Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

90% Remedial Design Volume II, Part I

Construction Quality Assurance Plan for the Lower Duwamish Waterway Upper Reach

For submittal to

The US Environmental Protection Agency
Region 10
Seattle, WA

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ABBREVIATIONS

ANL	air, noise, and light
ANLMP	Air, Noise, and Light Monitoring Plan
ARAR	applicable or relevant and appropriate requirement
BMP	best management practice
BODR	Basis of Design Report
CCM	Construction Contract Manager
CM	Construction Management
COCP	Community Outreach and Communications Plan
CQAO	Construction Quality Assurance Officer
CQAP	Construction Quality Assurance Plan
DCR	Daily Construction Report
DFAR	Daily Field Activity Report
DU	Decision Unit
ENR	enhanced natural recovery
EPA	U.S. Environmental Protection Agency
EQAO	Environmental Quality Assurance Officer
HSO	Health and Safety Officer
HSP	Health and Safety Plan
IQAT	Independent Quality Assurance Team
LDW	Lower Duwamish Waterway
MIDP	Monitoring and Inadvertent Discovery Plan
P.E.	Professional Engineer
PM	Project Manager
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RAL	remedial action level
RAWP	Remedial Action Work Plan
RD	remedial design
RDWP	Remedial Design Work Plan
RM	river mile
RMC	residuals management cover
ROD	Record of Decision
SMA	Sediment Management Area
SSO	Site Safety Officer

WCR	Weekly Construction Report
WFAR	Weekly Field Activity Report
WQMP	Water Quality Monitoring Plan

1 Introduction

This document presents the pre-final (90%) remedial design (RD) draft Construction Quality Assurance Plan (CQAP) for the Lower Duwamish Waterway (LDW) upper reach. The CQAP describes how the Owner (defined in this section and described in Section 2.2) will provide quality assurance (QA) inspection and monitoring during remedial construction activities. The purpose of this work will be to ensure that the selected Remedial Action Contractor (Contractor) is complying with the conditions and requirements of the design documents approved by U.S. Environmental Protection Agency (EPA) for the implementation of remedial action in the upper reach of the LDW Superfund site in King County, Washington. The upper reach encompasses river mile (RM) 3.0 to RM 5.0 of the LDW.

This CQAP has been prepared consistently with the EPA-approved *Remedial Design Work Plan for the Lower Duwamish Waterway Upper Reach* (hereinafter referred to as the Remedial Design Work Plan [RDWP]) (Anchor QEA and Windward 2019) and EPA's November 2014 Record of Decision (ROD) (EPA 2014), as modified by the Explanation of Significant Differences (EPA 2021). The CQAP is part of Volume II of the 90% RD submittal to EPA and has been prepared on behalf of the Lower Duwamish Waterway Group.

The remedial action for the upper reach will be conducted under a Consent Decree or similar agreement between EPA and a group that will include the performing parties. This future group is referred to herein as the Implementing Entity and will be responsible for adhering to the terms of the Consent Decree. One individual member of the Implementing Entity (referred as the Owner) will contract with the selected construction Contractor. The Implementing Entity may contract with a Construction Management (CM) Consultant, who would provide QA inspection and monitoring support.

The selected Contractor will be responsible for providing quality control (QC) of its work to ensure compliance with contract drawings and specifications and applicable or relevant and appropriate requirements (ARARs). The Contractor's QC requirements are defined in the specifications, and the Contractor will be required to develop a QC plan as part of its Remedial Action Work Plan (RAWP) pre-construction submittal.

QA activities will be conducted by the Independent Quality Assurance Team (IQAT), who will inspect and document the Contractor's progress and compliance with contract documents. In addition, EPA will provide oversight of field activities to ensure the selected remedy is implemented in accordance with design objectives. EPA is the regulatory authority and agency responsible for overseeing and authorizing the selected remedy. EPA will review and approve the final (100%) RD, including the CQAP, and review and approve Contractor pre-construction submittals, including the

RAWP, to ensure that the Contractor's proposed construction approach complies with design objectives.

This CQAP details the verification methods and approaches that will be used to provide QA review of the Contractor's activities during implementation of construction activities in the project area, including compliance with ARARs. This document describes the QA methods to be used to measure compliance with performance and method requirements. This document also specifies the types of environmental monitoring that will be performed and how modifications to the construction procedures will be directed, if necessary, in response to monitoring data. A summary of required inspections, surveys, monitoring actions, verification samples, reporting mechanisms, and documentation is included. Furthermore, this CQAP delineates the QA protocols necessary for project personnel to understand construction QC issues, monitoring and feedback processes, and potential corrective actions.

This CQAP will be modified during final (100%) RD to address EPA's 90% comments. However, the plan will need to be finalized and approved by EPA after the Implementing Entity has assigned individuals to fill key roles (e.g., Project Coordinator, Project Representative, IQAT leads); the QA team will review and update the CQAP to reflect specific QA means and methods and make additional modifications after receipt of the Contractor's RAWP. This CQAP will, therefore, be implemented in conjunction with the contract drawings and specifications and the Contractor's final RAWP.

1.1 Activities Addressed by the CQAP and Schedule

This CQAP addresses QA of the following construction inspection and environmental monitoring activities/elements within the LDW upper reach:

- Construction implementation inspection and engineering support (i.e., compliance with drawings and specifications), including:
  - Demolition and removal of piles and debris and transportation and disposal of these items
  - Dredging and excavation
  - In-water transport, transload, upland transport, and off-site disposal of dredged/excavated materials
  - Material placement, including post-dredge backfilling, residuals management cover (RMC) placement, enhanced natural recovery (ENR) placement, amended cover (area-specific technology) placement, and engineered capping
  - Modification of existing structures, including wall reinforcing and strengthening
  - Reinstallation of removed piling that are used for Tribal fishing

- Environmental controls and monitoring (compliance with environmental protection requirements, including water quality monitoring)
- Remedy performance (compliance with ROD remedial action requirements immediately following construction)
- Establishment and maintenance of project limits and survey controls

In-water remedial construction activities will occur during in-water work windows designated for the LDW (to be determined by EPA but anticipated to be from approximately October 1 through February 15 or an approved extension). The in-water work window will be set to protect threatened and endangered species listed under the Endangered Species Act. Construction activities will be coordinated with the Muckleshoot Indian Tribe to reduce impacts on Tribal fishers.

Remedial construction for the upper reach is anticipated to require three construction seasons, based on the pre-final (90%) RD production rates for dredging and material placement. The anticipated sequence of work elements, production rates, and construction schedule are discussed in Section 13 of the Basis of Design Report (BODR) (Anchor QEA and Windward 2023) and will be further developed in the Contractor's RAWP.

An estimated preliminary construction schedule was developed in Gantt chart format for the BODR (BODR Figure 13-1). The schedule was based on assumptions presented in the BODR, including past construction production rates for similar work at other sites within the LDW; assumptions regarding Contractor, crew, and equipment resources that may be dedicated to the project; and engineering best professional judgment. The Contractor will develop the actual construction schedule in the RAWP and maintain and update that schedule throughout construction.

1.2 Document Organization

The remaining sections of this document summarize the elements of the CQAP that will be implemented to inspect, monitor, and oversee the Contractor's construction activities, as well as how modifications to construction procedures will be directed, if necessary, in response to monitoring results. These CQAP elements will be used to verify that Contractor QC practices are used and appropriate documentation is prepared for the remedial action. The remaining sections are as follows:

- Section 2 presents the roles and responsibilities of the QA personnel involved in remedial action implementation.
- Section 3 describes the construction management activities—including meetings, inspections, and reporting activities—and environmental monitoring requirements and activities that will be performed during remedial action implementation; this section also describes general contract administration activities supported by key QA personnel.

- Section 4 describes contract administration activities.
- Section 5 describes the process for contingency actions, correction actions, and notifications.
- Section 6 provides a list of references used in this CQAP

The appendices to this CQAP are as follows:

- Appendix A: Water Quality Monitoring Plan (WQMP)
- Appendix B: Construction Sediment Sampling Quality Assurance Project Plan (Sediment QAPP)
- Appendix C: Air, Noise and Light Monitoring Plan (ANLMP)
- Appendix D: Monitoring and Inadvertent Discovery Plan (MIDP)
- Appendix E: IQAT Health and Safety Plan (HSP)

Details on water quality monitoring during construction are provided in the WQMP. The Sediment QAPP details sediment sampling and data-gathering methods to be used post-dredging/excavation to verify that post-dredge surface concentrations meet ROD post-dredge surface concentration requirements; the Sediment QAPP also provides the QA and QC protocols necessary to achieve the required data quality objectives. The ANLMP describes environmental requirements and the monitoring approach for air, noise, and light (ANL) conditions that may occur during implementation of construction activities. The MIDP describes required monitoring and inadvertent discovery protocols for cultural resource considerations during construction.

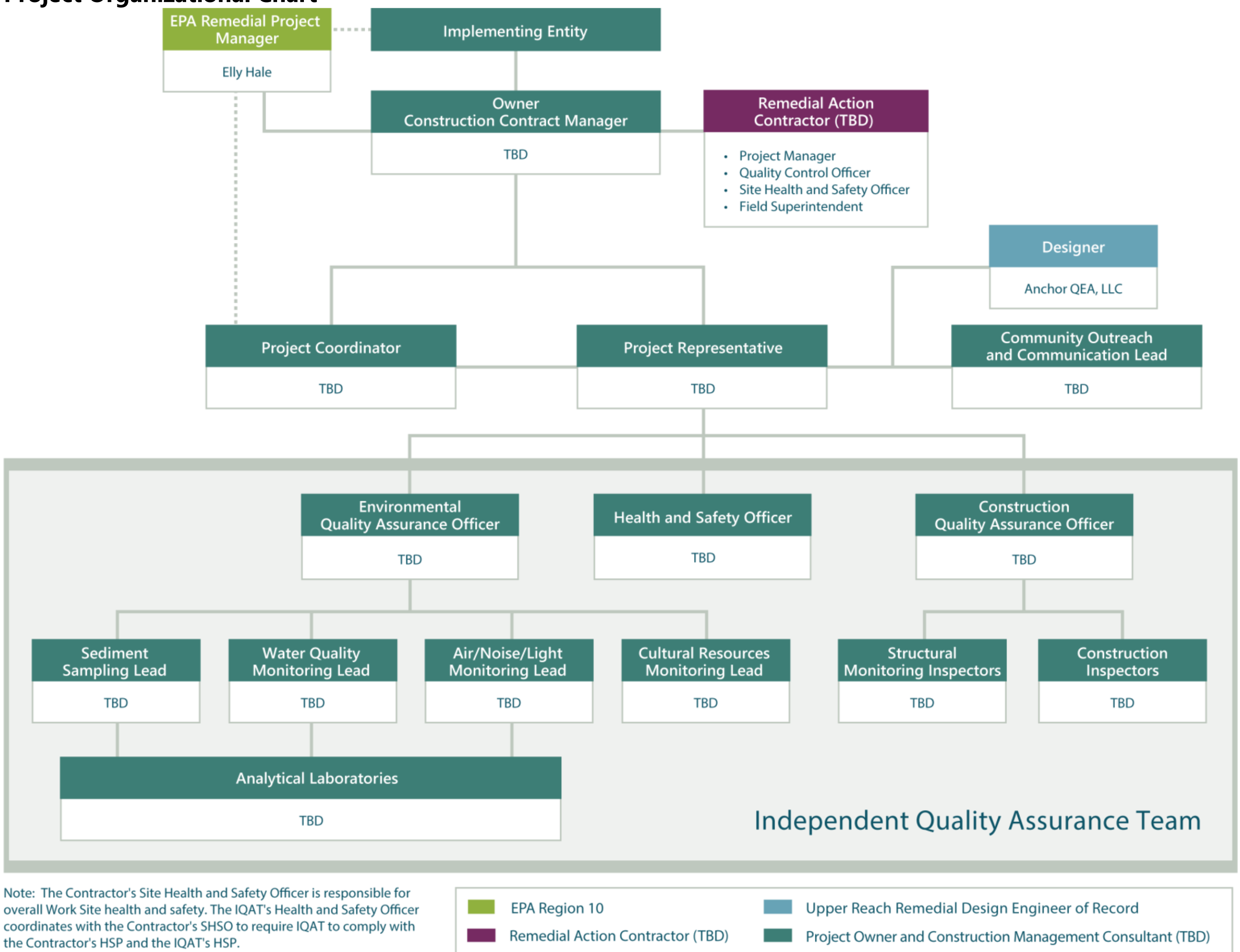
The IQAT HSP addresses the protection of IQAT worker health and safety during performance of QA inspection and monitoring work. The IQAT HSP will be prepared by the IQAT's Health and Safety Officer (HSO) (TBD) and will be developed after the Implementing Entity has selected the individual to fill the role of the IQAT HSO. This 90% RD CQAP contains only a placeholder (Appendix E) for the HSP.

The Contractor will be responsible for overall Work Site health and safety and will prepare its construction HSP as part of its RAWP submittal, describing the Contractor's approach to construction worker, community, and IQAT health and safety within the Work Site. The IQAT, Owner's representatives, EPA representatives, and any other personnel entering the Work Site will be required to comply with the Contractor's HSP.

2 Project Organization and Responsibilities

This section provides an overview and description of the organizational structure and key roles for the implementation of remedial action activities covered by this CQAP (Figure 2-1).

Figure 2-1
Project Organizational Chart



Note: The Contractor's Site Health and Safety Officer is responsible for overall Work Site health and safety. The IQAT's Health and Safety Officer coordinates with the Contractor's SHSO to require IQAT to comply with the Contractor's HSP and the IQAT's HSP.

2.1 EPA

EPA is the regulatory authority and agency responsible for overseeing the implementation of remedial actions and authorizing CQAP activities. In this capacity, EPA will review and approve the RD documents, as well as the Contractor's RAWP and associated Contractor pre-construction submittals, to ensure that the Contractor's QC program is consistent with the remedial objectives.

EPA's Remedial Project Manager (PM), Elly Hale, will be responsible for overseeing the remedial action to ensure that the remedy is protective of human health and the environment, and to ensure that the remedial action is implemented in accordance with the ROD. EPA's Remedial PM will oversee EPA's remedial action oversight team and provide key personnel contact information to the Project Representative.

2.2 Owner (TBD)

On behalf of the Implementing Entity, the Owner will be responsible for procuring and contracting with the Remedial Action Contractor (see Section 2.4) and overseeing execution of the remedial action implementation (i.e., construction) phase of the project. The Owner will also coordinate directly with the Designer (see Section 2.5), as necessary, during remedial action implementation to verify that the Contractor's RAWP approach and construction activities meet the intent of the design. The Owner will be authorized to make decisions during construction on behalf of the Implementing Entity. The Owner will also implement and oversee remedial construction QA activities, as described in this CQAP.

The Owner will designate a Construction Contract Manager (CCM) (see Section 2.2.1) to manage contract administration, a Project Coordinator (see Section 2.2.2) to serve as primary point of contact for EPA, a Community Outreach and Communications Plan Lead (see Section 2.2.3) to implement the Community Outreach and Communications Plan (COCP), and a Project Representative (see Section 2.2.4) to be the day-to-day representative during construction and assist the Owner's CCM with technical review and decision making. The Project Representative will oversee and manage the IQAT (see Section 2.3).

2.2.1 Owner's Construction Contract Manager (TBD)

The Owner's CCM will be responsible for internal coordination of construction contract administration. The Owner's CCM will manage all scheduling and coordination of resources as needed to ensure successful procurement of the Contractor and execution of the contract. Through the Project Representative, the Owner's CCM will ultimately be responsible for supervising the work. Responsibilities will include but not be limited to:

- Coordinating with the Implementing Entity and Project Coordinator

- Planning regular internal team meetings during Contractor procurement and construction implementation to track progress and identify schedule or resource issues
- Coordinating timely execution and administration of the construction contract
- Managing review and approvals of Contractor progress payment requests
- Managing Contractor claims and change orders
- Overseeing the Project Representative throughout construction

2.2.2 Owner's Project Coordinator (TBD)

The Project Coordinator for upper reach remedial construction will serve as the primary point of contact for EPA to communicate and coordinate different elements of the remedial action activities under EPA oversight. The Project Coordinator will help coordinate and manage the many overlapping project components during remedial construction. In this overall capacity, the Project Coordinator for remedial action will track progress and coordinate efforts among all major tasks associated with implementation of the remedy and oversee various program support services for the Implementing Entity.

Specific to the upper reach remedial construction, the Project Coordinator will work with the Project Representative (see Section 2.2.4) to track and communicate progress, and will coordinate with project stakeholders to provide specific services, including:

- Acting as a central coordinator for interface among the Project Representative (who will lead the IQAT), Implementing Entity technical staff, Project Owner (who will hold the construction contract), and EPA for all construction related work

- Coordinating other program support functions such as real property services, IQAT staffing, project scheduling, community outreach and communications, and construction progress reporting

2.2.3 Owner's Community Outreach and Communications Plan Lead (TBD)

The Owner will either lead or use consultant support to implement the COCP. The COCP Lead will coordinate directly with the Owner's Project Representative to communicate community input and complaints to the Project Coordinator and IQAT.

2.2.4 Owner's Project Representative (TBD)

The Project Representative will be the Owner's day-to-day representative during construction and will assist the Owner's CCM with technical review and decision making on behalf of the Owner when construction issues (e.g., QC, construction delays, monitoring exceedances) arise. The IQAT (see Section 2.3) will report to the Project Representative. The responsibilities and authorities of the Project Representative will include, but not be limited to:

- Oversight of the Contractor and management of the IQAT
- Implementation of the CQAP
- Overseeing review and final approval of construction submittals
- Schedule and project progress tracking
- Attending all construction meetings with the Contractor and key members of the IQAT
- Directing Contractor work stoppage due to Contractor noncompliance or if directed by EPA
- Reviewing and approving Contractor progress payments in conjunction with the CCM
- Approving—in conjunction with the CCM and in consultation with EPA—any deviations from the requirements in the project drawings and specifications, and initiating change orders to the contract as appropriate
- Providing certification, based on Designer and IQAT review, that the remedial action has been completed in general accordance with the intent of the contract documents
- Functioning as the liaison with representatives of the Owner, EPA (and other agencies when applicable), Contractor, and others
- Coordinating with the Designer to verify design requirements or modifications during implementation of construction activities
- Coordinating with the Owner's COCP Lead to respond to community complaints and concerns
- Providing proposed responses and corrective actions (if needed) to address community complaints and concerns during construction
- Coordinating on contract administration requirements with the CCM
- Working with the Project Coordinator to provide construction progress and inspection and monitoring reports

The Project Representative will be the only person authorized by the Owner to provide direction to the Contractor. The Contractor will regularly interact, communicate, and have a formal reporting relationship with the Project Representative.

