a range of riverbank remedial alternatives that included laybacks into the uplands to support removal of impacted sediments and riverbank soils. EE/CA figures representing remedial alternatives show the overlap between excavation laybacks and portions of the HC&C system infrastructure, indicating that some of the HC&C system infrastructure would be stabilized or removed and reinstalled under various in-water and riverbank remediation scenarios.	See response to Comment 3a.
		ii. In the August 31, 2012 Agreement to Construct Groundwater Source Control Extraction System and Performance Monitoring Network, NW Natural agreed to use structural supports at extraction wells, as needed, as an approach to stabilizing wells during future remedial actions (including riverbank and in-water remedial actions). Construction of the HC&C system proceeded with the understanding that system stabilization may be necessary to facilitate uplands and/or in-water remedial actions.	See response to Comment 3a.
		iii. The EPA's January 24, 2014 response to NW Natural's Proposed Methods for Substantial Product Accessibility Analysis, EPA indicated that upland structures, including the HC&C system, "will not likely be considered as obstructions without substantial justification." The BOD-PDR does not present additional justification to support considering the HC&C as an obstruction to remediation.	See response to Comment 3a.
		iv. As indicated in EPA's December 21, 2018 comments to the July 13, 2017 version of the Technical Evaluations Work Plan (TEWP), the presence of source control measures, such as the HC&C system (including associated infrastructure), should not restrict the scope of the Gasco Sediments Site remedy.	See response to Comment 3a.
		v. In the response to EPA Specific Comments #5 and #34 on the TEWP dated August 29, 2019, NW Natural states, "…due to unstable, oversteepened riverbank slope adjacent to the Gasco property, the entire riverbank in this area will automatically be reconfigured (excavated) to a shallow slope and capped." The first paragraph of Section 3.6.3 (Uplands Source Control) of the TEWP indicates that, "The sediment and riverbank remedial design will consider impacts to the existing upland WBZ HC&C source control system…" The BOD-PDR does not consider, discuss, or evaluate potential impacts to the HC&C system. Instead, the document relies on designating and protecting the HC&C system as critical infrastructure as the basis for the proposed remedy concept.	See response to Comment 3a.
		[cont. from "a." above] Designating the HC&C system as critical functional infrastructure unnecessarily restricts remediation along and near the top of the riverbank. It is EPA's understanding that the sediment and riverbank remedy may need to include removal and reinstallation of some of the HC&C system infrastructure. Consideration of the HC&C system as an obstruction to sediment and riverbank soil removal requires substantial justification. Any disruptions to the HC&C system during remedy implementation should be coordinated with the Oregon Department of Environmental Quality (DEQ) due to potential impacts to upland source control.	See response to Comment 3a. Any potential disruptions to the HC&C system during remedy implementation will be coordinated with DEQ.
		b. NW Natural's source control measure evaluation for the Fill WBZ was completed in April 2015 (SCM Evaluation) (Anchor QEA, 2015). The SCM Evaluation identifies trenches and horizontal wells as suitable source control technologies, assesses potential configurations of these technologies, and includes preliminary design information, a trench construction approach, and a conceptual implementation sequence. Implementation of a Fill WBZ source control measure was postponed because the scope of the riverbank remedial alternatives presented in the EE/CA would potentially interfere with, damage, or destroy a Fill WBZ source control measure constructed along the shoreline. The BOD-PDR should confirm whether construction of the proposed riverbank remedy will interfere with the configuration of the optimal alignment of Fill WBZ source control measure identified in the SCM Evaluation (i.e., along the top of the riverbank) and clarify how Fill WBZ source control measure construction will be sequenced with the in-water remedy construction. If the EPA-approved remedy concept for riverbank remediation does not include removal that would impact a Fill WBZ source control measure constructed along the top of the bank, the Fill WBZ source control measure design can proceed without further delay. As indicated in the BOD-PDR, NW Natural is committed to implementing a Fill WBZ source control measure prior to or concurrent with in-water remedy construction.	See response to Comment 3a. The Full Dredge and ISS Design includes the installation of a series of top of riverbank Fill WBZ shallow wells to control hydraulic mounding behind the ISS treatment barrier wall to prevent surface flooding either prior to or concurrent with sediment remedy implementation. It will also include an expansion of the HC&C system at the southern end of the alignment. The upland Feasibility Study will incorporate these final source control measures in all alternatives.

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4	General	**DNAPL vs. PTW-NAPL:** The TEWP and other pre-design reports discussed PTW-NAPL in the Project Area as being NAPL, and a distinction of dense non-aqueous phase liquid (DNAPL) vs. light non-aqueous phase liquid (LNAPL) was not made. The BOD-PDR is the first remedial design document to identify NAPL in the Gasco Project Area as DNAPL. However, a rationale or justification for this change in terminology has not been provided. Revise the BOD-PDR to explain what site-specific data/information from the Gasco Project Area sediment bed was used to make this determination, including for example any information on the specific gravity of NAPL in the Project Area.	The use of DNAPL in the uplands vs. in-water has been clarified in the Revised BODR.
5	General	**Project-Specific PTW-NRC Thresholds:** Per Specific Comment 32 in EPA's June 10, 2019 comments on the TEWP, it was agreed that a Gasco specific PTW-NRC evaluation will be provided to EPA for review. Based on the information provided in the BOD-PDR, EPA cannot approve this approach and a thorough evaluation of locations with naphthalene and chlorobenzene concentrations exceeding Table 21 PTW threshold should be provided in the revised BOD-PDR. The ROD does not allow site-specific exceptions to Table 21 thresholds and any such change would require EPA to issue an ESD (see EPA's response to General Comment 7 in the September 6, 2010 Conditional Approval letter for the Final TEWP and Revised DGWP), so the evaluation of PTW-NRC should focus on the feasible extent of removal.	Comment is no longer applicable. The Full Dredge and ISS Design will remove or directly treat the full PTW-NRC extent. NW Natural provided technical rationale of why the FS-level cap model used in the ROD to develop the PTW-NRC thresholds are not applicable to the Final Project Area in Section 6.2.1.2.1 of the Combined BOD-PDR, but has agreed to directly apply the Table 21 thresholds in response to this comment.
6	General	**Applicable or Relevant and Appropriate Requirement Compliance:**	
		a. The BOD-PDR as written for the preliminary design phase does not provide a centralized and comprehensive discussion of substantive compliance with applicable or relevant and appropriate requirements (ARARs) as identified in the ROD. EPA recognizes that Section 3.1.2 of the BOD-PDR, proposes that a detailed review be performed for interim and/or final remedial design and a detailed cross check of substantive compliance with ARARs may not be possible during the preliminary remedial design. However, deferring a comprehensive preliminary cross check of substantive compliance until interim or final remedial design is not acceptable since compliance with ARARs could substantially affect the design criteria and/or the concepts for remedy components presented in this BOD-PDR. EPA requires that the ARARs and To Be Considered advisories, criteria, or guidance (TBCs) from ROD Section 9 and Tables 25a through 25c that are potentially pertinent to the remedial design for the Gasco Sediments Cleanup Action be briefly identified in this BOD-PDR to indicate what remedy components and/or design parameters they could affect by referencing the pertinent sections and/or appendices of the BOD-PDR. (suggest using a table, checklist, or similar within Section 3.1.2).	Section 3.1.2 of the Revised BODR has been revised to include a more comprehensive discussion of ARARs and TBCs, and Tables 3-1a through 3-1c identify ARARs and TBCs from ROD Section 9 that are expected to be pertinent to remedial design and the plan for substantive compliance for each ARAR.
		b. The BOD-PDR implies in Section 3.1.2 that compliance with substantive chemical specific ARARs is demonstrated in this BOD-PDR (by excluding them from the statement that compliance with action- and location-specific ARARs will be included in the interim and/or final remedial design). Presumably Sections 3.1.3 and 3.1.4 are meant to show compliance with the chemical specific ARARs as there is mention of specific contaminants of concern (COCs) and cleanup levels but they are not specifically referenced to ARARs. Provide that linkage in Section 3.1.2. See also Part "a" of this comment.	Section 3.1.2 of the Revised BODR has been revised to include a reference to chemical-specific, location-specific, and action-specific ARARs. Chemical-specific ARARs are identified in Table 3-1a.
		c. The ARARs and TBCs within the ROD Tables 25 a through 25c that NW Natural has determined are not pertinent to the Gasco Sediments Cleanup Action should be individually identified in Section 3.1.2 along with brief rationale as to why they would not be pertinent and thus not discussed further in the BOD-PDR. This will allow EPA to make a determination on concurrence with exclusion of the ARAR prior to proceeding with interim remedial design.	Revised BODR Tables 3-1a through 3-1c include the requested information.
		d. Overall, there is a lack of detail in discussion of ARARs identified as pertinent to remedial design in this BOD-PDR. ARAR compliance should be demonstrated at all phases of the design process, it cannot wait until interim/final design. At this phase while it is understandable that the specifics of compliance with ARARs cannot be fully demonstrated there should at least be a section that identifies key ARARs and explains how the design will comply. Examples of where more detail is needed with respect to demonstrating substantive compliance with ARARs are provided in the section specific comments. The BOD-PDR should be closely reviewed for other instances where more detail may be needed to sufficiently address this comment.	See response to Comment 6a.
		e. It is expected that some appendices, for example Appendix P and Q, will help demonstrate substantive compliance with associated ARAR requirements. Appendix P, which provides a biological assessment outline, should help show compliance with the Migratory Bird Treaty Act (MBTA), Magnuson-Stevens Fishery Conservation and Management Act., 50 Code of Federal Regulations (CFR) Part.600.920 and Endangered Species Act. 16 USC 1536 (a)(2), listing of endangered or threatened species per 50 CFR 17.11 and 17.12 or designation of critical habitat of such species listed in 50 CFR 17.95. The BOD-PDR text (e.g., Section 3.1.2) should explain the role of the supplemental analyses in each appendix in demonstrating substantive compliance with ARARs.	See response to Comment 6a.

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7	General	**Groundwater Seepage:** The BOD-PDR references empirical seepage flux measurements from pre- and post-HC&C system startup to indicate that the HC&C system eliminates groundwater-to-surface water discharge from the Alluvium WBZs. In the August 29, 2019 response to EPA General Comment #10 on the TEWP, NW Natural committed to providing the following information in the BODR: • A conceptual site model (CSM) for groundwater-surface water interaction along the HC&C system alignment and the Gasco OU riverbank boundary, • A more comprehensive analysis of seepage meter measurements in the context of other lines of evidence further evaluating seepage data and conclusions, including river stage, HC&C performance data (installation hydrographs, extraction well pumping rates), monitoring well and piezometer groundwater elevations, measurements of groundwater/surface water temperatures and specific conductance, boring logs, and geologic cross sections, and; • Information regarding the suitability of the groundwater model for in-water use and the representativeness of surface seepage measurements – combined with modeling – for design in the BODR. Revise to include this information in the BOD-PDR and meaningfully use it to further analyze and independently verify previous assumptions regarding the influence of the HC&C system on groundwater seepage. Revise to include a CSM which provides a basis for understanding the roles and functions of Fill WBZ source control measures and the HC&C system in the context of the Gasco Project Area hydrogeology and cap design. This information is necessary in order to consider the influence of the HC&C system on groundwater seepage for remedial design.	As discussed in response to Comment 2a and Section 6.5.5 of the Revised BODR, the Full Dredge and ISS Design includes the continued operation of the existing HC&C system to eliminate groundwater to surface water discharge from the Alluvium WBZs. This design also includes installation of a ISS treatment barrier wall that eliminates discharge from the Fill WBZ. The only groundwater that is allowed to discharge to the river is the Deep Lower Alluvium WBZ that DEQ has identified is not a potential source of recontamination of the sediment remedy because all contamination exceeding the ROD Table 21 RALs and PTW thresholds are either removed or treated by ISS, which eliminates the advective flux pathway.
8	General	Navigation Channel Dredging Lateral Buffer: Consistent with Section 5.3.3 of EPA's Remedial Design Guidelines and Considerations (RDGC), a 50-foot lateral buffer from the navigation channel towards the shore is required to enable United States Army Corps of Engineers (USACE) to carry out overwidth dredging, including side slope sloughing from maintenance dredging of the navigation channel to -45 feet CRD. If a 50-foot lateral buffer is not feasible because of site-specific constraints, NW Natural should coordinate with EPA and USACE to assess future dredging requirements in light of deepening, side slope stability, equipment, and layback requirements. Revise the BOD-PDR to address the requirement for a 50-ft lateral buffer from the navigation channel.	NW Natural held a meeting with USACE on November 19, 2021, to discuss the Combined BOD-PDR remedial design relative to the existing 10-foot horizontal offset shown in the Combined BOD-PDR and the impacts to the remedy, and impacted structures, shoreline, and upland infrastructure, using a 50-foot offset. USACE indicated that they would be willing to consider a horizontal offset of 10 feet for the Gasco Sediment Site Project Area provided that the information requested by USACE and EPA needed to justify the offset is included in the preliminary design for a final decision. The remedial design will include the details requested by USACE. NW Natural will continue to coordinate with EPA and USACE to ensure compliance with USACE offset requirements.
9	General	**Data Gaps:** The BOD-PDR asserts that there are no remaining data gaps applicable to the remedial design; however, the depth of contamination (DOC) is not fully delineated in some areas. An assessment of data gaps should be performed after the BOD-PDR is revised and the evaluations needed to finalize remedial technologies are completed. Depending on the final technology selection, data gaps associated with delineating DOC and the limit of dredging technologies, and characterizing sediment and porewater for design and management purposes may require additional investigation.	Sections 7.1 through 7.10 of the Revised BODR describe the technical evaluations to be performed in future design deliverables, including data requirements and data gaps, if any, associated with each evaluation. NW Natural also submitted an EPA-approved: 1) memorandum titled *Final Revised Additional Depth of Contamination Characterization Addendum within the Gasco Sediments Site Project Area* dated March 23, 2023; and 2) *Additional Revised In Situ Stabilization and Solidification Bench Scale Treatability Study Work Plan* dated May 19, 2023, to determine Project Area-specific remedial design parameters for optimizing ISS performance.

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EPA Section-Specific General Comments			
10	General Section 3 (General Project Design Parameters)	**Limited Dredging Technology Evaluation:** Hydraulic dredging as an alternative is not sufficiently considered in the BOD-PDR. Consistent with the recommendations in the Gasco Early Action-Construction Oversight Report prepared by Parametrix on behalf of EPA (Parametrix 2006), *"It is recommended that hydraulic dredging should be considered with any future dredging projects at GASCO or other Portland Harbor sites. The significant advantages of hydraulic dredging to control potential water quality impacts may outweigh disadvantages due to financial or logistical concerns. In addition, the use of hydraulic dredging may significantly reduce the necessity of containment structures."* Hydraulic dredging has the potential to decrease construction times by increasing production rates, and potentially decrease residuals and water quality impacts. A more robust rationale for exclusion of hydraulic dredging should be provided in Section 7.2.	Section 6.2.2.3 of the Revised BODR describes the dredge technology evaluation that will be conducted in the PDR, which will provide a more robust rationale for exclusion of hydraulic dredging.
11	General Section 3 (General Project Design Parameters)	**Removal under Dock Structures:** The BOD-PDR should sufficiently consider dredging construction methodologies and/or specialized equipment that can access the sediment under dock structures. Diver assisted dredging should be assessed as well as the amount of sediment accrual since installation of the docks. Any accumulated sediment since installation would not have been accounted for in the design of the dock and should be considered for removal. Revise the document throughout.	Section 6.3.2.5 of the Revised BODR states that the Design Team will consider the construction methodologies required to ISS under and directly adjacent to functional structures during remedial design.
12	General Section 4 (Final Project Area Refinement)	Due to the deficiencies identified in EPA comments on Section 4, Appendix E, and Appendix L, the final Project Area boundary presented in the BOD-PDR cannot be approved at this time. Refinements to the Project Area boundary based on EPA's comments will be reviewed in the revised BOD-PDR.	Comment noted. Section 4 and Appendix I of the Revised BODR identify the proposed Project Area boundary based on multiple lines of evidence.
13	General Section 4 (Final Project Area Refinement)	The final Gasco Pre Remedial Design Investigation (PDI) data were not available to EPA in the Portland Harbor Interim Database (PHIDB) with sufficient time to fully evaluate the Gasco Project Area refinement sediment management area (SMA) delineation as presented in the BOD-PDR. When the final Gasco PDI data become available to EPA in the PHIDB additional comments on a subsequent draft of the BOD-PDR may be provided.	Comment noted.
14	General Section 5 (Summary of the ROD Remedial Technology Application Decision Tree)	Section 5 discusses whether capping on grade is an appropriate remedial technology in the intermediate and shallow regions. Consistent with RDGC Section 3.1, capping on grade may be allowed if remedial design evaluations determine that there are no adverse impacts to habitat and the floodway. Capping on grade in the intermediate and shallow regions cannot be approved unless the results for Hydrologic Engineering Center River Analysis System (HEC-RAS) modeling to evaluate impacts to flood rise are provided. The revised BOD-PDR should include all supporting information and evaluations needed to finalize remedial technologies.	The Full Dredge and ISS Design no longer includes capping on grade. See response to Comment 2. HEC-RAS modeling to evaluate flooding impacts will be presented in PDR as described in Section 6.8.2 of the Revised BODR.
15	General Section 5 (Summary of the ROD Remedial Technology Application Decision Tree)	The Final Project Area is divided into four remedial technology subareas that are different from the ROD-identified river regions. The ROD's selected remedy has different requirements based on the river regions and there is no apparent reason for making site-specific adjustments based on the information provided in the BOD-PDR. The BOD-PDR should use the river regions described in the ROD. Alternative river regions will not be considered by EPA without sufficient justification to support the deviation from the river regions identified by the ROD.	The remedial technology subareas have been removed from the Revised BODR, and river regions described in the ROD are used instead.
16	General Section 8 (Riverbank Design Technical Evaluation)	The BOD-PDR states that "the ROD did not identify initial remedial technologies for the Riverbank Subarea". However, Section 3.6.2.10 of the Gasco Statement of Work (SOW) requires the removal of riverbank soils containing PTW-NAPL to the greatest extent feasible and indicates that some product in the riverbank may be left in-place if it is too deep to be integrated into the sediment dredge prism. This section of the SOW further requires an engineered cap that addresses contaminant flux to the river where it is infeasible to remove riverbank soils. The requirements discussed in the SOW should be incorporated into the riverbank remedy design and evaluated in the revised BOD-PDR.	Consistent with this comment, the Full Dredge and ISS Design remediates to the full depth of contamination at the Gasco riverbank and can be used to remediate the full depth of contamination at Siltronic property riverbank if required by the ROD.
17	General Section 8 (Riverbank Design Technical Evaluation)	The BOD-PDR states that no evidence exists for a subsurface PTW-NAPL transport pathway from the upland to the sediments. One of the eight angled borings advanced along the Gasco property shoreline during the pre-design investigation contained evidence of PTW-NAPL. Furthermore, manufactured gas plant (MGP) residuals occur throughout the fill along and/or near the top of the riverbank, as documented by the Draft Gasco OU Interim Feasibility Study. Impacts associated with PTW-NAPL and other MGP residuals along, near, and potentially within the riverbank should be acknowledged, discussed, and considered in the revised BOD-PDR to align the uplands and in-water remedies along the riverbank. Additionally, the BOD-PDR should acknowledge that per the conditional approval of the Sufficiency Assessment, any data gaps associated with PTW-NAPL migration will be evaluated through NW Natural's upland FS data gaps work plan prior to the implementation of the in-water remedy.	As documented in Figures 3-13a through 3-13f in the PAR (Anchor QEA 2022), the Full Dredge and ISS Design eliminates NAPL migration from the uplands to the river via the installation of a ISS treatment barrier wall that extends to elevations much deeper than all observations of NAPL in the top of riverbank and other upland borings.

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18	General Section 8 (Riverbank Design Technical Evaluation)	Section 3.4.1.3 of the Gasco SOW states that the need for riverbank work will be determined, in part, by the need for soils remediation consistent with the uplands risk assessment. The proposed design for the unsubmerged riverbank (placing cover material on the bank surface after slightly excavating and grubbing the riverbank) does not consider, and may not be protective of, uplands receptors. Complete uplands pathways identified in the 2014 *Gasco Site Human Health and Ecological Risk Assessment Report* (Gasco Site HERA) represent risk of exposure to human and ecological receptors by contaminated riverbank soil (birds, mammals, plants, invertebrates) and seeps of contaminated groundwater onto the unsubmerged riverbanks (birds, mammals). The revised BOD-PDR should include and describe data available from previous investigations along, near, within, and on the riverbank for context. If the unsubmerged riverbank design presented as part of the in-water remedy does not address risk documented in the HERA, DEQ may require remediation of riverbanks as part of the Gasco OU Feasibility Study.	See response to Comment 16.
19	General Section 8 (Riverbank Design Technical Evaluation)	The identified remedial technology of "monitoring" for the Siltronic riverbank does not meet the requirements of the ROD and must be revised. Data presented in the BOD-PDR and attached Pre-Remedial Design Data Gaps Data Summary Report (DSR) indicates that PTW-NAPL was observed in upland borings and shallow zone sediment borings located adjacent to the Siltronic riverbank (see BOD-PDR Figures 2-7C, 4-1 and TEWP Figure 2). The identification of PTW-NAPL within the Siltronic riverbank is likely based on the high level of contamination identified in rotosonic, angle-drilled borehole PDI-142 that was drilled in the Siltronic riverbank in November 2019. Evidence of potential substantial product and Table 17 and Table 21 exceedances encountered at boring PDI-142 included: **a.** from 28.0 to 30.4 feet (depths not corrected for angle boring orientation) encountered sand with tar-like material, strong hydrocarbon-like odor **b.** rainbow sheen when wet observed at 30.2 feet **c.** Composited soil sample from 20 to 30.4 feet had following detected concentrations: **i.** Total polycyclic aromatic hydrocarbons (PAHs) detected at 280,000 JT micrograms per kilogram (ug/kg), exceeding the ROD Table 21 remedial action level (RAL) of 30,000 ug/kg **ii.** Benzene detected at 2,140 T ug/kg **iii.** ROD Table 17 cleanup level (CUL) exceedances for arsenic, dieldrin, DDx, dioxin furans, total polychlorinated biphenyls (PCBs), and TPH-diesel (J or T-flagged values). Additional delineation and evaluations should be conducted, and a remedial technology suitable for removal or containment of the full extent of contamination should be assigned to the affected area.	See response to Comment 18.
20	General Section 8 (Riverbank Design Technical Evaluation)	The basis of design for the Siltronic riverbank should include discussion of transport of contamination from riverbank soil via non-erosion processes, such as leaching to groundwater, surface water interaction with contaminated soil through the rip rap, or via precipitation infiltrating the rip rap and leaching contamination from riverbank soil.	See response to Comment 18.
21	General Section 8 (Riverbank Design Technical Evaluation)	The proposed available technology does not address post-remediation riverbank vegetation/riparian habitat and necessary slope layback. The BOD-PDR proposes vegetation removal (grubbing) as part of remediation but does not discuss any revegetation or subsequent monitoring. Indeed, the habitat equivalency analysis calculations presented as part of its Preliminary Mitigation Evaluation Methods (Attachment A to Appendix O) describe all post-remediation habitats as "unvegetated." Per ROD Section 14.2.5: "Engineered caps or vegetation with beach mix will be placed as the final cover based on area-specific designs, which will account for appropriate slope according to the programmatic or site-specific Biological Opinion, as appropriate." Add a discussion of planned post-construction vegetation appropriate for riparian habitat and consideration of self-mitigating slope layback along with source removal.	Post-remediation riverbank vegetation and slope layback will be discussed in the PDR.
22	General Section 9 (Remedial Technology Selection and Preliminary Design Approach)	The selected remedial technologies and preliminary design approach cannot be approved until the substantial concerns highlighted in EPA's general comments on Sections 4 through 8 are addressed in the revised BOD-PDR. Therefore, specific comments are not being provided on Section 9 at this time. The revised BOD-PDR should include all supporting information and evaluations needed to finalize remedial technologies.	As discussed in response to Comment 1a, the detailed technical rationale for the selection of the Full Dredge and ISS Design is presented in the PAR (Anchor QEA 2022).