Depending on final staffing determinations, the Owner may delegate some or all Project Representative responsibilities to a qualified member.

2.3 Independent Quality Assurance Team (TBD)

The Implementing Entity may procure a Construction Management (CM) Consultant to provide staffing and other resources to the IQAT for construction inspection and monitoring during implementation of the EPA-approved CQAP. The IQAT will be responsible for implementation of all Owner QA activities associated with remedial construction.

Specific IQAT roles will include the IQAT HSO (see Section 2.3.1), the Environmental Quality Assurance Officer (EQAO) (see Section 2.3.2), the Construction Quality Assurance Officer (CQAO) (see Section 2.3.3), environmental monitoring leads, and construction inspectors, as described in the following sections. Individuals may fill more than one key role within the IQAT. All on-site personnel will have current health and safety training required by the Washington State Department of Labor and Industries (Chapter 296-2 Washington Administrative Code, Subpart P, HAZWOPER), including on-site training.

2.3.1 Health and Safety Officer (TBD)

As previously noted, the Contractor will be responsible for overall Work Site health and safety for anyone entering into the Work Site (e.g., Contractor staff, IQAT, Owner and EPA representatives, community). The IQAT HSO will manage and oversee all health and safety-related requirements and procedures associated with the IQAT HSP, as well as IQAT compliance with the Contractor's HSP. The HSO will coordinate closely with the Contractor's site HSO, who will be responsible for overall Work Site health and safety.

The HSO will review the Contractor's HSP and inspect construction activities to assess Contractor compliance with that document. The HSO will also be responsible for ensuring that QA monitoring and inspection activities are performed in compliance with both the Contractor's HSP and the IQAT HSP.

2.3.2 Environmental Quality Assurance Officer (TBD)

The EQAO will be responsible for overseeing all environmental monitoring efforts for the QA program and will manage the Water Quality Monitoring Lead (see Section 2.3.2.1), the Sediment Sampling Lead (see Section 2.3.2.2), the ANL Monitoring Lead (see Section 2.3.2.3), and the Cultural Resources Monitoring Lead (see Section 2.3.2.4). The Water Quality Monitoring Lead, Sediment Sampling Lead, and ANL Monitoring Lead will be responsible for coordinating directly with the analytical laboratory(ies) (see Section 2.3.2.5) for the analysis and reporting of environmental data associated with the completion of water quality and sediment sampling and air monitoring. The EQAO will report directly to the Project Representative and advise the Project Representative on all technical issues related to environmental QA monitoring efforts.

The EQAO, or applicable environmental monitoring leads, will be present on site during implementation of all appropriate construction activities, including but not limited to dredging and excavation and material placement. Responsibilities of the EQAO will include but not be limited to:

- Overseeing and ensuring effective execution of all environmental QA monitoring activities
- Conducting meetings with site personnel covering the environmental monitoring QA requirements of the contract documents, Contractor's RAWP and QC procedures, and this CQAP

- Reviewing environmental QA monitoring results of the Contractor's construction activities, as well as those of its subcontractors, to ensure compliance with contract documents and ARARs
- Reviewing field reports to verify that appropriate field methods and QC procedures are being implemented in accordance with the procedures specified in this CQAP
- Overseeing coordination of the field sampling and laboratory programs and supervising data review, including coordination with analytical laboratories
- If a confirmed water quality or ANL criteria exceedance is observed, working with the Project Representative to coordinate with EPA to determine an appropriate path forward if a response action is warranted

2.3.2.1 Water Quality Monitoring Lead (TBD)

The Water Quality Monitoring Lead will be responsible for oversight and implementation of the WQMP (see Appendix A), as described in Section 3.7.2, and for coordination with the analytical laboratory(ies). The Water Quality Monitoring Lead will report to the EQAO.

2.3.2.2 Sediment Sampling Lead (TBD)

The Sediment Sampling Lead will be responsible for oversight and implementation of the Sediment QAPP (see Appendix B), as described in Section 3.7.2, and for coordination with the analytical laboratory(ies). The Sediment Sampling Lead will report to the EQAO.

2.3.2.3 Air, Noise, and Light Monitoring Lead (TBD)

The ANL Monitoring Lead will be responsible for oversight and implementation of the ANLMP (see Appendix C), as described in Section 3.7.2. The ANL Monitoring Lead will report to the EQAO.

2.3.2.4 Cultural Resources Monitoring Lead (TBD)

The Cultural Resources Monitoring Lead will be responsible for oversight and implementation of the MIDP (see Appendix D), as described in Section 3.7.2. The Cultural Resources Monitoring Lead will report to the EQAO.

2.3.2.5 Analytical Laboratory(ies) (TBD)

Analytical chemistry support for both sediment and water quality sampling conducted by the Sediment Sampling Lead and Water Quality Monitoring Lead will be provided by a National Environmental Laboratory Accreditation Program-accredited laboratory, as described in both the WQMP and Sediment QAPP.

2.3.3 Construction Quality Assurance Officer (TBD)

The CQAO will be responsible for overseeing all construction inspection and construction monitoring activities (which are different than environmental monitoring activities) for the QA program and will manage the Construction Inspectors (see Section 2.3.3.1) and Structural Monitoring Inspectors (see Section 2.3.3.2). The CQAO will report directly to the Project Representative and advise the Project Representative on all technical issues related to construction inspection and construction monitoring QA efforts.

The CQAO or associated construction inspectors will be present on site during implementation of all critical remedial action activities, including but not limited to:

- Dredging and excavation
- Material placement
- Demolition and structures modifications
- Inspections of placement materials for acceptance
- Interpretation of pre- or post-dredge bathymetric surveys and post-material placement surveys

Responsibilities of the CQAO will include but not be limited to:

- Overseeing Construction Inspectors
- Coordinating required special investigations or material inspection activities
- Implementing and ensuring effective execution of all construction QA monitoring and inspection activities
- Conducting meetings with site personnel covering QA requirements of the contract documents, Contractor's RAWP and QC procedures, and the CQAP
- Reviewing QA construction inspection and monitoring results of the Contractor's construction activities, as well as those of its subcontractors, to ensure compliance with contract documents and project permits
- Identifying and resolving nonconformances in accordance with the requirements of the contract documents, Contractor's RAWP and QC procedures, and the CQAP
- Reviewing and providing recommendations to the Project Representative regarding required remedial action progress, including required dredging, contingency re-dredging, material placement, and cap placement
- Providing recommendations to the Project Representative regarding the need for corrective actions in the event of nonconformance with the contract documents, Contractor's RAWP and prescribed procedures

2.3.3.1 Construction Inspectors (TBD)

The Construction Inspectors will be responsible for implementing all construction inspection activities, in accordance with the construction inspection requirements described in Section 3. The Construction Inspectors will report to the CQAO.

2.3.3.2 Structural Monitoring Inspectors (TBD)

The Structural Monitoring Inspectors will be responsible for oversight and implementation of structures monitoring during construction activities, in accordance with the structures monitoring requirements in the contract documents. The Structural Monitoring Inspectors will report to the CQAO.

2.4 Remedial Action Contractor (TBD)

The Contractor will implement remedial construction activities in accordance with the contract documents (drawings and specifications) and Contractor's RAWP, as approved by the Owner and EPA. The Contractor will propose a team with key positions to implement the work, provide QC, and manage Work Site health and safety. The team will include, but not be limited to, the following positions: Contractor PM, QC Officer, Site HSO, and Field Superintendent. The RAWP will include the Contractor's proposed organization chart, QC plan, and HSP. The Contractor will coordinate directly with the Project Representative throughout all phases of construction implementation and will be responsible for managing all construction subcontractors retained to support completion of the construction activities.

2.5 Designer (Anchor QEA)

Anchor QEA is the upper reach remedy Designer and has overseen the development of the contract documents (drawings and specifications) and cost estimate. The Engineer of Record is employed by Anchor QEA, is a Washington State Professional Engineer (P.E.), and is responsible for the remedy design. The term "Engineer of Record" generally does not appear in the drawings and specifications, except where the role of the Engineer of Record relates to consultation during the construction phase to support construction QA and design changes, if needed.

The construction activities will be supported by the Design Team PM (Tom Wang, P.E.) and the Engineer of Record (John Laplante, P.E.). They will be available to the Owner's CCM and Project Representative to provide input on the intent of the drawings and specifications and support changes to the design, as necessary. The Engineer of Record will be responsible for reviewing all Contractor pre-construction submittals to ensure their compliance with the contract bid documents.

3 Construction Management Activities

This section describes general construction management activities to support the engineering design elements; these activities will be implemented as part of the QA program during remedial action implementation. This section focuses on providing QA inspection and documentation guidelines for the Contractor's construction work to verify the work complies with engineering design requirements in the drawings and specifications.

The following subsections describe required project meetings, submittal reviews, construction field inspections and monitoring, environmental monitoring, reporting requirements, and safety considerations. Table 3-1 provides a summary of construction inspections and environmental monitoring for each remedial activity. It should be noted that this CQAP may need further revision after receipt of the Contractor's approved RAWP to better address the meetings, construction submittals, and inspections that will be implemented during construction.

Table 3-1
Summary of Inspection and Monitoring Requirements by Construction Activity

Construction Activity	Required Construction Inspection and Monitoring Activities[1]	Required Environmental Monitoring Activities
Dredging and Excavation	• Provide daily inspection • Review Contractor's bathymetric and topographic surveys (progress and post-dredge) • Review Contractor's bucket plots, barge displacement tonnages, disposal weight tickets, and other QC information	• Construction sediment sampling per Sediment QAPP • Water quality monitoring per WQMP (for dredging only) • Cultural resources monitoring per MIDP • ANL monitoring per ANLMP
Offloading, Upland Transportation, and Disposal at Transload Facility	• Provide regular inspection of transload facility operations • Conduct site visit of disposal facility, if requested	None
Material Placement (Backfill, RMC, Engineered Caps, ENR, Amended Cover)	• Provide daily inspection • Review Contractor's bathymetric and topographic surveys (progress and post-material placement) • Review Contractor's bucket plots, placement tonnage estimates, and other QC information • Review import material testing gradation and chemistry analytical results • Inspect import material borrow facilities (as necessary) • Inspect amended cover mix for specifications compliance • Inspect on-site import material stockpiles	ANL monitoring per ANLMP

Construction Activity	Required Construction Inspection and Monitoring Activities[1]	Required Environmental Monitoring Activities
Demolition and removal (Identified Debris and Piles)	• Provide daily inspection • Confirm that debris and pile removal is performed at correct locations • Conduct structures monitoring	ANL monitoring per ANLMP
Modification of Existing Structures, Outfalls, Utilities, and Pile Installation	• Provide daily inspection • Inspect pile installation • Inspect outfall scour protection installation • Inspect temporary shoring installation • Inspect work to confirm Contractor does not impact existing structures and utilities • Conduct structures monitoring	ANL monitoring per ANLMP

Notes:
1 All Required Construction Inspection and Monitoring Activities include daily observation and photographic documentation of work completed, review of Contractor DCRs and WCRs, and development of DFARs and WFARs for QA documentation.
ANL: air, noise, and light
ANLMP: Air, Noise, and Light Monitoring Plan
DCR: Daily Construction Report
DFAR: Daily Field Activity Report
MIDP: Monitoring and Inadvertent Discovery Plan
QAPP: Quality Assurance Project Plan
QA: quality assurance
QC: quality control
WCR: Weekly Construction Report
WFAR: Weekly Field Activity Report
WQMP: Water Quality Monitoring Plan

3.1 Pre-Construction Meetings

A pre-construction meeting will be scheduled by the Owner for each construction season and conducted prior to commencement of any work at the Work Site. The Contractor will propose agenda topics for the pre-construction meeting, in addition to the pre-construction meeting agenda topics identified in Specifications Section 01 31 19 (Contract Meetings). The Owner's CCM and Project Representative, IQAT key personnel, Contractor key representatives, and EPA (or designated oversight staff) will be required to attend, as described in Specification Section 01 31 19.

Meeting notes will be compiled by the Project Representative and distributed in draft format to all attendees for review and comment. If no comments are received by the due date, the meeting notes will be taken as final. If comments are received before the due date, and if the Project Representative agrees with the comments, the meeting notes will be updated accordingly and then issued as a final record of the meeting.

3.2 Contractor Submittals

A Contractor submittal is considered to be anything specified in the Contract documents (e.g., work plans, shop drawings, and similar items) or off-site project permits (i.e., off-site transload facility permit) that requires QA review by the Project Representative and IQAT key personnel. Contractor submittals are required to supplement the drawings and specifications by showing the details necessary to construct, verify, and confirm items to be incorporated into the work.

The Project Representative will oversee and coordinate the review of Contractor submittals by the IQAT, Project Coordinator and Owner, Designer, and EPA as applicable. There are three discrete categories of Contractor submittals: pre-construction submittals, construction submittals, and post-construction submittals. A complete list of required submittals, including specification references and schedule, is provided in Specification Section 01 33 00A (Submittals Attachment A). Many of the Contractor submittals required by the specifications are related to contract administration and will not be submitted to EPA for review and approval. This CQAP describes key Contractor submittals that focus on remedial design elements that will be submitted to EPA for review and approval, or for general information and discussion.

The Contractor will track required submittals using the Master Submittal List (Standard Form 01 33 00-D, provided in Specification Section 01 33 10A [Standard Forms, Attachment A1]). The Master Submittal List spreadsheet will be provided to the Contractor by the Project Representative for tracking purposes. The Project Representative will provide QA tracking to verify the Contractor is providing the required submittals by the required due dates. Each month, the Contractor will update the Master Submittal List to match the submittal requirements of the Contract and submit the list to be discussed. It will be the responsibility of the Contractor to transmit the proper project submittals by their required due dates.

3.2.1 Pre-Construction Submittals

The Contractor will be required to submit key pre-construction submittals for approval by the Owner and EPA (as noted) before remedial construction activities will be allowed to start.

3.2.1.1 Draft Contractor Remedial Action Work Plan

The Contractor's RAWP will be prepared in accordance with Specification Section 01 11 00 (Summary of Work) and will require Owner and EPA approval before any construction activities can begin. The Contractor's RAWP will detail the Contractor's construction approach, means and methods, construction schedule, and staffing organization chart to implement the EPA-approved RD, including how construction activities are to be coordinated with the Owner and EPA.

Required elements of the Contractor's RAWP include but are not limited to:

- Project work plan:
    1. Description of construction elements, including proposed means and methods
    2. Equipment and personnel list
    3. Construction sequencing plan for each anticipated construction season
- Project organization chart and reporting responsibilities
- Detailed baseline project construction schedule
- Dredging and excavation plan (including dredge material dewatering and transportation plan)
- Material placement plan
- Transloading, upland transportation, and disposal plan, including proposed transload and disposal facility names, locations, and certifications/ permits.
- Environmental mitigation binder (see Section 3.7.1)
- Site-specific HSP
- Emergency response plan
- Surveying and positioning control plan, including surveyor certifications (bathymetric and topographic)
- Green remediation plan
- Vessel management plan
- Demolition plan
- Construction QC plan
- Temporary facilities and control plan
- Notifications plan
- Instrumentation and monitoring plan
- Site clearing and management plan
- Examples of progress reporting forms
- Change order forms and process

The Contractor's proposed construction QC plan will address QC means and methods for the overall construction project; specific QC procedures may also be identified under various elements of the RAWP. The draft RAWP will be reviewed by the Owner's CCM, Project Representative, Designer, and appropriate IQAT subject matter experts. The Project Representative will provide comments to the Contractor, which will be required to address comments and resubmit an updated draft RAWP. The updated draft RAWP will be submitted to EPA for review in accordance with the Consent Decree (or equivalent legal order).

3.2.1.2 Final Contractor Remedial Action Work Plan

The Contractor will coordinate with the Project Representative and EPA to modify its draft RAWP based on EPA comments and submit a draft final RAWP to the Owner for review. The Contractor will address Owner comments and prepare a final RAWP to submit to EPA. Upon EPA approval of the final RAWP, EPA will issue a notice to proceed for initiation of construction activities. No construction activities can begin until the RAWP has been approved by EPA and the Owner.

3.2.1.3 Preconstruction Structural Condition Report

Prior to initiating construction in the vicinity of an existing structure, the Contractor will be required to inspect the condition of that existing structure and submit a Preconstruction Structural Condition Report (as described in Specification Section 31 09 00 – Geotechnical Instrumentation and Conditions Inspections) to the Project Representative for review. This preconstruction submittal is not a submittal requiring EPA review and approval.

The purpose of the preconstruction structural inspection will be to observe and document any material differences between actual site conditions and site conditions described by the contract documents regarding structures within and adjacent to areas requiring remediation. This inspection will require attendance (at a minimum) by the Project Representative (or designee), structural monitoring inspector, and Contractor. During each structural inspection, the Contractor will take photographs and video (as required by the specifications) of pertinent existing conditions for record purposes and submittal in its Pre-Construction Structural Condition Report. The Project Representative or designee will also document conditions during the inspection. All material differences noted by the Contractor and brought to the attention of the Project Representative will be documented as part of the report.

3.2.1.4 Pre-Construction Bathymetric and Topographic Survey

Prior to any dredging or excavation, the Contractor will complete a pre-construction bathymetric and/or topographic survey (as applicable) of the work area to verify bed elevations and Contract volumes for completion of dredging/excavation and material placement activities. This survey(s) will be conducted by the Contractor's selected third-party surveyor, which will be licensed in Washington State. The survey(s) will be supplied to the Project Representative for review prior to acceptance. The pre-construction survey(s) timing will be coordinated with the Project Representative. Since it is anticipated that remedial action implementation will take place over three construction seasons, pre-construction surveys will occur at the beginning of each construction season, rather than just once during the project.

While the pre-construction surveys will not require EPA approval, pre-construction submittals will be discussed with EPA to identify whether there are any unanticipated changes to elevations or grades from the contract documents (drawings) that may affect dredging and placement volumes.

3.2.2 Construction Submittals

The Contractor will be required to provide construction submittals to the Project Representative during construction to document progress and other construction elements, as described in this section. The Project Representative, working with the IQAT, will prepare the Owner's QA daily and weekly field activity reports (see Section 3.4) and submit to EPA the weekly field activity reports that summarize key information from the Contractor's construction reports. The Contractor's construction reports will be appended to the Owner's QA reports. This section describes the Contractor's construction submittals.