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Comment No.	Section/Topic	Comment	Comment Response
23	General Section 10 (Dredged Material Classification and Management Evaluation)	A materials management plan (MMP) should be provided in the BOD-PDR, compliant with NW Natural's response to EPA's October 18, 2017 comments on the Final Pre-Remedial Basis of Design TEWP, the 2009 ASAOC, and the 2004 Opalski dispute decision[1]. The MMP should include: ***[Footnote 1]*** Formal Dispute Regarding EPA Comments on Draft Preliminary Design Submittal, letter and attached memorandum from Daniel D. Opalski, USEPA to Robert J. Wyatt, NW Natural dated December 17, 2004.	An MMP will be included in the PDR.
		a. Means and methods, including recordkeeping, to demonstrate compliance with substantive requirements of ARARs for waste handling work conducted within the PHSS	
		b. Means and methods, including recordkeeping, to demonstrate compliance with substantive and administrative substantive and procedural requirements of applicable Federal, state, and local laws and regulations for work conducted offsite, including transload, transport, worker safety, and waste disposal outside of the PHSS	
		c. Organizational structure of waste management activities	
		d. Dredge sediment characterization and classification approach for offsite transport and disposal, including determination of whether the dredged sediment contains Resource Conservation and Recovery Act (RCRA) listed or characteristic hazardous waste, Toxic Substance Control Act (TSCA) waste, and/or State of Oregon listed hazardous waste including frequency and type of testing. Discussion of the means and methods for classification including procedures for requesting any required approvals from DEQ, such as "contained in" determinations, should be presented. The approach proposed should demonstrate compliance with substantive and administrative requirements of applicable Federal, state, and local laws and regulations for transport and waste disposal outside of the PHSS. Pertinent information developed as part of Waste Disposal Classification Evaluation as described in Section 4.6 (and as modified by comments provided herein) should be included.	
24	General Section 13 (Preliminary Mitigation Evaluation)	The proposed capping on grade is described as an available remedial technology even though the ROD specifically assumed a 5-foot dredge and cap scenario to avoid conversion of shallow water habitat. Although Section 13 indicates that measures would be incorporated into the design to offset habitat modifications, no such measures are described, and the preliminary mitigation evaluation presented in Section 13 and Appendix O relies solely on the Habitat Equivalency Assessment (HEA) to estimate mitigation requirements. This information should be provided in the revised BOD-PDR so that capping on grade may be approved as a remedial technology for the Gasco Project Area.	See response to Comment 2.
25	General Section 13 (Preliminary Mitigation Evaluation)	Revise the BOD-PDR to describe what is meant by "habitat material" with respect to grain size, shape, and general percentage of various material sizes.	Section 3.2 of Appendix H (*Mitigation Evaluation Work Plan*) in the Revised BODR has been revised.
26	General Section 13 (Preliminary Mitigation Evaluation)	EPA recommends coordination with NMFS early in the HEA development process to reduce the NMFS review time and verify that the inputs and formulas used in the HEA calculations are correct. EPA is not approving the HEA approach provided in the calculations attached to Appendix O.	NW Natural understands that EPA is not approving the HEA calculations without having NMFS review and provide input. However, EPA already approved the overall HEA approach through approval of the *Mitigation Evaluation Work Plan* , which was part of the Technical Evaluation Work Plan (TEWP). NW Natural will directly coordinate with the Portland Harbor NMFS contact to review the HEA calculations prior to submittal of the PDR.
27	General Section 13 (Preliminary Mitigation Evaluation)	The preliminary mitigation evaluation presented in Section 13 and Appendix O results in a wide range of Discounted Service Acre-Years (DSAYs) depending on whether habitat material stays in place, stating that "hydrodynamic modeling conducted during Interim and/or Final Design will inform where material will and will not be expected to remain in place." In addition to modeling, empirical data will be required based on post-remediation monitoring (see RDGC Appendix C) to determine where habitat material is not remaining in place and thus, where additional compensatory mitigation is required. DSAY credits should not be assumed before empirical data are available. Revise the discussion accordingly.	Final mitigation determination will rely on post-construction monitoring, and this will be discussed in the PDR.
28	General Section 13 (Preliminary Mitigation Evaluation)	The BOD-PDR discusses the hydrodynamic conditions at the site (e.g., Section 2.4.2); however, this discussion does not include an evaluation of the potential for the habitat material to remain in place. Revise the text to provide an explanation of the additional hydrodynamic modeling that will be conducted to inform where material will and will not be expected to remain in place.	Section 3.2 of Appendix H (*Mitigation Evaluation Work Plan*) in the Revised BODR has been revised.

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Comment No.	Section/Topic	Comment	Comment Response
29	General Section 16 (Dredging Water Quality Barrier Control Evaluation)	The Best Management Practices (BMPs) discussed in Section 16 and Appendix R are focused on dredging. BMPs for other remedial activities such as removal of pilings, placement of cap materials, etc. should be provided in the Interim and Final Design. Revise the text accordingly.	Text has been added to Section 6.6.3 regarding BMPs for other remedial actions with reference to future design deliverables.
EPA Specific Comments			
30	Executive Summary	**Executive Summary, 1st bullet, page ES-2:** Add the expected maximum vertical extent of dredging and cap thickness to the text noting comments below on the practical limits of dredging.	The executive summary has been removed from the Revised BODR, so this comment is no longer applicable.
31	Section 1	**Section 1.3, Design-Build Approach, page 5:** Remove the reference to the lessons learned summary for the Former Portland Gas Manufacturing (PGM Site) since Section 5 has been removed from the Project Completion Report.	The reference to lessons learned at the Former PGM site has been removed from the Revised BODR.
32	Section 2	**Section 2, Project Area Background, Conditions, and Data Sources, page 8, Vertical Datum bullet:** Provide a reference for the City of Portland datum (COP) to Columbia River datum (CRD) conversion and an example calculation (e.g., 47 CRD + 3.1 feet = 50.1 COP). It is not clear whether the equation variables are absolute values or distance from the datum (e.g., 43 CRD or -43 CRD).	A reference has been provided in Section 2 of the Revised BODR.
33	Section 2	**Section 2.4.2, Hydrodynamic Conditions, pages 15 through 16:** Typical hydrodynamic conditions in the Willamette River are included in the BOD-PDR; however, there is little discussion on the frequency of flooding and flood flows to date as well as likely future changes. Include a description of the frequency of flooding and flood flows in the Willamette River near the Final Project Area in the BOD-PDR.	Frequency of flooding and flood flows in the Willamette River near the Project Area has been added to Section 2.4.2 of the Revised BODR.
34	Section 2	**Section 2.4.3 Fine Sediment Distribution, pages 16 through 17:** Provide the rationale and any supporting literature for the statement that US Moorings docks, "hinder surficial sediment migration of fine sediments downriver from the Final Project Area", and that the boundary "creates an eddy on the upriver side of the US Moorings docks, leading to coarser-grained sediments in this isolated portion of the Final Project Area (just upstream of these structures) and a much depositional environment located between the US Moorings structures."	The text has been revised.
35	Section 2	**Section 2.4.4, Wind- and Vessel-Generate Waves, page 17, and Section 2.4.5, Vessel Propeller Wash, page 17, second paragraph:** Text in these sections state that the Final Project Area has a total acreage of 23.2 acres. It is unclear why the total acreage of the Final Project Area has increased from 20.2 acres as stated by the Final Gasco Sediments Site Sufficiency Assessment. Revise the text to resolve this inconsistency.	As stated in Section 2.1 of the Revised BODR, the Project Area was refined based on an extensive and densely spaced data set collected with EPA's approval specifically to support remedial design. This refinement is detailed in Section 4 of the Revised BODR.
36	Section 2	**Section 2.5 Riverbank Conditions, page 42:** The referenced Siltronic Bank Assessment of Non-Point Source Consequences of Sediment (BANCS) should be presented in the remedial design for technical review. Preliminary review of this assessment indicates that the referenced BANCS methodology was performed incorrectly and underestimates the height of riverbank parameter.	The BANCS has been appended to the Revised BODR, and the text has been revised.
37	Section 2	**Section 2.7 Project Area Ongoing and Future Uses, Navigation Channel bullet, page 26:** Note that the authorized dredge depth in the navigation channel is 43 feet CRD with a 2-foot overdredge depth (-45 feet CRD = 48.1 feet COP). Per Section 5.3.3 of the RDGC, a 50-foot lateral buffer from the navigation channel towards the shore is required so that the navigation side slope does not undermine any remedies adjacent to the channel. If a 50-foot lateral buffer is not feasible because of site-specific constraints a supporting evaluation should be included and NW Natural should coordinate with EPA and USACE to assess future dredging requirements in light of deepening, side slope stability, equipment, and layback requirements.	Noted. See response to Comment 8.
38	Section 2	**Section 2.10.1.1, Alluvial Groundwater, page 30:** The text states, "The DEQ-approved Gasco Groundwater Modeling Report (Anchor QEA 2017a) demonstrates that the HC&C system is capturing groundwater from Deep Lower Alluvium WBZ. Specifically, Figures 5-5 through 5-10b of the Gasco Groundwater Modeling Report show particle tracking paths under pumping and non-pumping conditions." The HC&C system is controlling groundwater gradients in the Upper and Lower Alluvium WBZs. However, EPA does not agree that groundwater modeling demonstrates that the HC&C system is capturing groundwater from the Deep Lower Alluvium WBZ during ongoing operations and such statements should be removed from the text. As noted in EPA's April 4, 2017 letter to NW Natural regarding the Gasco Groundwater Modeling Report, EPA considers the primary lines of evidence to demonstrate offshore seepage control to be empirical data to corroborate the groundwater model results and give confidence to model predictions. The groundwater modeling provides a line of evidence that groundwater is captured from the Deep Lower Alluvium WBZ, but the modeling results have not been verified to show they are representative of ongoing HC&C operations.	The text has been removed.

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Comment No.	Section/Topic	Comment	Comment Response
39	Section 2	**Section 2.10.1.2, Shallow Fill Groundwater, page 31:** The text implies that the recent removal action conducted under DEQ authority to address mobilization of COCs in Fill WBZ groundwater downgradient of the liquid natural gas basin constitutes an interim source control measure. However, removal action performance has not been evaluated to determine what influence, if any, it has on controlling the contaminant migration pathway to the Willamette River from the Fill WBZ. Any reference to the Fill WBZ Removal Action as an interim source control measure should be removed from the BOD-PDR.	References to the Fill WBZ Removal Action as an interim source control measure have been removed.
40	Section 2	**Section 2.10.2.1, Stormwater Source Control at Gasco Property:** The BOD-PDR text states, *"Stormwater source control on the Gasco property is complete, as DEQ has determined in its draft source control decision dated January 4, 2021. Implementation of these stormwater SCMs have already addressed any potential for sediment recontamination from stormwater discharge at the Gasco property."* Revise the text to clarify that a draft determination stating the stormwater pathway from the Gasco property is sufficiently controlled was prepared; however, the final source control decision will be issued by DEQ when source control measures for all applicable pathways have been implemented, and the source control decision will be reviewed by EPA and the Technical Coordinating Team (TCT) before being issued.	The text has been revised.
41	Section 2	**Section 2.10.2.2. Stormwater Source Control at Siltronic Property:** The BOD-PDR text states, "Stormwater source control on the Siltronic property is complete, based on DEQ's stormwater source control determination (DEQ 2021)." Revise the text to clarify that a draft determination stating the stormwater pathway from the Siltronic property is sufficiently controlled was prepared; however, the final source control decision will be issued by DEQ when source control measures for all applicable pathways have been implemented, and the source control decision will be reviewed by EPA and the TCT before being issued.	The text has been revised.
42	Section 3	**Section 3.1.2 Applicable or Relevant and Appropriate Requirements and To Be Considered, pages 36 through 37:** EPA has the following comments on this section and the text should be revised accordingly: **a.** The second paragraph specifically uses the terminology "applicable or relevant" with respect to determining whether regulatory citations will be considered for the Gasco Sediments Site. The determination whether ARARs were applicable or relevant and appropriate to the selected remedy were made in the ROD and should not be reinterpreted. Suggest revising terminology to state that all ARARs identified in the ROD will be considered during remedial design but those that are not pertinent to the activities for the selected remedy for the Gasco Sediments (if any) will be specifically identified and excluded from consideration during remedial design, as approved by EPA. See also General Comment on Applicable or Relevant and Appropriate Requirement Compliance, Part b. **b.** The last paragraph states that methods to demonstrate substantive compliance with ARARs are presented in other sections of the BOD-PDR and will be included as part of the Gasco Sediments Site design documents. The methods of documenting compliance with substantive ARAR requirements should be discussed. For example, discuss whether forms will be used for each ARAR or activity, or whether electronic documentation (spreadsheets, etc.) will be used. While this information has been added in a general sense, this BOD-PDR should be more specific as to each ARAR and which method(s) will be used to demonstrate substantive compliance. For example, the BOD-PDR does not describe how fugitive emissions will be assessed or monitored or that a performance evaluation will be completed for the remedial design to meet the substantive compliance with Oregon Air Pollution Control Oregon Revised Statutes (ORS) 468A et. seq., General Emissions Standards Oregon Administrative Rules (OAR) 340-226 as identified in Table 25b of the ROD. See also General Comment on Applicable or Relevant and Appropriate Requirement Compliance, Part d.	 The text has been revised. See response to Comment 6b. See response to Comment 6d.
43	Section 3	**Section 3.1.3.1, Remedial Action Levels, page 37**: Remove or revise the following statement, "sediment remediation of areas established based on the select contaminants of interest will also address the remaining contaminants potentially posing unacceptable risk, as described in the ROD." This language is inconsistent with the ROD and should be removed. As noted in ROD Section 8.2.5, Table 16 contaminants posing potentially unacceptable risk will be compared with post-remedial action conditions to confirm that alternatives developed for the ecologically significant contaminants (i.e., contaminants considered in the development of remedial actions) would also be protective of risks of lower ecological significance.	The text has been revised.
44	Section 3	**Section 3.1.3.2, Principal Threat Waste, No. 1 PTW-NAPL page 38:** Revise the second to last sentence as follows: "PTW-NAPL is one of the primary criteria used to determine the lateral boundaries of the Final Project Area". According to the ROD, RALs and PTW thresholds are also primary criteria to determine lateral extent of SMAs.	The text has been revised.
45	Section 3	**Section 3.1.4, Long-Term Cleanup Levels, page 39:** Remove "Long-term" temporal qualification from this title as some cleanup levels may be achieved in the short term (i.e., immediately post construction while others may take longer).	The text has been revised.
46	Section 4	**Section 4.2, Evaluation of PTW-NRC, page 43**: Provide a figure showing locations where chlorobenzene and naphthalene concentrations exceed the PTW thresholds provided in ROD Table 21. See EPA's general comment regarding the project-specific PTW-NRC thresholds.	Figure 4-2 has been revised.

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Comment No.	Section/Topic	Comment	Comment Response
47	Section 4	**Section 4.3.2.1 Indicator Kriging to Delineate Subsurface Sediment Exceedance Extent, page 45:** Regardless of whether cores PDI-100SC, PDI-150SC, PDI-173, or PDI-174 are determined to have buried contamination that is chemically and physically stable, these core locations have contamination above RALs and/or PTW thresholds at depth. Manually adjusting the DOC to 0 feet (as described in Figure 7-1, Note 1) causes the contouring between adjacent core concentrations to artificially approach 0 feet. This is likely underpredicting the actual DOC. The boundary line of the SMA may be considered for adjustment based on some of the interpretations presented, but the actual DOC used to develop the DOC model should not be ignored or manipulated. The actual DOC at these locations should be used in the interpolations of surrounding cores for the DOC model to be representative. After revising the interpolation and determining daylight slopes, the remaining overburden at these locations should be assessed for physical and chemical stability.	Discussion of buried contamination has been removed from the text. The actual DOC will be used at during future interpolation work. NW Natural will coordinate the remediation between the B1 Navigation Channel Project Area and the Gasco Final Project Area to ensure the remedial designs are compatible with each other and with the ROD.
48	Section 4	**Section 4.3.2.2, Subsurface Sediment Buried Contamination Evaluation, pages 45 through 47:** EPA has the following comments on this section and the text should be revised accordingly: **a.** In the bullet list of buried contamination locations, include the elevation for these exceedances in CRD/COP so that it may be compared to the Congressionally authorized maintenance dredging depth for the navigation channel and requirements discussed in Section 5.3.3 of the RDGC. Based on the currently authorized depth, future maintenance dredging operations have the potential to expose buried contamination at elevations above -47 ft CRD. **b.** Revise the text in the first paragraph to discuss changes in bathymetry over different time steps (i.e., differential bathymetry shown on Figure 2-16 series) in the localized area with buried contamination. Simply looking at net bathymetric change is not sufficient to evaluate potential for physical exposure because this does not account for episodic scour events. Also include discussion of: **i.** Erosive forces and bed shear stress under the 100-yr flood event **ii.** sediment grain size **iii.** embedded debris, anchor drag, structure and piling-attributed scour, as applicable **c.** The evaluation of physical exposure concludes that "there is limited potential for physical exposure of subsurface sediment exceedances, especially at depths greater than 4 feet below mudline where the exceedances are located." The basis for this conclusion is unclear. Discuss the anticipated depths of disturbance for each physical line of evidence to support this conclusion and how those anticipated depths were derived from existing information. **d.** Two of the four cores excluded from SMA delineation, PDI-100 and PDI-150, appear to be very close to the boundary of the SMA so the buried contamination in this area could be exposed during adjacent dredging during remedial action. The physical stability of these cores should be better justified in light of future adjacent remedial dredging and maintenance dredging. **e.** The four proposed buried contamination locations are not approved for exclusion from SMAs because the information provided is the BOD-PDR is insufficient and inconsistent with EPA's expectations of physical and chemical stability evaluations. Regardless, assigning an indicator value of 0 leads to artificial shrinking of the SMA and is not representative of the contamination in the area. Refer to comments on Appendix L. **f.** For detailed comments on the chemical stability approach, see EPA's comments on Appendix E.	Comment is no longer applicable as the Full Dredge and ISS Design includes full removal or directly treats all sediments containing ROD Table 21 RAL and PTW threshold exceedances within the Project Area, including buried contamination.
49	Section 4	**Section 4.3.2.2 Subsurface Sediment Buried Contamination Evaluation, pages 47:** The buried contamination framework must account for the potential for erosion during flood events as modeled during the Portland Harbor remedial investigation/feasibility study (RI/FS). RI/FS Map 3.1-7 shows bed shear from approximately 0.11 to 3 pascals in the portion of the Project Area in the navigation channel for the low-flow and high-flow events, respectively (EPA 2016).	See response to Comment 48.
50	Section 4	**Section 4.4.1, Downriver Refinement, page 48:** Contamination at the downriver extent of the Project Area is not fully delineated and is expected to be addressed by NW Natural under the B1 Navigation Channel or U.S. Moorings ASAOCs. Revise the text to acknowledge that NW Natural will be responsible for ensuring that the remedial designs for all three areas are compatible with each other and the ROD.	The text in Section 4.5.2 of the Revised BODR has been revised.
51	Section 4	**Section 4.4.2, Upriver Adjustment, page 48:** EPA agrees with the refinement of the upriver Project Area boundary based on the known extent of PTW-NAPL. However, EPA's review of the BOD-PDR does not pertain to topics which allude to allocation, such as the discussion in Section 4.4.2. EPA's review of the BOD-PDR is focused solely on its remedial design objectives consistent with the ASAOC and an absence of comments on the discussion of contamination sources should not be considered approval of allocation related discussions included in the text in this section and elsewhere in the BOD-PDR. The revised BOD-PDR should exclude allocation related discussions.	Allocation related discussions have been removed from Section 4.5.3 of the Revised BODR.

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Comment No.	Section/Topic	Comment	Comment Response
52	Section 4	**Section 4.6, Final Project Area Conclusions, page 49:** Due to the deficiencies identified in EPA comments on Section 4, Appendix E, and Appendix L, the final Project Area boundary presented in the BOD-PDR cannot be approved at this time. Refinements to the Project Area boundary based on EPA's comments will be reviewed in the revised BOD-PDR.	Comment noted. See responses to the referenced EPA comments on Section 4, Appendix E, and Appendix L.
53	Section 5	**Section 5.1.1, Navigation Channel Region, pages 50 through 51:** EPA has the following comments on this section and the text should be revised accordingly:	Several significant design challenges to the feasibility and implementability of extensive dredge and cap technologies were identified when attempting to address EPA's objectives identified in the Combined BODR-PDR comments. Therefore, several different remedial technology configurations were considered and evaluated in Appendix A of the PAR (Anchor QEA 2022) to determine whether another acceptable technology in the ROD, or a combination of ROD technologies, could better address EPA's objectives for the ROD-identified Intermediate, Shallow, and Riverbank Regions of the Project Area. As detailed in the PAR, only the Full Dredge and ISS Design fully achieves all of EPA's design objectives and prevents sediment recontamination. Section 5 has been fully updated to summarize the findings described in the PAR.
		a. The text in this section discusses navigation channel maintenance dredging requirements based on the 2020 version of the RDGC. The April 23, 2021 RDGC update states that cap elevations within the navigation channel should not exceed -47 feet CRD. Revise this discussion as needed based on RDGC Section 5.3.3.	The most recent version of the RDGC will be used as guidance during remedial design and will be discussed in the PDR.
		b. Revise the definition of DOC to be consistent with RDGC Section 5.1.2. that requires DOC to be delineated based on two consecutive 1-ft intervals with no Table 21 exceedances. If this requirement was not met the DOC was not adequately delineated and this is a potential data gap for remedial design. See General Comment on data gaps.	Section 4.2 of the Revised BODR has been revised to include the RDGC definition of DOC. As described in Section 6.2.4 of the Revised BODR, the *Final Revised Additional Depth of Contamination Characterization Addendum within the Gasco Sediments Site Project Area* was submitted to USEPA to collect additional site-specific data to determine the DOC at the remaining vertically unbounded locations throughout the Project Area.
54	Section 5	**Section 5.1.2, FMD Region, page 51:** Per ROD Section 14.2.2, revise the last sentence of the first paragraph as follows: "… the cap would be placed such that the top of the post-construction surface is below the required berthing elevation ***including an overdredge allowance or buffer zone"(emphasis added)*** .	This text is no longer included in the Revised BODR. See response to Comment No. 53.
55	Section 5	**Section 5.1.6, Functional Structures Determination, page 54:** Provide the basis for the assumed 10-foot offset from structures in the revised BOD-PDR. This assumption should be verified based on structural stability evaluations.	The functional structures determination will be included in the PDR.
56	Section 5	**Section 5.1.6.2, Functional Structures Determination Findings, Shell Dock/Timber Dolphin, page 56:** Provide additional information regarding the remedial activities and future site operations that are to be supported by the Shell Dock/Timber Dolphin. Since it is not currently a functional structure, additional information is needed to support not removing this structure consistent with the technology application decision tree on ROD Figure 28. Also see EPA comment on Appendix F.	The text has been revised to identify that neither of these structures are functional structures and that the timber dolphin was removed as part of the ISS field pilot study and the Shell dock will be subsequently removed as part of the final sediment remedy.