3.2.2.1 Contractor's Daily Construction Report

The Contractor will be required to submit a Daily Construction Report (DCR) to the Project Representative (per Specification Section 01 33 00 – Submittals). The DCR will be reviewed by the Project Representative to ensure that it summarizes the required information and is complete; the Contractor will be required to revise the DCR if the Project Representative rejects the submitted DCR. The Contractor's DCR will include, at a minimum (per the specifications):

- Work conditions (e.g., weather, predicted tides, commercial navigation impacts)
- Activities: details of each activity, references to the construction schedule as possible, and location where each activity is taking place
- Daily progress summary: quantities dredged, transported, and disposed; material quantities placed; bucket plots displaying work areas, Sediment Management Areas (SMAs) completion progress; and any delays
- Specific QC activities performed (on days when QC activities are performed) (Contractor's daily progress survey[s] will be attached to the DCR)
- Health and safety summary: safety infractions, near misses, and accidents
- Equipment: arrival at and shipment from the Work Site of each major item of equipment by manufacturer, model, serial number, and capacity; equipment in use and reasons for idle equipment
- Tests: Contractor-conducted testing and results
- Construction progress photograph
- Daily record of QC activities for the construction work completed

3.2.2.2 Contractor's Weekly Construction Report

The Contractor will be required to submit its Weekly Construction Report (WCR) to the Project Representative (per Specification Section 01 33 00 – Submittals). The WCR will summarize the previous week's work, including the information listed in the Contractor's DCR. The WCR will also comprise an updated project construction schedule and construction activity look ahead, including identification of any critical issues for the upcoming work week.

3.2.2.3 Bathymetric and Topographic Surveys

Progress surveys, post-construction surveys (referring to surveys conducted after each specific remedial action, such as dredging, contingency re-dredging, and placement, has been completed), and measurement surveys that are completed on a daily or event basis will be submitted to the Project Representative as part of the Contractor's DCR or WCR (as applicable). Drawings, field notes, and quantity computations will be submitted by the Contractor to the Project Representative in compliance with Specification Sections 02 21 00 (Site Surveys), 35 20 23 (Remedial Dredging, Barge Dewatering, and In-Water Transportation), and 35 37 10 (Material Placement). The Project Representative and CQAO will review Contractor surveys to inform acceptance of completed work, identification of corrective action if needed, and measurement and payment for the work completed.

3.2.2.4 Import Material Characterization

The Contractor must conduct import material testing at an approved testing laboratory to demonstrate that the source material meets EPA-approved chemistry criteria, in accordance with Specification Section 35 37 10 – Material Placement. The Contractor will submit laboratory results and a physical sample of each material type to be used to the Owner and EPA for review and approval in advance of material use at the Work Site, in accordance with Specification Section 35 37 10 – Material Placement.

3.2.3 Post-Construction Submittals

This section discusses both annual construction season summary reporting and close out documentation requirements in the specifications.

3.2.3.1 Annual Construction Summary Technical Memorandum (TBD)

The anticipated construction duration is three construction seasons, using an assumed in-water construction window of October 1 through February 15 of any given year. Considering this schedule, the CQAP assumes that EPA will require the Owner to prepare an Annual Construction Summary Technical Memorandum, as described in Specification Section 01 78 39 (Project Record Documents), after each construction season has been completed by the Contractor. This memorandum may include the following information (consistent with the Consent Decree - TBD) to be provided by the Contractor:

- Summary of remediation activities completed, specifying areas remediated during the construction season and documenting where construction has been completed within an SMA
- Compilation of pre-construction and post-construction surveys completed within the SMAs where work was performed

- Summary of total volumes dredged and disposed, material placed, and surface area completed (% complete)
- Summary of structures and identified debris removal work and structures installation completed within the construction season
- As-built drawing for completed SMAs
- Summary of deviations from the contract document or RAWP, if any, and corrective actions take to reconcile the deviations so that remediation objectives were met

3.2.3.2 Record Drawings, Manuals, and Certificates

In compliance with Specification Section 01 70 00 (Closeout Requirements), after all remedial construction is complete for the upper reach, the Contractor will be required to submit record drawings for various elements of construction, including piling demolition, dredging/excavation/material placement surveys, and capping/outfall scour protection limits and materials. The Contractor will also submit certificates of conformance for imported materials.

3.2.3.3 Pre-Final Punch List

After all remedial construction work is complete, and following inspection of the completed work with the Owner and EPA (or its oversight designee), the Contractor will assist the Owner's CCM, Project Representative, CQAO, and EQAO in preparing a consolidated list of items (i.e., the pre-final punch list) to be completed or corrected after inspection. The Contractor may also be asked to assist the Project Representative and IQAT in preparing the pre-final or final inspection reports.

3.3 Construction Meetings

3.3.1 Daily Tailgate Meetings

The Contractor will hold daily tailgate meetings in accordance with Specification Section 01 31 19 (Contract Meetings). Besides the Contractor and Project Representative, additional attendees may include key members of the IQAT and other appropriate parties. The purpose of these meetings will be to have a field review of construction health and safety concerns, as well as a review of planned daily work activities and related environmental concerns.

3.3.2 Weekly Progress Meetings

Weekly progress meeting will be conducted, as described in Specification Section 01 31 19 (Contract Meetings), to review work progress, schedules, and other matters needing discussion and resolution. The Project Representative will lead these meetings and take meeting notes. Anticipated attendees include the Owner's CCM and Project Representative, IQAT key staff, the Contractor, and EPA. Anticipated weekly progress meeting agenda items will include review of:

- Minutes of previous meetings
- Health and safety issues
- Progress of the work
- Construction schedule and three-week look ahead
- Environmental monitoring results
- Field observations, problems, proposed changes, and decisions
- Submittals, schedule, and status of submittals
- Updated project construction schedule
- Corrective actions to address environmental, project progress, health and safety, or other issues
- Community and ARARs issues

The schedule for recurring weekly progress meetings will be determined at the pre-construction meeting based on a time that is most practicable for the participants.

3.3.3 Pre-Final Inspection Meeting

The pre-final inspection meeting will be conducted after all work has been completed and before the Contractor is allowed to demobilize. The meeting will be attended by the Owner and its QA team, EPA, and the Contractor. All attendees will review construction completion documentation and assess whether the remedy was constructed in accordance with the approved RD and any approved changes thereto, and whether the project met construction performance standards.

3.3.4 Other Meetings

Additional meetings may also be held during the Contract as construction issues arise, or at the request of the Contractor, Project Representative, IQAT, or EPA. Participants may include the Owner CCM, Project Representative, IQAT key staff, Designer, Contractor, EPA, representatives of local jurisdictions, or other attendees as appropriate. Agenda items will range from technical issues to administrative matters. Any discussions leading to an action item for the Contractor must be reviewed and approved by the Project Representative. The Project Representative will decide documentation requirements for informal meetings on a case-by-case basis.

During the Contract, it will be necessary to schedule additional meetings to review specific issues on topics that are too involved for construction progress meetings. Such topics could include Change Order negotiations, claims conferences, quality or safety issues, community relation issues, and others. Agendas will be prepared, and meeting notes will be submitted to EPA by the Project Representative or Project Coordinator.

3.4 Owner Documentation

This section discusses Owner documentation that will be led by the Project Representative.

3.4.1 Owner's Quality Assurance Daily Field Activity Report

To keep track of QA work activities and the Contractor's progress, the Project Representative working with the CQAO and EQAO will prepare a Daily Field Activity Report (DFAR) as internal IQAT documentation. The Project Representative will review the Contractor's DCR, communicate with the Contractor if the DCR is deficient, and require the Contractor to revise its DCR if necessary; the Contractor's DCR will then be appended to the DFAR. The DFAR will serve as an overarching QA document and will record all items of importance regarding the work performed, including:

- Work conditions (e.g., weather, predicted tides, commercial navigation impacts, etc.): if and how any adverse condition may have affected the Contractor's operations.
- QA Activities: details of each QA activity, references to the construction schedule where possible, location where each activity is taking place.
- QC Activities: The DFAR will note QC activities performed by the Contractor on days when these activities are performed; Contractor daily progress survey information will be provided in the DCR (per the specifications).
- Difficulties: all difficulties encountered by the Construction Monitoring and Inspection staff, including the location where the difficulty is occurring.
- Controversial matters (e.g., disputes, questionable items, etc.): facts of the event, if matters were settled, and if so, how they were settled.
- Deviations, deficiencies, and violations: observed deviations from Contractor's RAWP and drawings and specifications, construction safety incidents, labor, etc.
- Progress information: any observed delays, actions taken, and actions contemplated.
- Photograph log: key photographs to illustrate the work conducted

The DFARs will be completed on the next working day following completion of the inspection. DFARs will include inspection documentation for all construction activities observed, including structural inspection.

Environmental monitoring efforts and results (as described in Sections 3.7 and 5) and reports prepared by the IQAT will be appended to the DFAR. The DFAR will be completed as one compiled inspection and monitoring report on the next working day following completion of the inspection and any environmental monitoring.

3.4.2 Owner's Quality Assurance Weekly Field Activity Report

The Project Representative will prepare a Weekly Field Activity Report (WFAR) as a QA submittal and submit it to EPA on the Monday following the previous week's work. The WFAR will include a summary description of construction events, as well as any delays and their causes. The WFAR will provide a high-level summary of the previous week's QA inspections, testing, surveying, and monitoring activities; the effectiveness of the Contractor's QC activities; and any corrective actions taken during that week. The Contractor's WCR for the previous week will be appended to the WFAR. When QA inspections use the results of the Contractor's surveys and tests, these results will be summarized and included in the WFAR.

The Contractor, Owner's CCM, Project Coordinator, and Project Representative will meet weekly with the EPA PM to review the WFAR and keep EPA informed of continuing events as the remediation work proceeds. Any work that deviates from the EPA-approved remedial action design drawings, specifications, and RAWP will be brought to the attention of EPA. Any proposed changes to EPA-approved documents will be approved by EPA before being implemented.

3.4.3 Annual Construction Summary Technical Memorandum

EPA will require the Owner to prepare an Annual Construction Summary Technical Memorandum, as described in Section 3.2.3.1, after each construction season has been completed by the Contractor. Anticipated elements of this memorandum include a summary and tabulated results of construction-related QA inspections and monitoring conducted by the IQAT, as well as information provided by the Contractor during construction (Section 3.2.2).

3.4.4 Remedial Action Project Report

Following completion of the upper reach remedial action, the Owner will prepare a Remedial Action Project Report. This report will include documentation to demonstrate that construction of the remedial action project is complete, and it will include as-built drawings signed and stamped by a registered P.E.

3.5 Construction Inspection Requirements for Remedial Action Activities

This section discusses QA inspection and monitoring remedial action activities. Environmental compliance and monitoring efforts are described in detail in Section 3.7. Field construction inspection and construction monitoring will be conducted to achieve the following objectives:

- Monitor compliance with contract document requirements, ensuring that each item of work complies with the drawings and specifications.

- Identify activities that do not comply with the contract document requirements and the Contractor's RAWP, and identify reason(s) why the work was not completed in accordance with the requirements of the Contract. The Project Representative (and Designer as appropriate) and Contractor will coordinate to decide on an appropriate course of action to either implement corrective action or document the reasons why deviations still meet the intent of the design and achieve remediation objectives.
- Document construction progress on a daily and weekly basis.

This section covers engineering-related construction inspection and monitoring requirements for the remedial action activities in the following four specification sections and other applicable technical specifications:

- Remedial Dredging, Barge Dewatering, and In-Water Transportation (Specification Section 35 20 23)
- Offloading, Upland Transportation, and Disposal (Specification Section 35 20 23.01)
- Material Placement (Specification Section 35 37 10)
- Site Surveys (Specification Section 02 21 00)

Details regarding inspection and monitoring activities for structural aspects of the project are provided in Section 3.6 of this document.

3.5.1 Dredging/Excavation, Barge Dewatering, and In-Water Transportation of Dredged Materials

Dredging, barge dewatering, and in-water transportation construction inspection requirements will be overseen by the CQAO and conducted by the construction inspectors and will include:

- General inspection of work, including means, methods, and sequencing of dredging, excavation, dewatering (on- and off-site as applicable), and in-water transportation activities to verify compliance with drawings and specifications
- Review of Contractor's DCRs to identify that reporting of activities completed is consistent with observations of the activities and in compliance with the requirements of the drawings and specifications
- Daily observation of Contractor work activities and review of Contractor-provided daily progress survey information to document that:
  - The Contractor is implementing best management practices (BMPs) while conducting dredging, as described in its RAWP.
  - The Contractor is completing dredging activities to the required dredge elevation/thickness (including overdredge allowances) within the various SMAs as shown on the drawings and described in the specifications. CM inspectors will notify the CQAO and Project Representative if review of Contractor progress surveys

indicates that required dredge elevation/thickness is not being achieved, or overdredge allowance is being exceeded.

- The Contractor is adhering to dredging offset requirements when performing dredging activities adjacent to specified structures.
- The Contractor is not stockpiling material on the seabed floor or leveling the completed dredging surface by dragging a beam or clamshell bucket over the completed area.
- The Contractor is collecting and disposing of incidental debris using procedures consistent with its RAWP.
- The Contractor is maintaining stability of material haul barges for temporary storage of dredged materials or for their transport to the Contractor's Transload Facility. Barges shall not be overloaded or loaded such that the barge is imbalanced.
- Dredged material haul barges are not leaking or showing signs of taking on water. The Project Representative shall be immediately notified if any signs of barge instability are observed.
- No leakage is occurring during transportation of dredged materials to the Contractor's Transload Facility (inspections of the barge trip will occur on a periodic basis, as deemed necessary to confirm the Contractor's compliance with the Contract documents).
- Upland excavation soil management and stockpile areas are being managed to prevent trackout and runoff and avoid potential impacts on groundwater and LDW water quality.
- Stormwater runoff control, management of all liquids that drain from stockpiles, and reduced precipitation contact with impacted and non-impacted material in the stockpile area (using covers) are occurring.
- The Contractor is documenting and immediately recovering and removing any material accidentally dropped overboard from the in-water transport dredge material haul barges.
- Other Contract activities deemed appropriate for monitoring by the Project Representative are being monitored.

* Daily visual observation of the Work Site for the following environmental conditions (environmental monitoring is described in Section 3.7.2).[1] Any of the following observations will be communicated to both the CQAO and EQAO for documentation and potential corrective action, as determined by the Project Representative in coordination with the CQAO and EQAO:

[1] All construction field inspectors, including the Contractor, CQAO and construction inspection staff, will be responsible for observing and reporting potential environmental impacts.

- Presence of oil sheen associated with construction activities
- Evidence of distressed or dying fish
- Floating debris and/or visible turbidity plumes generated by construction activities
- Dredged material haul barges are not leaking and their exteriors are clean (i.e., no dredged materials are present on outside rails/walls of barges) prior to transport off-site to the Contractor's Transload Facility.

3.5.1.1 Required Dredging Acceptance Criteria

The Project Representative and CQAO will review results of Contractor post-dredge (or excavation) surveys to determine whether the Contractor has adequately achieved the required dredge elevation/thickness. In general, acceptance of a required dredge area where a required dredge elevation applies will be considered reasonable when the Contractor has demonstrated that it has achieved the required removal in 95% of an SMA. In locations where removal does not meet the required dredge elevation, the remaining area's elevation/thickness should not be more than 6 inches above the required dredging elevation. For areas with required thickness cuts, the Contractor will be required to achieve the minimum cut thickness over the entire area. Table 3-2 summarizes the required dredging acceptance criteria.

However, there may be locations where the Contractor does not achieve the required dredge elevation/thickness due to underlying subsurface conditions, such as the presence of a native, compacted sediment layer or hardpan within the required dredge prism. In such cases, the Project Representative will work with EPA to adaptively decide on accepting locations that the Contractor indicates cannot be dredged to the required dredge elevation/thickness, and for which the Project Representative agrees with the Contractor's basis. Areas that are not dredged to the required dredge elevation/thickness will be documented for EPA, along with the reason why the Project Representative accepted the area as completed.

Table 3-2
Required Dredging Acceptance Criteria

Criteria	Dredging Area Tolerance for Each SMA[1]	Vertical Tolerance
Required Dredge Elevation	95% of dredge area must meet required dredge elevation	No spots higher than 6 inches above the required dredge elevation within the remaining high spots
Required Dredge Thickness	100% of dredge area must meet required dredge thickness	Not applicable

Notes:
[1] The Project Representative may accept an SMA as completed for required dredging if the contractor demonstrates that there are underlying subsurface conditions that impact the Contractor's ability to meet the required dredging elevations or thicknesses (e.g., hardpan).
SMA: Sediment Management Area

3.5.2 Offloading, Upland Transportation, and Disposal of Dredged Materials

Inspection of the Contractor's Transload Facility, where offloading, upland transportation, and disposal activities will occur, will be conducted on a periodic basis and as deemed necessary to confirm the Contractor's compliance with the specifications and drawings. The CM inspectors' requirements will include:

- General inspection of work, including means and methods of offloading dredged sediment and debris at the Contractor's Transload Facility, sediment and debris handling and dewatering (as applicable), upland transportation, and disposal at a permitted landfill facility.
- Review of Contractor DCRs to ensure that reporting of activities completed is consistent with observation of the activities and in compliance with the requirements of the Drawings and Specifications
- Verification of Contractor operations at the Contractor's Transload Facility in accordance with facility permit requirements
- Observation of work activities at the Contractor's Transload Facility to ensure that the following are in accordance with the specifications and RAWP:
  - The Contractor's Transload Facility is laid out according to the Contractor's RAWP.
  - The Contractor is implementing BMPs while conducting offloading activities at the Contractor's Transload Facility, in-water and/or upland transportation, and disposal as described in its RAWP.
  - The Contactor is storing/handling dredged material stabilization materials (if used) in an appropriate manner such that the materials are contained while being stored and are not released in an uncontrolled manner when being mixed with the dredged material prior to offloading materials to haul trucks or rail cars.
  - The Contractor's transport equipment (i.e., rail cars and/or trucks) are clean and are not spilling or tracking contaminated material onto roadways.
  - Trucks and railcars used for transport are lined and covered.
  - The Contractor is maintaining its Transload Facility in a clean manner (i.e., sweepers and erosion control BMPs).
  - The Contractor is in compliance with environmental protection requirements as stated in Specification Section 01 35 43 (Environmental Procedures), and in accordance with the ARARs and any required off-site permits (as required by Specification Section 01 41 26 [Permits, Easements, and Right of Entry]).
  - Appropriate measures are being taken (as required by the specifications [such as employment of a spill apron]) at the Contractor's Transload Facility to prevent spillage of material into water during offloading.

   - No leakage from the transportation barge is observed while at the Contractor's Transload Facility.
   - All dredged material effluent from the Contractor's Transload Facility staging and stockpile area (as applicable) is collected and treated according to the requirements of Specification Section 35 20 23.01 (Transloading, Upland Transportation, and Disposal).

Inspections of the disposal facility(ies) will occur on a periodic basis, as deemed necessary, to confirm the Contractor's compliance with the BMPs and accepted procedures in the RAWP.

3.5.3 Clean Material Placement

Inspection requirements for material placement activities will include:

- Daily inspection of work, including means, methods, and sequencing of all material placement activities and compliance with drawings and specifications. Material placement will include backfill, ENR, engineered caps, amended cover, and RMC.
- Review of Contractor DCRs to ensure that reporting of activities completed is consistent with observation of the activities and in compliance with the requirements of the drawings and specifications
- Daily observation of work activities to ensure that the Contractor is:
   - Implementing BMPs while conducting material placement, as described in its RAWP
   - Placing material in a manner that prevents any damage to adjacent structures
   - Using materials that meet the gradation requirements provided in the specifications
   - Employing means and methods that allow for placement of materials on stable slope grades and within the defined material placement thicknesses, and including the overplacement allowances or tolerances provided in the specifications
   - Not completing placement of materials close to active dredging locations where dredging activities could result in contamination of clean backfill materials
   - Using appropriate equipment for placement of material at the Work Site, consistent with equipment descriptions provided in its RAWP
   - In compliance with environmental protection requirements as stated in Specification Section 01 35 43 (Environmental Procedures) and in accordance with ARARs
   - Placing materials in a manner that minimizes the resuspension of sediment. Such measures may include limiting the fall distance of material through the water column and/or using diffusers

3.5.3.1 Import Material Inspection and Testing

The Contractor will be required to provide materials testing for all material brought to the Work Site and intended for use on the Project (i.e., import material). The Contractor will provide the results of QC laboratory testing to the Project Representative and EPA for review and acceptance per the schedule required by the specifications prior to the start of material placement activities.

The IQAT may complete inspections of the borrow facility(ies) (i.e., facilities providing import material to the Work Site) in advance of materials being brought to the Work Site for placement. The Contractor will provide physical QA samples of import materials to the Project Representative. The Project Representative and EPA must approve the borrow facility(ies) prior to the Contractor importing the materials to the Work Site.

Upon the arrival of import material at the Work Site, construction inspectors will conduct visual observations of the stockpiles of material on the import material barges to evaluate general compliance with Specification Section 35 37 10 (Material Placement]), and to make comparisons to observations from borrow site inspections. These Work Site observations will be recorded in the DFAR and will include:

- General appearance of material (color, gradation, angularity, odor, etc.)
- Evidence of staining or sheen
- Presence of debris

If the results of visual inspection indicate that import materials are not in compliance with the specifications, the construction inspectors will notify the CQAO and Project Representative for follow-up notification to the Contractor.

The IQAT may elect to collect samples of the stockpiles of import materials (as appropriate) and send them to an Owner-selected laboratory for QA chemical testing. Testing methods will follow the chemical testing specified for the Contractor in Specifications Section 35 37 10 (Material Placement). This Owner-provided testing by a third party will not alleviate the responsibility of the Contractor to conduct its required QC testing and reporting.

3.5.3.2 Material Placement Acceptance Criteria

The Project Representative and CQAO will review results of the Contractor post-material placement surveys and other lines of evidence (e.g., Contractor bucket plot placement maps, placement tonnage estimates [including weight tickets] from the Contractor) to determine whether the Contractor has adequately achieved the required material placement elevation/thickness within each SMA in accordance with the material placement acceptance criteria provided in Table 3-3. Both acceptance criteria (i.e., vertical placement tolerance or overplacement allowance and placement area tolerance) must be met for the material placement to be accepted within each SMA.

Table 3-3
Material Placement Acceptance Criteria

Material Type	Criteria	Vertical Placement Tolerance or Overplacement Allowance	Placement Area Tolerance
Backfill Material	Targeted placement elevation and grades	Elevation +/- 6 inches from targeted placement elevation and grades	Minimum of 50% of surface area at or higher than targeted placement elevation and grades
ENR Material	9-inch targeted placement thickness	+/- 3 inch of vertical placement tolerance	Minimum of 50% of surface area equal to or thicker than targeted placement thickness
RMC Material	Flat Cut Areas within SMAs and Inner and Outer Perimeters: 9-inch targeted placement thickness Exterior Sideslopes with 3H:1V sideslope placement: 24-inch targeted placement thickness	Flat Cut Areas: Thickness +/- 3 inches of tolerance from targeted placement thickness Exterior Sideslopes: Thickness +/- 6 inches of tolerance from targeted placement thickness	Minimum of 50% of surface area equal to or thicker than targeted placement thickness
Amended Cover Material	12-inch targeted placement thickness	+/- 3 inch of vertical placement tolerance	Minimum of 50% of surface area equal to or thicker than targeted placement thickness
Engineered Cap Layers	Isolation Base Layer: 12-inch minimum with 6-inch overplacement allowance Filter Layer: 6-inch minimum with 6-inch overplacement allowance Erosion Protection Layer: 12-inch minimum with 6-inch overplacement allowance	Minimum placement thickness with overplacement allowances	100% of surface area must meet minimum thickness

Notes:
Both acceptance criteria (vertical placement tolerance or overplacement allowance plus placement area tolerance) must be met for the material placement to be accepted within each SMA.
ENR: enhanced natural recovery
NA: not applicable
SMA: Sediment Management Area

3.5.4 Surveying and Positioning Control

The Contractor will be required (per Specification Section 02 21 00 – Site Surveys) to contract with a Washington State-licensed surveyor (to be determined) to conduct various bathymetric and topographic surveys during implementation of the upper reach remedial actions. Objectives and general scope for completion of surveys for the project include:

- The Contractor will identify and describe means and methods for establishing and maintaining positioning control throughout completion of the construction activities required in the Contract documents. Construction inspectors will verify that the Contractor can demonstrate acceptable positioning control prior to the start of construction activities at the Work Site.
- The Contractor will complete pre-construction bathymetric and/or topographic surveys of the Work Site to verify bed elevations and Contract volumes for completion of dredging and material placement activities. The Contractor will need to conduct multiple pre-construction surveys sequenced to address a portion of the Work Site for each construction season, since the work is anticipated to take place over three construction seasons.
- The Contractor will conduct daily progress surveys to provide QC of the dredging and material placement work, and to calculate or verify progress volumes, areas, limits, and positions.
- The Contractor will conduct post-dredge or excavation surveys once it has completed required dredging or contingency re-dredging work in a SMA. These surveys will either confirm the completion of required dredging activities in the SMA or identify areas that may require additional material removal prior to acceptance of the work.
- The Contractor will conduct post-material placement surveys once it has completed material placement work in a SMA. These surveys will occur following completion of placement of each material type to verify that the required material placement elevation/thickness has been achieved, or to identify areas that may require additional material placement prior to acceptance of the work.

The Construction Inspectors and CQAO will review the results of all Contractor surveys on an ongoing basis to verify that survey results demonstrate consistency with the progress of work reported in the Contractor DCRs, and to confirm completion of the work in accordance with the requirements of the Contract documents. The CQAO shall notify the Project Representative immediately if review of Contractor surveys indicates that work being completed is not in compliance with the requirements of the drawings and specifications; in such a situation, the CQAO will provide recommendations for corrective action for the Project Representative to review. The Project Representative will coordinate with the Owner's CCM and EPA to decide upon corrective actions, if warranted.

3.5.4.1 Quality Assurance for Surveying

QA surveying may be conducted at the discretion of the Project Representative (per recommendation from the CQAO) to ensure that the Contractor's QC surveys are complete and accurate. The Owner may hire a separate QA licensed surveyor to help review the Contractor's QC licensed surveyor's work or conduct its own QA survey; the Owner's QA surveyor may compare the results of its QA surveys to those of the Contractor's surveys and identify any significant discrepancies. The results of any review will be provided in WFARs, as applicable, and any edits to volumes or other quantities will be discussed in the WFAR. The decision whether to include a separate QA surveyor on the IQAT will be made by the Owner during pre-construction review of the Contractor's RAWP; if the Owner decides to hire a separate QA surveyor, the Owner's CCM or Project Representative will inform EPA.

3.6 Inspection Requirements for Monitoring Structural Works

The Structural Monitoring Inspectors, who will report to the CQAO, will conduct structural inspections and monitoring to confirm compliance with Specification Sections 02 41 00 (Demolition and Salvage), 31 09 00 (Geotechnical Instrumentation and Condition Inspections), 31 62 10 (Steel Pipe Piling), 32 32 10 (Bulkhead Wall Shoring Systems), as well as with details stated on the drawings. The schedule for structural inspection and monitoring activities will be determined based on the Contractor's RAWP and proposed schedule for structures demolition and modification work. Structural monitoring observations will be documented by the Structural Monitoring Inspectors for inclusion in the DFAR. Monitoring details for the structural inspections are provided on the drawings and in the specifications. No standalone structures monitoring plan is included in this CQAP.

During completion of all structural demolition and modification work, the Contractor will be required to follow BMPs and meet any construction conditions imposed by EPA through ARARs compliance, as directed by the Project Representative. Such conditions may include those regarding pile driving conditions included in the Biological Opinion (or substantive compliance letter) provided by the Services (i.e., National Marine Fisheries Service, U.S. Fish and Wildlife Service, and Washington State Department of Fish and Wildlife) or included by EPA in the Clean Water Act Section 404 ARAR Memorandum (forthcoming).

3.6.1 Demolition and Removal (Identified Debris and Piles)

Removal of pilings (i.e., extraction of derelict timbers) will be performed prior to dredging and material placement activities at an SMA. Candidate structures for demolition include treated timber piles and dolphins located within SMAs. Pilings designated for removal are shown on the drawings. Construction inspectors will observe the Contractor's activities to verify that pile removal is performed at the correct locations and complies with pile demolition specifications and the Contractor's RAWP. Removed pilings will be transported to EPA-approved off-site permitted disposal or recycling facilities, if accepted by the facility.

Removal of identified debris (i.e., large debris that cannot be removed with standard dredging equipment, as defined in the specifications) will also be performed prior to dredging and material placement activities at an SMA. Identified debris is shown on the drawings. Construction inspectors will observe the Contractor's activities to verify that identified debris removal is performed at the correct locations and complies with identified debris removal specifications and the Contractor's RAWP. Removed identified debris will be transported to EPA-approved off-site permitted disposal or recycling facilities, if accepted by the facility.

Characterization of identified debris and off-site disposal or recycling at an approved location is the Contractor's responsibility. Any materials to be recycled must be acceptable to the recycling facility, and the facility must be approved by EPA as a suitable off-site facility. Trucks, rail, or barges may be used to transport demolition debris to an approved and permitted disposal or recycling facility.

Potential environmental concerns include releases of turbidity, debris, or petroleum hydrocarbons into the water column during demolition or removal of pilings and identified debris. Control measures to prevent such releases will be outlined in the Contractor's RAWP, as appropriate. The Contractor will be required to stage an oil containment boom during piling and identified debris removal. The Contractor will also be required to maintain a supply of oil-absorbent pads and snares on any dredged material haul barges; these items will be employed if visible oil sheens are observed.

Environmental conditions will be observed by the Contractor and Construction Inspectors during demolition and removal activities, including:

- Presence of oil sheen associated with construction activities
- Evidence of distressed or dying fish
- Floating debris and/or suspended materials generated by construction activities

Any such observations will be communicated to the CQAO and Project Representative for documentation and potential corrective action, as determined by the CQAO and Project Representative.

3.6.2 Modification of Existing Structures, Outfalls, and Utilities and Pile Installation

The RD includes limited work to modify existing structures, such as the installation of replacement pilings (as shown on the drawings) for Tribal fishing purposes. Other structures modifications include constructing outfall scour protection at certain locations where an outfall is located near an SMA (as shown on the drawings), to help protect the remediated SMA from future scouring from existing outfall discharge. In addition, temporary shoring of an existing bulkhead (sheetpile wall) is required to allow dredging and debris removal adjacent to the bulkhead.

Pile installation locations are shown on the drawings, and pile installation requirements are described in Specification Section 31 62 10 (Steel Pipe Piling). Construction inspectors will observe Contractor activities to verify that pile installation is performed at the correct locations and complies with pile installation specifications and the Contractor's RAWP.

No outfall structures are identified for demolition and replacement because there are no active outfalls located within the SMAs; any outfall structures encountered will be protected in place. Inactive/abandoned outfalls within SMAs are assumed to have been removed. If an inactive/abandoned outfall is encountered in an SMA and its location impacts the Contractor’s ability to complete the remedial action, the Contractor will be required to remove the inactive/abandoned outfall and grout/plug the remaining pipe in the bank. Specification Section 35 20 23 (Remedial Dredging, Barge Dewatering, and In-water Transportation) describes the Contractor’s requirements when encountering inactive/abandoned outfalls. Specification Section 33 05 25 (Outfall Energy Dissipation Structure and Bank Protection) describes the Contractor’s requirements when constructing outfall scour protection. Construction inspectors will observe Contractor activities to verify that the Contractor is meeting specification requirements and Contractor RAWP means and methods for scour protection layer thickness and material gradations, as well as achieving required placement limits.

Shoring requirements are included in Specification Section 32 32 10 (Bulkhead Wall Shoring Systems) and the Contractor will be required to describe its means and methods for implementing shoring as part of its RAWP. Construction inspectors will observe Contractor activities to verify that shoring installation meets specification requirements and complies with the Contractor’s RAWP.

The Contractor will be required to conduct its own utility locate notification to 811. The RD has previously conducted utility locates, and the drawings show all identified utilities located within an SMA. The Contractor will be responsible for identifying in its RAWP whether the Contractor’s means and methods have the potential to adversely affect any buried and active utilities, and for proposing mitigative measures (including construction offsets) to prevent damage to any buried utility. Construction inspectors will observe Contractor activities to verify that the Contractor is complying with specifications and the Contractor’s RAWP and carefully working around identified utilities to ensure utilities are protected in place.

3.7 Environmental Compliance and Monitoring

This section describes the environmental monitoring program for the upper reach remedial action implementation. The objective of the program will be to conduct environmental monitoring to verify that the work is being carried out in accordance with ARARs, approved environmental monitoring plans, and off-site permit requirements (if applicable).

3.7.1 Environmental Compliance Documentation

The Contractor will be required to submit an Environmental Mitigation Binder, per Specification Section 01 35 43 (Environmental Procedures), describing the environmental protection measures and monitoring activities that the Contractor will be required to implement during completion of construction activities. The Environmental Mitigation Binder will cover potential environmental releases as a result of construction operations on land, as well as monitoring and corrective actions necessary to control such releases. The Environmental Mitigation Binder will contain separate sections addressing contamination prevention, containment and cleanup, stormwater pollution prevention, stormwater control, noise level control, light control, air pollution and dust control, and water quality. The following plans are described in Specification Section 01 35 43 (Environmental Procedures) and will be included as part of the Environmental Mitigation Binder, which will be an appendix to the RAWP:

- Water quality protection plan
- Erosion and sediment control plan
- Stormwater pollution prevention plan
- Water management plan
- Spill prevention, control, and countermeasure plan
- Air pollution and odors control plan
- Noise control plan
- Light control plan
- Personnel and equipment decontamination plan
- Traffic control plan

The Project Representative, key members of the IQAT, and EPA will review the Contractor's Environmental Mitigation Binder. The Environmental Mitigation Binder must be approved by the Owner and EPA (in conjunction with the RAWP) prior to the start of construction activities.

3.7.2 Environmental Monitoring Program

Following Owner and EPA approval of the Contractor's Environmental Mitigation Binder and prior to starting construction activities, the Project Representative and EQAO will implement an environmental monitoring program that will include the following monitoring elements:

- WQMP
- Sediment QAPP
- ANLMP

- Cultural resources monitoring as required by the MIDP

Implementation of these four environmental monitoring plans will be led by the EQAO, who will report results and coordinate nonconformance and need for contingency or corrective action with the Project Representative and EPA as necessary.

3.7.2.1 Water Quality Monitoring Plan

Water quality monitoring will be conducted during dredging activities to monitor potential water quality impacts caused by contaminated sediment resuspension or dredge return water. Water quality monitoring activities will be managed by the Water Quality Monitoring Lead in accordance with the procedures described in the WQMP (Appendix A) to ensure water quality compliance criteria are maintained throughout the project. The Contractor will be responsible for conducting construction operations that result in compliance with the water quality criteria identified in the specifications. If the Contractor's dredging operations are not in compliance with the water quality criteria, the Project Representative will direct the Contractor to modify its operations or, if the Contractor continues to be out of compliance, to stop work. Refer to the WQMP for specific reporting and response procedures for any exceedances of water quality criteria.

Water quality monitoring summaries and data will be submitted to EPA during construction, as described in the WQMP and this CQAP.

3.7.2.2 Construction Sediment Sampling QAPP

Construction sediment sampling will be performed following completion of required dredging activities to confirm that post-dredge surface sediment concentrations meet ROD-defined post-dredge surface concentration requirements, and to inform the need for conducting contingency re-dredging activities. In addition, sediment sampling will be performed near two public access areas, as defined in the Sediment QAPP. Public access areas sediment sampling and post-dredge confirmation sampling and testing will be conducted by the Sediment Sampling Lead and the analytical laboratory(ies) after the Project Representative accepts that required dredging activities are complete, based on required dredge elevation or thickness (i.e., following review of the post-dredge survey for an SMA). All details for sediment sampling—including sampling locations, methods, and laboratory analysis and reporting of post-dredge confirmation sampling—are described in the Sediment QAPP (Appendix B). The decision framework for contingency re-dredge actions and RMC placement is described in Section 5.2.

3.7.2.3 Air, Noise, and Light Monitoring Plan

ANL monitoring may be conducted during construction activities when there are community complaints, when Contractor work occurs at nighttime, and when construction begins, as described in the ANLMP (Appendix C). The purpose of this monitoring will be to document that the

Contractor's equipment and operations are not exceeding local ANL ordinances. The project Work Site is located on the upper reach of the LDW. The only land-based remedial actions to take place are expected to occur at industrial sites. However, some of the construction activities will take place close to residential communities, some located directly adjacent to the waterway and some composed of live-aboard residents at two marina facilities on the upper reach. ANL monitoring activities will be managed by the ANL Monitoring Lead in accordance with the procedures described in the ANLMP (Appendix C). Based on monitoring results, the Contractor may be required to modify construction operations, implement additional BMPs, or revise working hours to meet ANL quality concerns. The Project Representative will be responsible for communicating any needs for corrective action to the Contractor.

3.7.2.4 Cultural Resources Monitoring

Cultural resources monitoring and inadvertent discovery protocols will be in place during completion of all dredging and excavation activities to identify whether any cultural resources items of interest are encountered. Cultural resources monitoring will be managed by the Cultural Resources Monitoring Lead in accordance with the procedures described in the MIDP (Appendix D). This plan describes the details and sequencing for completing cultural resources monitoring activities; it also provides the process that must be followed if a cultural resource item of interest is identified during dredging and excavation activities. The Cultural Resources Monitoring Lead will communicate any concerns or required actions to the EQAO, who will then advise the Project Representative for communication to the Contractor regarding any need for corrective action or stop work direction.