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Comment No.	Section/Topic	Comment	Comment Response
57	Section 5	**Section 5.3, Site-Specific Remedial Technology Refinement Considerations, Navigation Channel Lateral Buffer (3rd) bullet, page 59:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. The Duwamish River is not an appropriate comparison for the Willamette River. The authorized channel depth for the Willamette River is currently -45 feet CRD, which is much greater than the depth of the Duwamish River. A 10-foot lateral buffer is not appropriate for a 45-foot CRD channel. A 50-foot lateral buffer from the navigation channel is required as discussed in RDGC Section 5.3.3. Also see General Comment on navigation channel dredging lateral buffer.	Comment noted. See response to Comment 8.
		b. Clarify what is meant by "Navigation Channel requirements will be followed". EPA does not approve of applying navigation channel RALs to the Intermediate Region and Future Maintenance Dredge (FMD) areas.	This statement has been removed from the Revised BODR.
		c. RDGC Section 5.3.3 was revised to state that: "In addition, remedial designs in and immediately adjacent to the FNC will incorporate at least a 50-foot lateral buffer to enable USACE to carry out overwidth dredging, including side slope sloughing from maintenance dredging to -45 feet CRD, as needed. If a 50-foot lateral buffer is not feasible because of site-specific constraints, NW Natural will coordinate with EPA and USACE during remedial design to assess future dredging requirements in light of deepening, side slope stability, equipment, and layback requirements." The 10-ft lateral buffer proposed in the BOD-PDR is not acceptable and NW Natural should coordinate with EPA and USACE on this matter.	Comment noted. See response to Comment 8.
58	Section 5	**Section 5.3, Site-Specific Remedial Technology Refinement Considerations, Upland Infrastructure (Sections 2.6) (3rd) bullet, page 60:** The text states: "Siltronic has reported that these operations are sensitive to vibrations and that significant vibration-creating construction may result in product damage, facility shut down, and lost revenue." Note that short-term impacts to business relating to remediation-related vibration do not constitute a reasonable basis for favoring on-grade caps over dredging and capping/backfilling particularly for removal of PTW-NAPL. NW Natural should consider whether construction activities can be timed to minimize business impacts. An evaluation of how dredging in this area would cause vibrations on the Siltronic property should be provided in the BOD-PDR (also see specific comment on Section 7.5).	This comment will be addressed in the PDR.
59	Section 5	**Section 5.4.1, Final Project Area Remedial Technology Subareas, Transition Slope Subarea, page 61:** Revise the text to clarify how a mostly natural bed slope supports identifying the Transition Slope Subarea as a box. This seems like an oversimplification of conditions at the Project Area and is not strictly supported by the bathymetric contours in this area.	This comment is no longer applicable. See response to Comment 15.
60	Section 5	**Section 5.4.2, Retained Remedial Technologies, Transition Slope Subarea, page 62:** The text states that: "In addition, although the ROD assumes full removal inside of the PTW-NAPL footprint and cap on grade outside of the PTW-NAPL footprint, full removal of RAL exceedances and PTW is infeasible throughout large areas of the Transition Slope, including within the FMD Area, because the resulting required long-term stable layback slope would impact the in-water and land based functional and permanent structures identified in Section 5.1.6 and shown in Figures 5-3a through 5-3c." Detailed engineering evaluations related to slope and structural stability should be provided to support this assumption. Deviating from the ROD's selected remedy requires project area-specific evaluations that are not provided in the BOD-PDR. Furthermore, the ROD does not assume capping on grade.	The remedial technologies have been revised. See response to Comment 53.
61	Section 5	**Section 5.4.2 Retained Remedial Technologies, Gasco Dock, page 64:** As noted in the Section 3 General Comment on Removal under Dock Structures, diver-based dredging should be evaluated under this permanent structure to remove as much material above RALs and PTW-NAPL as possible before cap placement.	See response to Comment 11.
62	Section 6	**Section 6.2.1.2.1, Dissolved Phase Isolation and Attenuation, page 74:** Provide a table summarizing the dissolved phase concentrations for the riverbank borings and maximum in-water sediment dissolved phased concentrations so that the following statement may be verified: "Using the site-specific equilibrium partitioning presented in Appendix G, estimated dissolved phase concentrations from the angled borings are generally similar to or lower than the maximum in-water sediment dissolved phased concentrations that have been modeled for the Nearshore."	This comment is no longer applicable given the Full Dredge and ISS Design includes ISS treatment of the Gasco riverbank and can be used to remediate the full depth of contamination at the Siltronic property, if required by the ROD, so the comment-requested partitioning is no longer applicable.
63	Section 6	**Section 6.2.1.3, DNAPL Mobility and Sequestration, page 74:** EPA disagrees that extensive site-specific data was collected to support a detailed evaluation of NAPL advection and gas ebullition. Revise this section based on EPA comments on Appendices, H, I, and J.	This comment is no longer applicable because the Full Dredge and ISS Design eliminates advective flux and ebullition-facilitated transport as a contaminant transport pathway.

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Comment No.	Section/Topic	Comment	Comment Response
64	Section 6	**Section 6.2.1.3.1 DNAPL Flux via Advection, pages 74 through 75:** EPA has the following comments on this section and the text should be revised accordingly:	This comment is no longer applicable because the Full Dredge and ISS Design eliminates advective flux and ebullition-facilitated transport as a contaminant transport pathway.
		a. Revise the third bullet point to specify the number of samples for which DNAPL saturation was measured (17 samples) and the number of samples for which the DNAPL saturation was estimated/calculated.	
		b. EPA has several comments on the DNAPL mobility assessment provided in Appendix H and summarized in Section 6.2.1.3.1 that should be resolved before the conclusion that "DNAPL loading to the cap due to advective flux will be zero" can be confirmed. Revise this section based on EPA comments on Appendix H.	
65	Section 6	**Section 6.2.1.3.2 DNAPL Flux via Ebullition-Facilitated Transport, pages 75 through 77:** EPA has several comments on the ebullition evaluations provided in Appendices I and J and summarized. Revise this section based on EPA comments on Appendices I and J.	This comment is no longer applicable because the Full Dredge and ISS Design includes ISS treatment of the entirety of Intermediate, Shallow, and Riverbank Regions where ebullition-facilitated transport of NAPL has been documented.
66	Section 6	**Section 6.2.1.3.3 DNAPL Flux via Post-Capping Consolidation, pages 77 through 79:** EPA has the following comments on this section and the text should be revised accordingly:	See response to Comment 64.
		a. Provide a basis and references for using Equation 6-2 to calculate DNAPL mass flux due to sediment consolidation.	
		b. Provide the basis for the 0.044 initial DNAPL saturation value. Initial DNAPL saturation values for the DNAPL mobility test samples ranged from 0.06% to 41.67%. It is unclear why such a low value was selected for the calculation of DNAPL mass flux due to sediment consolidation.	
		c. Revise this section to include a discussion of uncertainty in the DNAPL mass flux calculation. The discussion in this section identifies perceived conservatism in the DNAPL flux calculation but fails to mention uncertainties in the calculation.	
		d. The proposed cap structure as depicted in Figure 6-7 and discussed in Section 6.2.1.3.3 includes a habitat layer with a minimum thickness of 6 inches. A habitat layer less than one foot in thickness should be better justified, given that the biologically active zone to ranges from 10 to 20 cm (EPA 2017).	
67	Section 6	**Section 6.2.1.3.4 DNAPL Sequestration, page 79:** The calculated thickness of the DNAPL sequestration (organophilic clay) layer is based on the DNAPL mobility and ebullition evaluations detailed in Appendices H though J. The calculated sequestration layer thickness should be re-evaluated after EPA's comments on these appendices and uncertainties associated with DNAPL mass flux estimates are addressed. Also provide a reference for Equation 6-1.	See response to Comment 64.
68	Section 6	**Section 6.2.3, Element 3 - Erosion Resistance, page 81:** It is not clear what is meant by "forces along the edge of the cap" for erosion resistance design (last sentence on page 81). The various formulations and concepts in Sections 6.2.3.1 through 6.2.3.6 relate to sizing armor material to resist surface erosion. Revise the text to clarify.	This comment is no longer applicable because the Full Dredge and ISS Design eliminates the capping technology assignment.
69	Section 6	**Section 6.2.3.2, River Currents, pages 82 through 83:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. Revise the text to clarify if the Environmental Fluid Dynamics Code model used to support armor stone design under design flood conditions included the post-remedy bathymetry. If not, design parameters (depth-average velocity and water depth) should also be evaluated using the planned post-remedy bathymetry.	To be addressed in the PDR.
		b. The statement that "the 500-year flood flow event is unlikely to produce higher bed shear stress than that of the 100-year flood event" is unsupported. Since it is subsequently noted that cap design will be evaluated for the 500-year event, delete the referenced text or provide justification to support the statement.	The text has been revised.
70	Section 6	**Section 6.2.3.3, Wind-Generated Waves, page 84 through 86:** The spatial extent of areas subject to breaking waves versus orbital velocities will be different depending on the instantaneous water level which varies as a function of the tide and river flow rate. This should be considered during the interim and/or final design. Revise the text to mention this refinement.	To be addressed in the PDR.
71	Section 6	**Section 6.2.3.4, Vessel-Generated Waves, page 86 through 87:** The comment on Section 6.2.3.2 discusses the spatial extent of areas subject to breaking waves versus orbital velocities varying as a function of the instantaneous water level is also applicable to vessel-generated waves. This should be considered during the interim and/or final design. Revise the text to mention this refinement.	To be addressed in the PDR.

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Comment No.	Section/Topic	Comment	Comment Response
72	Section 6	**Section 6.2.3.5, Propeller Wash, page 87 through 89:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. Similar to preceding comments regarding the effect of instantaneous water level on wave impacts, propeller wash will also be sensitive to the local spatial and temporal water depths. This should be considered during the interim and/or final design. Revise the text to mention this refinement.	To be addressed in the PDR.
		b. In addition to the USACE, the United States Coast Guard (USCG), and Pacific Northwest Waterways Association should be consulted when evaluating vessel traffic.	To be addressed in the PDR. NW Natural agrees the USCG and Pacific Northwest Waterways Association should be consulted.
		c. Evaluation of propeller wash used as the basis of the cap armor design should assume that tugs apply 100% of their engine's horsepower close to shore. It is common for tugs to use significant engine power when docking and undocking barges.	To be addressed in the PDR.
73	Section 6	**Section 6.2.5, Element 5 – Static and Seismic Slope Stability, 3rd paragraph, page 92:** Revise the text to state, "Material properties for the proposed capping materials were developed based on the nature of the proposed cap materials and estimated in-place density" (emphasis added).	See response to Comment 68.
74	Section 6	**Section 6.2.5, Element 5 – Static and Seismic Slope Stability, 4th paragraph, 1st bullet, page 92:** Expected magnitudes of settlement or deformation should be calculated under the design seismic event (contingency level earthquake per RDGC Section 5.2.5) if factors of safety are less than 1.1. The effectiveness of the cap in meeting the performance requirements under the expected deformations should be assessed and a detailed discussion of potential design alternatives that mitigate the impacts of deformations on cap effectiveness should be included in the interim or final design. Constructability challenges, if any, that limit the implementation of such design alternatives should also be presented.	See response to Comment 68.
75	Section 6	**Section 6.2.5, Element 5 – Static and Seismic Slope Stability, 5th paragraph, page 92:** The interim or final design should consider the feasibility of constructing rock toe buttresses, if needed for slope stability, by evaluating the bearing capacity of underlying sediments near the proposed rock buttresses.	See response to Comment 68.
76	Section 6	**Section 6.2.6.1, Bearing Capacity, Equation 6-6, page 94:** Clarify if undrained shear strengths from vane shear test or cone penetration test were used for bearing capacity evaluations. If vane shear test results were used, clarify if peak or remolded strengths were used for calculations.	See response to Comment 68.
77	Section 6	**Section 6.2.6.1, Bearing Capacity, last paragraph, page 94:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. Include an in-situ penetration testing chart or data summary that illustrates how the stated depth versus undrained strength correlation (25 pounds per square foot increase in undrained strength per foot of depth) was developed.	See response to Comment 68.
		b. Clarify if overdredge/overplacement allowances were included in the bearing capacity evaluations. For example, state whether the assumed cap thicknesses of 1 to 6 feet includes overplacement allowances for individual cap layers. Cap overplacement allowances, if not accounted for in analysis, could result in overestimated bearing capacity and slope stability factors of safety.	See response to Comment 68.
78	Section 6	**Section 6.2.6.2, Settlement, 3rd paragraph, page 95:** Provide references or citations for the published correlations used to estimate sediment material properties that are noted in this paragraph.	See response to Comment 68.
79	Section 6	**Section 6.5 Cap Design Summary, pages 100 through 105:** The cap design summary discussed in this section needs to be revised based on EPA comments on cap design elements 1 through 10. Additionally, text indicating that there are no data gaps for cap design also needs to be revised, as needed, based on EPA comments on the BOD-PDR.	See response to Comment 68.
80	Section 6	**Figure 6-7:** The range of thicknesses for each layer of the different cap configurations based on preliminary design evaluations should be provided on Figure 6-7.	See response to Comment 68.
81	Section 7	**Section 7.2.1 DOC Surface Delineation, pages 108 through 109:** EPA has the following comments on this section:	
		a. Bullet 1 states that DOC was considered bounded if there was at least one sampling interval below DOC without exceedances. This is inconsistent with the RDGC which defines DOC as bound by two consecutive one foot intervals below RALs. DOC surface delineation should be revised to be consistent with the RDGC.	The DOC within the Project Area is currently being finalized in accordance with the EPA-approved memorandum titled *Final Revised Additional Depth of Contamination Characterization Addendum within the Gasco Sediments Site Project Area* dated March 23, 2023. Results of the DOC program will be incorporated into the PDR. This is described in Section 6.2.4 of the Revised BODR.
		b. This section should describe what depth was used for DOC surface development at the cores with unbounded DOC. For example, if DOC was determined to be at the bottom of the unbounded core, that should be stated in this section.	See response to Comment 81a.

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Comment No.	Section/Topic	Comment	Comment Response
82	Section 7	**Section 7.2.5, Equipment Selection Process, Pages 113 through 115:** This section relies predominantly on contractor preference. EPA requests that a table be provided to compare each method (including hydraulic dredging) for all the bullets listed. Additionally, this table should be expanded to discuss how each method manages dredging steep side slopes typical of the Gasco Project Area, minimizing release of NAPL and associated dissolved constituents in the water column, and accessing areas between the Nearshore Bench and Riverbank (discussed in Section 7.3.4).	To be addressed in the PDR.
83	Section 7	**Section 7.2.6, Water Depth Limitations, last paragraph, page 116:** Clarify what is meant by "mattress-supported excavators". It is not clear whether the text is discussing marine armored mattresses or other.	To be addressed in the PDR.
84	Section 7	**Section 7.2.6, Water Depth Limitations, page 116:** Refer to the specific comment above regarding dredge depth limitation and revise the text in this section accordingly.	To be addressed in the PDR.
85	Section 7	**Section 7.2.9, Structural Horizontal Dredge Offsets, page 118:** See Section 3 General Comment on Removal under Dock Structures regarding consideration of diver assisted dredging considerations under permanent/immovable structures and revise the text in this section accordingly.	See response to Comment 11.
86	Section 7	**Section 7.3.3, Ongoing Operations—Vessel Traffic, page 120:** While limiting disruption of tenants is a desirable goal, it is not an absolute project requirement in consideration of overall project goals and ROD requirements. Revise this section accordingly.	The statement that NW Natural's tenant operations will continue uninterrupted during dredging activities has been removed from the Revised BODR.
87	Section 7	**Section 7.3.5, Cultural Resources, page 121:** While this subsection is an example of better detail when showing substantive compliance with an ARAR for past actions and those contemplated for additional consideration later in this design as it explains the steps that were taken to address cultural resources, it does not specifically mention the related location specific ARARs such as the Native American Graves Protection and Reparation Act, 25 USC 3001-3013, 43 CFR 10 (Federal ARAR) and the Indian Graves and Protected Objects ORS 97.740-760 (State ARAR) that are identified in Table 25c of the ROD. There are other sections of the document that contain substantive technical information that could also be tied into compliance with ARARs. Provide the appropriate linkage to the pertinent ARARs, either directly in this subsection or by cross referencing the checklist developed for Section 3.1.2. See also the General Comment on Applicable or Relevant and Appropriate Requirement Compliance, parts a. and d.	Revised BODR Tables 3-1a through 3-1c include the requested information.
88	Section 7	**Section 7.5, Dredge Design Summary, pages 122 through 123:** The second paragraph on page 122 indicates that there are no data gaps related to dredging moving into the interim design. However, paragraph 2 on page 123 identifies undefined DOC at five subsurface sediment cores and indicates that NW Natural intends to sample these areas after initial removal. Undefined DOC in dredge areas is considered a data gap that needs to be addressed during RD. See also the comment on Section 7.2.1 above regarding two consecutive 1-foot core intervals being necessary to fully define DOC per the RDGC.	See response to Comment 81a.
89	Section 7	**Section 7.5, Dredge Design Summary, Transition Slope Subarea bullet, page 123:** This section indicates that removal of contamination to the full DOC is not feasible due to unacceptable vibrations or destabilization of the Siltronic riverbank. Provide a threshold range of acceptable vibrations and/or an evaluation of how dredging in this area would directly cause vibrations on the Siltronic property. This analysis should also consider hydraulic dredging which may have less impact due to vibration than clam shell or fixed arm excavators. Additionally, EPA recommends that a section related to proposed deflection and vibration monitoring be added to the BOD-PDR. A baseline survey and construction monitoring plan should be developed. This should be added to the Specifications in Appendix T. The BOD-PDR should assess additional design considerations including the installation of low vibration drilled walls (tangent or secant walls) to provide an option for full depth removal of PTW-NAPL without destabilizing the Siltronic riverbank.	To be addressed in the PDR. Project Area-specific vibration monitoring data was collected as part of the field pilot study in the Fall 2023 that will be used to support evaluation of the extent, if any, by which potential vibration impacts from in-water work exceed baseline conditions.
90	Section 8	**Section 8.4, Riverbank Design Summary, page 135:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. EPA requests that future remedial design deliverables characterize the proposed habitat layer including how closely its characteristics will or will not match those of native surficial media.	To be addressed in the PDR.
		b. Note that the selected technologies should accommodate removal of any former MGP-related infrastructure components (such as abandoned sewer outfalls and drainage ditches) encountered during riverbank remediation.	To be addressed in the PDR.
91	Section 9	**Section 9, Remedial Technology Selection and Preliminary Design Approach, Navigation Channel Subarea, page 138.** Provide a more detailed discussion of the planned additional subsurface sediment characterization in areas with currently unbounded DOC. Identify the analytes to be sampled and clarify whether analytical results will be available to inform additional dredging during the same mobilization.	See response to Comment 81a.

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Comment No.	Section/Topic	Comment	Comment Response
92	Section 10	**Section 10.1, Dredged/Excavated Material Disposal Framework, page 151:** This section is an example of where more detail is needed regarding compliance with specific ARARs. There needs to be a clear explanation of how the proposed disposal framework complies with substantive requirements of RCRA, TSCA, other ARARs, and the National Contingency Plan. For example, the text should mention that waste characterization would meet the substantive requirement to characterize dredged materials for off-site disposal in 40 CFR § 264.13(a)(1) as identified in Table 25b of the ROD.	Revised BODR Table 3-1b includes the requested information.
93	Section 10	**Section 10.1, Dredged/Excavated Material Disposal Framework, pages 151 through 152:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. Hazardous Waste: Provide the technical rationale for considering only select F002 listed analytes at the site. It is not clear from the text how that subset of F-listed hazardous wastes was selected.	TCE and its degradation products (cis-DCE, trans-DCE, 1,1-DCE, and vinyl chloride) were selected for analysis because of historical use of TCE at the site directly upstream of the Project Area. These analytes were agreed upon in the Project Area-specific disposal framework described in the 2009 SOW. Additional discussion of dredged material disposal will be provided in the Material Management Plan to be included with the PDR.
		b. Special Waste: Table 10-2 includes a small subset of the contaminants listed in 40 CFR 261.24 Table 1. Provide the technical rationale for considering only benzene, chromium, lead, and cresol when assessing special waste.	The definition of the toxicity characteristic in 40 CFR 261.24 (a) has a specific exception for manufactured gas plant waste. By agreement with EPA Region 10, as documented in the 2009 SOW, waste from the Gasco site that fails TCLP for benzene, chromium, lead, or phenols is to be managed as "special waste," that is disposed of at a Subtitle C facility as a non-hazardous waste. These analytes were agreed upon in the Project Area-specific disposal framework described in the 2009 SOW as they are the only toxicity characteristic constituents at all associated with MGP waste. Additional discussion of dredged material disposal will be provided in the Material Management Plan to be included with the PDR.
		c. Cleanup Material: Evaluate whether cleanup materials may be eligible for beneficial use in the uplands. If beneficial use has already be evaluated elsewhere, reference the evaluation in the text.	The text in Section 6.2.3 of the Revised BODR has been revised.
		d. This section inadequately addresses how worker safety will be addressed on-site and offsite. For example, materials handling needs will more typically resemble procedures at a Subtitle C landfill vs a Subtitle D. Revise this section to address considerations regarding fugitive air emissions, PPE/surveillance/HAZWOPER training, and offsite tracking concerns per 3.6.3.1 of the 2009 ASAOC.	To be addressed in the PDR.

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Comment No.	Section/Topic	Comment	Comment Response
94	Section 11	**Section 11.1, In-Water Transportation and Dewatering, pages 157 through 161:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. Consistent with EPA's comments on the *Pre-Remedial Design Data Gaps Data Summary Report* (Anchor QEA 2021), clarify how sampling with only one of the specified ferric sulfate concentrations meets the data quality objective. The field sampling plan, Appendix A to the *Pre-Remedial Design Data Gaps Work Plan* (Anchor QEA 2019b), states that a range of ferric sulfate mixtures would be sampled: 40 milligrams per liter (mg/L), 60 mg/L, and 80 mg/L. The DSR indicates that samples were only treated with 40 mg/L.	To be addressed in the PDR.
		b. The pentachlorophenol, hexachlorobenzene, benzo(j,k)fluoranthene, dibenzo(a,h)anthracene, DDx, aldrin, total chlordane, and PCB Aroclors results shown in Table 11-1 may serve as a line of evidence to analyze these acute water quality constituents at a reduced frequency during construction but is not sufficient to completely avoid sampling for them. Sediment contamination is heterogeneous and in-situ conditions vary from bench-scale tests. Revise text to note that additional monitoring is required to ensure that acute water quality criteria are not exceeded during construction.	The statement that these constituents do not need to be analyzed during construction has been removed from the Revised BODR. NW Natural will coordinate further with EPA regarding water quality monitoring COCs during development of the Water Quality Monitoring and Quality Assurance Plan.
		c. Revise to discuss relevant permits necessary for transload facility siting and operations.	To be addressed in the PDR.
95	Section 11	**Section 11.2.2.4, Loading, page 164:** Provide examples of best management practices anticipated to be used during loading operations.	To be addressed in the PDR.
96	Section 11	**Section 11.2.2.6, Decontamination, page 165:** EPA expects future remedial design deliverables to contain a description of additional decontamination procedures anticipated at the time of demobilization (e.g., pressure wash equipment and transport vehicles, disposal of equipment liners, etc.).	To be addressed in the PDR.
97	Section 13	**Section 13.2.2, Capping and Cover Placement, page 170:** In addition to the change in elevation and water depths, this section should discuss loss of riparian vegetation from capping and associated effects on habitat and ecological function.	See response to Comment 68.
98	Section 13	**Section 13.2.3 Preliminary Mitigation Evaluation, page 170:** Clarify why, unlike the Nearshore Bench and Riverbank Subareas, the Transition Slope Subarea is "***Generally*** consistent" ***(emphasis added)*** with the remedial technologies in Sections 6.5 and 7.6.	This comment is no longer applicable due to ISS treatment in the referenced subareas.
99	Section 14	**Section 14, Preliminary Flooding Impact Evaluation, page 173:** HEC-RAS modeling to evaluate impacts to flood rise should not be delayed until the Interim Design. In order to approve the capping on grade remedy proposed in the BOD-PDR a detailed flood rise analysis needs to be provided in the revised BOD-PDR.	To be addressed in the PDR.
100	Section 14	**Section 14.2, National Flood Insurance Program Requirements, page 173:** EPA has the following comments on this section and the text should be revised accordingly:	Comment no longer applicable. Floodrise is evaluated consistent with FEMA Region X guidance. See Section 6.8.2 of the Revised BODR.
		a. Section 4.9.2 of the TEWP states that an alternative HEC-RAS model of the Lower Willamette River has already been developed and meets Federal Emergency Management Agency (FEMA) guidelines (Anchor QEA 2019a). This alternative model should be referenced including the model limits, added cross sections (if any), and terrain data leveraged. This model may be considered the "Corrected Effective Model" if it meets FEMA Region 10 guidance document Procedures for "No-Rise" Certification for Proposed Developments in the Regulatory Floodway (FEMA 2013) requirements. Results should be presented to demonstrate compliance with FEMA requirements.	
		b. Provide a figure showing limits of the alternative model referenced in Section 4.9.2 of the TEWP, with additional cross sections identified (Anchor QEA 2019a).	
		c. Provide details on location of additional proposed cross sections for the existing and proposed conditions models. This should clearly demonstrate that the additional cross sections will include capture the changes due to implementation of the proposed project.	
		d. Provide a list of key HEC-RAS model parameters at each cross section (e.g., Manning's roughness coefficients, boundary conditions, peak discharge, computational parameters, etc.) for the existing conditions and proposed models. Justify proposed methodology for selecting the proposed parameters.	
101	Section 14	**Section 14.3 HEC-RAS Modeling, page 174:** Per RDGC Section 5.2.11, this section should discuss how 500-year flood conditions are going to be evaluated.	Section 7.9.2 of the Revised BODR discusses how the 500-year flood conditions will be evaluated.
102	Section 15	**Section 15, Green Remediation Practices, page 175:** While EPA Region 10's Clean and Green Policy is cited, the specific aspects of the regional guidance are not explicitly discussed, e.g., Environmental Management System (EMS) aspects, buying office paper with recycled content, using recycled toner cartridges, etc. Include in the text how this regional guidance was considered.	To be addressed in the PDR.

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103	Section 15	**Section 15.1, Performance Standards and Design Objectives, page 176:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. This section should make it clear that the intention of the regional and national EPA guidance is to reduce impacts from *design investigations as well as construction* , e.g., use of alternative fuels in vehicles used for sampling work and construction activities. See: Consideration of Greener Cleanup Activities in the Superfund Cleanup Process https://semspub.epa.gov/work/HQ/100000160.pdf.	Section 6.9 of the Revised BODR has been revised.
		b. Consistent with the Region 10 policy noted above, in either this section or the Green Remediation Plan to be developed as part of the Interim and/or Final Design explain how baseline versus reductions in energy usage (e.g., via plug in meters noted in Section 15.3.3), particulate emissions, waste generation, and other improvements will be tracked during design and construction and reported.	To be addressed in the PDR.
104	Section 15	**Section 15.2, Construction Activities, last paragraph, page 176:** Revise the text to clarify that green remediation practices will also be defined and evaluated for the "other ancillary activities", as a handful of the BMPs listed later in this section apply to these activities. For example, applicable green remediation practices include purchase of greener products, alternative fuels, and local/reused/recycled materials to reduce the environmental footprint associated with the ancillary activity of "manufacturing of construction equipment, construction materials, fuels, lubricants, staging equipment, and support facilities".	Section 6.9 of the Revised BODR has been revised.
105	Section 15	**Section 15.3 Green Remediation Best Management Practices, page 176:** The Superfund Green Remediation Strategy (EPA 2010) identifies minimizing water use and protecting water quality as the two components of the water core element of the green remediation strategy. However, only protecting water quality is addressed in the BOD-PDR. Add a discussion of water use reduction strategies.	Section 6.9 of the Revised BODR has been revised.