3.8 Health and Safety

As noted, the Contractor will be responsible for overall Work Site health and safety for anyone entering into the Work Site (e.g., Contractor staff, IQAT, Owner and EPA representatives, community). The Contractor's HSP will be the primary HSP with which anyone working in the Work Site must comply. If IQAT construction inspectors or environmental monitors observe unsafe actions, they will immediately notify the HSO and Project Representative, who will inform the Contractor's Site HSO.

The Project Representative and IQAT's HSO will be responsible for documenting and reporting on safety issues for the IQAT. Each member of the IQAT will comply with both the IQAT HSP and the Contractor's HSP. All personnel on the IQAT will be responsible for observing and notifying the HSO if they observe violations of the IQAT HSP or the Contractor's HSP associated with IQAT personnel actions.

4 Contract Administration

Contract administration will be primarily the responsibility of the Owner's CCM, with support from the Project Representative, CQAO, and EQAO. The Project Representative's role in contract administration will be to assist in the review of the following elements:

- Construction progress payments
- Requests for information
- Field changes change orders
- Identification of nonconformance and/or noncompliance
- Contingency and corrective action recommendations
- Other requests that may come from the Owner's CCM

Implementation of all contract administration elements and communications with the Contractor will be the responsibility of the Owner's CCM and the Project Representative. Specific details regarding contract administration, management of changes to the design, assessment of nonconformance and noncompliance, and the process for identifying and implementing corrective actions will be developed by the Owner in conjunction with EPA.

5 Contingency Actions, Corrective Actions, and Notification Process

Construction QA inspection and monitoring of the Contractor's activities will be performed by the IQAT on the Owner's behalf to verify that the Contractor's work is complying with design drawings and specifications, the Contractor's approved RAWP, and ARARs. When there is an observed nonconformance, the Project Representative will notify the Contractor and direct the Contractor to perform corrective actions in order to bring the construction work into compliance; the Project Representative will document the Contractor's efforts in this regard.

EPA will be notified and coordinated with whenever there is an environmental compliance issue, contingency re-dredging decision, potential design deviation (e.g., contract administration), or health and safety incident. However, most nonconformance notifications will not require EPA coordination or approval when the nonconformance is not related to environmental compliance, contingency re-dredge decisions, design deviations, or health and safety incidents.

For environmental compliance, the Project Representative will provide appropriate notifications to EPA in accordance with the WQMP, Sediment QAPP, ANLMP, and MIDP and coordinate with EPA to determine if contingency or corrective actions are required, as summarized below:

5.1 Water Quality Monitoring

In the event of a confirmed water quality exceedance, the Project Representative will notify the Contractor and EPA PM as soon as possible (within two hours) of the confirmed exceedance, and the Contractor will be directed to identify and implement its approach to return dredging operations to compliance with water quality criteria. If the water quality exceedance continues, even with additional BMPs and/or operational modifications, the Project Representative will discuss next steps with the Contractor and EPA to determine if corrective actions are needed, as described in the WQMP.

5.2 Sediment Sampling

After required dredging has been completed and accepted by the Project Representative, post-dredge sampling confirmation, EPA coordination, and contingency actions will be implemented as described in the Sediment QAPP.

The decision framework that will be used to evaluate the sediment samples and determine what (if any) contingency actions are needed is presented in Figure 5-1 and Table 5-1. The table and figure describe how the sediment data will be evaluated (i.e., the applicable thresholds for each type of sample), and what the resulting actions will be in each situation. Depending on the results of the sediment sampling, contingency actions may be required. The two types of contingency actions that may be required include re-dredging and/or placement of RMC.

- **Contingency re-dredging** will be required on a Decision Unit (DU)[2]-specific basis under the following conditions.
  - **Missed inventory** – If concentration(s) in a subsurface 0–30-cm core intervals are greater than the surface sediment remedial action level (RAL)
  - **Generated residuals** – If concentration(s) in a 0–10-cm sample within the toe of cut of the dredge prism are more than three times the surface sediment RAL

  Note that if missed inventory is discovered for a given DU, the contingency action will be based on the depth of the missed inventory. The specifics of the contingency re-dredging (i.e., the target depth in each DU) will be determined by the Project Representative, the Designer, and EPA based on the sediment sampling results.

- **Placement of RMC** in the outer perimeter of a dredge prism will be required to address generated residuals if perimeter samples have concentrations that are greater than the surface sediment RALs. Note that RMC will also be placed automatically within the dredge prism, on the side slopes after the completion of dredging (or re-dredging if applicable), and in the inner perimeter of the dredge prism.

If the post-dredging composite sample collected adjacent to a given public access area has a contaminant concentration greater than the surface sediment RAL, contingency actions will occur as follows.

- The composite sample taken prior to dredging will be analyzed for the chemical(s) with RAL exceedances to assess temporal differences.
- Discussions with EPA will occur regarding next steps (e.g., the analysis of archived composite subsamples and potential contingency actions).

[2] For the purposes of evaluating the removal actions and conducting construction sediment sampling, each SMA has been divided into DUs, such that there are approximately four to six DUs per acre within the compliance area (toe of cut). DUs are discussed further in the Sediment QAPP.

Figure 5-1
Post-Dredge Confirmation Sampling and Contingency Action Decision Framework

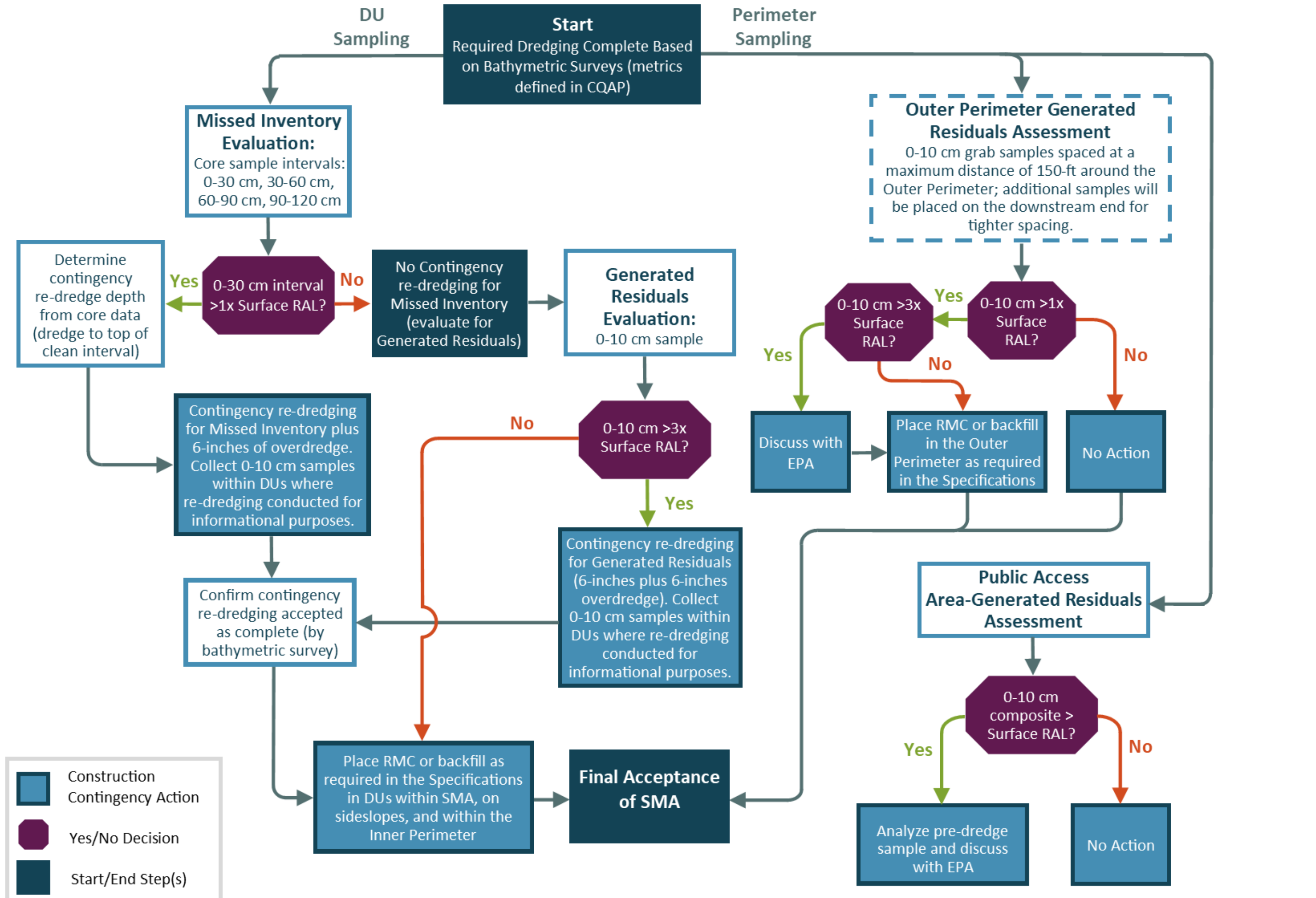


Table 5-1
Summary of Post-Dredge Confirmation Sampling and Contingency Action Framework

<table>
<tr><th rowspan="2">Sampling Objective</th><th rowspan="2">Sample Type[1]</th><th rowspan="2">Criteria[2]</th><th colspan="2">Contingency Action</th></tr>
<tr><th>Contingency Re-Dredging</th><th>RMC Placement[3]</th></tr>
<tr><td rowspan="2">Missed Inventory within DUs[4]</td><td rowspan="2">120-cm [4-ft] subsurface sediment core (0–30 cm, 30–60 cm, 60–90 cm, and 90–120 cm)</td><td><1x surface RAL</td><td>If 0–30-cm sample result is less than surface RAL, no re-dredging for missed inventory</td><td rowspan="4">• <u>Within DU</u>: Place RMC (targeted 9-inch thickness) or backfill (to targeted pre-construction elevations/grades)
• <u>Within Inner Perimeter</u>: Place RMC (targeted 9-inch thickness) or backfill (to targeted pre-construction elevations/grades)
• <u>Side slopes</u>: Place RMC (targeted 2-ft thickness) or backfill (to targeted pre-construction elevations/grades)</td></tr>
<tr><td>>1x surface RAL</td><td>If 0–30-cm sample result is greater than surface RAL, contingency re-dredge down to top of 30-cm interval (within the 120-cm [4-ft] core) that does not have concentrations greater than the RAL, plus 6-inch overdredge</td></tr>
<tr><td rowspan="2">Generated Residuals within DUs[5]</td><td rowspan="2">Surface sediment sample (0-10 cm)</td><td>< 3x surface RAL</td><td>If 0–10-cm sample is less than 3x the surface RAL, no re-dredging for generated residuals</td></tr>
<tr><td>> 3x surface RAL</td><td>If 0–10-cm samples is greater than 3x the surface RAL, contingency re-dredge for generated residuals (6 inches plus 6-inch overdredge)</td></tr>
<tr><td rowspan="3">Generated Residuals in the Outer Perimeter (includes EAAs)[6]</td><td rowspan="3">Surface sediment sample (0-10 cm)</td><td>< 1x surface RAL</td><td rowspan="3">Not applicable (No contingency re-dredging in outer perimeter)</td><td>If 0–10-cm sample concentrations are less than the surface RAL, no action required</td></tr>
<tr><td>> 1x surface RAL</td><td>If 0–10-cm sample concentrations are greater than the surface RAL, place RMC (targeted 9-inch thickness) in Outer Perimeter station with RAL exceedance halfway to adjoining stations</td></tr>
<tr><td>> 3x surface RAL</td><td>If 0–10-cm sample concentrations are greater than 3x the surface RAL, discuss results with EPA before placing RMC</td></tr>
<tr><td>Public Access Area Generated Residuals</td><td>Composite surface sediment sample (0-10 cm)</td><td>> 1x surface RAL</td><td colspan="2">If post-dredge composite surface sediment sample has contaminant concentration(s) greater than the RAL, analyze pre-dredge sample and discuss results with EPA to determine next steps</td></tr>
</table>

Notes:
1. Details regarding sample types and placement are presented in Section 4.1 of the Sediment QAPP.
2. Analytes are SMA-specific (see Section 4.1.2 of the Sediment QAPP). Surface sediment RALs are those presented in the 2014 LDW ROD (e.g., 12 mg/kg-organic carbon for total polychlorinated biphenyls), except for carcinogenic polycyclic aromatic hydrocarbon RALs, which are presented in the Explanation of Significant Differences (EPA 2021).

3. All RMC thicknesses are targeted thicknesses (construction specifications for acceptable tolerances for RMC placement are presented in this CQAP).
4. For thin-cut dredge areas (1-ft cut), there is no missed inventory sampling.
5. As shown in Figure 5-1, generated residuals within a given DU are only addressed if there is no missed inventory because re-dredging for missed inventory would result in a deeper contingency re-dredge than that for generated residuals.
6. The outer perimeter is the 20-ft width outside the inner perimeter boundary, except for downstream where the outer perimeter is 30 ft wide. The inner perimeter is the 20-ft width from the top of the dredge cut that will receive RMC placement (no sampling in inner perimeter), except for downstream where the inner perimeter is 30 ft wide.
cm: centimeter
DU: Decision Unit
EAA: early action area
EPA: U.S. Environmental Protection Agency
mg/kg: milligram per kilogram
QAPP: quality assurance project plan
RAA: remedial action area
RAL: remedial action level
RMC: residuals management cover
SMA: Sediment Management Area

5.3 Air, Noise, and Light Monitoring

As described in the ANLMP, if ANL monitoring is triggered during construction, EPA will be informed of the monitoring and its results. Should monitoring results indicate that the Contractor is exceeding threshold criteria, the Project Representative will notify the Contractor and direct the Contractor to implement corrective actions to its operations to return them to compliance with criteria.

5.4 Cultural Resources Monitoring and Inadvertent Discovery

If Tribal or other cultural materials are inadvertently discovered during excavation, project specifications require that dredging/excavation must cease and the affiliated Tribe(s) or other group(s) be notified and consulted. The Project Representative will implement reporting and notification requirements as described in the MIDP, which will include notifying EPA.

6 References

Anchor QEA, Windward. 2019. Remedial design work plan for the Lower Duwamish Waterway upper reach. Final. Submitted to EPA December 16, 2019. Anchor QEA, Inc. and Windward Environmental LLC, Seattle, WA.

Anchor QEA, Windward. 2023. Pre-final (90%) remedial design basis of design report for Lower Duwamish Waterway upper reach. Draft. Submitted to EPA July 24, 2023. Anchor QEA and Windward Environmental LLC, Seattle, WA.

EPA. 2014. Record of Decision. Lower Duwamish Waterway Superfund Site. US Environmental Protection Agency.

EPA. 2021. Proposed explanation of significant differences. Draft for public comment. Lower Duwamish Waterway Superfund site. US Environmental Protection Agency Region 10, Seattle, WA.

90% Remedial Design Volume II, Part I

Appendix A
Water Quality Monitoring Plan

Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

90% Remedial Design Volume II, Part I

Construction Quality Assurance Plan for the Lower Duwamish Waterway Upper Reach

Appendix A – Water Quality Monitoring Plan

For submittal to

The US Environmental Protection Agency
Region 10
Seattle, WA

July 24, 2023

Prepared by:

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TABLES

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ABBREVIATIONS

7-DADMax	7-day average of the daily maximum temperatures
ARAR	Applicable or Relevant and Appropriate Requirement
BMP	best management practice
BODR	*Basis of Design Report*
COC	contaminant of concern
CQAP	Construction Quality Assurance Plan
CRM	certified reference material
CV-AFS	cold vapor-atomic fluorescence spectrometry
CWA	Clean Water Act
DO	dissolved oxygen
DQI	data quality indicator
EPA	U.S. Environmental Protection Agency
EQAO	Environmental Quality Assurance Officer
FC	Field Coordinator
FNU	Formazin Nephelometric Unit
FLPE	fluorinated high-density polyethylene

GC-ECD	gas chromatography-electron capture detection
GPS	global positioning system
HDPE	high-density polyethylene
ICP-MS	inductively coupled plasma-mass spectrometry
LCS	laboratory control sample
LDW	Lower Duwamish Waterway
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NTU	nephelometric turbidity units
PCB	polychlorinated biphenyl
PM	Project Manager
QA/QC	quality assurance/quality control
RD	remedial design
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SMA	sediment management area
SRM	standard reference material
WAC	Washington Administrative Code
WQMP	Water Quality Monitoring Plan

1 Introduction

This draft Water Quality Monitoring Plan (WQMP) is a component of the remedial design (RD) for the upper reach of the Lower Duwamish Waterway (LDW). The upper reach encompasses river mile 3.0 to river mile 5.0 of the LDW. The RD has been prepared consistently with the sediment remedy outlined in the U.S. Environmental Protection Agency's (EPA's) November 2014 *Record of Decision* (ROD) (EPA 2014), as modified by the *Explanation of Significant Differences* (EPA 2021). The purpose of the LDW upper reach WQMP is to obtain water data during construction to identify water quality effects that may be caused by remedy construction.

This WQMP, which is an appendix to the Construction Quality Assurance Plan (CQAP), identifies the specific requirements for monitoring water quality during in-water dredging, including steps to be taken to mitigate exceedances of water quality criteria, if any occur. A draft final WQMP will be included in the Final (100%) RD and will be updated by the Implementing Entity, in coordination with EPA, as required to reflect any conditions or requirements in the final Clean Water Act (CWA) §404 Applicable or Relevant and Appropriate Requirement (ARAR) Memorandum. The Implementing Entity's selected water quality monitoring firm will identify key staff in the organizational chart and develop remaining monitoring details.

1.1 Project Description

Remedial activities in the LDW upper reach are described in the *Basis of Design Report* (BODR). Construction best management practices (BMPs), environmental protection measures, and water quality management controls for the anticipated work activities are described in Section 11 of the BODR.

The in-water components of the upper reach remedy will be conducted within the LDW-designated in-water work window, which is expected to occur between October 1 and February 15, annually. Scheduling will also take into account the tribal net fishery. The total project is estimated to take approximately three construction seasons to complete, as discussed in Section 13 of the BODR.

The Implementing Entity will designate a Water Quality Monitoring Lead to oversee water quality monitoring during dredging activities to ensure compliance with Washington State water surface water quality criteria. For safety reasons, water quality monitoring will be restricted to daylight hours.

Water quality monitoring will not be performed when land-based excavation alone (i.e., no in-water work) is being conducted. Construction specifications will require the Contractor to use temporary erosion and sediment control measures to minimize spillage of excavation materials into the LDW during land-based excavation.

1.2 Water Quality Effects Assessment

A site-specific water quality modeling evaluation was performed to assess the potential for water quality exceedances during dredging (Appendix M). The conclusion was that water quality criteria are unlikely to be exceeded for contaminants of concern (COCs) from resuspension of sediment during dredging operations, or from barge dredge return water discharge.

The results of Appendix M can be considered by EPA to inform the detailed water quality monitoring requirements in EPA's CWA §404 ARAR Memorandum.

2 Monitoring Personnel and Responsibilities

The individuals responsible for various tasks required for water quality monitoring sample collection and analysis are described here and shown in CQAP Figure 2-1. Persons fulfilling these roles will be designated at least one month prior to the start of monitoring activities, and contact information will be provided to EPA at that time. All monitoring personnel will be experienced in the collection and measurement of water quality data.

2.1 Project Representative

The Project Representative, whose role is described in the CQAP, is assigned by the Owner to oversee the entire construction QA program. The Project Representative is the only person authorized to direct the Contractor and will be kept updated on water quality monitoring results and notified when there is an observed water quality exceedance. The Project Representative will coordinate with the Contractor to ensure appropriate construction BMPs are being implemented and strategize ways to use BMPs or enhance the effectiveness of existing BMPs as necessary to mitigate water quality exceedances.

2.2 Environmental Quality Assurance Officer

The Environmental Quality Assurance Officer (EQAO), whose role is described in the CQAP, is responsible for coordinating, reviewing, and reporting all environmental monitoring activities, including water quality monitoring. The EQAO reports to the Project Representative; key responsibilities for water quality monitoring include:

- Reviewing field reports to verify that appropriate field methods and QC procedures are being implemented in accordance with the procedures specified in this WQMP
- Overseeing coordination of the field sampling and laboratory programs and supervising data review, including coordination with the analytical laboratories and the EPA QA chemist, Don Matheny. Don Matheny is the EPA contact for this sampling and works on behalf of the EPA QA manager, Cindy Fields. Mr. Matheny can be reached as follows:
  - Mr. Don Matheny
    US Environmental Protection Agency, Region 10
    1200 6th Avenue
    Seattle, WA 98101
    Telephone: 206.553.2599
    Email: matheny.don@epa.gov
- Reporting weekly water quality results to the EPA Project Manager

- Notifying EPA if a confirmed water quality exceedance is observed, and working with the Project Representative to coordinate with EPA to determine an appropriate path forward if a response action is warranted

2.3 Water Quality Monitoring Lead

The Water Quality Monitoring Lead will report to the EQAO and is responsible for the following activities:

- Overseeing all water quality monitoring activities and field personnel
- Overseeing sample collection, preservation, and holding times, and coordinating delivery of water quality samples to the designated laboratories for chemical analyses.
- Verifying that station, sample collection, and conventional field measurement results are properly recorded and forms are completely filled out
- Verifying that appropriate calibration and quality assurance/quality control (QA/QC) field procedures are being implemented
- Notifying the EQAO and Project Representative when water quality exceedances are observed, and providing all necessary supporting field documentation so the Project Representative can identify an appropriate path forward can be determined in consultation with EPA.

2.4 Monitoring Personnel

Under the Water Quality Monitoring Lead's oversight, water quality field monitoring personnel will be responsible for conducting field activities, instrument calibrations, QA/QC procedures, and documentation of results in daily field reports.

2.5 Analytical Laboratory

The analytical laboratory (TBD) will perform all chemical analyses. The laboratory will meet the following requirements:

- Adhere to the methods outlined in this plan, including those methods referenced for each procedure
- Adhere to documentation, custody, and sample logbook procedures
- Implement QA/QC procedures defined in this plan
- Meet all reporting requirements
- Deliver electronic data files as specified in this plan
- Meet turnaround times for deliverables as described in this plan
- Allow EPA and the EQAO, or a representative, to perform laboratory and data audits.

2.6 Data Management

The Data Manager (TBD) will oversee data management; they will ensure that analytical data are incorporated into the LDW database with appropriate qualifiers following review of the data.

3 Water Quality Monitoring Plan

Water quality monitoring during dredging includes monitoring conventional parameters and water chemistry. Monitoring for conventional parameters, described in Section 3.1, will use a tiered-testing approach. Intensive monitoring for 3 days will be conducted in the following circumstances:

- At the start of dredging in each sediment management area (SMA)[1]
- The first time that a new type of dredging equipment is used
- If an exceedance of turbidity criteria is confirmed during monitoring, which would trigger an additional 2-day intensive monitoring period for conventionals.

Routine monitoring of conventional parameters will occur whenever intensive monitoring is not required (i.e., there is no confirmed exceedance of turbidity criteria during the 3-day intensive monitoring period and any additional 2-day periods for turbidity exceedances). In addition, conventional monitoring will be conducted if a turbidity plume is observed at the 150-foot compliance station. If there is a confirmed turbidity exceedance, then 2 days of intensive monitoring will begin.

The collection and analysis of water samples for chemical analysis is described in Section 3.2. Water chemistry monitoring will occur under three specific conditions:

- Chemistry condition 1: the initiation of dredging
- Chemistry condition 2: a confirmed turbidity exceedance (up to 3 events)
- Chemistry condition 3: dredging in an area with elevated COC concentrations in sediment (relative to COC concentrations in other SMAs) or dredging in the vicinity of public access areas.

3.1 Conventional Parameters

The ROD (EPA 2014) states that the LDW is considered marine water under the Washington State's water quality standards regulation, because it meets the salinity threshold described in Washington Administrative Code (WAC) 173-201A-260(3)(e), and because salinity measurements show tidal conditions exist beyond the Turning Basin. The ROD also states that the LDW is not specifically noted in WAC 173-201A-610 and 612, Table 612, but rather is a continuation of Elliott Bay for the purposes of applying marine criteria. Based on the beneficial use classification of the LDW as "excellent quality" to support salmonid migration and rearing, the applicable compliance criteria for conventional

[1] The start of dredging is defined as the beginning of dredging in the SMA. If contingency re-dredging is required in the SMA, the initiation of contingency re-dredging will not trigger intensive monitoring of conventionals.

parameters are the "excellent quality" Washington State Surface Water Quality Standards for marine waters (WAC 173-201A-210).

The Contractor will be responsible for construction QC including following BMPs with the goal of meeting applicable and relevant state water quality criteria at the designated point of compliance. Dredging effects on water quality are typically assessed by complying with the provisions of EPA's CWA §404 ARAR Memorandum.

The following field conventionals will be monitored during dredging activities at the compliance and background stations:

- Turbidity (in nephelometric turbidity units [NTU])
- Dissolved oxygen (DO) (in mg/L)
- Temperature (in °C)
- Hydrogen ion concentration (in pH units)
- Salinity[2] (in parts per thousand) – informational only.

3.1.1 Conventionals Criteria

3.1.1.1 Turbidity

Expected provisions of the CWA §404 ARAR Memorandum are that in-water construction activities do not increase in-water turbidity >5 NTU above background (or 10% above background if background is ≥50 NTU) at the compliance mixing zone distance. Compliance is typically measured at the edge of the EPA-approved mixing zone 150 feet from the construction work zone (Figure A.3-1). The proposed area of mixing for marine waters is a 150-foot radius (i.e., point of compliance) surrounding the in-water activity. The background stations will be upstream and 500 feet away from the influence of the dredging activities occurring in the construction work zone. If barge dewatering occurs more than 150 feet from the dredging then visual monitoring will be conducted 150 feet downstream of the dewatering barge to ensure that there is no turbidity plume associated with the barge dewatering.

If there is a preliminary exceedance of the turbidity criteria, the EQAO and Project Representative will be informed, and the turbidity will be measured again at the same station 30 minutes after the original exceedance to determine if there is a confirmed turbidity exceedance requiring corrective action (Section 5). If there are two consecutive turbidity exceedances recorded 30 minutes apart, this will be defined as a confirmed turbidity exceedance.

[2] Salinity will be calculated based on specific conductance and temperature readings.

3.1.1.2 Dissolved Oxygen

The DO criterion in marine waters with "excellent quality" is 6.0 mg/L; the DO at the point of compliance shall not decrease to less than 6.0 mg/L within a 24-hour period, per WAC 173-201A-210: "If the background DO is less than 6.0 mg/L (or within 0.2 mg/L of that criterion) and is due to natural conditions, then human actions considered cumulatively may not cause the DO of the water body to decrease >0.2 mg/L."

3.1.1.3 Temperature

Per WAC 173-201A-210: "When the water body temperature is >16°C (or within 0.3°C of 16°C; 1-day maximum) and that condition is due to natural conditions, then human actions considered cumulatively may not cause an incremental increase of >0.3°C (7-day average of the daily maximum temperatures [7-DADMax]), per Table 210 (1)(c) of WAC 173-201A-210 for "excellent quality" marine water, wherein the 7-DADMax is the arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the 3 days prior and the 3 days after that date.

If water body temperature is <16°C (or >0.3°C below 16°C [<15.7°C]), incremental temperature increases resulting from individual point source activities must not, at any time, exceed 12/(T-2) as measured at the edge of a mixing zone boundary, where T = highest representative ambient background temperature in the vicinity (°C)."

3.1.1.4 pH

In marine waters with "excellent quality," pH must be within the range of 7.0 to 8.5, with a human-caused variation within that range of <0.5 units difference from background, per WAC 173-201A-210.

Table A.3-1 summarizes the conventional water quality parameters and criteria.

Table A.3-1
Criteria for Conventional Parameters

Parameter	Criteria	Units
Turbidity	If background is <50 NTU the criteria is background +5 NTU If background is >50 NTU the criteria is background +10%	NTU
DO	>6.0 mg/L[1]	mg/L
Temperature	Water body temperature <16°C (60.8°F): incremental temperature increases must not exceed 12°/(T-2) where T is the highest ambient background temperature[2]	°C
pH	7 to 8.5 pH units	pH units

Notes:
1. If background DO is less than 6.0 mg/L and due to natural conditions, then dredging cannot reduce the background DO by more than 0.2 mg/L.
2. If the water body temperature is greater than 16°C (60.8°F), the incremental increase due to dredging cannot exceed 0.3°C.
DO: dissolved oxygen
NTU: nephelometric turbidity unit
WAC: Washington Administrative Code

3.1.2 Monitoring Stations and Depths

During each monitoring event, conventional parameters will be measured at both the background station (500 feet upriver of the construction work zone) and at the 150-foot compliance monitoring station. When the water depth is at least 10 feet, measurements will be made at two depths: near surface (approximately 3 feet below the water surface) and near bottom (approximately 3 feet above the mudline) (see Figure A.3-1). In water deeper than 20 feet, measurements will be made at three depths: the midpoint of the water column and the near-surface and near-bottom depths. In water shallower than 10 feet, one measurement will be made in the middle of the water column. Whenever possible, samples will be collected at a location with a minimum water depth of 10 feet to minimize the potential for disturbance of the sediment bed by monitoring vessels.

Compliance stations will be based on the distance downriver from the construction activity. All compliance stations will be monitored downriver of the construction activity and approximately one to two hours after a tide reversal during the ebb tide condition to represent the worst-case condition.

3.1.3 Monitoring Frequency

Water quality monitoring frequency for conventionals will be based on two tiers—intensive monitoring and routine monitoring.

3.1.3.1 Intensive Monitoring

Intensive monitoring will be conducted the first 3 days of dredging in each SMA (Figure A.3-2), and will be conducted twice per day. The first daily monitoring round will be conducted at least one hour after the start of daily work activities. The second daily monitoring round will be separated from the first monitoring round by a minimum of four hours. For one of the sampling events, monitoring will target one to two hours after tide reversal during the ebb tide condition. No monitoring will be performed if it cannot be completed one hour before dark/during dark hours due to safety concerns.

Intensive monitoring will also be required: 1) the first time there is a significant change to the Contractor's dredging equipment, such as changes bucket type (e.g., environmental bucket to open clamshell bucket) for the first time, and 2) if there is a confirmed turbidity exceedance associated with dredging activities at the 150-foot compliance monitoring station.

If no exceedances of the water quality criteria for conventional parameters are identified over 3 consecutive days, then routine monitoring will be implemented.

Background stations will be monitored prior to compliance stations. The compliance station(s) will be monitored within one hour of the completion of background station monitoring.

3.1.3.2 Routine Monitoring

Routine monitoring is performed when intensive monitoring is not required. Routine monitoring will occur once per day, 2 days per week (Figure A.3-3). Monitoring events will target one to two hours after tide reversal during the ebb tide.

If a turbidity plume is observed at the 150-foot compliance station at any time, monitoring will be conducted as soon as the monitoring vessel gets to the station.

3.1.3.3 Exceedance-Triggered Monitoring

If exceedances of the water quality criteria for conventional parameters are confirmed during any monitoring event, 2 days of intensive monitoring will occur.

3.1.4 Monitoring Methods

Water quality monitoring of conventionals will be conducted from a boat during daylight hours. Monitoring will be performed using a calibrated multi-probe meter (e.g., Hydrolab, YSI© probe, or similar) and/or a calibrated Hach© turbidity meter (the standard operating procedure will be provided with final WQMP). Turbidity, DO, pH, and salinity[3] will be measured and recorded for each station.

All stations for water column measurements will be positioned relative to the location of the dredging and barge dewatering activity at the time of sampling (e.g., 150 feet downriver from the construction activity) (Figure A.3-1). Distances from construction activity will be verified using a range

[3] Salinity will be calculated based on specific conductance and temperature readings.

finder. Actual differential global positioning system coordinates, times, and depths of all water column sample stations will be recorded.

Monitoring equipment will be calibrated daily and allowed to equilibrate prior to use. Calibration information will be recorded in the field notebooks. Monitoring equipment will be handled according to the manufacturers' recommendations. Unusual or questionable readings will be noted, and duplicate readings will be collected.

3.1.5 Conventional Parameter Compliance

The compliance station results will be compared to those for the corresponding depth intervals at the background station. For example, the near-bottom results for both stations will be compared to one another. If the background station has only one sample because of a water depth of less than 10 feet, the results for all compliance station samples will be compared to the results for the background station sample.

If the water quality criteria are exceeded at the compliance station for one or more of the conventional parameters, the measurements will be repeated at the compliance station 30 minutes after the initial measurements were taken. The exceedance will be considered a confirmed exceedance if the results of the second measurement also exceeds the criteria.

EPA will be notified within 2 hours of a confirmed conventional parameter exceedance at the compliance station, and conventional parameter monitoring will be conducted approximately every two hours for the remainder of the day until compliance is documented. If there is a confirmed turbidity criteria exceedance during dredge monitoring, the Project Representative will coordinate with the Contractor to identify and institute additional BMPs or modify the Contractor's operations to bring its activities back into compliance with water quality criteria. Some potential anticipated BMPs or operational changes that may be proposed by the Contractor include:

- Adjust dredging process by decreasing the velocity of the bucket through the water column and pausing the bucket above the bottom before dredging
- Decrease dredging cycle time to reduce suspended sediment loading to water column
- Dislodge material that may adhere to the bucket over the haul barge
- Modify dredged material barge loading to reduce potential material spillage
- Change buckets or modify equipment
- Use adaptive management processes to adjust dredge operations, in conjunction with discussions with EPA and monitoring to confirm that the cause of the exceedance has been addressed.

3.1.6 Summary of Water Quality Monitoring Plan for Conventional Parameters

The water quality monitoring plan for conventional parameters is summarized in Table A.3-2 and Figures A.3-2 and A.3-3.

Table A.3-2
Summary of Conventional Parameter Water Quality Monitoring Plan During Dredging

Component	Intensive Monitoring	Routine Monitoring
Conditions	• Contractor begins dredging a new SMA • First time there is a major change in equipment (e.g., dredge bucket type) • Following confirmed turbidity exceedances[1]	When intensive monitoring is not required
Duration	• 3 consecutive days if no confirmed exceedance • 2 consecutive days following any confirmed exceedance	2 days per week
Frequency	2 sampling events per day	1 sampling event per day
Conventional Parameters and Stations	Monitor *in situ* conventional parameters (turbidity, pH, DO, and temperature) per WAC 173-201A-210 at 150-ft compliance monitoring station downriver and background monitoring station 500 feet upriver of the in-water construction work zone. Sampling will occur on the ebb tide whenever possible.	
Preliminary Exceedance Criteria	Preliminary exceedance occurs when the results exceed criteria for any of the conventional parameters at the compliance monitoring station.	
Confirmed Exceedance Criteria	Exceedance is confirmed when two consecutive measured exceedances (30 minutes apart) occur at the same compliance monitoring station.	
Conventional Water Quality Criteria Exceedance Corrective Action	• After a confirmed conventional exceedance, Project Representative will notify EPA and Contractor within two hours. In situ conventional parameter testing will be conducted every two hours for the remainder of the day or until compliance is demonstrated (during daylight). If the confirmed exceedance is a turbidity exceedance, Contractor will modify its operations and turbidity monitoring will be conducted every two hours (for the remainder of day or until compliance is demonstrated) after additional BMPs or operational modifications have been implemented by Contractor to demonstrate and document that Contractor's modifications have returned the site to compliance. • Intensive monitoring will begin for a 2-day period the next day.	

Notes:
1. Monitoring will occur if a turbidity plume is observed at the 150-foot compliance monitoring station.
BMP: best management practice
DO: dissolved oxygen
EPA: U.S. Environmental Protection Agency
SMA: sediment management area
WAC: Washington Administrative Code

3.2 Chemical Testing

Chemical testing will be conducted based on the chemistry conditions 1 through 3, summarized herein.

Chemistry condition 1: Construction initiation

Chemical testing will be conducted at the start of dredging in the upper reach to assess whether dredging activities result in a water quality chemical criteria exceedance. Samples will be collected after the Contractor has finished its startup operations and tested its equipment operational methods and is performing production dredging to verify that BMPs are working effectively. In the LDW upper reach, there are many smaller SMAs that will require limited dredging. Therefore, sampling will occur when dredging begins in the first SMA that will require at least 4 days of dredging. The Project Representative or EQAO will consult with EPA to identify the first SMA to trigger water chemistry monitoring.

Chemistry condition 2: Confirmed turbidity exceedance

Chemical testing will be conducted as soon as possible after confirmation for each of the first three confirmed turbidity exceedances during dredging. Chemical testing is intended to document whether a turbidity exceedance may also be associated with elevated chemical concentrations that exceed Washington State Acute Water Quality Criteria. Chemical testing will not be used to initiate real-time construction corrective action, because there is a long lag time between collecting samples for chemical testing and receiving test results from the laboratory. Turbidity measurements are the primary indicator of the potential for water quality chemical exceedance, as described and evaluated in the BODR Appendix M. It is expected that any corrective measures in the field will be based on confirmed turbidity exceedances.