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Comment No.	Section/Topic	Comment	Comment Response
106	Section 15	**Section 15.3.1, BMPs for Air Pollutant Emission Reduction, pages 177 through 178:** EPA has the following comment on this section and the text should be revised accordingly:	
		a. Proper sizing of the dredge equipment including the barge and collection device (e.g., bucket) is critical for optimizing fuel use. Guidance provided in *Green Remediation Best Management Practice: Clean Fuel & Emission Technologies for Site Cleanup* (EPA 2010) suggests that selection of appropriately sized vehicles and equipment for the task at hand is a method for minimizing fuel consumption and air emissions resulting from fuel consumption. This BMP should be discussed in Section 15.3.1 as a strategy for air pollutant emissions reduction.	To be addressed in the PDR.
		b. The guidance provided in *Green Remediation Best Management Practice: Clean Fuel & Emission Technologies for Site Cleanup* (EPA 2010) suggests using automatic shift-down devices programmed to cut an engine after a pre-determined time limit as a BMP for air pollutant emissions reduction. This BMP should be included in the Effective Operation and Maintenance section.	To be addressed in the PDR.
		c. Elaborate on what "preventative maintenance" would consist of under the Effective Operation and Maintenance section or in the Green Remediation Plan to be developed as part of the Interim and/or Final Design. For example, per guidance in *Green Remediation Best Management Practice: Clean Fuel & Emission Technologies for Site Cleanup* (EPA 2010) preventative maintenance may include engine tune-ups, checking fuel tank for dirt/insects, keeping moving parts well lubricated, periodic replacement of filters, use of manufacturer's recommended grade of motor oil, etc.	To be addressed in the PDR.
		d. Add driving techniques to the changes in daily routines section under Effective Operation and Maintenance. Driving techniques including avoiding rapid acceleration, avoiding braking and excessive speeds, and removing unneeded items from vehicles are BMPs for air pollutant emission reduction as defined in *Green Remediation Best Management Practice: Clean Fuel & Emission Technologies for Site Cleanup* (EPA 2010).	To be addressed in the PDR.
		e. Elaborate on what is meant by "Effective fleet management" in this section or in the next iteration of this document (i.e., the Green Remediation Plan). For example, planning to minimize fuel consumption through efficient transportation routes, transfer of only full loads, selection of appropriate vehicles, and low-carbon commuting and travel by workers are BMPs for effective fleet management as defined in *Green Remediation Best Management Practice: Clean Fuel & Emission Technologies for Site Cleanup* (EPA 2010).	To be addressed in the PDR.
		f. Under Advanced Diesel Technologies, "elective catalytic reduction" should be "selective catalytic reduction".	To be addressed in the PDR.
		g. Only partial diesel particulate filters are mentioned. Both diesel particulate filters (DPFs) and partial diesel particulate filters (pDPFs) should be given consideration.	To be addressed in the PDR.
		h. The Advanced Diesel Technologies section lists several forms of advanced clean diesel technologies. It is not clear in this section which technologies are being proposed for the design. It is EPA's understanding that the specific BMP for advanced diesel technology that will be implemented will be stated in the Green Remediation Plan.	To be addressed in the PDR.
		i. This section currently reads as though it is discussing only heavy-duty vehicles. The *Green Remediation Best Management Practice: Clean Fuel & Emission Technologies for Site Cleanup* (EPA 2010) identifies that 60 percent (%) of all transportation-related greenhouse gas emissions are from light-duty vehicles. Clarify when heavy-duty vehicles are being discussed versus when light-duty vehicles are being discussed or if the BMP applies to both heavy- and light-duty vehicles in either this section or Green Remediation Plan to be developed as part of the Interim and/or Final Design. Elaborate on how electric light-duty vehicles could be used for employee commuting and other less demanding transportation.	To be addressed in the PDR.
		j. Use of ultra-low sulfur fuel is noted as an alternative fuel in this section, though it is already required for use in off-road diesel powered vehicles and equipment with engine ratings of 50 horsepower or more (refer to *Green Remediation Best Management Practice: Clean Fuel & Emission Technologies for Site Cleanup* (EPA 2010). Discuss additional steps that might be taken for alternative fuels beyond legally required minimums that exist and/or note that this particular step is already a requirement for vehicles to be used for site design and construction.	To be addressed in the PDR.

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Comment No.	Section/Topic	Comment	Comment Response
107	Section 15	**Section 15.3.2, BMPs for Waste Generation Reduction, page 178:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. The section on purchase of greener products states that "incorporation of greener products should begin during planning stages of the cleanup". EPA anticipates that the identification of potential green products with a copy of their material safety data sheets (or similar document) will be provided in the Green Remediation Plan.	To be addressed in the PDR.
		b. This section discusses sustainable material management but there is no mention of the *Green Cleanups Contracting and Administrative Toolkit* (EPA 2011). This guidance should be referenced because it includes sample contract language and criteria for sustainable materials management that may be incorporated into Contract Specifications.	To be addressed in the PDR.
		c. To further establish BMPs to reduce the use of virgin materials, include consideration of using regenerative activated carbon instead of virgin activated carbon for enhanced natural recovery in the Green Remediation Plan. Also consider use of non-virgin and/or locally sourced backfill and cap material. These are BMPs discussed in *Green Remediation Best Management Practices: Materials and Waste Management* (EPA 2013).	To be addressed in the PDR.
		d. Elaborate on the salvaging and sorting of clean materials with potential value for onsite reuse, recycling, resale, or donation in either this section or in the Green Remediation Plan to be developed as part of the Interim and/or Final Design. It is EPA's understanding that this site will have excavated sediment, removed vegetation, and removed armor/debris with the potential for reuse.	To be addressed in the PDR.
		e. While locally sourced capping material may reduce transportation related emissions, this is not necessarily true. For example, a locally sourced material trucked to the site can use substantially more energy that material taken from further away via rail. Discuss transportation mode as it applies to this principle of local sourcing and overall greenhouse gas and particulate emissions.	To be addressed in the PDR.
108	Section 15	**Section 15.3.4, BMPs for Land Resource/Ecosystem Protection, page 179:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. Add the following BMPs to the Site Preparation and Land Restoration section or state the justification for exclusion of these BMPs in the response to comment. These BMPs are from guidance in Green Remediation Best Management Practices: Excavation and Surface Restoration (EPA 2019). **i.** Seed or install native rather than non-native species, which typically increases the rate of plant survival and minimizes the need for irrigation and soil or plant inputs. **ii.** Substitute chemical fertilizers, herbicides, or pesticides with non-synthetic inputs, integrated pest management methods, and soil solarizing techniques during vegetation planting, transplanting, or ongoing maintenance.	To be addressed in the PDR.
		b. Add a reference to Section 13.3 of the BODR-PDR which details design measures to offset habitat modifications. Avoiding habitat disruption by appropriately designing work zones, traffic plans, and construction phases is a BMP for greener cleanups related to ecosystem services as defined in *Ecosystem Services at Contaminated Site Cleanups* (EPA 2017).	To be addressed in the PDR.
109	Section 15	**Section 15.3.5, BMPs for Water Quality Protection, page 179:** EPA suggests adding the following BMPs specific to dewatering contaminated sediment defined in Green Remediation Best Management Practices: Excavation and Surface Restoration (EPA 2019).	
		a. Avoid use of dewatering coagulants or flocculants containing chemicals that are potentially toxic to aquatic life.	To be addressed in the PDR.
		b. Use a passive rather than active mechanical process to dewater sediment when possible. A passive process relies on natural gravity flow and evaporation of the water rather than equipment such as filter presses powered by slurry pumps.	To be addressed in the PDR.
		c. Implement a dewatering process that maximizes recycling of slurry and other process water.	To be addressed in the PDR.
		d. Use geotextile bags or nets when possible to assure containment of excavated sediment during dewatering and to increase efficiency when handling and transporting the dewatered sediment.	To be addressed in the PDR.
110	Section 15	**Section 15.4, Application of Green Remediation Practices in Remedial Design, pages 179 through 180:** The text states that the application of green remediation practices will be defined in the Green Remediation Plan, which will be developed as part of the interim and final designs. EPA anticipates that the Green Remediation Plan will provide clear definitions, methods, expectations, and goals that can be used by the remedial action contractor and other relevant stakeholders to achieve site-specific green remediation practices during cleanup. While Section 15 identifies general green remediation BMPs, the Green Remediation Plan should identify which BMPs specifically will be implemented and detail the method for doing so. The Green Remediation Plan should also establish metrics for measuring and/or reporting achievement of green remediation goals during the remedial action, in alignment with the ASTM International Standard Guide for Greener Cleanups (ASTM International 2017).	To be addressed in the PDR.
111	Section 16	**Section 16.2.2.3 Full-Depth Sheetpile Walls, page 187:** Revise this section to be consistent with Appendix R comments, including reference to the 2006 Final Early Removal Action Construction Oversight Report (Parametrix 2006).	To be addressed in the PDR.

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Comment No.	Section/Topic	Comment	Comment Response
112	Section 16	**Section 16.2.2.3 Full-Depth Sheetpile Walls, page 188:** Include reference to salient ARARs, such as the Rivers and Harbors Act, in this section when discussing impediments to navigation.	Revised BODR Table 3-1b includes the requested information.
113	Section 16	**Section 16.2.3 Selected Barrier Controls, Navigation Channel Subarea, 2nd bullet, page 188:** Revise the text to note that any pile supported anchoring in the navigation channel will require USACE, USCG, and harbor pilots' coordination.	To be addressed in the PDR.
114	Section 16	**Section 16.2.3 Selected Barrier Controls, Nearshore Bench and Riverbank Subareas, page 189:** If the proposed cap on grade remedy in the nearshore area is not approved by EPA based on flood rise or habitat impact concerns, sheetpile walls may need to be retained as a barrier control for dredging in the nearshore area. This section should be revised based on EPA's comments on the remedial technology selection proposed in the BOD-PDR.	The Full Dredge and ISS Design no longer includes capping on grade, so this comment is no longer applicable.
115	Section 16	**Section 16.4.1 BMPs During Dredged/Excavated Material Amendment, page 191:** Revise this section to include monitoring for volatiles (e.g., benzene) for worker and community protection in addition to dust.	To be addressed in the PDR.
116	Section 16	**Section 16.4.3 BMPs During Haul Barge Loading and Transportation, page 192:** Revise this section to include barge covering to limit fugitive dust generation. This requirement may be revised based on actual field conditions during remedial action.	To be addressed in the PDR.
117	Section 16	**Section 16.4.4 BMPs During Transloading and Transport to Upland Disposal Facility, page 192-193:** Revise this section to include pre- and post- haul route sampling to verify offsite tracking of contaminants has not occurred and include a reference to the 2006 Final Early Removal Action Construction Oversight Report (Parametrix 2006) regarding necessary sample numbers for this data quality objective.	To be addressed in the PDR.
118	Section 16	**Section 16.4.4 BMPs During Transloading and Transport to Upland Disposal Facility, page 192-193:** Revise to note that this list will be revised based on the Biological Opinion (BiOP) requirements as directed by EPA as well as permit requirements.	To be addressed in the PDR.
119	Section 16	**Section 16.4.5 Decontamination of Construction Equipment, page 193:** Revise the first sentence as follows: "Decontamination of the dredge and haul barges will be done at the completion of the removal activities at the end of each construction season." Revise this section to discuss the timing and frequency of any required truck decontamination.	To be addressed in the PDR.
120	Section 17	**Section 17.1, Schedule, page 195:** Modify the text to note that construction would begin after Consent Decree entry with the court following public comment, not "execution."	This section has been eliminated from the Revised BODR, so this comment is no longer applicable. Schedule will be discussed in future remedial design reports.
121	Section 17	**Section 17.2, Sequence, pages 195 through 196:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. Explain how "sufficiently distant" will be determined to guide concurrent dredging and capping operations. Capping and dredging concurrently in the transition slope sub area would seem to make the risk of residual contaminant incorporation into the biologically active zone (BAZ) post-construction more significant. Discuss how the delay of capping work could occur to follow dredging to minimize the risk of incorporating residuals into the BAZ.	This comment is no longer applicable because the Full Dredge and ISS Design eliminates the capping technology assignment.
		b. Discuss flow reversals and how this does or does not impact the planned sequencing approach of "upriver to downriver."	To be addressed in the PDR.
		c. Discuss how sequencing will occur if dredging to DOC is not possible in the navigation channel and a cap, rather than residual management cover, will be placed.	To be addressed in the PDR.
		d. Discuss sealed barge availability, number of barges expected to be present at the site concurrently, and barge transit to transload loop logistics and how this might impact/not impact sequencing. The sequence section should give an idea of how many work areas might synchronously be working at one time.	To be addressed in the PDR.
		e. Discuss how sequencing and parallel work areas may be revisited depending on water quality monitoring.	To be addressed in the PDR.
122	Section 18	**Section 18.1, Interim Design, pages 197 through 198:** This section leaves out components from the SOW that are required at the interim design phase, such as, "analyses necessary to protect personnel from potential chemical hazards posed by this remedial action", Clean Water Act (CWA) 404 analysis regarding capping, and analysis of transition zone water impacts. Include all the required elements from the SOW in this section or explicitly note how and where these elements were addressed in the BOD-PDR, and how such consideration at the BOD-PDR stage (rather than the interim design) consistent with the SOW is not premature given the level of uncertainty at the preliminary design stage. It is EPA's expectation that all SOW required components will be included in the interim design where such topics can be refined with the additional information available at that time.	All SOW-required components for the Interim Design Report (IDR) have been listed in Section 8.2 of the Revised BODR.

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Comment No.	Section/Topic	Comment	Comment Response
123	Section 18	**Section 18.1, Interim Design Analysis Report, page 197:** The text states the following: "The SOW states that the Preliminary Design will include an annotated outline of the Design Analysis Report. However, the BOD-PDR provides more information than the SOW requirements for Preliminary Design, including many of the SOW-identified Interim Design components that were needed to refine the ROD-identified remedy within the Final Project Area." This sentence does not explain why a complete and annotated outline of the interim design was not provided. Provide an outline of the interim design with all sections required by the SOW. Additional details should be provided for the outline of the interim design for EPA's review and approval consistent with the SOW requirement for outline annotation. The following two comments are examples of the additional detail that should be included in such an outline.	An annotated outline of the IDR with sections required by the SOW will be provided in the PDR. This information has been added to Section 8.1.
124	Section 18	**Section 18.1, Interim Design, 1st bullet, 3rd sub-bullet, page 197:** Note that general permit requirements pertain to offsite areas only and describe what will be included in this section, such as the 401/402 permits for the transload facility and any necessary construction permits for the facility.	Revised BODR Tables 3-1a through 3-1c include the requested information.
125	Section 18	**Section 18.1, Interim Design, 1st bullet, 4th sub-bullet, page 197:** Note that reduction of impacts to surrounding communities should also include route choices for truck traffic, e.g., avoiding routes near schools in the interest of improved safety and emissions exposure to sensitive subpopulations. Further refinement of green remediation components should also be discussed in this portion of the interim design.	To be addressed in the PDR.
126	List of Tables	**Table 6-5, Soil Modeling Parameters:** The armor stone component of the armored cap typically has unit weights significantly greater than 110 pounds per cubic foot (pcf). Assuming a unit weight of 110 pcf for the armored cap will underestimate the cap loads and consequently result in overestimated bearing capacity/slope stability factors of safety. EPA recommends re-evaluating assumed unit weights for the armored cap.	To be addressed in the IDR.
127	List of Figures	**Figure 4.5:** Consider changing the legend to change in bathymetric elevation rather than scour. The largest area of scour on this figure is in the dredge location for the early action removal. A note should be added to this figure indicating what surveys were compared to determine the bathymetry changes.	Comment is no longer applicable.
128	List of Figures	**Figure 5-3 Series:** EPA has the following comments on this figure and the figure should be revised accordingly:	
		a. The text in Section 5 should discuss these figures. Two cross sections are depicted to illustrate where full depth removal would not work. However, there are areas depicted on the design cross sections A and C (Figures 9-1b and Figure 9-1d) where a 2.5H:1V slope from the 10 ft HC&C offset would accomplish full depth removal in most of the Project Area and lessen the need for capping on grade in the shallow zone. Revise the BOD-PDR to provide a discussion on alternatives that would allow for full depth removal where feasible by laying back the slope.	Comment is no longer applicable due to the Full Dredge and ISS Design. These figures have been removed from the Revised BODR.
		b. The DOC remains unbounded in some portions of the Project Area, and the line representing the elevation of contamination (EOC) surface should be revised to be a dashed line where the EOC is unknown and/or not vertically delineated. Notation should be added to the figures to indicate where the DOC remains unbounded.	
129	List of Figures	**Figure 7-1:** EPA has the following comments on this figure and the figure should be revised accordingly:	
		a. Describe how the approximate riprap boundary was developed. The line presented extends well beyond the visible limits of riprap in the underlying satellite image. If the limits of riprap will be used in assessing the extent of offsets on the Siltronic riverbank provide discussion on how the boundary of riprap will be surveyed to improve the accuracy of what a appears to be an arbitrary demarcation.	The riprap boundary is shown as an approximation for informational purposes. The boundary was estimated from side scan sonar survey conducted by Blue Water Engineering in April 2011. Riprap removal will be evaluated in the Full Dredge and ISS Design.
		b. In the northwest portion of the riverbank adjacent to the US Moorings Dock, it appears that one sample (SDUD2SB) under a dock is creating what may be an artificially shallow DOC in this area. Additional samples along the riverbank or in the shallow zone should be added to address issues or artifacts with the model in this area.	This will be revaluated when DOC is reinterpolated using all available data including the additional Gasco DOC data (Anchor QEA 2023e) collected in spring/summer 2023 and relevant US Moorings PDI data. The interpolation will be provided in a future design deliverable as soon as all applicable DOC data is available.
		c. A more recent hydrosurvey (May 2021) for the navigation channel is available from USACE and should be used in future deliverables.	Data from the 2021 and 2023 USACE surveys were reviewed and compared to the 2019 eTrac survey data. NW Natural plans to proceed with remedial design using the eTrac survey data because that survey provides higher resolution data required for design and analysis needs. Note that bathymetry will be characterized with a multi-beam survey prior to construction of the remedy to ensure the use of current conditions.

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130	List of Figures	**Figure 8-1 Series:** The figures do not include all available uplands data in the immediate vicinity of the top-of-bank. Figures 4-1a through 4-1c of the Draft Gasco OU Interim Feasibility Study indicate that MGP residuals occur along and/or near the top of the riverbank. Revise the figures to show available soil sampling data from uplands borings completed near the riverbank for completeness.	The data shown in Figures 4-1a through 4-1c of the Draft Gasco OU Interim Feasibility Study was not collected under an EPA-approved work plan for the Portland Harbor Superfund Site. The riverbank soil data included in the Revised BODR includes the EPA-approved data sets that will be used for remedial design. Additional riverbank borings were collected as part of the additional Gasco DOC investigation (Anchor QEA 2023e), and that data will be added to future design deliverables as soon as it is available.
131	List of Figures	**Figure 9-1 Series:** EPA has the following comments on these figures and the figures should be revised accordingly:	
		a. Some cores contained contaminant concentrations above RALs deeper than the modeled extent portrayed on the cross sections. For example, PDI-166SC on Figure 9-1b depicts concentrations above RAL 6-8 feet below the modeled DOC; PDI-027SC depicts concentrations above RAL extending up to four feet below the modeled surface.	To be addressed in the PDR.
		b. The DOC remains unbounded in some portions of the Project Area, and the line representing the EOC surface should be revised to be a dashed line where the EOC is unknown and/or not vertically delineated. Revise the figures to indicate where the DOC remains unbounded.	
		c. Additional cross sections parallel to the riverbank in each of the zones should be added so that dredge depths and modeled DOC can be reviewed between sections perpendicular to the riverbank. At least one riverbank parallel section through each of the regions (Shallow, Intermediate, Navigation Channel and FMD) should be provided. Additional riverbank perpendicular and parallel sections should also be added in areas unique to the design or in locations where specific engineering challenges are present.	
		d. Areas with PTW-NAPL impacts should be added to the cross sections. On the core sticks an additional hatch or color should be added to depict this vertically. The area extent callouts on the top of each figure should also show the PTW-NAPL areas so they can be depicted horizontally or a PTW-NAPL surface should be developed and presented on each figure.	
		e. The line representing the EOC surface is terminated below the top of the riverbank. There are MGP residuals that occur in uplands fill at and near the top of the riverbank, in many locations to the base of the Fill WBZ. Revise the figures to indicate the presence of MGP residuals and identify the elevation of the bottom of the Fill WBZ for comparison to the EOC. This information is important for assessing the alignment of the uplands and in-water remedies along the riverbank.	
		f. The navigation channel and buffer elevations should be added to the cross sections to add context to the figures and allow for assessment of any capping that is proposed in the navigation channel	
		g. The design elevations and buffer zones in the FMD areas should be added to the cross sections to assess the impact of dredging and capping in these areas.	Comment is no longer applicable due to change in remedial technologies in this area.
		h. In the areas designated as ROD riverbank, the caps depicted are thinner than any types of caps that are discussed in Section 6.5 or shown on Figure 6-7. The cross sections should depict dredging or removal necessary to place full thickness caps (or deeper if needed to remove PRW-NAPL and/or PTW-NRC) in this area and the cap hatch should be extended to depict the assumed cap thickness.	
		i. Consider adjusting the vertical exaggeration on cross sections so that elevation elements are presented more accurately in a manner that is easier to view by reviewers.	To be addressed in the PDR.
		j. Some 9-1 series sections depict cores with DOC below the proposed dredge and modeled extents. The model and dredge surface should be corrected in these areas.	
132	List of Figures	**Figure 9-1a:** EPA has the following comments on this figure and the figure should be revised accordingly:	
		a. A depiction of the angled borings and DOC (similar to the sediment core sticks) should be added to all cross sections. The locations should be added to Figure 9-1a.	To be addressed in the PDR.
		b. Sediment core locations and IDs should be added to this figure so their location relative to the cross sections can be reviewed.	
133	List of Figures	**Figure 9-1b:** EPA has the following comments on this figure and the figure should be revised accordingly:	
		a. Based on the existing slope it is not clear why dredge and cap or full depth dredging is not feasible on this cross section. The existing slope and distance from the HC&C System seem to be manageable with a 2.5H:1V dredge cut.	Comment is no longer applicable due to change in remedial technologies in this area.
		b. The DOC in core PDI-166SC is missed in the DOC model.	To be addressed in the PDR.
		c. Between stations 315 and 340 the top of cap surface is drawn at a 1.5H:1V slope. This is inconsistent with the criteria in Section 6.5.	