Chemistry condition 3: Dredging in SMAs with elevated sediment concentrations or in the vicinity of public access areas

Chemical testing will occur when dredging begins in SMAs with substantially higher sediment COC concentrations relative to those in other SMAs. A review of the upper reach design dataset identified SMA 6 (RAA 27) as requiring water chemistry monitoring when dredging is initiated. Polychlorinated biphenyl (PCB) concentrations of more than 1,000 µg/kg were reported for 10 locations in this area, with concentrations of more than 10,000 µg/kg in vertical intervals from pre-design investigation sampling locations 652 and 653. The elevated PCB concentrations in the surface intervals and at depth and the volume of material that will be dredged in this area were factors in selecting this area for water chemistry monitoring during dredging.

In addition, chemical testing will occur when dredging occurs within 150 feet of public access areas (i.e., the Duwamish Waterway Park and the People's Park at Terminal 117).

3.2.1 Analytes

Chemicals with water quality criteria values for the protection of aquatic life and sediment concentrations greater than RALs in the UR were identified as analytes for the water quality monitoring. PCB concentrations exceed the RALs in all of the SMAs and all water chemistry samples will be analyzed for PCBs. In addition, arsenic, lead, mercury, and zinc concentrations exceed sediment RALs in specific SMAs. The water chemistry analytes and the associated SMAs are provided in Table A.3-3. The individual metals will be included as analytes during water chemistry monitoring associated with the SMAs they are associated with. For example, water chemistry samples collected during dredging RAA 22 will be analyzed for total PCBs, lead, mercury and zinc.

Table A.3-3
Water chemistry analytes and associated SMAs

Chemical	SMAs
Total PCBs	All
Arsenic	SMA 10 (RAA 18)
Lead	SMA 9 (RAA 22)
Mercury	SMA 12A (RAA 17), SMA 9 (RAA 22), SMA 6 (RAA 27)
Zinc	SMA 9 (RAA 22)

Notes:
PCB: polychlorinated biphenyl
RAA: remedial action area
SMA: sediment management area

3.2.2 Chemistry Criteria

The Washington State Marine Acute and Chronic Water Quality Criteria for the protection of aquatic life (WAC 173-201A-210) are the compliance criteria for chemical parameters (Table A.3-4). Dredging will not be conducted over a continuous 24-hour period, and construction equipment will be moved multiple times per day. Therefore, results from water quality samples collected for chemical analyses and compared to acute and chronic water quality criteria will represent very conservative scenarios. Specifically, samples will be collected during active dredging and will not factor in water quality during periods when dredging is not being conducted over a 24-hour or 4-day period.

Table A.3-4
Marine Chronic and Acute Water Quality Criteria[1]

Chemical	Marine Chronic (µg/L)[2]	Marine Acute (µg/L)[3]
Metals		
Arsenic	36 (dissolved)	69 (dissolved)
Lead	8.1 (dissolved)	210 (dissolved)
Mercury	0.025 (whole water)	1.8 (dissolved)
Zinc	81 (dissolved)	90 (dissolved)
PCBS		
PCBs	0.030 (whole water)	10 (whole water)

Notes:
1. Standards listed are the lowest of National Recommended Water Quality Criteria: Aquatic Life Criteria EPA or Water Quality Standards for Surface Waters of the State of Washington (WAC 173-210A-240, Table 240).
2. Marine chronic criteria for metals are relevant to a 4-day exposure timeframe. The exposure timeframe for PCBs is 24 hrs.
3. Marine acute criteria are relevant to a 1-hour exposure timeframe for metals and a 24-hour exposure timeframe for PCBs.
EPA: U.S. Environmental Protection Agency
PCB: polychlorinated biphenyl
WAC: Washington Administrative Code

3.2.3 Monitoring Stations and Depths

The points of compliance for chemical parameters are 150 feet and 300 feet from the construction activity for acute and chronic water quality criteria, respectively. During each monitoring event, samples will be collected at the 150-foot (acute) and 300-foot (chronic) compliance monitoring stations. When the water depth is at least 10 feet, measurements will be made at two depths: near surface (approximately 3 feet below the water surface) and near bottom (approximately 3 feet above the mudline) (see Figure A.3-1). In water deeper than 20 feet, measurements will be made at three depths: the midpoint of the water column and the near-surface and near-bottom depths. In water shallower than 10 feet, one measurement will be made in the middle of the water column. The sample with the highest turbidity for each station will be selected for analysis each day. The samples not selected for analysis will be archived. The following conditions will also apply:

- Whenever possible, samples will be collected at a location with a minimum water depth of 10 feet to minimize the potential for disturbance of the sediment bed by monitoring vessels.
- Compliance station stations will be based on the distance downriver from the dredging activity.

3.2.4 Frequency of Chemical Testing

3.2.4.1 Chemistry Conditions 1 and 3

Water chemistry samples will be collected from both the 150-foot and 300-foot compliance stations twice a day for as many as 4 days[4] at the initiation of dredging (condition 1) and at SMAs identified with higher sediment concentrations or near public access areas (condition 3). At each compliance station, samples will be collected at two water depths and twice a day.

On days 1 and 3, the sample associated with the highest confirmed turbidity reading (among the four samples at each compliance station) will be analyzed. The remaining samples collected on days 1 and 3 and all samples collected on days 2 and 4 will be archived pending the results from the initial analyses.

If the metals concentrations in the sample with the highest turbidity analyzed from the 150-foot compliance station exceed the acute water quality criteria, then the archive sample from the 150-foot compliance station collected at the same time will be analyzed, and the two results will be averaged to represent the 1-hour exposure for metals. If the PCB concentrations in the sample analyzed exceed the acute criterion at the 150-foot compliance boundary, then the three archived samples collected at that station from both sampling events that day will be analyzed. If the average PCB concentration of the 4 samples (representing a portion of the 24-hour acute exposure period) exceeds the acute criteria, that may be considered an exceedance of the acute water quality criteria. In consultation with EPA, a time-weighted concentration will also be evaluated.

If any of the metals concentrations in the sample analyzed from the 300-foot compliance station exceed the chronic water quality criteria, all samples collected over the 4-day period will be analyzed, and the average of the samples will be compared to the chronic criteria. If the average concentration for 4 days exceeds the chronic value, that may be considered an exceedance of the chronic water quality criteria. In consultation with EPA, a time-weighted concentration will also be evaluated.

If the PCB concentration in the sample analyzed from the 300-foot compliance station exceeds the chronic water quality criteria, the three archived samples collected at that station that day will be analyzed to determine if there is a chronic exceedance. If the average exceeds the chronic water quality criteria for PCBs, that may be considered an exceedance of the chronic water quality criteria for PCBs. In consultation with EPA, a time-weighted concentration will also be evaluated.

[4] When the analytes are metals and PCBs, sampling will occur for 4 days because the chronic exposure period for metals is 4 days. When PCBs are the only analyte, sampling will occur for 2 days because the chronic exposure period for PCBs is 24 hours.

3.2.4.2 Chemistry Condition 2

If a confirmed turbidity exceedance occurs at the 150-foot compliance station, water chemistry samples will be collected after each of the first three confirmed turbidity exceedances as soon as possible after the confirmation of the turbidity exceedance. Samples will be collected at the near-surface and near-bottom water depths, and the results will be averaged for comparison to acute criteria for informational purposes. A turbidity exceedance generally represents a transient condition. If the turbidity exceedance persists for several days, additional water chemistry sampling may be considered in consultation with EPA in addition to corrective measures in the field.

3.2.5 Water Chemistry monitoring methods

3.2.5.1 Field Methods

Water samples for chemical testing will be collected using a 5-L Teflon-lined Niskin bottle sampler, which will be manually lowered on a line to the targeted depth and triggered to close via a messenger. After the end caps of the sampler have been triggered shut, the sampler will be retrieved. Sampling standard operating procedures will be provided in the final WQMP.

Conventional water quality parameters will be measured at the time of chemistry sample collection, as discussed in Section 3.1.

Chemistry samples will be packed in coolers and held at ≤ 4°C (± 2°C). Samples for analysis will be delivered directly to the laboratory.

3.2.5.2 Laboratory Methods

Laboratory methods and sample handling requirements for the water samples are provided in Table A.3-5. The dissolved metals samples will be filtered by the laboratory upon sample receipt[5], consistent with the sample handling conducted for the LDW baseline surface water sampling (Windward 2017). The selected laboratory will provide specific reporting limits for these analyses.

Table A.3-5
Analytical Methods and Sample Handling Requirements for Water Samples

Parameter	Method	Reference	Laboratory	Container	Preservative	Sample Holding Time
Total PCBs	GC-ECD	EPA 8082	TBD	2 L (amber glass)	None	1 year to extract, 1 year from extraction to analysis

[55] Dissolved metals samples will be filtered the day of collection. If the laboratory is unable to filter the sample upon receipt, then the samples will be filtered in the field.

Parameter	Method	Reference	Laboratory	Container	Preservative	Sample Holding Time
Dissolved metals	ICP-MS	EPA 6020	TBD	250-mL HDPE	nitric acid to pH < 2; dissolved samples filtered with 0.45-µm filter[1]	180 days
Mercury	CV-AA	EPA 7470A	TBD	250-mL HDPE	nitric acid to pH < 2	28 days

Notes:
1. Samples will be filtered in the laboratory as soon as possible following collection. The method specifies field filtration within 15 minutes of sample collection. However, laboratory filtration under clean, controlled conditions greatly reduces the risk of sample contamination during filtration. The resulting data will be qualified as estimated (J-flagged).
CV-AA: cold vapor-atomic absorption spectrometry
EPA: U.S. Environmental Protection Agency
FLPE: fluorinated high-density polyethylene
GC-ECD: gas chromatography-electron capture detection
HDPE: high-density polyethylene
ICP-MS: inductively coupled plasma-mass spectrometry
TBD: to be determined

3.2.6 Summary of Water Quality Monitoring Plan for Water Chemistry

The water quality monitoring plan for water chemistry is summarized in Table A.3-6.

Table A.3-6
Summary of Water Quality Monitoring Plan for Chemistry During Dredging

Component	Chemistry Conditions 1 and 3	Chemistry Condition 2
Conditions	• Condition 1 – Initiation of dredging in the upper reach • Condition 3 – When dredging an SMA with elevated sediment chemistry or if the SMA is near (within 150 feet of) a public access area	• Condition 2 – Associated with the first three confirmed turbidity exceedances
Duration	4 days of sampling (PCBs and metals) 2 days of sampling (PCBs only)	1 day of sampling
Stations	150 feet and 300 feet downstream	150 feet downstream
Collection Frequency	Two sampling events per day	One sampling event
Timing	One of the two sampling events to occur 1 to 2 hours after tide reversal during ebb tide	As soon as possible after confirmed turbidity exceedance (for the first three confirmed exceedances)
Analytical Frequency	• Analyze one sample with the highest confirmed turbidity from each compliance location per day on days 1 and 3 • Archive all other samples pending results from initial samples	Analyze samples from both depth intervals

Component	Chemistry Conditions 1 and 3	Chemistry Condition 2
Chemical Parameters	Analyze for PCBs and metals with RAL exceedances at that SMA	Analyze for PCBs and metals with RAL exceedances at that SMA
Exceedance Criteria	If concentrations in selected analytical sample exceed acute or chronic criteria, analyze archived samples to determine if the average of samples representing acute exposure (24 hours for PCBs, 1 hour for metals) or chronic exposures (24 hours for PCBs, 4 days for metals) exceeds the criteria.	Concentrations compared to acute criteria. The results will be averaged to represent acute exposure (24 hours for PCBs, 1 hour for metals).

Notes:
EPA: Environmental Protection Agency
PCB: polychlorinated biphenyl
SMA: sediment management area

3.3 Analytical Data Quality Objective and Criteria

The analytical data quality objective for the water samples is to develop and implement procedures that will ensure the collection of representative data of known, acceptable, and defensible quality. Parameters used to assess data quality are precision, accuracy, representativeness, comparability, completeness, and sensitivity.

3.3.1 Precision

Precision is the measure of reproducibility among individual measurements of the same property, usually under similar conditions, such as multiple measurements of the same sample. Precision is assessed by performing multiple analyses on a sample; it is expressed as a relative percent difference when duplicate analyses are performed, and as a percent relative standard deviation when more than two analyses are performed on the same sample (e.g., triplicates). Precision is assessed by laboratory duplicate analyses (e.g., duplicate samples, matrix spike duplicates (MSDs), and laboratory control sample [LCS] duplicates) for all parameters. Precision measurements can be affected by the nearness of a chemical concentration to the detection limit, whereby the percent error (expressed as either percent relative standard deviation or relative percent difference) increases. The DQI for precision varies depending on the analyte (Tables A.3-7 and A.3-8). The equations used to express precision are as follows:

$$RPD = \frac{\text{(measured conc}-\text{measured duplicate conc)}}{\text{(measured conc+measured duplicate conc)}\div 2} \times 100$$ **Equation 1a**

$$\%RSD = (SD/D_{ave}) \times 100$$

Where:

$$SD = \sqrt{\left(\frac{\sum(D_n - D_{ave})^2}{(n-1)}\right)}$$ **Equation 1b**

%RSD	=	percent relative standard deviation
D	=	sample concentration
D_{ave}	=	average sample concentration
n	=	number of samples
SD	=	standard deviation

Table A.3-7
DQIs for Conventional Water Quality Measurements

Parameter	Precision[1]	Accuracy[2]	Completeness
DO	± 20%	± 0.1 mg/L or 1% of reading	90%
pH	± 20%	± 0.2 pH unit	90%
Specific conductance	± 20%	± 0.5% of reading or 0.001 mS/cm	90%
Temperature	± 20%	± 0.05 °C	90%
Turbidity	± 20%	0 to 999 FNU: 0.3 FNU or ±2% of reading (whichever is greater); 1000 to 4000 FNU: ±5% of reading	90%

Notes:
Water quality measurements will be made using a YSI© EXO1 or similar water quality meter.
1. Precision is based on duplicate results for standard solutions following instrument calibration.
2. Accuracy is as reported for YSI© EXO1 instrument specifications.
DO: dissolved oxygen
DQI: data quality indicator
FNU: Formazin Nephelometric Unit

Table A.3-8
DQIs for Chemistry Laboratory Analyses

Parameter	Unit	Precision[1]	Accuracy[b]		Completeness
			LCS	Spiked Samples	
Total and dissolved metals	µg/L	± 20%	80–120%	75–125%	90%
Mercury	µg/L	± 25%	80–120%	75–125%	90%
Total PCBs	µg/L	± 20%	51–128%	51–128%	90%

Notes:
1. Values listed are performance-based limits provided by the laboratories.
DQI: data quality indicator
LCS: laboratory control sample
PCB: polychlorinated biphenyl
SRM: standard reference material

3.3.2 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Accuracy may be expressed as a percentage recovery for MS and LCS analyses. The DQI for accuracy varies depending on the analyte (Tables A.3-7 and A.3-8). The equation used to express accuracy for spiked samples is as follows:

$$\text{Percent recovery} = \frac{\text{spike sample result} - \text{unspiked sample result}}{\text{amount of spike added}} \times 100$$ **Equation 2**

3.3.3 Representativeness

Representativeness is an expression of the degree to which data accurately and precisely represent an environmental condition. Assuming those objectives are met, the samples collected should be considered adequately representative of the environmental conditions they are intended to characterize.

3.3.4 Comparability

Comparability is an expression of the confidence with which one dataset can be evaluated in relation to another dataset. Therefore, the sample collection and chemical testing will adhere to the most recent Puget Sound Estuary Program QA/QC procedures (PSEP 1997) and EPA analysis protocols.

3.3.5 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. The equation used to calculate completeness is as follows:

$$\text{Completeness} = \frac{\text{number of valid measurements}}{\text{total number of data points planned}} \times 100$$ **Equation 3**

The DQI for completeness for all components of this project is 90%. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

3.3.6 Sensitivity

Analytical sensitivity is the minimum concentration of an analyte above which a data user can be reasonably confident that the analyte was reliably detected and quantified. For field analyses, the resolution information provided by the probe manufacturer defines the capability of the method to recognize small differences between values. For chemistry, the method detection limit (MDL)[6] will be used as the measure of sensitivity for each measurement process.

Tables A.3-7 and A.3-8 list specific DQIs for water quality measurements, laboratory analyses of water samples.

3.4 Chemistry Quality Assurance/Quality Control

The types of samples analyzed and the procedures conducted for QA/QC samples collected in the field and analyzed in the laboratory are described in this section.

3.4.1 Field QC Chemistry Samples

Field QA/QC samples, such as field duplicates and rinsate blanks, are generally used to evaluate the efficiency of field decontamination procedures and the variability attributable to sample handling. One equipment blank will be generated once for each batch of water chemistry samples. An additional Niskin bottle sampler will be used to collect a field duplicate during the multi-day water chemistry monitoring associated with chemistry conditions 1 and 3. Note that the interval with the field duplicate may not be selected for analysis.

3.4.2 Laboratory Chemistry QC

Before analyzing the chemistry samples, the laboratory must provide written protocols for the analytical methods to be used, calculate reporting limits for each analyte in each matrix of interest as applicable, and establish an initial calibration curve for all analytes. The laboratory must also demonstrate its continued proficiency by participation in inter-laboratory comparison studies, and by repeated analysis of certified reference materials (CRMs), calibration checks, laboratory reagent and rinsate blanks, and spiked samples.

3.4.2.1 Chemistry Analysis QC Samples

Method-specific QC measures, such as MSs and MS duplicates or laboratory duplicates, will be analyzed per preparatory or analytical batch as specified in the analytical methods and Table A.3-9.

[6] The term method detection limit (MDL) includes other types of detection limits,. Recent revisions to EPA SW846 methods no longer require the calculation of MDLs.

Table A.3-9
Laboratory chemistry QC sample analysis summary

Analyte	Initial Calibration	Initial Calibration Verification (second source)	Continuing Calibration Verification	LCS	Laboratory Replicates	MSs	MSDs	Method Blanks	Surrogate Spikes
Dissolved metals	prior to analysis	after initial calibration	every 10 samples and at end of analytical sequence	1 per prep batch	1 per prep batch	1 per prep batch	na	1 per prep batch	na
Mercury	prior to analysis	after initial calibration	every 10 samples and at end of analytical sequence	1 per prep batch	1 per prep batch	1 per prep batch	na	1 per prep batch	na
PCB Aroclors	prior to analysis	after initial calibration	before and after sample analysis, every 10-20 analyses or 12 hours	1 per prep batch	na	1 per prep batch	1 per prep batch	1 per prep batch	each sample

Notes:
A batch is a group of samples of the same matrix analyzed or prepared at the same time, not exceeding 20 samples.
LCS: laboratory control sample
na: not applicable or not available
QC: quality control

3.4.2.2 Laboratory QC Samples

The analyst will review the results of QC analyses from each laboratory prep batch immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine whether control limits have been exceeded.