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Comment No.	Section/Topic	Comment	Comment Response
134	List of Figures	**Figure 9-1c:** EPA has the following comments on this figure and the figure should be revised accordingly:	
		a. Capping in the elevations below 0 feet COP are described as requiring a stable slope of 2.5H:1V or flatter. The Gasco dock on Figure 9-1c is proposed to be capped on an existing slope of 1.5H:1V which does not meet the criteria outlined in Section 6.5. Based on a theoretical 2.5H:1V slope starting at station 240, the height of the cap at the end of the structural offset (Station 300) would need to be approximately 10-12 feet higher in elevation than shown on Section 9-1c. The cap retaining structure or planned removal under the dock to accommodate the slope requirements of the cap should be depicted on Figure 9-1c and discussed in the BOD-PDR as this may be a significant component of the design.	Comment is no longer applicable due to change in remedial technologies in this area.
		b. Between stations 320 and 340 the top of cap slope is drawn at 1.5H:1V This slope exceeds all stability tolerances listed in Section 7.2.8. The sections should be revised to depict stable slopes.	
135	List of Figures	**Figure 9-1d:** EPA has the following comments on this figure and the figure should be revised accordingly:	
		a. The dredge cut between stations 300 and 325 is drawn at 1.5H:1V. This slope exceeds all stability tolerances listed in Section 7.2.8. The sections should be revised to depict stable slopes.	Comment is no longer applicable due to change in remedial technologies in this area.
		b. The top of cap between stations 300 and 325 is drawn at a slope of 1.5H:1V. this slope exceeds all tolerances in Section 6.5. Adjust the dredge and cap line to achieve a stable capping slope.	
		c. Core PDI-027SC has DOC below the dredge surface. Adjust the dredge surface to account for DOC at this location.	To be addressed in the PDR.
		d. Core DGS-22SC_2010 has DOC depicted below the DOC model surface. Correct the model to accurately capture DOC at this location.	
136	List of Figures	**Figure 9-1e:** EPA has the following comments on this figure and the figure should be revised accordingly:	
		a. The 2.5H:1V label does not match the slope drawn on the cross section. The dredge and top of cap slopes between station 240 and 320 are drawn at 2H:1V which is steeper than the stable slopes provided in section 6.5 and is steeper than slopes indicated in Section 7.2.8. Section 7.2.8 indicates only in areas where existing slopes are 2H:1V short term stability is acceptable with slopes of 2H:1V, therefore the existing slope between stations 240 and 285, and between 320 and 340 do not meet stability requirements.	Comment is no longer applicable due to change in remedial technologies in this area.
		b. The top of cap slope depicted between stations 320 and 340 is displayed at a slope of approximately 1.5H:1V, exceeding all requirements listed in section 6.5. Additionally, the cap thickness tapers to a thickness of 2.5 feet, thinner than the minimum thickness for any cap details on Figure 6-7. Correct this figure to be consistent with the proposed design criteria.	
		c. Clarify why the DOC surface ends at station 160, approximately 22 feet below the top of bank. Adjust the DOC surface as necessary or add in riverbank boring data to address this data gap. This comment is relevant to Figures 9-1c and 9-1d also.	To be addressed in the PDR.
		d. Add a depiction of the Siltronic armored slope to this figure along with any proposed offsets.	
EPA Editorial Comments			
137	General Editorial Comment	The BOD-PDR references multiple vertical data, including CRD, COP and NAVD88. One datum should be used for the entire document or converted elevations referenced to each vertical data in the report should be provided in parentheses. EPA prefers the use of CRD, consistent with the ROD.	Section 2 of the Revised BODR has been revised to provide the rationale for use of the COP datum.
138	Editorial Comment Section 2	**Section 2.4.3 Fine Sediment Distribution, page 17:** Revise the following text for clarity, "a much depositional environment located between the US Moorings structures."	Text has been revised.
139	Editorial Comment Section 3	**Section 3.1.4, Long-Term Cleanup Levels, 4th paragraph, page 39.** The text discusses an EPA General Comment on the TEWP, and states that it can be found in Appendix A-3 of the TEWP (Anchor QEA 2019a). The comment referenced appears to be in Appendix A-1 of the TEWP. Revise text as needed to clarify.	Appendix A-3 of the TEWP is the correct reference. No revisions have been made to the Revised BODR.
140	Editorial Comment Section 5	**Section 5.1.5, Riverbank Region, page 53:** Revise text to note which comment set the referenced EPA comments are from (i.e., Appendix A-1, A-2, or A-3). There are multiple EPA comments 5 in Appendix A and a reference will ensure the reader refers to the correct comment.	This text has been removed from the Revised BODR.
141	Editorial Comment Section 5	**Section 5.1.6.2 Functional Structures Determination Findings, HC&C System Infrastructure, page 57:** The text states that: "Alternatively, the 19 functional piezometer clusters located along the toe of the riverbank in the Nearshore Bench Subarea that are integral to the HC&C system operations are currently anticipated to be removed and reinstalled, as necessary to support continued operations and monitoring of the HC&C system." For clarity, replace "Alternatively" with "In contrast."	To be addressed in the PDR

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142	Editorial Comment Section 10	**Section 10, Dredged Material Classification and Management Evaluation, 3rd paragraph, page 151:** The text states, "confirmation classification will be performed by analyzing representative samples of removed materials and applying the criteria summarized in ***Section 9.1*** " ***(emphasis added)*** . The section reference appears to be incorrect. Revise as needed.	The section numbers in the Revised BODR have been revised, so this comment is no longer applicable.
143	Editorial Comment Section 10	**Section 10.2, Dredged Management Units, page 152:** The text references Section 7.2.3, but it appears that it was meant to reference Section 7.2.4. Revise as needed.	The section numbers in the Revised BODR have been revised, so this comment is no longer applicable.
144	Editorial Comment Section 11	**Section 11.1, In-Water Transportation and Dewatering, 2019/2020 bench-scale testing bullet, page 159:** The text states that the regulatory level for benzene is 500 milligrams per kilogram (mg/kg), but 40 CFR 261.24 shows that the appropriate regulatory level is 0.5 micrograms per kilogram (µg/kg). It appears that the toxicity characteristic leaching procedure (TCLP) testing results were also reported in the wrong units. Revise as needed.	To be addressed in PDR
145	Editorial Comment Section 11	**Section 11.2.1, Potential Facility Location(s), 1st sentence, page 162:** The first sentence appears to contain a typographical error: "the following criteria will be used to ***select a*** transload facility location" ***(emphasis added)*** . Revise as needed.	To be addressed in the PDR
146	Editorial Comment Section 13	**Section 13.2.3, Preliminary Mitigation Evaluation, page 171:** The last two sentences in the first paragraph on page 171 are a repeat of the two prior sentences. Revise as needed.	To be addressed in the PDR
Appendix A - Pre-Remedial Design Data Gaps Data Summary Report			
147	Specific Comment Appendix A	**Table 4-7a, Data Summary:** Top of Riverbank Angled Boring: Add a note defining the T data qualifier.	The DSR was approved by EPA in February 9, 2022. No revisions are being made to this report.
148	Specific Comment Appendix A	**Figure 4-1, PTW-NAPL Core Locations:** Show the trace of the subsurface extent of the PDI riverbank angled borings.	The DSR was approved by EPA in February 9, 2022. No revisions are being made to this report.
Appendix E (REMOVED) - Fate and Transport Modeling Analysis in Support of Buried Contamination Evaluation			
149	General Comment Appendix E	Add text to confirm and acknowledge that RAL and/or PTW threshold exceedances in the navigation channel should be deeper than -47 CRD to be considered in the buried contamination evaluation to maintain the authorized federal navigation channel dredge depth, 2-foot overdredge depth, and 2-foot buffer per USACE requirements outlined in RDGC Section 5.3.3.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
150	General Comment Appendix E	All project area-specific contaminants on ROD Table 17 with sediment and groundwater CULs must be modeled. Table 17 contaminants with sediment CULs will be compared to sorbed phase concentrations in surface sediment, and Table 17 contaminants with groundwater CULs will be compared to porewater concentrations in surface sediment. If CULs are not exceeded, or if concentration profiles are flat or decreasing with time, no further remedial design evaluation is required, and the buried contamination is considered chemically stable. Increasing concentration profiles indicate there may be impact to surface sediments from buried contamination.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
151	General Comment Appendix E	Surface sediment and porewater results for all project area-specific contaminants should be provided for each buried contamination location.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
152	General Comment Appendix E	Text stating that the objective of the evaluation was to determine whether these exceedances could potentially be transported to the surface sediments and cause exceedances of RAL and/or PTW-highly toxic threshold concentrations in surface sediments needs to be removed from Appendix E as well as other sections of the BOD-PDR, as applicable. The objective of evaluating chemical stability at buried contamination locations is to determine if the subsurface RAL and/or PTW exceedances will impact achievement of RAOs, which is why the modeled concentrations in surface sediment should be compared to the applicable CULs for project area-specific contaminants.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
153	Specific Comment Appendix E	**Section 2.2.1, Chemical-Specific Properties, 3rd bullet, page 3:** The octanol-water partition coefficient (K_{ow}) values used to calculate organic carbon partition coefficient (K_{oc}) values and associated literature sources should be provided for EPA review.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
154	Specific Comment Appendix E	**Section 2.2.2 Chemical Mass Transport Properties, page 3:** Since the chemical mass transport properties used for the chemical stability evaluations provided in this appendix are based on the cap modeling parameters in Appendix G, Appendix E should be revised based on EPA's comments on Appendix G regarding seepage rates and bioturbation depths.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
155	Specific Comment Appendix E	**Section 2.2.3, Sediment Layer Properties, page 4:** Clarify what concentration was used in the modeling for the underlying sediment below the tenth layer i.e., whether the modeling was conducted using a finite source assumption or an infinite source with concentrations equivalent to the deepest model layer.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.

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Comment No.	Section/Topic	Comment	Comment Response
156	Specific Comment Appendix E	Section 3, Sensitivity Analysis, page 13: For total PCBs at PDI-173, the model-predicted sorbed phase concentrations in the surface sediment increase by more than the sediment CUL (0.009 mg/kg) after approximately 30 years. The buried contamination at this location is not considered chemically stable under the scenario where the HC&C system is no longer in operation. The buried contamination evaluation is intended to demonstrate that there will be no impact to achievement of RAOs and based on the predicted CUL exceedance PDI-173 should be included in the Final Project Area. Revise the text as appropriate.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
157	Specific Comment Appendix E	**Table 3c, Sediment Properties for Location PDI-173SC-A, Note "a":** Clarify if the concentration used to model layers 8, 9, and 10 was the measured concentration in the 7- to 8-foot interval.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
Appendix F - Structural Inspection Report (KPFF)			
158	General Comment Appendix F	The Appendix F Structural Inspection Report states that KPFF was able to assess eight of the twelve existing marine structures at the Gasco Site. NW Natural should provide the results of the summer 2021 structural conditions assessment mentioned in Appendix F which EPA understands will include Structures No. S-1 (North Mooring Dolphin/Pedestrian Pier), No. S-6 (South Mooring Dolphin/Pedestrian Pier), No. S-3b (North Access Ramp) and No. S-3e (South Access Ramp). In addition, a structural conditions assessment is needed for Structure No. S-7 (Shell Dock/Timber Dolphin). Future structural conditions assessments should reference the same structure numbers/names used in the BOD-PDR to avoid confusion.	To be addressed in the PDR.
Appendix G - Chemical Dissolved Phase Chemical Isolation Modeling in Support of Capping as a Remedy			
159	Specific Comment Appendix G	**Section 2.2, Model Domain and Layers, page 5:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. In the December 21, 2018 response to EPA Specific Comment 18, part d on the TEWP, NW Natural had agreed to run a sensitivity analysis for the range of bioturbation depths identified in the ROD (10 to 20 centimeters [cm]). This analysis is not included in the BOD-PDR. Unless NW Natural can provide project area-specific empirical data to support the use of a 10-cm bioturbation depth, the cap configuration should be evaluated for a 20 cm maximum bioturbation depth.	This comment is no longer applicable because the Full Dredge and ISS Design eliminates the capping technology assignment.
		b. Clarify how the approach of modeling underlying concentrations as an infinite source will be revisited/refined as stated by the text. EPA considers modeling as an infinite source to be especially important in areas with unbounded DOC.	
160	Specific Comment Appendix G	**Section 3.2.2, Adjustment for Potential DNAPL Effects, page 15:** EPA understands that CapSim 3.8 was used for cap modeling. For cap modeling refinements during interim and final designs NW Natural should use the latest version of the model (CapSim 4.0 or later) and consider modeling NAPL as immobile and mobile phase for cap design. Immobile NAPL can be modeled using precipitation/dissolution processes by keeping porewater concentration at solubility until NAPL is depleted. This will allow for NAPL solubility to be factored in without having to adjust the input porewater concentrations based on an estimated effective solubility. The CapSim 4.0 Quick Start Manual should be reviewed for additional information on modeling mobile and immobile NAPL.	See response to Comment 159.
161	Specific Comment Appendix G	**Section 3.2.2.2, Identifying Effective Solubility Concentrations, page 17:** The text states, "It is interpreted that these two samples represent the effective solubility of detected DNAPL chemical components at the (Step 2a-2 on Figure 3b)." Clarify if this interpretation and general approach for identifying DNAPL effective solubility is consistent with methods used in cited 2009 Kueper and Davies document and/or other studies. EPA cannot verify the validity of this approach in the absence of supporting information that demonstrates the efficacy of determining effective solubility in this manner.	See response to Comment 159.
162	Specific Comment Appendix G	**Section 3.2.2.3, Porewater Concentration Adjustments, page 19:** Clarify why measured porewater and groundwater sample results were adjusted. Measured porewater/groundwater concentrations represent the dissolved aqueous concentrations and should not be corrected for solubility because the contaminants clearly exist at those concentrations in porewater/groundwater.	See response to Comment 159.
163	Specific Comment Appendix G	**Section 3.3.3.1, Assessing WBZ Influence on Seepage Rate, page 26:** Provide additional rationale for using average seepage rates, considering maximum seepage rates for stations listed in Appendix G Table 6 are much higher than the average seepage rates (e.g., GS-PC1 has an average seepage rate of 1 cm/day compared to its maximum measured seepage rate of 10.10 cm/day). All cap configurations should be evaluated using the 90th percentile and/or maximum observed seepage rates in addition to average seepage rates to evaluate worst case flux conditions for conservative cap design.	See response to Comment 159.
164	Specific Comment Appendix G	**Section 3.3.4, Seepage Rates for Basis of Design Cap Modeling, page 26:** The 0.1 cm/day seepage rate is not the upper end of the measured range of seepage rates. The y-axis of Appendix G Figures 10 through 12 needs to be modified to clarify that the plotted values are the average seepage rates. As stated in the comment above, the 90th percentile and/or maximum seepage rates should also be evaluated to provide for a conservative cap design.	See response to Comment 159.

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Comment No.	Section/Topic	Comment	Comment Response
165	Specific Comment Appendix G	**Section 3.3.5, Seepage Rates for Sensitivity Analysis, page 27:** Based on NW Natural's June 7, 2019 response to EPA Specific Comment 51 on the TEWP, it was expected that cap design modeling will be conducted with and the without the HC&C system in operation for the design period of 100-years, and not just as a sensitivity analysis for a temporary down time of 30 days. This evaluation should be provided in the revised BOD-PDR by using the 90th percentile seepage velocity and modeling for a period of 100 years.	See response to Comment 159.
166	Specific Comment Appendix G	**Section 6, Summary, pages 34 through 35.** EPA has the following comments on this section and the text should be revised accordingly:	See response to Comment 159.
		a. Clarify how the assumption of no biodegradation will be refined in the future. Also discuss whether there is empirical data based on current or future investigations to quantify site-specific biodegradation rates at the Project Area.	See response to Comment 159.
		b. Clarify how the conservative consolidation assumption will be refined and whether empirical data based on current or future investigations will be available to support these refinements.	See response to Comment 159.
167	Specific Comment Appendix G	**Table 1, Contaminants of Concern and Applicable Groundwater Cleanup Levels from ROD Table 17 (Errata #2):** All CULs based on RAO 8 PRGs will be evaluated on a point-basis. Table 1 inaccurately identifies area-based spatial scales for RAO 8 contaminants. While this is not a consideration for the current cap design evaluations, the table should be revised to identify the accurate spatial scale (point-based) for CULs based on RAO 8.	See response to Comment 159.
168	Specific Comment Appendix G	**Table 2, Input Parameter Values for the Chemical Isolation Cap Model:** EPA has the following comments on this table and the report should be revised accordingly:	See response to Comment 159.
		a. Molecular diffusivity row: Provide a table listing the molecular diffusivity values and associated literature sources for each of the contaminants being modeled for EPA's review and approval.	See response to Comment 159.
		b. Total porosity row: The stable armor stone sizes identified in BOD-PDR Table 6-4 are cobbles and boulders; therefore, the assumption of using porosity of sandy to gravelly sized materials is inaccurate. EPA understands that refinements are expected as design advances and this assumption will be re-evaluated based on armor layer and filter layer design. Clarify how porosity values are expected to be refined, i.e., will armor and filter material porosities be determined empirically.	See response to Comment 159.
		c. Boundary layer mass transfer coefficient row: Provide an expanded discussion of the boundary layer mass transfer coefficient sources and the range of coefficients obtained from these sources. Also discuss the sensitivity of the model to this parameter.	See response to Comment 159.
		d. Net groundwater seepage rate row: As discussed in RDGC Appendix B, a range of seepage velocities should be evaluated for cap design modeling. Therefore, a sensitivity analysis for the range of seepage rates measured in or near the Project Area should be provided.	See response to Comment 159.
169	Specific Comment Appendix G	**Table 3 Chemical-Specific Partition Coefficients:** EPA has the following comments on this table and the report should be revised accordingly. Proposed partition coefficients will be reviewed and approved after these comments have been addressed.	See response to Comment 159.
		a. Add a footnote to Table 3 to clarify whether the K_{oc}/ chemical-specific equilibrium partition coefficient (K_d) values for sediment are based on site-specific partition coefficients or literature-based coefficients, specify if the mean or lower-bound coefficients were selected from Appendix G Attachment 1, Table 5, and include the source for the literature-based coefficients. Revise Appendix G Section 3.1 to provide a summary of the rationale for the selected K_{oc}/K_d values for sediment based on information provided in Attachment 1 of Appendix G.	See response to Comment 159.
		b. Metals row: The log Kd value provided for arsenic is not conservative. It is an order of magnitude higher than the value in the EPA regional screening levels table where log Kd is 1.4 L/kg. Metals can have large variability in the partition coefficients reported in literature. Provide the source for this literature-based partition coefficient and any other sources that may have been considered in its selection.	See response to Comment 159.
170	Specific Comment Appendix G	**Attachment 1 Partitioning Evaluation and Screening Evaluation for Sediment Cap Remedial Design, Section 5 Candidate Chemicals for Consideration in Cap Design Modeling:** NW Natural anticipates that a cap designed for PAHs, VOCs, and arsenic will be sufficiently protective for the other Table 17 contaminants not expected to drive cap design. EPA acknowledges that detailed modeling evaluations of all Table 17 contaminants with groundwater CULs may not be needed. However, the final cap configurations should be modeled for all Table 17 contaminants using conservative literature-based partition coefficients in order to verify the assumption that caps designed based on contaminants expected to drive cap design are adequately protective of all Table 17 contaminants with groundwater CULs.	See response to Comment 159.
171	Specific Comment Appendix G	**Attachment 1 Partitioning Evaluation and Screening Evaluation for Sediment Cap Remedial Design, Table 5 Preliminary Screening Analysis Results, Note #1:** Since additional data collection for partitioning evaluations is not being proposed, clarify how/why the partition coefficients provided in Table 5 are expected to change.	See response to Comment 159.
172	Editorial Comment Appendix G	**Section 2.2, Model Domain and Layers, 1st bullet, page 3:** Correct the text to reference the accurate section. The BOD-PDR does not have Section 6.2.1.2.2.	See response to Comment 159.

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Comment No.	Section/Topic	Comment	Comment Response
173	Editorial Comment Appendix G	**Section 3.2.2.2, Identifying Effective Solubility Concentrations, page 17:** The text states, "It is interpreted that these two samples represent the effective solubility of detected DNAPL chemical components at the (Step 2a-2 on Figure 3b)." There appears to be missing text. Revise as needed.	See response to Comment 159.
Appendix H - Sediment DNAPL Mobility Assessment			
174	General Comment Appendix H	The objective of this appendix is to assess the potential for DNAPL to migrate toward surficial sediment via advection. Revise the text to clarify how dissolved contaminant concentrations in porewater migrating from the DNAPL impacted sediment will be addressed.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
175	General Comment Appendix H	Provide a figure showing the depth of DNAPL visual observations (start and end DNAPL observations) for all NAPL mobility cores and other subsurface cores, as applicable. Use this information to inform and expand the discussion of the potential of overlying sediment to sequester DNAPL migration.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
176	Specific Comment Appendix H	**Section 1, Introduction, page 1:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. The text states that: "Based on the Gasco upland property history, measured fluid properties of upland NAPL samples, and its presence below subaqueous sediments, NAPL in the Final Project Area sediments is interpreted to be DNAPL." The Gasco TEWP did not indicate that the NAPL in the Project Area is DNAPL. Provide the rationale to support this interpretation and clarify what site-specific data/information from the Gasco Project Area sediment bed was used to make this determination.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		b. The text includes the following quote: "Based on the Gasco Sediments Site conceptual model, PTW-NAPL was emplaced in sediment due to historical overland discharges or upland runoff. There is no evidence that PTW-NAPL in sediments migrated from upland DNAPL sources via a subsurface pathway." The quoted text needs to be revised for consistency with the actual text in the TEWP which states that: "Based on the Gasco Sediments Site conceptual model, the presence of PTW-NAPL in sediments is due to historical overland discharges or upland runoff rather than subsurface flow (Anchor QEA 2018a).	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
177	Specific Comment Appendix H	**Section 1.1, Background, page 2:** Add clarifying text to acknowledge that a lack of DNAPL advection does not mean contaminants cannot migrate from NAPL-impacted sediments as dissolved concentrations via advection, diffusion, dispersion, etc. or get mobilized due to sediment bed disturbances from anthropogenic activities such as boat anchoring.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
178	Specific Comment Appendix H	**Section 1.3, DNAPL Mobility Classifications, 2nd item page 2:** It is misleading to state that the Interstate Technology & Regulatory Council (ITRC) document describes three general classes of DNAPL mobility as discussed in this section. These classifications are not explicitly stated in the ITRC 2015 guidance. In fact, the discussion of residual NAPL in the guidance states that "After cessation of the release, as a DNAPL migrates through the subsurface, it leaves a residual trail, which is essentially immobile unless subsurface pore pressures change due to disturbance of the matrix or other activities." Further, the guidance also states that: "Although residual DNAPL is considered immobile under normal subsurface conditions, it can act as a long-term source of dissolved-phase groundwater contamination." The document does not provide classification based on mobility. Revise this section to accurately cite the ITRC guidance or remove this discussion entirely.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
179	Specific Comment Appendix H	**Section 1.3, DNAPL Mobility Classifications, 2nd item, page 2:** The text states that: "For the purpose of this document, PTW-NAPL is considered equivalent to potentially mobile DNAPL." There is no basis to support the assumption that PTW-NAPL is considered equivalent to potentially mobile DNAPL." Revise the text to clarify the purpose of this statement, whether PTW-NAPL includes DNAPL classified as potentially mobile and mobile, and if/how DNAPL classified as immobile will be addressed by the remedy.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
180	Specific Comment Appendix H	**Section 2, DNAPL Core Sample Collection and Observation, page 5:** The text identifies sediment cores at 8 locations where PTW-NAPL was visually identified. Discuss how these 8 locations were identified out of 130 core locations. Simply stating it was visually identified is not sufficient rationale since that line of evidence is subjective.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
181	Specific Comment Appendix H	**Section 4.1, DNAPL Effective Hydraulic Conductivity, pages 8 through 9:** EPA has the following comments on this section and the text should be revised accordingly:	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		a. The use of DNAPL effective hydraulic conductivity (K_n) as one line of evidence for classifying DNAPL mobility in test samples was not a part of the EPA-approved DGWP. The rationale for this approach should be provided to EPA for review and approval.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		b. Since in-situ stabilization/solidification (ISS) is not being proposed as a remedial technology at the Gasco Project Area, the last sentence in Section 4.1 should be deleted. Additionally, Appendix H Table 3 and the summary table in Appendix H, Attachment 3 use this value as a threshold for hydraulic conductivities to infer mobility classifications. Since ISS is not a proposed remedial technology using this as a decision metric is not acceptable.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.

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Comment No.	Section/Topic	Comment	Comment Response
182	Specific Comment Appendix H	**Section 4.2 DNAPL Mobility Classification Using Multiple Lines of Evidence, page 9:** EPA has the following comments on this section and the text should be revised accordingly:	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		a. 3rd paragraph: Provide the basis for establishing the residual saturation in this manner. This discussion is unsupported and stating that it is conservative because a sample with initial DNAPL saturation of 16.20% did not produce DNAPL is misleading because another sample with initial DNAPL saturation of 16.14% did produce DNAPL via centrifuge testing. Therefore, there is large uncertainty in this estimated residual DNAPL saturation value and does not provide a reliable line of evidence for determining NAPL mobility.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		b. The text states that the "hydraulic gradient applied during testing was orders of magnitude stronger than those that exist in the field." Replace this text with quantitative comparison by providing the hydraulic gradient(s) that exists in the field and the hydraulic gradients that were applied during testing.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
183	Specific Comment Appendix H	**Section 5, DNAPL Saturation Based on Sediment Analytical Results, pages 10 through 13:** EPA has the following comments on this section and the text should be revised accordingly:	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		a. Based on the September 11, 2019 response to EPA Specific Comment 78 on the DGWP, NW Natural was supposed to provide supporting information to document that NAPL mass can be estimated using TPH measurements, in addition to information from two EPA-managed cleanup sites where the measurement of TPH was performed as the primary metric to evaluate mass flux. This information has not been provided and the validity of this approach is still unclear. The approach presented in this section goes even further to develop correlations between total PAH and TPH concentrations to determine mass flux. EPA does not approve the use of this approach and this line of evidence cannot be used to estimate mass flux for cap design. Provide robust technical rationale to support the use of this approach. In the absence of supporting information, Appendix H Section 5 and associated discussions throughout the BOD-PDR should be deleted because the approach used to calculate NAPL saturation values for PDI sediment samples is not accurate.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		b. List #5: Based on the approach described in the DGWP, it was expected that NAPL density and other fluid properties would be developed based on NAPL collected from sediments. The use of upland DNAPL fluid properties to estimate sediment bed NAPL properties was not approved by EPA. To EPA's knowledge, there have been no investigations to evaluate whether upland DNAPL has the same characteristics and properties as NAPL in sediments. Since NAPL from sediments was not able to be extracted for analysis of NAPL fluid properties, there is no data to verify that NAPL in sediments has the same physical properties as upland DNAPL. Revise the BOD-PDR to provide empirical data to support the use of upland DNAPL properties for in-water sediment remedy design.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		c. The conclusion that 99.2% of the sediment has DNAPL saturation values less than the residual saturation and, therefore, contains immobile DNAPL is unsupported by the information provided in Appendix H. There appears to be uncertainty in the calculation of the residual saturation value and the average NAPL saturation values for PDI sediment samples. Remove this unsupported conclusion from the text. Additionally, the conclusion that approximately 3.5% of the samples contain discrete layers of potentially mobile DNAPL based on the evaluation illustrated in Figure 4 is similarly unsupported and cannot be corroborated with empirical data since all PDI cores were not photographed under ultraviolet (UV) light. Revise this section as appropriate.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		d. Describe how sample depths with the "most notable" visual observations of PTW-NAPL were determined from the core photographs as this process can be subjective (e.g., whether any break in observed fluorescence is used to identify the end of an interval with NAPL, or there is a certain thickness of interval showing lack of fluorescence used to identify the end of an interval with NAPL). Additionally, the depths for each interval with NAPL should be noted on Attachment 1 figures and/or tabulated for all NAPL mobility cores.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
184	Specific Comment Appendix H	**Section 6.2.1, Pore Entry Pressure, Equation 4, page 17:** See comment on Appendix H, Section 1, Introduction regarding applicability of upland DNAPL properties. Except for porosity, all other parameters used to determine pore entry pressure were estimated, assumed based on literature, or obtained from upland DNAPL data. Centrifuge testing of shallower sample intervals overlying the potentially mobile NAPL sediment was not conducted which was an optional step in the DGWP approach. Revise the text to include a discussion of uncertainties associated with the calculation of pore entry pressure and stable DNAPL thickness.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
185	Specific Comment Appendix H	**Section 6.2.2, Maximum Stable DNAPL Thickness, Equation 5, page 18:** Except for porosity, all other parameters used to determine maximum stable vertical thickness of DNAPL were estimated, assumed based on literature, or obtained from upland DNAPL data. Centrifuge testing of shallower sample intervals overlying the potentially mobile NAPL sediment was not conducted which was an optional step in the DGWP approach. Revise the text to include a discussion of uncertainties associated with the calculation of the maximum stable vertical thickness of DNAPL.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.

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Comment No.	Section/Topic	Comment	Comment Response
186	Specific Comment Appendix H	**Section 7, Conclusions, page 19:** EPA has the following comments on this section and the text should be revised accordingly:	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		a. 1st bullet: Discuss why the threshold 10^{-7} centimeters per second is relevant for identifying hydraulic conductivities that are "very low".	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		b. 2nd bullet: Revise Appendix H and relevant sections of the BOD-PDR to remove text specifying that residual NAPL is "immobile". EPA understands that the term immobile refers exclusively to the ability of NAPL to advect through sediment pore spaces. However, equating this with immobility in misleading because other transport mechanisms capable of mobilizing NAPL are ignored.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		c. 3rd bullet: Revise this bullet point to also discuss samples within the navigation channel.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		d. Last paragraph: Revise the text to also discuss transport processes and anthropogenic activities that may lead to mobilization of NAPL. In the absence of this information the discussion of factors expected to reduce the potential for NAPL movement is biased and should be deleted.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
187	Specific Comment Appendix H	**Attachment 4 Calculation of Pore Entry Pressure and Maximum Stable DNAPL Thickness, Note #1:** Clarify whether the sensitivity analysis is based on the hydraulic conductivity and hydraulic gradient expected if the HC&C system is not in operation or the hydraulic conductivity and hydraulic gradient were arbitrarily set to 10 times higher (hydraulic conductivity) or 10 times lower (hydraulic gradient) than the base case.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
Appendix I - Ebullition-Based DNAPL Mass Flux Assessment			
188	General Comment Appendix I	As indicated in BOD-PDR general comments regarding removal of PTW-NAPL, it was expected that most of the NAPL in the Gasco Project Area will be removed consistent with the ROD and Gasco ASAOC. Therefore, the gas ebullition evaluations were intended to address the migration of NAPL remaining in the Project Area after removal of NAPL impacted sediments to the maximum degree feasible. However, the remedial technology assignments proposed in the BOD-PDR indicate that most of the PTW-NAPL will be capped so the validity of these approaches for determining NAPL mass flux from such a large volume of PTW-NAPL is of concern. Visual field observations are subject to numerous limitations, uncertainties, and biases that lend to this concern. The BOD-PDR should be revised to address EPA's concerns regarding preferential removal of PTW-NAPL (see EPA General Comment 1). A comprehensive, multi-event sampling program may be required for areas where significant quantities PTW-NAPL is left in place to fully address uncertainties with the gas ebullition evaluation. Revise the document accordingly.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
189	General Comment Appendix I	NAPLs are often mixtures of contaminants and that composition can vary spatially (see Appendix I Report Table 3-6 as an example of spatial heterogeneity). Without full analytical chemical analyses of all sediment bed NAPL samples, the characteristics of the NAPL (i.e., LNAPL versus DNAPL) and the mass of its chemical constituents cannot be definitively known. Consequently, mass flux estimates based only on TPH and TPH correlations may be biased or erroneous, which could negatively impact modeling projections and subsequent remedial designs. Based on NW Natural's September 11, 2019 response to EPA Specific Comment 78 on the DGWP, supporting information was be provided to document that NAPL mass can be estimated using TPH measurements, in addition to information from two EPA-managed cleanup sites where the measurement of TPH was performed as the primary metric to evaluate mass flux. Based on the information provided in the BOD-PDR, EPA does not approve the use of this approach and this line of evidence cannot be used to estimate mass flux for cap design. Discussions of TPH correlations in Appendix I and associated discussions throughout the BOD-PDR should be removed.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
190	General Comment Appendix I	The comments provided in this set are focused on EPA's larger concerns. Absence of a comment on a particular topic (e.g., use of a *Temperature Adjustment Based on Zhu et al. 2015* that was developed for the Grand Calumet River in Indiana and potentially does not capture the site-specific characteristics of the Gasco Project Area) does not imply concurrence.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
191	Specific Comment Appendix I	**Section 1, Introduction, page 1, 1st paragraph:** The text states: "Based on the Gasco upland property history, measured fluid properties of upland NAPL samples, and its presence below subaqueous sediments, NAPL in sediments is interpreted to be DNAPL." Revise the text to specify the measured physiochemical properties of the NAPL found in the Project Area sediment bed. If this information is not available, revise the text to note that no direct assessment of NAPL properties is available for NAPL present in the sediment bed. While the measured fluid properties of upland NAPL samples may be similar to those of the sediment bed NAPL, they should not be assumed to be analogous without empirical confirmation.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.

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Comment No.	Section/Topic	Comment	Comment Response
192	Specific Comment Appendix I	**Section 1.1, Background, page 1, 2nd paragraph:** Revise the text as follows: "In general, upward DNAPL migration may ***typically*** occur via three ***natural*** mechanisms, alone or in combination: 1) advection (i.e., flow) as a continuous fluid phase within the sediment pore spaces; 2) ebullition-facilitated transport; and 3) sediment consolidation (squeezing) following cap placement." ***(Emphasis added)*** . Anthropogenic disturbances of the sediment bed (e.g., anchor retrieval) could result in DNAPL being brought upward through the sediment column.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
193	Specific Comment Appendix I	**Section 1.1, Background, page 1, 3rd paragraph:** The text states that: "Containment booms have been deployed around the entire perimeter of the Project Area for over a decade to address sheens related to ebullition." Revise the text to clarify if other NAPL transport mechanisms (e.g., advection) contributed to or could have contributed to the sheens that were contained by the booms. If only ebullition-facilitated NAPL transport contributed to the observed sheens, revise the text to cite the studies/sampling programs that empirically determined this.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
194	Specific Comment Appendix I	**Section 1.3, DNAPL Transport via Ebullition, page 2:** EPA has the following comments on this section and the text should be revised accordingly:	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		a. The first paragraph states: "When the buoyancy of the gas bubble is greater than the pressure of the overlying sediment and water, the gas bubble rises upward through the sediment and then to the water surface (i.e., gas ebullition)." Revise the text, if appropriate, to clarify if the cohesiveness of the sediment (e.g., sand vs. clay) impacts ebullition potential.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		b. The second paragraph states: "Less gas is produced during colder months when microbial activity in sediment decreases, and more gas is produced during warmer months when microbial activity in sediment increases (McLinn and Stolzenburg 2009; Viana et al. 2007, 2012; Waldo 2018; Zhu et al. 2015)." Revise the text to reflect that sediment bed temperatures, and not the more general "colder" and "warmer" months, is a key factor influencing the rate of gas production.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		c. Revise the third paragraph text to read as follows: "Gas ebullition release depends, ***in part*** , on water depth. In settings with fluctuating water levels, ebullition rates depend, ***in part*** , on surface water stage conditions." ***(Emphasis added)***	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		d. Revise the text to define "surficial" sediment based the ROD-identified 0- to 30-centimeter depth or define "surficial" sediments quantitatively.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
195	Specific Comment Appendix I	**Section 2, Ebullition Data Collection, 2nd paragraph, 3rd bullet, page 3:** The text states: "Collection of sheen blossom samples concurrent with LOE 1 and LOE 2 data collection and analysis of these samples for TPH C9 to C44 to calibrate the DNAPL mass flux estimated based on the visual LOEs." Revise the text to present the full list of analytes for sheen blossom samples and describe why only TPH is used to calibrate DNAPL mass flux, as NAPLs often contain a mixture of contaminants.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
196	Specific Comment Appendix I	**Section 2.1, Phase 1:** Initial Reconnaissance, general comment: Revise the text to acknowledge the limitations of visual assessments. These limitations may include orientation of the observers in the vessel, temporal differences in ebullition occurrence (survey time period vs. non-surveyed time period), the ability of aerial photography to simultaneously capture the entire Project Area with sufficient image resolution to detect sheen generation, etc.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
197	Specific Comment Appendix I	**Section 2.1, Phase 1: Initial Reconnaissance, 5th paragraph, page 4:** EPA has the following comments on this section and the text should be revised accordingly:	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		a. The text states: "Following the Phase 1 reconnaissance, the on-land aerial photograph/video operator and the boat crew reviewed observations and identified the three locations (PDI-146ASB, PDI-147ASB, and PDI-148ASB) with the most notable active sheen blossom observations for Phase 2 focused observations (Figure 6)." Revise the text to quantitatively (as much as possible) define what is meant by "most notable".	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		b. The text states: "These three locations were selected for detailed sheen blossom visual assessment, video recording, and sampling to provide a conservative (i.e., worst case) estimate of DNAPL mass flux associated with ebullition." Given the numerous spatial and temporal variables affecting ebullition, remove "conservative (i.e., worst case)" from this statement unless empirical, temporally-spaced evidence can be provided indicating that this assessment was conducted during "worst case" conditions.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
		c. The text states: "As shown on Figure 6, the areas with active sheen blossoms observed in September 2019 are consistent with some of the sheen blossom areas observed during ebullition surveys conducted in 2012 and 2017." The difference in ebullition areas between 2012 and 2017 appear to be significant (e.g., 2012 areas appear to be more than twice as large as 2017 areas) and the 2019 areas appear non-existent on Figure 6. The potential causes for these differences (e.g., variations in event timing, water conditions, survey techniques), in addition to any of the hypothesized impacts of the HC&C system, should be discussed to determine the validity/comparability of this assessment program to previous surveys. Revise the document accordingly.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.

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Comment No.	Section/Topic	Comment	Comment Response
198	Specific Comment Appendix I	**Section 2.2 Phase 2: Detailed Data Collection, pages 5 through 7:** Discuss the limitations associated with the video recording and field observation techniques, including, but not limited to: vessel/camera orientation (e.g., what if ebullition occurs on the other side of the vessel), limited field of view (e.g., any ebullition outside of the 10 foot x 10 foot frame), limited temporal coverage (i.e., one day), etc. These limitations and uncertainties should be incorporated into any mass flux assessment.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
199	Specific Comment Appendix I	**Section 3.2, Sheen Blossom Sample Data Evaluation, pages 13 through 14:** Revise this section to present the results for all NAPL analytes and revise the text to discuss each class of contaminant.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
200	Specific Comment Appendix I	Section 3.3, DNAPL Mass Flux Results Based on September 2019 Data, page 16: Revise Section 3.3 to reflect the limitations and uncertainties of the assessment protocols used in this effort, especially as compared to more direct and quantitative survey/sampling techniques such as flux chambers. Limitations/uncertainties to discuss include the significant difference in the ebullition footprints presented in Figure 6, the impact of vessel/observer orientation, the limitation to a 10 foot x 10 foot viewing area, etc. Ebullition is subject to a variety of spatially and temporally varying factors, and assuming that estimates based on subjective observations, correlation/correction factors, etc. are "conservative" or "worst case" cannot be justified without supporting empirical evidence.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
Appendix J - Ebullition Laboratory and Modeling Studies to Inform Cap Design Evaluations			
201	General Comment Appendix J	Revise Appendix J conclusions, and, if necessary, modeling approaches to address EPA's concerns highlighted in the General Comments on Appendix I.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
202	General Comment Appendix J	Provide EPA with the ebullition potential model that was used, including model code, compilation instructions (Makefile or compiler name, version, flags), model inputs for all simulations (calibration, validation, application), example outputs for benchmarking purposes, and justification for any "adaptations" made to the model. Additional comments on ebullition modeling, including Appendix J, may be provided after EPA has reviewed the model, its adaptations, its inputs, and supporting documentation and files.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
203	General Comment Appendix J	Provide EPA with the experimental references and regulatory precedents used to develop the biogas generation potential testing described in Section 2.3. Also cite or provide standard operating procedures (SOPs) for all laboratory activities/procedures, including control experiments. Additional comments on biogas generation potential testing, results, and conclusions may be provided following receipt and review of the requested experimental references, regulatory precedents, and SOPs.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
204	General Comment Appendix J	The comments provided on Appendix J are focused on EPA's larger concerns with the BOD-PDR. Details of the Appendix J approach, computations, results, and conclusions will be reviewed and commented on after EPA's larger concerns are addressed.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
205	Specific Comment Appendix J	**Section 1, Introduction, page 1, 1st paragraph:** The text states "…to be transported upward through subaqueous sediments via gas ebullition (i.e., ebullition-facilitated transport) toward surficial sediment and the overlying surface water following dredging followed by partial dredging and capping or capping on grade." This statement is unclear. For example, it is not clear what is meant by dredging followed by partial dredging. Revise the text for clarity.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
206	Specific Comment Appendix J	**Section 1, Introduction, page 1, 1st paragraph:** The text states "Based on the Gasco upland property history, measured fluid properties of upland NAPL samples, and its presence below subaqueous sediments, NAPL in sediments is interpreted to be DNAPL." Revise the text to specify the measured physiochemical properties of the NAPL found in the Project Area sediment bed. If this information is not available, revise the text to note that no direct assessment of NAPL properties is available for NAPL present in the sediment bed. While the measured fluid properties of upland NAPL samples may be similar to those of the sediment bed NAPL, they should not be assumed to be analogous without empirical confirmation.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
207	Specific Comment Appendix J	**Section 1, Introduction, page 1:** Revise the text to identify and discuss all sources of carbon in the sediment bed and describe the organic carbon inputs that the HC&C system has "cut off". Also see BOD-PDR General Comments regarding the HC&C system.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
208	Specific Comment Appendix J	**Section 1, Introduction, page 2, 2nd to last paragraph:** The text states "Based on the model results, ebullition is expected to cease sooner in areas with lower-than-average hydrocarbon concentrations". This conclusion is supported, in part, by the observed decrease in the ebullition footprint between 2012 and 2019. See EPA's comments on Appendix I and revise this text accordingly.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
209	Specific Comment Appendix J	**Section 1.1, Project Background, page 3, 1st paragraph:** Revise the text as follows: "In general, upward DNAPL migration may ***typically*** occur via three ***natural*** mechanisms, alone or in combination: 1) advection (i.e., flow) as a continuous fluid phase within the sediment pore spaces; 2) as a result of sediment consolidation (pore squeeze) following cap placement; and 3) ebullition-facilitated transport as a film adhering to upward migrating gas bubbles that are produced within the sediment." ***(Emphasis added for comment clarity)*** . Anthropogenic disturbances of the sediment bed (e.g., anchor retrieval) could result in DNAPL being brought upward through the sediment column.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.

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Comment No.	Section/Topic	Comment	Comment Response
210	Specific Comment Appendix J	**Section 1.3, Ebullition Monitoring Observations, page 3, general comment:** EPA's comments on Appendix I regarding ebullition monitoring activities and General Comment 1 above are relevant to this section. Revise the document, conclusions, and, if necessary, modeling approaches to address EPA concerns highlighted in Appendix I comments.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
211	Specific Comment Appendix J	**Section 2.2, Sediment Characterization, page 7, 2nd paragraph:** The Report states "Upon arrival at EGL, the 10 sediment sample intervals were homogenized and subsampled for LOC analysis." Revise the text to clarify if the various sample intervals were combined and homogenized, or if the samples were kept as discreet intervals and each individual interval was homogenized.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
212	Specific Comment Appendix J	**Section 2.3.1, Experimental Setup, page 15, 2nd paragraph:** The Report states that: "Sediment samples were homogenized by hand in an anaerobic glove box…" Revise the text to cite the homogenization SOP that was followed.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
213	Specific Comment Appendix J	**Section 4, Site-Specific Ebullition Potential Model, pages 23 through 34:** The site-specific ebullition potential model relies on information from field and laboratory efforts that EPA has commented on in Appendices I and J. Additional comments may be provided on the site-specific ebullition potential model once EPA comments on Appendices I and J, and the larger PTW-NAPL concerns are addressed in the revised BOD-PDR.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
214	Editorial Comment Appendix J	The table of contents identifies eight tables that are part of the appendix; however, EPA was unable to locate the tables Provide the tables in the next version of Appendix J.	This comment is no longer applicable. This appendix has been removed from the Revised BODR.
Appendix L - Depth of Contamination Surface Delineation			
215	General Comment Appendix L	**Kriging Analysis:** The kriging analysis is used to develop a deterministic DOC surface but there is no mention of the uncertainties of predicted concentrations in the mapped surfaces. When used as a deterministic interpolator there is little or no advantage to the use of kriging. The primary advantage of a kriging analysis is the accompanying estimation variance and methods for estimating probability of exceedance of selected thresholds of DOC or concentration. It is noted that probability was used as a metric for the indicator kriging analysis; however, only the 50% contour line was used, thereby also rendering it essentially equivalent to deterministic application of ordinary kriging for the geometric mean. The indicator kriging analysis should be used to develop color scale maps of at least three probability levels which should be selected in consultation with EPA. As an example, by overlaying the 20%, 50%, and 80% contours and coloring the map with two three colors, blue for areas where probability of exceedance is less than 20%, gray for areas between 20% and 80% probability and red for areas exceeding 80% probability would provide maps identifying areas that are very likely to be clean (<20%) likely to be dirty (>80%) and areas that are uncertain between 20% and 80%. If the areas mapped as uncertain are relatively narrow "halos" between high and low probability areas, then data in those areas are considered adequate for lateral delineation of the deposits. Gray uncertain areas that are laterally expansive indicate locations where the lateral extent is uncertain and additional sampling or expansion of the footprint would be recommended. EPA recommends NW Natural utilize the power of the geostatistical methods that have been developed to create maps that capture uncertainty in the lateral footprint and provide a mechanism to direct further sampling to refine the lateral dimension. Revise Appendix L to include the analysis described in this comment.	An SMA Uncertainty Evaluation has been included as Appendix I.
216	General Comment Appendix L	**Semi-Variogram analysis:** Plots of the crossflow semi-variograms for DOC and the indicator variable lack clear definition of the range of influence because there is no point at which the semivariance reaches a horizontal asymptote. This is a common situation indicating that the variables of interests have large-scale directional gradients over the area of interest. In this case it is clear that DOC and the binary indicator for presence of contamination both decrease strongly with distance from the shoreline. This trend represents a violation of the stationarity assumptions of kriging, so the variograms are incorrectly estimated. The range of influence, the ratio of anisotropy, and nugget effect estimates are all likely to be inaccurate because of this. The fitted models also suffer problems with what appear to be incorrect fits to the empirical estimates including the sill and nugget effect estimates. Some form of trend model should be used to fit the data and then re-fit the semivariograms and provide draft results to EPA for review, prior to additional development of design surfaces. The nature of the trend model could be based on a continuous (perhaps s-shaped) function of the distance from the shoreline, or simply separate means for navigation channel and nearshore areas. The residuals from either of these trend models should then be subjected to a semivariogram analysis to re-estimate long- and crossflow directional semivariograms. With this model, NW Natural should then krig the residuals followed by addition to the trend model. This could be termed universal kriging, or kriging with a spatially varying mean depending on the particular references one consults. Revise the semi-variogram analysis as appropriate.	Additional data is being collected within the Refined Project Area to determine DOC at sampling locations that were previously vertically unbounded (Anchor QEA 2023e). This comment will be addressed when the DOC surface is re-interpolated in a future design deliverable once all applicable DOC data is available.
217	General Comment Appendix L	**Vertical extent of NAPL:** Include a figure similar to Figure 2-2 indicating the vertical delineation and extents of NAPL.	To be addressed concurrent with DOC interpolations. See response to Comment 216.

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Comment No.	Section/Topic	Comment	Comment Response
218	Specific Comment Appendix L	**Section 2 Data used in DOC Surface Interpolation, pages 2 through 7:** EPA has not approved an approach for replacing subsurface locations. NW Natural should provide a table with comparisons of all cores that have been omitted from the DOC surface with the location that has replaced it. This table should include the maximum concentrations identified in both cores, mudline elevation of the core, distance between the two cores, any NAPL observations, and number of consecutive intervals used to delineate DOC. EPA disagrees with the removal of higher concentration samples for the purpose of model simplification.	See response to Comment 216.
219	Specific Comment Appendix L	**Section 3.3 Cross Validation Results, page 13 and Figure 2-2:** Inspection of the resultant mapping of the depth and elevations of contamination indicate that in nearshore areas where deposits are apparently thickest, the majority of cores did not fully penetrate the contaminated sediment layer leaving the elevation of contamination largely unknown. This section discusses minimizing the underestimation biases and provides a bullet list of procedures. Only the fourth bullet in this list would be expected to provide a substantive assurance that the target sediment will be accurately targeted and that would only be the case if a very specific dredge sample and redredging program were planned and implemented. A summary of the TEWP Appendix E - NW Natural's Additional Revised Gasco Sediments Site Dredge and Cover Design, Implementation, Verification, and Closeout Approach should be described within this appendix because the nature of this plan determines the degree of accuracy required for the surfaces developed in Appendix L.	See response to Comment 216.
Appendix O - Preliminary Mitigation Evaluation Methods			
220	General Comment Appendix O	Habitat conditions characterization data will be reviewed by NMFS to inform the HEA. Habitat data should be collected along transects within the various habitat types (e.g., shallow water to -15 CRD, active channel margin, and riparian) on a spacing appropriate to fully describe habitat conditions for input into the HEA. Data should include representative photos at a frequency necessary to capture the habitat conditions along each transect. As stated in comments on Section 13, EPA recommends coordination with NMFS early in the HEA development process. EPA is not approving the HEA approach as provided.	See response to Comment 26. NW Natural has collected habitat data along transects within the active channel margin and riparian areas and in the shallow water zone as far as could be visually observed during low tide conditions and took photos as recommended in the comment. This information will be used in the mitigation evaluation performed as part of the PDR.
221	Specific Comment Appendix O	Attachments A and B: Clarify why the Pre-Remediation Habitat Characteristics (shown on spreadsheet tab "PrePostHabitatTypebyAcres") differ between Scenario A and Scenario B.	To be addressed in the PDR.
Appendix P - Biological Assessment Outline			
222	General Comment Appendix P	The Biological Assessment should follow revised Endangered Species Act regulations (e.g., direct and indirect effects are no longer described; interrelated and interdependent actions are no longer described). In addition, the term PCE is obsolete and should be replaced with physical and biological feature (PBF).	This comment is no longer applicable because a site-specific report to demonstrate compliance with the Programmatic Biological Opinion will be prepared, once the Programmatic Biological Opinion is issued.
223	General Comment Appendix P	The Biological Assessment should include an evaluation of potential effects on listed species and critical habitat in the Columbia River, including Eulachon (Thaelichthys pacificus) and Green Sturgeon (Acipenser medirostris). In addition, the effects analysis should consider the potential for contaminant dispersal from remedial activities in the PHSS downstream to the Columbia River and effects related to construction of compensatory mitigation projects in the Columbia River.	This comment is no longer applicable because a site-specific report to demonstrate compliance with the Programmatic Biological Opinion will be prepared, once the Programmatic Biological Opinion is issued.
224	Specific Comment Appendix P	**Section 2.2, Project Description, page i:** Add subsections for riverbank-related remediation activities, in addition to the in-water sections already included.	This comment is no longer applicable because a site-specific report to demonstrate compliance with the Programmatic Biological Opinion will be prepared, once the Programmatic Biological Opinion is issued.
Appendix Q - Clean Water Act Section 404(b)(1) Outline			
225	General Comment Appendix Q	Ensure the outline includes all sections which apply to dredging, capping, and cap amendments; exclude any sections and subsections that apply to in-water disposal. See the 2016 Feasibility Study for reference.	To be addressed in the PDR.
226	Specific Comment Appendix Q	**Table of Contents, Section 2 Purpose and Need:** Include subsections on objectives and a segment on water dependent usage.	To be addressed in the PDR.
227	Specific Comment Appendix Q	**Section 3.2.2, Transportation and Disposal of Dredged Material:** This section should specifically discuss impacts and tradeoffs between different forms of conveyance to the landfill and should include, at a minimum, a barge versus rail comparison and offloading impacts.	To be addressed in the PDR.
228	Specific Comment Appendix Q	**Section 6, Potential Impacts on Special Aquatic Sites:** Remove sections that do not apply to the site such as coral reefs, wetlands, and riffle and pool complexes.	To be addressed in the PDR.

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Comment No.	Section/Topic	Comment	Comment Response
229	Specific Comment Appendix Q	**Section 9, Actions to Minimize Potential Adverse Effects and Practicable Steps to Minimize Potential Adverse Impact:** Include subsections to discuss ways in which capping and dredging impacts will be mitigated if not otherwise discussed in Section 4, including onsite mitigation measures following dredging and capping activities.	To be addressed in the PDR.
230	Specific Comment Appendix Q	**Section 10, Analysis of Practicable Alternatives Pursuant to Site Criteria:** Remove "aquatic impacts from disposal" since this action does not include any in water disposal.	To be addressed in the PDR.
Appendix R - Site-Specific Water Quality Barrier Control Technical Evaluation and Selection			
231	General Comment Appendix R	The focus of Appendix R is physical and gas barrier controls without consideration of the significant impact of dredge equipment, such as fixed arm versus cable arm, type of dredge bucket, software, and operational BMPs as well as barge return water on the creation of residuals. Outcomes for two primary projects are discussed in the context of barrier controls in a way that implies that barrier controls are solely responsible for positive and negative outcomes. Include a discussion of a combination of choices on each of these factors from lessons learned at a variety of sites to evaluate the best possible outcome in terms of limiting short term impacts for the Gasco remedial action.	To be addressed in the PDR.
232	Specific Comment Appendix R	**Section 2.1, Anchored Full- and Partial-Depth Silt Curtains, pages 4 through 6:** EPA has the following comments on this section and the text should be revised accordingly:	
		a. The text should note that debris on the river bottom in combination with changing water levels can cause rips in silt curtains.	To be addressed in the PDR.
		b. While silt curtains can be effective in controlling short term water quality impacts, they were not entirely effective during the 2005 removal action (Parametrix 2006). Revise the text accordingly.	To be addressed in the PDR.
233	Specific Comment Appendix R	**Section 2.3, Full-Depth Sheetpile Walls, pages 7 through 8:** EPA has the following comments on this section and the text should be revised accordingly:	To be addressed in the PDR.
		a. This section should discuss the potential for releases (i.e., ebullition, floatable NAPL with a specific gravity less than 1) during sheet pile installation.	To be addressed in the PDR.
		b. This section should discuss the potential to work outside of the construction window with some type of wall configurations that do not involve gate openings/closings and associated water quality impacts. EPA acknowledges this would require coordination and approval by relevant agencies such as the U.S. Fish and Wildlife Service and NMFS.	To be addressed in the PDR.
234	Specific Comment Appendix R	**Section 3.3, Operational Uses, 2nd bullet, page 11:** As described in the ROD and FS, mobile dock areas should expect some level of disruption during cleanup. Language assuring no disturbance of tenant operations should be removed here and from the document as a whole.	To be addressed in the PDR.
235	Specific Comment Appendix R	**Section 3.4, Other Characteristics, 5th bullet, page 11:** The description should also note that a full-depth silt curtain deployment would mitigate fish entrapment by removing fish prior to deployment and cite studies noting that once removed fish typically avoid areas of sediment disturbance.	To be addressed in the PDR.
236	Specific Comment Appendix R	**Section 4.1.1, Gasco Early Action Removal Action, pages 12 through 14:** EPA has the following comments on this section and the text should be revised accordingly:	To be addressed in the PDR.
		a. To ensure a complete discussion, reference and discuss findings from the 2006 *Final Early Removal Action Construction Oversight Report* (Parametrix 2006). Include a discussion of water quality exceedances, BMPs (i.e., the use of different buckets), and offsite impacts.	To be addressed in the PDR.
		b. The anecdotal information discussed here regarding the bubble curtain's performance is not sufficient to fully understand water quality impacts relative to other disturbances such as debris ripping the silt curtain, various levels of dewatering treatment, and dilution provided by the partial silt curtain versus the full silt curtain. This section should be appropriately qualified as anecdotal as it is not correlated with measured turbidity or downstream chemical concentrations. Alternately, those data, analyses, and associated timelines should be presented. For reference, text from the *Final Early Removal Action Construction Oversight Report* states: "Although visual observations indicated that the bubble curtain may have contributed to elevated turbidity measurements, a review of the field measurement data does not support this conclusion. This may be due to the periodic nature of field sampling or the heterogeneity of the river bottom near the bubble curtain. The data indicates that turbidity was not significantly less after the bubble curtain was shut down. The most significant impact on turbidity appears to have resulted from the change from the inner removal area to the outer removal area, which resulted in greater connection of flow between the river and the contained area" (Parametrix 2006).	To be addressed in the PDR.
		c. While short term hazards to workers is a fact, the "ineffectiveness" of fish seining in removing fish lacks basis given that many fish were relocated and while some remained trapped and died, these were relatively few by comparison (12 dead fish). Revise this section to note actual numbers of fish relocated and those that perished based on the Anchor QEA and EPA reports and reference the *Final Early Removal Action Construction Oversight Report*: "Considering that 12 dead fish (some very small) were discovered during the project, the ratio of fish removed to those potentially missed suggests that the seining was a very effective means of removing fish within the containment area, specifically considering that depths of greater than 20 feet were located in the removal areas" (Parametrix 2006).	To be addressed in the PDR.

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Comment No.	Section/Topic	Comment	Comment Response
237	Specific Comment Appendix R	**Section 4.1.2, Former Portland Gas Manufacturing Site Cleanup, pages 14 through 15:** To draw conclusions on what steps should be taken for the remedial action at the Gasco Sediments Site in a fully informed fashion, this section should discuss particulars of the design used for the PGM moonpool, such as the exact height over bottom to which the silt curtain was hung relative to the exact heights of any deployed bedload baffles. Discussion should be included regarding water quality results for PGM and the 2005 Gasco action outer removal area on the effects of dilution with partial curtain systems relative to water quality results and potential offsite impacts. Tables should be included which display and discuss the 2005 and 2020 work relative to BMPs used and differences in NAPL material weathering at each site as well as any other factors that might help the reader better understand the quantitative short term impact monitoring from each project and what this means in terms of chemical concentrations in the water column as well as potential distribution of particle bound contamination. Note the conclusion in the 2006 *Final Early Removal Action Construction Oversight Report* relative to bottom baffle/hanging curtain type approaches, water quality, and the dilution the moonpool design allows for in achieving water quality standards for COCs and other parameters: "The partial length silt curtain utilized during dredging within the outer removal area also had some impact on water quality. Significantly lower concentrations of contaminants were observed during the outer removal operations. However, based on the data reviewed and visual indications, it appears that a significant portion of the lower concentrations detected may be attributed to the apparent flow between the partial length silt curtain and the offset bedload baffle. This gap in containment likely provided a preferential pathway for flow to occur between the contained area and the river. The lower concentrations observed downstream is likely due to dispersion and dilution of contaminants. Though water quality samples were better with the partial-length silt curtain, it appears that more contaminated particles were lost using the partial-length silt curtain than the full-length silt curtains. However, there is not sufficient data to differentiate the mass loss between the two containment systems" (Parametrix 2006).	To be addressed in the PDR.
238	Specific Comment Appendix R	**Section 5.2 Technical Implementability, 3rd Bullet, page 22:** Stating business reason(s) to say a sheet pile wall is decisively precluded as a short-term impact control during remediation is not appropriate. Restate business concerns as a *consideration* regarding sheet pile usage in this area.	To be addressed in the PDR.
239	Specific Comment Appendix R	**Table 1, Case Study Summary on Dredging WQ BMPs - Advantages and Disadvantages:** The majority of these projects on the table do not involve NAPL dredging and as such may be of limited value in guiding work at the Gasco Sediments Site. Some may have NAPL, but not in the areas being dredged (e.g., Terminal 4). Add a column "NAPL in Project Area Y/N" to aid reviewers in judging comparability of these projects to the Gasco Sediments Site.	To be addressed in the PDR.
240	Specific Comment Appendix R	**Table 2, Case Study Information on Dredging WQ BMPs - Performance:** EPA has the following comments on this table and it should be revised accordingly:	To be addressed in the PDR.
		a. The table should discuss sites that treated barge return water or otherwise note how this was handled.	To be addressed in the PDR.
		b. The Terminal 4 project row should note that a hanging silt curtain was used along with a bubble curtain. Include a brief discussion of COC results.	To be addressed in the PDR.
		c. Boeing Plant 2 - Duwamish Sediment Other Area and Southwest Bank and East Waterway Phase I Removal Action project discussion should also include discussion of COC results.	To be addressed in the PDR.
241	Specific Comment Appendix R	**Table 3, Screening and Retainment of Applicable Water Quality Barrier Controls:** EPA has the following comments on this table and it should be revised accordingly:	To be addressed in the PDR.
		a. Note that an implementability advantage of a full sheet pile wall system could be operating outside the fish window timeframe, if a design can be used without a door.	To be addressed in the PDR.
		b. Mobile moonpool silt curtain usage should note a disadvantage is dissolved and particle bound material loss due to the permeability of the curtain material and lack of a continuous barrier from the water surface to the river mudline.	To be addressed in the PDR.
242	Specific Comment Appendix R	**Section 7 References, pages 28 through 29:** Revise the references to include precision dredging references and incorporate consideration of such into the discussion of overall BMP usage (e.g., https://www.battelle.org/docs/default-source/conferences/sediments-conference/proceedings/2019-sediments-conference-proceedings/a2.-monitoring-and-evaluating-remedy-effectiveness/a2_1145_-524_webb.pdf?sfvrsn=774e58f8_2).	To be addressed in the PDR.
Appendix S Draft Water Quality Monitoring Plan and Quality Assurance Outline			
243	General Comment Appendix S	**Willamette River Water Quality:** Add a new section discussing beneficial uses for the river. See *Water Quality Monitoring and Compliance Conditions Plan* (EPA 2008) as an example.	To be addressed in the PDR.
244	General Comment Appendix S	**Offsite measures:** Discuss offsite contaminant transport and measurement techniques such as sediment stakes, sediment traps, and other techniques and how this might guide BMPs such as a residual management area outside of dredge management units (DMUs).	To be addressed in the PDR.

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Comment No.	Section/Topic	Comment	Comment Response
245	Specific Comment Appendix S	**Section 2.5, Background Survey:** Include subsections here that explicitly include both physical and chemical parameters. As an editorial note, it would be of the most benefit if this work was targeted towards the summer work window and during times of flow reversals when the "downstream" station should be repositioned towards downtown rather than the Columbia River.	To be addressed in the PDR.
246	Specific Comment Appendix S	**Section 3, Sampling and Analysis Methods:** EPA has the following comments on this section and the outline should be revised accordingly:	To be addressed in the PDR.
		a. Include a detailed section here that includes discussion of lab turnaround times and justifications, including information from a variety of area labs. Also include a discussion about the advantages and disadvantages of an onsite lab to service the needs of water quality COC monitoring. See the Final Early Removal Action Construction Oversight Report (Parametrix 2006) and include explicit consideration of recommendations found therein including lab contingency actions: "The failure to report laboratory data in a timely manner was due to a combination of issues including, but not limited to, an increase in the number of samples collected, very low detection limits required, and the lack of project-dedicated laboratory equipment and personnel."	To be addressed in the PDR.
		b. Out of range samples were responsible for many turnaround time delays during the initial Gasco removal action (Parametrix 2006). Add a section or detailed subsection to discuss protocols for high hit samples to avoid gas chromatography/mass spectrometry calibration issues and delays associated with the analysis of out-of-range samples, e.g. parallel analysis of multiple ranges on several machines, field dilution of samples containing floating NAPL or blebs, etc.	To be addressed in the PDR.
247	Specific Comment Appendix S	**Tables:** At a minimum, add the following tables:	To be addressed in the PDR.
		a. The 303(d) list of parameters for the Willamette River	To be addressed in the PDR.
		b. Summary of Removal Action Activities and Impacts to Water Quality	To be addressed in the PDR.
		c. Water Quality Triggers for Additional Environmental Controls.	To be addressed in the PDR.
248	Specific Comment Appendix S	**Figures:** Add a section for figures to include conceptual DMU areas and monitoring stations at least as a placeholder for later insertion when known during the design.	To be addressed in the PDR.

Appendix C-2
PAR Response to Comments

Table C-2
PAR Response to Comments

Comment No.	Comment	Document Where Comment Is Addressed	Comment Response
GC 1	**Conceptual Design:** The PAR bases its conclusions on mostly conceptual approaches that will need to be verified during the pilot studies and/or future stages of design. EPA recommends future design deliverables clearly distinguish conceptual design concepts from design evaluations already conducted. Supporting evaluations are expected in the forthcoming revised Basis of Design Report (BODR). EPA agrees with the general approach of ISS treatment at the Gasco Project Area with the caveat that site-specific details of the approach will need to be further developed in collaboration with EPA during design of the ISS remedy.	Address during future design deliverables	Comment noted. The Revised BODR describes the evaluations that will be conducted for the Full Dredge and ISS Design. The results of those evaluations will be included in future design deliverables.
GC 2	**ISS as a ROD technology:** While EPA agrees that ISS is a remedial technology that is included in the ROD's selected remedy, future design deliverables should clearly discuss the conditions under which ISS was retained in the Feasibility Study (FS) and included in the selected remedy (e.g., for areas where access and slope stability issues exist, and for principal threat waste (PTW) underneath and around pilings, docks, berthing or mooring dolphins, and other structures servicing active wharfs or shore-based facilities that remain intact). ISS was specifically retained as a technology for use in areas with PTW and where groundwater is affecting porewater, which EPA recognizes are significant issues at the Gasco Project Area.	Address in Revised BODR	The BODR describes the conditions under which ISS was retained in the Feasibility Study as follows: "In situ treatment technology was retained in the Portland Harbor Feasibility Study (EPA 2016a) and included in the ROD's selected remedy for areas where access and slope stability issues exist, PTW/NAPL exists underneath and around functional structures, and/or contaminated groundwater is impacting porewater."
GC 3	**Shallow Region Elevations:** Future design deliverables should consider including figures depicting the elevation changes as they relate to Endangered Species Act (ESA) species down to -15 feet Columbia River Datum (CRD) for dredging and capping and also discuss whether an ISS approach could create additional shallow water habitat compared to the dredge and cap design.	No Longer Applicable	Future design deliverables for the Full Dredge and ISS Design will consider elevation changes relative to the -15 feet CRD elevation threshold and attempt to optimize additional shallow water habitat improvements relative to other engineering considerations (e.g., required slope elevations for long-term slope stability).
GC 4	**Other Site Examples:** Future design deliverables should describe whether ISS has been successfully used for other manufactured gas plant (MGP) sites in freshwater or marine environments along with any lessons learned and design and construction best management practices (BMP) elements that were particular to those specific applications.	Address in TSWP and BODR	A list of contaminated sites, including MGP sites, where ISS has been effectively used is included in Section 1.2 of the *Additional Revised In Situ Stabilization and Solidification Bench Scale Treatability Study Work Plan* (TSWP) and Section 5.1 of the Revised BODR.
GC 5	**Remedy Monitoring:** The PAR suggests that the "Full Dredge and ISS Design" alternative would not require capping and would have reduced monitoring requirements compared to capping. The laboratory pilot study treatability testing results should be used to inform the need for capping subsequent to ISS implementation. Monitoring of the in-river remedy will still be required for the ISS remedy and these capping and monitoring requirements should be evaluated during future design stages.	Address during IDR	To be addressed in the IDR following completion of the Phase IV testing detailed in the TSWP and long-term sampling described in the *Final Revised In Situ Stabilization and Solidification Field Pilot Study Work Plan* (FPSWP).
GC 6	**Habitat Quality:** Future design deliverables should describe in detail the anticipated habitat conditions (soil type, depth, vegetative conditions) if ISS were to be applied to the Siltronic riverbank. The PAR states that existing thick armoring would be removed to complete ISS across the riverbank but does not specify whether armoring would be replaced to support slope stability, whether the riverbank would be laid back to accommodate natural habitat configurations, and/or whether a soil layer would be added following implementation of ISS.	Address during future design deliverables	To be considered and addressed in future design deliverables.
GC 7	**Dredging Equipment:** The PAR states that the Revised Dredge and Cap alternative would require special equipment for dredging around the Gasco dock. Future design deliverables should address the need for follow-up dredging for the swell around the pier.	Address during future design deliverables	Future design deliverables will address the need for follow-up dredging for potential swell material generation around the pier.
SC 1	**Section 1. Introduction, page 2:** Whether ISS reduces or eliminates contaminant transport depends on the application. Until the pilot studies are completed it is premature to state that contaminant transport will be fully eliminated via any transport mechanism. Future design deliverables should note that ISS has the potential to eliminate contaminant transport via ebullition and advective flux, and this is contingent on the final design.	Address in Revised BODR	Section 5.1 of the Revised BODR notes that ISS has the potential to eliminate contaminant transport via ebullition and advective flux. The results of the Phase IV testing detailed in the TSWP, data from the Field Pilot Study, and long-term sampling described in the FPSWP will inform the extent of contaminant transport reduction from the surface of ISS-treated sediments.
SC 2	**Section 2 Summary of Remedial Technology Assignments Developed for the PAR, Revised Dredge and Cap Design, page 4:** The revised remedial technology assignments include capping on grade for a large portion of the project area adjacent to the riverbank. Future design deliverables should provide the rationale for proposing the cap on grade approach.	No Longer Applicable	The comment is no longer applicable as the Full Dredge and ISS Design includes full removal to the DOC in the Navigation Channel and fully addresses DOC in the remaining areas through ISS; therefore, a cap on grade is no longer proposed.

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SC 3	**Section 2 Summary of Remedial Technology Assignments Developed for the PAR, Full Dredge and ISS Design, page 5:** Future design deliverables should include a reference to an existing study to support the statement that ebullition does not occur in sediment that are directly treated with ISS.	Address in Revised BODR	The BODR states that potential for contaminant transport via ebullition will be verified in future design deliverables. However, the pH of ISS treated sediment is typically between 11 and 12 (Grubb et al. 2020), and high pH is generally incompatible with methanogenesis (S. Qiu et al. 2023). Therefore, these factors indicate that ebullition, which is driven by methane production, is unlikely to occur in ISS-treated sediments.
SC 4	**Section 3.1 Revise Design to Focus on Removal of PTW-NAPL/NRC to the Extent Feasible, Revised dredge and Cap Design, page 6:** EPA has the following comments on this item: a. This section indicates that a maximum amount of PTW-NAPL and PTW-NRC could be removed is approximately 70% and 50%, respectively. EPA recommends that future design deliverables include any analysis that support these quantities and illustrate where removal of these materials is considered feasible/infeasible. b, EPA does not agree with the following text in the last sentence in the first paragraph since it is unsubstantiated and subjective; any future design deliverables should restructure or exclude such text, as needed, for clarity: "and even that would require extraordinary effort."	No Longer Applicable	The comment is no longer applicable as the Full Dredge and ISS Design includes full removal to the DOC in the Navigation Channel and fully addresses DOC in the remaining areas through ISS.
SC 5	**Section 3.1 Revise Design to Focus on Removal of PTW-NAPL/NRC to the Extent Feasible, Revised dredge and Cap Design, Maintain long-term slope stability for post-dredge cap and habitat material placement, page 7:** Future design deliverables should clarify if the same software and methodologies described in the Combined BOD-PDR were used for the additional slope stability evaluations.	Address in Revised BODR and future design deliverables	The software and approach described in the Combined BOD-PDR were used to perform preliminary slope stability evaluations to inform the discussion in the PAR. Additional geotechnical evaluations will be performed in future design deliverables as described in Section 6 of the Revised BODR.
SC 6	**Section 3.1 Revise Design to Focus on Removal of PTW-NAPL/NRC to the Extent Feasible, Revised dredge and Cap Design, Minimize Potential Impacts to the Gasco Dock, page 7:** EPA has the following comments on this item: a. Future design deliverables should provide the required offset from the dock structure for the maximum 10-foot partial dredging depth. b. Future design deliverables should provide additional clarification regarding the mudline elevation increases discussed in this section and why the slope cannot be laid back to achieve the 3H:1V slope configuration and discuss if this would require greater than 10-foot excavation, result in removal of substantial material with concentrations below remedial action levels (RALs), or both.	No Longer Applicable	See response to Comment SC 4.
SC 7	**Section 3.1 Revise Design to Focus on Removal of PTW-NAPL/NRC to the Extent Feasible, Revised dredge and Cap Design, Minimize Water Quality Impacts During Dredging, page 9:** Future design deliverables should refrain from using water quality "permit" and replace it with substantive applicable or relevant and appropriate requirement (ARAR) water quality requirements, or similar.	Address in Revised BODR	References to water quality "permits" have been removed from the Revised BODR.
SC 8	**Section 3.1 Revise Design to Focus on Removal of PTW-NAPL/NRC to the Extent Feasible, Revised dredge and Cap Design, Control the Ebullition-Facilitated Transport of DNAPL, page 10:** EPA would prefer that the last sentence read as follows: "The Revised Dredge and Cap Design must be designed to fully address this documented DNAPL transport pathway and any potential DNAPL migration via advection."	No Longer Applicable	See response to Comment SC 4.
SC 9	**Section 3.1 Revise Design to Focus on Removal of PTW-NAPL/NRC to the Extent Feasible, Full Dredge and ISS Design, Maintain Long-Term Slope Stability for Post-Dredge Cap and Habitat Material Placement, page 10:** EPA has the following comments on this item: a. Performance standards for strength will be established in future design deliverables and will require EPA approval. b. Future design deliverables should expand the discussion of greater seismic stability factors of safety due to integration of ISS treatment layer with the ISS treatment barrier wall and provide the factors of safety for the ISS treatment layer with and without the ISS barrier wall.	a. Address in Revised BODR b. Address during future design deliverables	a. Section 6.3.1 of the Revised BODR includes performance standards for physical stability and strength and permeability testing. b. Future design deliverables will expand the discussion of seismic stability factors of safety due to integration of the ISS treatment layer with the deep ISS barrier wall and provide the factors of safety for the ISS treatment layer with and without the deep ISS barrier wall.

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SC 10	**Section 3.1 Revise Design to Focus on Removal of PTW-NAPL/NRC to the Extent Feasible, Full Dredge and ISS Design, Minimize Potential Impacts to the Gasco Dock, page 11:** The feasibility of ISS to treat to the full depth of PTW or RAL exceedances will also need to be evaluated in future design deliverables. A revised BODR should clarify if ISS in a river setting has a depth limitation and determine whether there is a potential for leaving untreated PTW or RAL exceedances below the feasible depth limit of ISS.	Address in Revised BODR	This information is included in Section 6.3.2.1 of the Revised BODR.
SC 11	**Section 3.1 Revise Design to Focus on Removal of PTW-NAPL/NRC to the Extent Feasible, Full Dredge and ISS Design, Minimize Water Quality Impacts During Dredging, page 11:** EPA expects that the efficacy of the moonpool as a BMP for ISS mixing will be evaluated during the field pilot study.	Address in FPSWP and Revised BODR	The efficacy of the use of moonpool as a water quality BMP was assessed during both ISS treatment and excavation of ISS-treated materials during completion of the FSP; a summary is provided in Section 6.3.2.5 of the Revised BODR.
SC 12	**Section 3.1 Revise Design to Focus on Removal of PTW-NAPL/NRC to the Extent Feasible, Full Dredge and ISS Design, Control Advective Flux, page 12:** a. Future design deliverables should clarify whether a permeability of 10E-6 cm/s is the intended performance standard for the proposed ISS treatment. As noted in the BOD-PDR, typical performance standards for ISS are on the order of 10E-7 cm/s permeability. EPA expects the performance standards for permeability will be established in future design deliverables and will require EPA approval. b. The Deep Lower Alluvium would potentially interact with sediments exhibiting concentrations above Table 17 clean up levels, and then discharge at higher rates around the perimeter of the ISS monolith. EPA recommends that NW Natural better evaluate groundwater fate and transport under this scenario to predict the range of groundwater concentrations and flow rates into the Willamette River as part of a revised BODR. EPA observes that the groundwater advective flux from the uplands may increase (not decrease or be eliminated) compared to the current condition as a result of constructing the upland measures. The current groundwater flow condition is conceptually illustrated in Figure 3-10. The increase in groundwater flow is conceptually illustrated in Figure 3-14. This increased groundwater flow from the Deep Lower Alluvium may introduce higher groundwater flux with low level contamination. As stated in Section 3.1, Deep Lower Alluvium groundwater "can become contaminated as it flows through contaminated sediments."	a. Address in Revised BODR b. Address during future design deliverables	a. Permeability of 10E-6 cm/s and the associated technical rationale has been added as a performance standard in Section 6.3.1 of the Revised BODR. b. Section 2.10.1.1 of the Revised BODR indicates that that the recontamination potential of the Deep Lower Alluvium will be addressed through DEQ's review of the *Revised Source Control Addendum Report* submitted to DEQ on November 2, 2023 as part of the upland Voluntary Agreement (DEQ No. WMCVM-NWR-94-13).
SC 13	**Section 3.2 Revise Design to Eliminate or Minimize Cap on Grade and Maintain Current Elevations to Minimize Habitat Impacts, Revised Dredge and Cap Design, pages 12-13:** EPA has the following comments on this section: a. Future design deliverables should describe the acreage, or range of acreage where shallow water habitat is lost or altered under this option. b. Text on page 13 states that: "Preliminary flood rise evaluations for the Revised Dredge and Cap Design, including these isolated elevation increases, indicate minimal potential for flood rise impacts; however, additional Project Area-specific modeling would be required to confirm the no net rise threshold can be met with sheetpile wall structures in place and incorporation of additional remedial design details." EPA would have preferred the qualitative term "minimal" be replaced with the range of increase in water surface elevations based on the results of the preliminary flood rise evaluations at the cross-sections evaluated. c. Additional Project Area-specific modeling would be required to confirm the no net rise threshold can be met using the HEC-RAS model provided by EPA on November 9, 2022.	No Longer Applicable	See response to Comment SC 2.

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SC 14	**Section 3.3 Revise Design to Better Integrate Upland Source Control Measures into the Sediment Remedy, pages 14-18:** EPA has the following comments on this section: a. The PAR would have benefited from an explanation how the schematic illustrations in Figures 3-9, 3-10, 3-12 and 3-14 were developed. While these conceptual evaluations of groundwater flow are acceptable for the PAR, groundwater flow and pathways need to be evaluated in greater detail during future design deliverables. b. Text on page 14 states that "the underlying Deep Lower Alluvium WBZ groundwater that does not pose a current of future risk of sediment recontamination upon entering the riverbank flows through the contaminated sediments, becomes contaminated at levels that exceed ROD Table 17 cleanup levels, and transports this contamination to the surface sediments and surface water." Future design deliverables should provide contaminant fate and transport evaluations for the Deep Lower Alluvium water-bearing zone (WBZ) groundwater pathway and its potential for recontamination as it flows through contaminated sediments. c. The text in the first bullet point on page 15 ideally would have touched on EPA comments regarding evaluation of cap modeling with and without the HC&C system in operation. Without this additional context, the text appears to inaccurately imply that EPA agreed that cap design will only consider post-HC&C seepage meter data. d. The text would have benefited from a reference to an upland source control document that presents results of groundwater modeling mentioned in the second full sentence page 16. e. Detailed groundwater evaluations will need to be conducted in future stages of design to substantiate the discussion in the Full Dredge and ISS Design text. It is premature to state that all groundwater pathways will be eliminated and "groundwater will not migrate" through ISS'd sediments and soils before the ISS mix designs are finalized. The objective of the ISS treatment will be to eliminate upland contaminated groundwater and ebullition pathways. f. Text in the 3rd bullet on page 15 ideally would have qualified that the recontamination potential of the Deep Lower Alluvium will be addressed through DEQ's review of the November 10, 2022 Source Control Addendum Report that NW Natural submitted to DEQ as part of the upland Voluntary Agreement (DEQ No. WMCVM-NWR-94-13). g. The Full Dredge and ISS Design text does not clarify how the average seepage rate of 0 cm/day shown on Figure 3-14 was determined. This concept of zero seepage should be verified during future stages of ISS design. EPA notes the advantage of the negligible seepage in limiting dissolved contaminant transport compared to the dredge and cap alternative which relies on the HC&C system to be fully operational in perpetuity.	a, b, d, e, f, and g. Address during future design deliverables c. No longer applicable	a, b, d, e, and f. Future design deliverables will provide greater detail regarding groundwater pathways and seepage rates. Also, see response to Comment SC 12b. c. The comment is no longer applicable.
SC 15	**Section 3.4 Revise Design to Evaluate/Perform Active Remediation at Siltronic Riverbank, page 18-20:** The Revised Dredge and Cap Design text ideally would have described the potential of dissolved contamination migrating through the Siltronic riverbank, and means for sampling behind the armor (e.g., angled riverbank borings), rather than through it.	No Longer Applicable	The Full Dredge and ISS Design eliminates dissolved contamination migration from the uplands to the river via the installation of a deep ISS barrier wall in conjunction with the existing HC&C system (expanded to include fill WBZ containment and southern expansion). If required by the ROD, ISS treatment can be used to remediate the entirety of the Siltronic riverbank channelward of the wall, so this comment is no longer applicable.
SC 16	**Section 3.5 Additional Design Performance Considerations, Seismic Stability, page 20:** ISS treatment of the sediment in the intermediate and shallow underwater regions is expected to increase the unit weight of sediments. Therefore, stability of these slopes must be evaluated under both static and seismic loading conditions to assess the effect of increased unit weight on local and global slope stability failure modes. Detailed slope stability calculations must be submitted to EPA for review in the revised BODR (see also General Comment No. 1).	Address in Revised BODR and during future design deliverables	Additional slope stability evaluations for ISS treatment areas will be performed in future design deliverables as described in Section 6.3.2.2 of the Revised BODR. The post-construction grades and associated slope stability calculations cannot be completed until receipt and evaluation of the Phase IV testing detailed in the TSWP and long-term sampling described in the FPSWP, so those calculations will not be included in the Revised BODR.

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SC 17	**Section 3.5 Additional Design Performance Considerations, Potential for Water Quality Impacts During Construction, page 20-21 and Appendix B, ARARs, page 4:** The text would have benefited from a discussion of the testing that will take place before any field pilot study, e.g. SPLP, DRET that could be conducted to demonstrate both water quality impacts of introduced grout, but also nominal levels of site contaminants of concern emanating from disturbed treated material during dredging to remove swell/obtain a particular elevation for slope stability and/or habitat. Consideration should be given to possible pH, turbidity, dissolved oxygen, and temperature impacts to the water column from ISS itself, or the dredging to target elevation of ISS treated materials as well as the types of grout that might be used including their active ingredients and possible water quality impacts.	Address in Revised BODR and during future design deliverables	Water quality monitoring was performed during completion of the FPS and the results and lessons learned will be summarized in the Revised BODR and future design deliverables.
SC 18	**Section 3.5 Additional Design Performance Considerations, Post-Dredge Residuals Management, page 22:** EPA has the following comments on this item: a. EPA recognizes the following statement revision (second to last sentence of the first full paragraph): "This simplifies the design and, unlike the Revised Dredge and Cap Design, reduces dredge residuals potentially containing PTW-NAPL and the associated risk for off-site migration." b. EPA recognizes the following statement revision (first part of the last sentence of this section): "The Full Dredge and ISS Design would, therefore, significantly reduce the short-term risks during remedial action,..."	Comment noted.	Comment noted.
SC 19	**Section 3.5 Additional Design Performance Considerations, Green Remediation, page 23:** EPA has the following comments on this item: a. The type of remedy that best meets remedial action objectives and ARARs is meant to be selected without an overriding carbon or energy footprint deciding factor, i.e. Green Remediation is not a 10th criteria for remedy selection (EPA 2016). The text ideally would have indicated whether or how green remediation concepts may be applied to ISS, rather than implying that ISS should be chosen over conventional dredging and capping due to its lower carbon footprint. b. The text would have benefited from a reference to green remediation plan(s) that exist and that will be developed in the future that do or will go into more detail on this topic.	Address in Revised BODR and during future design deliverables	The application of green remediation concepts will be included in a Green Remediation Plan that will be developed as part of future design deliverables, as discussed in Section 6.9 in the Revised BODR.
SC 20	**Section 4 Summary of Preferred Design, page 25:** EPA would have preferred bullet points 2 and 3 to start with the phrase "Eliminates or minimizes", or have includes footnotes to clarify that the assumption that these pathways will be eliminated will be verified in future stages of design.	Address in Revised BODR	A footnote (footnote 11) was added to similar statements in Section 5.1 of the Revised BODR.
SC 21	**Table 4-1:** EPA has the following comments on Table 4-1: a. Table 4-1 ideally would have included a row for "Estimated volume of PTW-NAPL/NRC treated with capping" or something similar. b. A footnote ideally would have been added to the table clarifying all the considerations (e.g., removal of armor stone) for determining possibility of active remediation of the Siltronic riverbank. EPA notes that if existing armor can be removed to implement ISS, then the armor could also be removed to construct a cap, and so both alternatives should indicate "yes" if this were the only consideration for active remediation of the Siltronic riverbank. However, based on Section 3.4, it appears that the armor layer is not the only limitation.	No Longer Applicable	The comment is no longer applicable because Table 4-1 will not be used in the Revised BODR and future design deliverables.
EC 1	**Section 2 Summary of Remedial Technology Assignments Developed for the PAR, page 4:** EPA has the following comments on Table 4-1: a. Although other alternatives considered are discussed in Appendix A, it would be helpful to have at least a bulleted list of those in Section 2. b. Section 2 currently presents arguments for the Full Dredge and ISS Design alternative, which should instead be presented and compared in later Sections of the report. Ideally Section 2 should be a straight-forward description of each alternative.	No Longer Applicable	The comment is no longer applicable because the Revised BODR and future design deliverables will only discuss the Full Dredge and ISS Design.

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EC 2	**Section 3.3 Revise Design to Better Integrate Upland Source Control Measures into the Sediment Remedy, pages 17-18:** Clarify in the text, and consider adding a figure, to explain what is meant by "…two side-by-side rows of ISS columns that will overlap/integrate with the riverbank columns."	Address during future design deliverables	Future remedial design documents will provide additional description and associated figures regarding the ISS design and associated ISS column overlaps throughout the Project Area.
EC 3	**Figure 2-1:** This figure could be improved by showing the location of the sheetpile walls, groundwater trench, and any other new elements on Figure 2-1. A legend would be helpful for the cross-hatched area, dashed blue line and circles, and other features. Showing in-water structures should also be considered.	No Longer Applicable	Figure 2-1 is not included in the Revised BODR, so this comment is no longer applicable.
EC 4	**Figure 2-2:** Ideally Figure 2-2 should be similar to Figure 2-1 in content, simply showing the locations of design elements and a legend (without the bullet points). It should visually identify any areas where shoreline configurations or upland treatment elements are changing, if any. Any existing treatment elements that are not included in this alternative should be removed from the figure, and new ones identified in the legend (e.g., is the dashed green line the new groundwater extraction trench?).	Address in Revised BODR	Figure 2-2 has been updated and included as Figure 5-1 in Revised BODR.
EC 5	**Table 4-1:** NW Natural should consider the following regarding Table 4-1: a. A key to explain shading and hatching on several figures is not included, and it is unclear what some of the shading and hatching is intending to communicate. For example, the intent of the blue shading/hatching on Figure 3-3 ideally would be provided. b. The "existing top of riverbank" label on Figure 3-7 does not accurately reflect the top of riverbank and implies that the ISS barrier wall is riverward of the top of riverbank. Figure 3-3 shows the same cross section but shows the "existing top of riverbank" at a different location.	No Longer Applicable	This comment is no longer applicable as these tables and figures are not included in the Revised BODR or future design deliverables.
TBC 1	**Upland Measures:** The PAR implies that the currently uncontrolled Fill WBZ groundwater will pose a risk to the in-water remedy. EPA notes that DEQ has already approved a Fill WBZ groundwater source control measure consisting of groundwater recovery trenches and/or horizontal wells extending the entire length of the Gasco OU shoreline and along the Gasco/US Moorings property boundary. At NW Natural's request and EPA's concurrence, DEQ postponed the implementation of the Fill WBZ source control measure because excavation of the riverbank during construction of the in-water remedy would potentially interfere with, damage, or destroy the Fill WBZ source control measure. It is important to recognize that key documents related to upland and in-water remedy have stated that NW Natural is committed to constructing the Fill WBZ source control measure prior to or concurrently with the riverbank and sediment remedy. The Final Gasco Sediments Site Sufficiency Assessment (SAR) identifies the Fill WBZ as conditionally controlled based on NW Natural's commitment. EPA understands that DEQ is prepared to direct NW Natural to implement the Fill WBZ source control measure without further delay if it is decided that riverbank remediation will not result in an impact to the source control measure. Otherwise, NW Natural will implement the Fill WBZ source control measure under DEQ oversight concurrent with the in-water remedy. EPA acknowledges that the long-term effectiveness of any in-water design alternative relies on effective source control, and that DEQ will approve and oversee implementation of source control measures.	Address in Revised BODR	Comment noted. Groundwater source control is described in Section 2.10.1 of the Revised BODR.
TBC 2	**Dredging Limits:** Except for dredging near the Gasco dock, the PAR does not clearly demonstrate the point at which removal of PTW-NAPL and PTW-NRC becomes impracticable based on feasible depth limit of dredging. It would have been helpful to include a conceptual dredge prism that illustrates the feasible limit of dredging be included in the revised BODR to provide support to the PTW-NAPL and PTW-NRC removal volumes reported in the PAR, with call outs to identify specific limitations to complete removal of PTW. In addition, the PAR does not assess the reduction in the footprint of PTW-NAPL and PTW-NRC in its assessment of long-term cap performance and a figure showing the existing footprint of PTW, and the estimated footprint of PTW after dredging to the extent feasible ideally would have been included.	No Longer Applicable	The comment is no longer applicable as the Full Dredge and ISS Design includes full removal to the DOC in the Navigation Channel Region and ISS treatment to the DOC in the remaining areas; therefore, a cap on grade is no longer proposed.

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TBC 3	**Table 4-1:** NW Natural should consider the following comments regarding Table 4-1: a. The percent of PTW-NAPL, PTW-NRC, and PTW-highly toxic material removed from various regions would ideally be listed separately. b. The estimated volume of PTW-NAPL/NRC remaining in place would ideally separate the volumes of PTW-NAPL and PTW-NRC left in place. The methodology for calculating these volumes would ideally also be explained.	No Longer Applicable	The comment is no longer applicable because Table 4-1 will not be used in the Revised BODR and future design deliverables.
TBC 4	**Figures:** The following figures would have benefited from having relative horizontal and vertical scales: Figures 3-1 through 3-4b, 3-7 through 3-10, 3-12, and 3-14.	No Longer Applicable	The comment is no longer applicable because these figures will not be used in the Revised BODR and future design deliverables.
TBC 5	"maintains current elevations to minimize habitat impacts." This latter description is still better than the cap on grade included in the dredge and cap alternative, but does not rise to the first statement that could allow for some desirable reconfiguration of the riverbank, nearshore, and shallow environments to improve habitat. EPA understands the Yakama Nation would like to work with NW Natural to incorporate some aquatic and terrestrial habitat into the design for ESA listed and tribally important species, away from operational areas and ideally with minimal impacts on feasibility and cost. Some of the questions and comments the Yakama Nation would like to explore in further discussions and design documents include: · Will the ISS method, including the treatment barrier wall, impede future habitat restoration efforts in nearshore and upland areas – for example, once in place does the ISS barrier result in a no work or no modification zone? · How does the ISS method, including the treatment barrier wall, allow for natural physical and biological processes to occur below and above the ordinary high water? · What impacts may occur to ESA listed and tribally important aquatic species and terrestrial species and habitats, including the biologically active zone? · What additives will be used for the ISS method? Will an evaluation of potential impacts to habitat and species of these additives be conducted? · Explore the feasibility for more specific information on how the ISS method allows for optimum design of habitat improvements – including input from habitat restoration experts and tribes. Also, NW Natural would ideally provide more information on how the ISS method improves habitat on its own without mitigation or restoration. · What will the treatment barrier wall and other areas incorporating the ISS method look like? There are photos in the 8/23/2022 presentation but they do not show how a wall will look in the environment. · What is the life expectancy of the ISS treatment barrier wall and other areas (how long is this treatment expected to last)? · The PAR mentions habitat objectives. When and how will these objectives be developed? Habitat restoration experts and tribes should be involved in this process.	Address in Revised BODR and during future design deliverables	NW Natural anticipates that habitat impacts and mitigation will be subject of further discussion with EPA and Tribal stakeholders. Habitat modifications associated with remedy implementation will be evaluated to demonstrate compliance with action- or location-specific ARARs, including but not limited to, the CWA Section 404[b][1] and the ESA. Section 6.6 of the Revised BODR describes the evaluations that will be conducted in future design deliverables.
TBC 6	**Section 1.1 EPA Comments on the Combined BOD-PDR, pages 2-3:** Please note that EPA General Comment 3 on the Combined BOD-PDR is written as "Integration **with** Upland Source Control Measures" (**emphasis added**). Decisions involving Upland Source Control Measures will require collaboration with DEQ, consistent with the lead regulatory authorities described in the 2009 ASAOC.	Comment noted.	Comment noted.
TBC 7	**Section 3.1 Revise Design to Focus on Removal of PTW-NAPL/NRC to the Extent Feasible, Full Dredge and ISS Design, Maintain Long-Term Slope Stability for Post-Dredge Cap and Habitat Material Placement, page 10 and Section 3.2 Revise Design to Eliminate or Minimize Cap on Grade and Maintain Current Elevations to Minimize Habitat Impacts, pages 12-13:** Due to the greater design strength of the ISS treated sediments, a larger range of slopes can be considered. However, based on the design challenges discussed for the Revised Dredge and Cap alternative, it is not clear if the design team is referring to steeper or slopes similar to current slopes being used to alleviate some of the engineering challenges discussed above. However, steeper slopes or slopes similar to existing slopes may not optimize habitat, which is presented as another benefit of this alternative. EPA understands the Yakama Nation would like to better understand how both objectives can be met using this alternative, and participate in discussions with EPA and the NW Natural design team to ensure the best outcome for habitat at the site. This comment also applies to bullets 3 and 4 on PAR page 11.	Comment noted.	See response to TBC 5.

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Comment No.	Comment	Document Where Comment Is Addressed	Comment Response
TBC 8	**Section 3.3 Revise Design to Better Integrate Upland Source Control Measures into the Sediment Remedy, page 15:** Because the 3rd bullet indicates the Deep Lower Alluvium WBZ may not require source control, the PAR would have benefited from a quantification (e.g., as a percent of total) of the extent to which this pathway might "increase[s] pumping volumes, operations and maintenance requirements, treated solids management and disposal, greenhouse gas emissions, and costs…"	Address in source control documents	Comment noted.
Appendix A SC 1	**Section 2.1 Revised Dredge and Cap Design with Full Removal of PTW-NAPL, pages 2-3:** EPA has the following comments on this section: a. The text would have benefitted from a description of what this evaluation entailed (e.g., a comparison of magnitude and extent of PTW-NAPL based on the historical and recent datasets). b. The following statement in the 3rd paragraph would ideally be revised to note that EPA did not approve the Combined BOD-PDR: "In addition, Section 6 and Appendix G of the Combine BOD-PDR (Anchor QEA 2021) demonstrate using Project Area-specific data that this additional PTW-NAPL can be protectively isolated in situ with an active cap, so dredging does not provide additional risk reduction." Considering the concerns with DNAPL migration described in the PAR and EPA's comment on the Combined BOD-PDR, EPA does not agree that isolation of PTW-NAPL using caps has been effectively demonstrated and that dredging will not provide additional risk reduction.	No Longer Applicable	The Full Dredge and ISS Design no longer includes capping on grade, so this comment is no longer applicable.
Appendix A SC 2	**Section 2.2 Hybrid Dredge and ISS Design, page 3-4:** EPA has the following comments on this section: a. The rationale for screening out the hybrid options in this section would ideally provide additional details and supporting information. The calculations or modeling to substantiate the conclusions regarding advective flux should be provided for EPA review in the revised BODR. The relative comparison of cost and water quality impacts would have ideally included additional supporting information to support the rationale for screening out the hybrid options (see also General Comment No. 1). b. Bullet point 1 ideally would have clarified whether this hybrid configuration requires dredging to the feasible depth of excavation and capping the remaining contamination or whether other simplifying assumptions were used to determine depth of dredging. c. Bullet point 2 would have benefited from the inclusion of the assumed distance from structures used for this evaluation. d. This section states that each of the hybrid options would need to manage advective flux through remaining contaminated sediments; however, this does not appear to be the case for the third hybrid option unless the third hybrid option excludes the ISS barrier wall. Ideally additional details would be included to support this statement regarding advective flux for the hybrid options. e. The text states that: "In the third configuration, only a small amount of the total PTW-NAPL was present in the shallow depth intervals, and removal of this small volume would be disproportionately costly without providing additional risk reduction." Any removal of PTW-NAPL is expected to provide additional risk reduction, even if the risk reduction is not substantial. This statement would have benefited from additional clarification. f. This section indicates that the hybrid options would complicate the design, listing the need to potentially include dredge residual management as part of the remedial approach and needing additional equipment staged in a small area. These are not considered to be complications to the design and are already required for the navigation channel portion of the project. Additionally, dredging equipment will also be needed for the "Full Dredge and ISS Design" alternative to manage swell.	No Longer Applicable	The Full Dredge and ISS Design is the selected design, so this comment is no longer applicable.

Table C-2
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Comment No.	Comment	Document Where Comment Is Addressed	Comment Response
Appendix A SC 3	**Section 2.3 Full Dredge and ISS Design Without ISS Barrier Wall, pages 4-5:** EPA has the following comments on this section: a. The text would have ideally clarified if this evaluation were based on the upland groundwater flow model or includes other lines of evidence. Additional details regarding the supporting evaluations and benefits of the ISS approach should be provided in future design deliverables. b. Future design deliverables should provide additional clarification and details regarding lack of protectiveness of the design without an ISS barrier wall.	Address in PDR	The comment will be addressed in the PDR or other future design deliverables.
Appendix A TBC 1	**EPA To-Be-Considered Comment on PAR Appendix A, Summary of Screened Out Revised Remedial Technologies** a. This section would benefit from figures illustrating the hybrid configurations considered. b. The bullet list describing the hybrid options considered is unclear. The descriptions of these options ideally would be revised for clarity.	No Longer Applicable	See response to Comment Appendix A SC 2.
Appendix B SC 1	**Section 1: Introduction, pages 1-2:** EPA has the following comments on this section: a. The statement at the end of the 4th paragraph ideally would provide additional clarification regarding what the ISS prevents the deeper groundwater from. The language is unclear or potentially missing a word. "It also prevents deeper groundwater that does not pose a current or future potential risk." b. EPA recognizes the following revision to the statement in the last paragraph in this section: "These analyses are presented as updates to supplement the ROD Section 12 summary of comparative analysis findings for the EPA-selected Alternative F Mod remedy."	No Longer Applicable	The comment is no longer applicable.
Appendix B SC 2	**Section 2.2: Primary Balancing Criteria, page 5:** EPA recognizes the following revision to the statement in the 1st bullet as follows: "Although a robust active cap can be designed to control these long-term contaminant migration pathways (as detailed in Section 6 of the Combined BOD-PDR), there exists some potential risk of long-term releases (e.g., compromised cap integrity due to seismic events, physical disturbance, or chemical isolation breakthrough) ***in comparison to the Full Dredge and ISS Design*** ."	Comment noted.	Comment noted.