If control limits have been exceeded, then appropriate corrective action, such as recalibration followed by reprocessing of the affected samples, must be initiated before a subsequent group of samples is processed. The project QA/QC Coordinator must be contacted immediately by the laboratory Project Manager (PM) if satisfactory corrective action to achieve the DQIs outlined in this WQMP is not possible. All laboratory corrective action reports relevant to the analysis of project samples must be included in the data deliverable packages.

All primary chemical standards and standard solutions used in this project will be traceable to the National Institute of Standards and Technology, Environmental Resource Associates, National Research Council of Canada, or other documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparing them to independent standards. Laboratory QC standards are verified in a multitude of ways: second-source calibration verifications (i.e., same standard, two different vendors) are analyzed to verify initial calibrations; new working standard mixes (e.g., calibrations, spikes, etc.) are verified against the results of the original solution and must be within 10% of the true value; or newly purchased standards are verified against current data. Any impurities found in the standard will be documented.

The following sections summarize the procedures that will be used to assess data quality throughout sample analysis. Table A.3-8 summarizes the QC procedures to be performed by the laboratory, as well as the associated control limits for precision and accuracy.

3.4.2.2.1 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of 1 method blank will be analyzed per prep batch or for every 20 samples, whichever is more frequent.

3.4.2.2.2 Laboratory Control Samples

LCSs are prepared from a clean matrix using the same process as the project samples that are spiked with known amounts of the target compounds. The recoveries of the compounds are used as a measure of the accuracy of the test methods. An LCS duplicate will be analyzed for metals, mercury, and PCB Aroclors.

3.4.2.2.3 Laboratory Replicate Samples

Laboratory replicate samples provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Laboratory replicates are subsamples of the original sample that are prepared and analyzed as a separate sample, assuming sufficient sample matrix is available. A minimum of 1 laboratory replicate sample will be analyzed for prep batch or for every 20 samples, whichever is more frequent, for inorganic and conventional parameters.

3.4.2.2.4 Matrix Spikes and Matrix Spike Duplicates

The analysis of matrix spike (MS) samples provides information on the extraction efficiency of the method on the sample matrix. By performing MSD analyses, information on the precision of the method is also provided for organic analyses. For organic analyses, a minimum of 1 MS/MSD pair will be analyzed for each prep batch or for every 20 samples, whichever is more frequent, when sufficient sample volume is available, For inorganic analyses (i.e., metals), a minimum of one MS sample will be analyzed for each prep batch, when sufficient sample volume is available.

3.4.2.2.5 Surrogate Spikes

All project samples analyzed for PCBs will be spiked with appropriate surrogate compounds as defined in the analytical methods. Surrogate recoveries will be reported by the laboratories; however, no sample results will be corrected for recovery using these values.

3.4.2.2.6 Internal Standard Spikes

Internal standards may be used for calibrating and quantifying organic compounds and metals using MSs. If internal standards are required by the method, all calibration, QC, and project samples will be spiked with the same concentration of the selected internal standard(s). Internal standard recoveries and retention times must be within method and/or laboratory criteria.

3.5 Instrument/Equipment Testing, Inspection, Calibration, and Maintenance

3.5.1 Conventional Monitoring Equipment

The Water Quality Monitoring Lead will be responsible for overseeing the testing, inspection, and maintenance of all field equipment. Prior to each sampling event, measures will be taken to test, inspect, and maintain all field equipment. All equipment used, including the multi-parameter water quality meter, differential global positioning system (GPS) unit, and digital camera, will be tested for accuracy before leaving for the field event.

The multi-parameter water quality meter will be used to collect in situ water quality data (i.e., specific conductance, temperature, DO, pH and turbidity) at each sampling station and associated with each composite sample, as outlined in this WQMP. All sensors, except temperature, require calibration to ensure high performance. The meter will be calibrated daily to ensure that the sensors meet the manufacturer's accuracy specifications for specific conductance, DO, pH, and turbidity.

A Trimble© SPS461 or similar GPS receiver unit will be employed for the various sampling methods outlined in this WQMP. The GPS receiver will be calibrated daily to ensure that it is accurately recording positions from known benchmarks and functioning within the individual unit's factory specifications.

3.5.2 Analytical Equipment

The laboratory PM will be responsible for ensuring laboratory equipment testing, calibration, inspection, and maintenance requirements are met.

Multipoint initial calibration will be performed on each analytical instrument at the start of the project, after each major interruption to the instrument, and when any continuing calibration does not meet the specified criteria. The number of points used in the initial calibration is defined in each analytical method. Continuing calibrations will be performed daily for organic analyses and every 10 samples for inorganic analyses to ensure proper instrument performance.

Calibration of analytical equipment used for chemical analyses includes the use of instrument blanks or continuing calibration blanks, which provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately after the continuing calibration verification, at a frequency of 1 blank for every 10 samples analyzed for inorganic analyses and 1 blank every 12 hours for organic analyses. If the continuing calibration does not meet the specified criteria, the analysis must stop. Analysis may resume after corrective actions have been taken to meet the method specifications. All project samples analyzed by an instrument found to be out of compliance must be reanalyzed.

3.6 Inspection/Acceptance of Supplies and Consumables

The Water Quality Monitoring Lead will gather and check field supplies daily for satisfactory conditions before each field event. Batteries used in any field gear will be checked daily and recharged as necessary. Supplies and consumables for the field sampling effort will be inspected upon delivery and accepted if the condition of the supplies is satisfactory.

3.7 Data Management

All field data will be recorded on field forms, which the Water Quality Monitoring Lead will check for missing information at the end of each field day and amend as necessary. A QC check will be done to ensure that all data have been transferred accurately from the field forms to the database.

The analytical laboratories are required to submit data in an electronic format. The laboratory PM will contact the project Data Manager prior to data delivery to discuss specific format requirements.

A library of routines will be used to translate typical electronic output from laboratory analytical systems and to generate data analysis reports. The use of automated routines will ensure that all data are consistently converted to the desired data structures, and that operator time is kept to a minimum. In addition, routines and methods for quality checks will be used to ensure such translations are correctly applied.

Written documentation will be used to clarify how field and analytical laboratory duplicates and QA/QC samples were recorded in the data tables, and to provide explanations of other issues that may arise. Accurate records of field and laboratory QA/QC samples will be maintained so that project team members who use the data will have appropriate documentation.

4 Reporting

This section presents the daily, weekly, and final reporting of water quality monitoring results.

4.1 Daily Reporting

Field observations and measurement data will be recorded in a Water Quality Monitoring Form, including the following:

- Monitoring station (background or compliance station and approximate river mile)
- Monitoring station coordinates
- Date and time
- Contractor dredging activity description
- Tidal phase (e.g., flood, ebb, or slack)
- Direction of monitoring, (i.e., downriver from the construction activity during ebb tide condition)
- Water depth at station
- Depth in the water column of each field parameter measurement (near-surface and near-bottom depths)
- Weather and current conditions

Completed forms will be scanned at the end of each field day and emailed to the EQAO.

4.2 Weekly Reporting

The results from each week's water quality monitoring activities will be compiled into a summary table with a comparison to water quality compliance criteria and provided to the EQAO and EPA. All reporting will include both regularly scheduled monitoring results and any additional monitoring results that may have been triggered by exceedances of water quality criteria.

4.3 Reporting of Exceedances

The Project Representative will notify EPA as soon as possible (within 2 hours) of a confirmed conventionals exceedance. A confirmed exceedance that occurs at the end of a workday (i.e., less than 2 hours of dredging remaining) will be reported to EPA at the beginning of the following workday. In the case of a confirmed turbidity exceedance, the Project Representative will also notify the Contractor and will direct the Contractor to implement corrective actions to return dredging operations to compliance with water quality criteria.

Chemical exceedances of acute or chronic criteria will be reported to EPA within 2 workdays of receipt of laboratory test results. Due to the timeframe to obtain chemistry results, any chemical exceedances will represent dredging activities in areas that have already been completed. Chemical exceedances will be discussed with EPA, along with conventional monitoring data, to help determine whether there is ongoing potential for chemical exceedances and a need to adjust dredging operations or compliance distances.

4.4 Laboratory Records

4.4.1 Chemistry Records

The analytical laboratories will be responsible for internal checks and data verification pertaining to sample handling and analytical data reporting, and they will correct errors identified during the QA review. The analytical laboratories will submit data packages electronically, including the following as applicable:

- **Project narrative**: This summary, in the form of a cover letter, will present any problems encountered during any aspect of sample analyses. The summary will include, but not be limited to, discussion of QC, sample shipment, sample storage, and analytical difficulties. The project narrative will document any problems encountered by the laboratory and their resolutions. In addition, the summary will provide operating conditions for instruments used for the analysis of each suite of analytes and definitions of laboratory qualifiers.
- **Records**: The data package will include legible copies of the chain of custody forms. This documentation will include the time of receipt and the condition of each sample received by the laboratory. These records will also document additional internal tracking of sample custody by the laboratory.
- **Sample results**: The data package will summarize the results for each sample analyzed. The summary will include the following information, as applicable:
    - Field sample identification code and corresponding laboratory identification code
    - Sample matrix
    - Date of sample extraction/digestion
    - Date and time of analysis
    - Weight used for analysis
    - Final dilution volumes or concentration factor for the sample Instruments used for analysis
    - MDLs[7] and reporting limits (RLs)[8]
    - All data qualifiers and their definitions.
- **QA/QC summaries:** These summaries will contain the results of all QA/QC procedures. Each QA/QC sample analysis will document the same information required for the sample results

[7] The term MDL includes other types of detection limits.
[8] RL values are consistent with the lower limit of quantitation values required under EPA-846.

(see previous bullet). The laboratory will make no recovery or blank corrections. The required summaries will include the following, as applicable:

- The calibration data summary will contain the concentrations of the initial calibration and daily calibration standards and the date and time of analysis. This summary will also list the response factor, percent relative standard deviation, relative percent difference (RPD), and retention time for each analyte, as appropriate, as well as standards analyzed to indicate instrument sensitivity.
- The internal standard area summary will report the internal standard areas, as appropriate.
- The method blank analysis summary will report the method blank analysis associated with each sample and the concentrations of all compounds of interest identified in those blanks.
- The surrogate spike recovery summary will report all surrogate spike recovery data for organic analyses, and it will list the names and concentrations of all compounds added, percent recoveries, and QC limits.
- The MS recovery summary will report the MS or MS/ MSD recovery data for analyses, as appropriate, including the names and concentrations of all compounds added, percent recoveries, and QC limits. The MS recovery summary will also report the RPD for all MS and MSD analyses.
- The matrix duplicate summary will report the RPD for all matrix duplicate analyses and will list the QC limits for each compound or analyte.
- The LCS analysis summary will report the results of the analyses of LCSs, including the QC limits for each compound or analyte.
- The relative retention time summary will report the relative retention times for the primary and confirmational columns of each analyte detected in the samples and the percent differences between the columns, as appropriate.

- **Original data**: The data package will include legible copies of the original data generated by the laboratory, including the following:
  - Sample extraction/digestion, preparation, and cleanup logs
  - Instrument specifications and analysis logs for all instruments used on days of calibration and analysis
  - Enhanced and unenhanced spectra of target compounds detected in field samples and method blanks, with associated best-match spectra and background-subtracted spectra, for all gas chromatography/mass spectrometry analyses
  - Enhanced and unenhanced spectra of target performance reference compounds detected in field samples, field blanks, and method blanks, with associated best-match spectra and background-subtracted spectra, for all gas chromatography/mass spectrometry analyses

  - Quantitation reports for each instrument used, including reports for all samples, blanks, calibrations, MSs/MSDs, laboratory replicates, LCSs, and CRMs.

The analytical laboratories will submit data electronically in EarthSoft EQuIS® standard four-file or EZ electronic data deliverable format, or in an alternative format to be specified prior to the implementation of this WQMP. Guidelines for electronic data deliverables for chemical data will be communicated to the analytical laboratories by the Data Manager. All electronic data submittals must be tab-delimited text files, or a format specified prior to implementation of this WQMP, that include all results, MDLs (as applicable), and RLs consistent with those provided in the laboratory report. If laboratory replicate analyses are conducted on a single submitted field sample, the laboratory sample identifier must distinguish among the replicate analyses.

4.4.2 Data Reduction

Data reduction is the process by which original data (i.e., analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which the appropriate project personnel will then subject to further review and reduction. The laboratory will generate the data in a format amenable to review and evaluation. Data reduction may be performed manually or electronically.

4.4.3 Data Storage and Backup

All electronic files related to the project will be stored on a secure server, with server contents backed up regularly

4.5 Water Quality Monitoring Report

After all construction has been completed, the water quality monitoring data for the entire upper reach construction project will be provided to EPA as part of the Remedial Action Project Report. The section on water quality monitoring will contain:

- Any deviations from the WQMP and reasons for the deviations
- Tabular summaries of all water quality monitoring data with comparisons to water quality compliance criteria
- Narrative discussion of any water quality exceedances, probable cause(s) of the exceedance(s) if known, results of follow-up measurements, agency communications and decisions, and actions taken to mitigate the exceedance(s), including implementation of additional or enhanced BMPs
- Lessons learned regarding BMP implementation and effectiveness

- An appendix containing all completed Water Quality Monitoring Forms
- Documentation of instrument calibration (upon request)
- An appendix containing results from any chemistry testing conducted

In addition, a summary and tabulated results of water quality monitoring results will be included in an Annual Construction Summary Technical Memorandum, which will be submitted by the Contractor after each construction season has been completed (see CQAP for more information).

5 Corrective Actions

Corrective actions will be implemented to address water quality exceedances.

In the event of a confirmed turbidity water quality exceedance, the Project Representative will notify the Contractor and EPA Project Manager as soon as possible (within two hours) of the confirmed turbidity exceedance, and will direct the Contractor to identify and implement its approach to return dredging operations to compliance with water quality criteria. The approach may involve modifying operations or implementing additional BMPs. Additional corrective actions may be required in the event of confirmed turbidity water quality exceedances at the compliance station; these actions are described in Section 3.1.6. If the water quality turbidity exceedance continues, even with additional BMPs and/or operational modifications, the Project Representative will discuss next steps with the Contractor and EPA. The path forward could include some or all of the following:

- Implement more aggressive BMPs or operational modifications
- Increase the compliance boundary distance for turbidity if the chemistry sample testing indicates there are no exceedances of chemical water quality criteria

If these options are not successful, it may be necessary to temporarily stop work to further assess the source of the exceedance, identify effective mitigation measures.

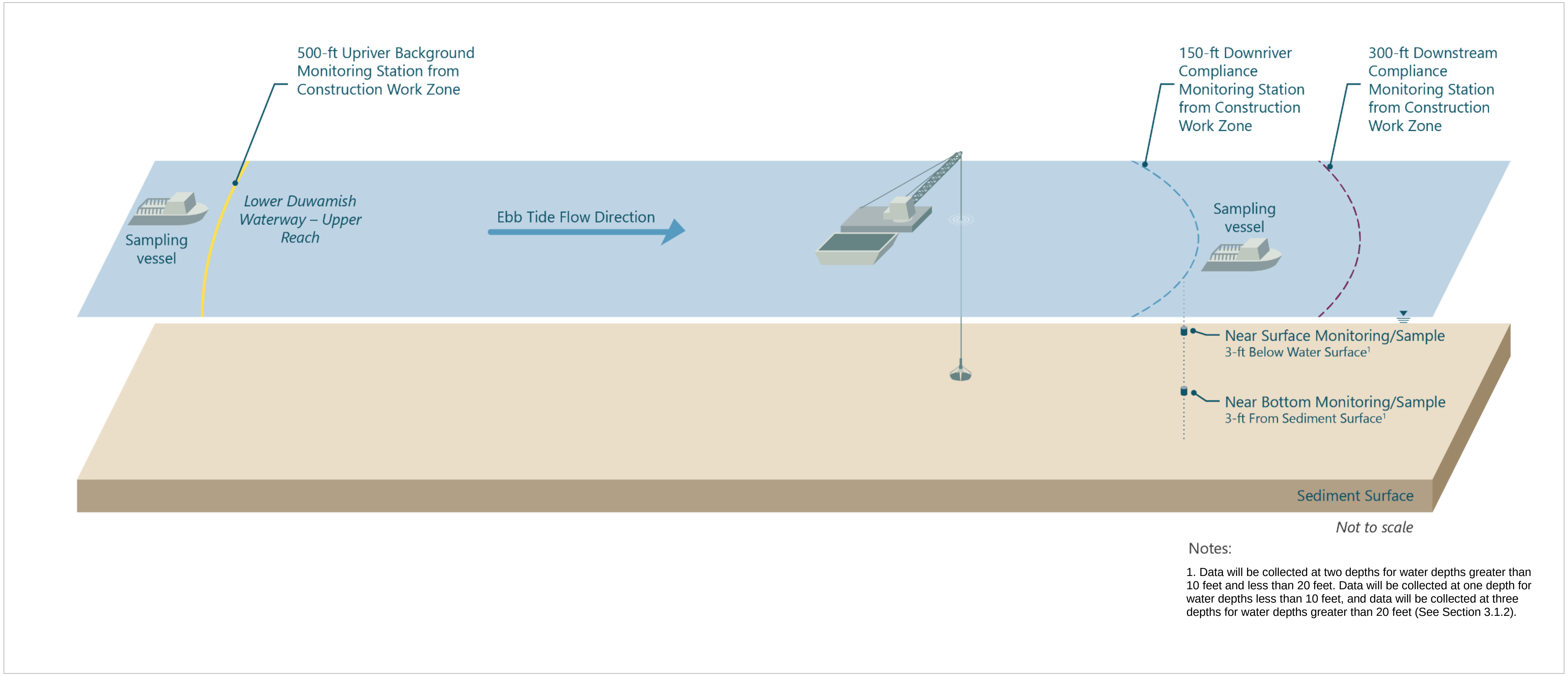
6 References

EPA. 2014. Record of Decision. Lower Duwamish Waterway Superfund Site. US Environmental Protection Agency.

EPA. 2021. Proposed explanation of significant differences. Draft for public comment. Lower Duwamish Waterway Superfund site. US Environmental Protection Agency Region 10, Seattle, WA.

Windward. 2017. Baseline surface water collection and chemical analyses - quality assurance project plan. Final. Submitted to EPA on August 2, 2017. Lower Duwamish Waterway Pre-Design Studies. Windward Environmental LLC, Seattle, WA.

Figures



Notes:

1. Data will be collected at two depths for water depths greater than 10 feet and less than 20 feet. Data will be collected at one depth for water depths less than 10 feet, and data will be collected at three depths for water depths greater than 20 feet (See Section 3.1.2).

Figure A.3-1
Water Quality Monitoring Stations and Depths

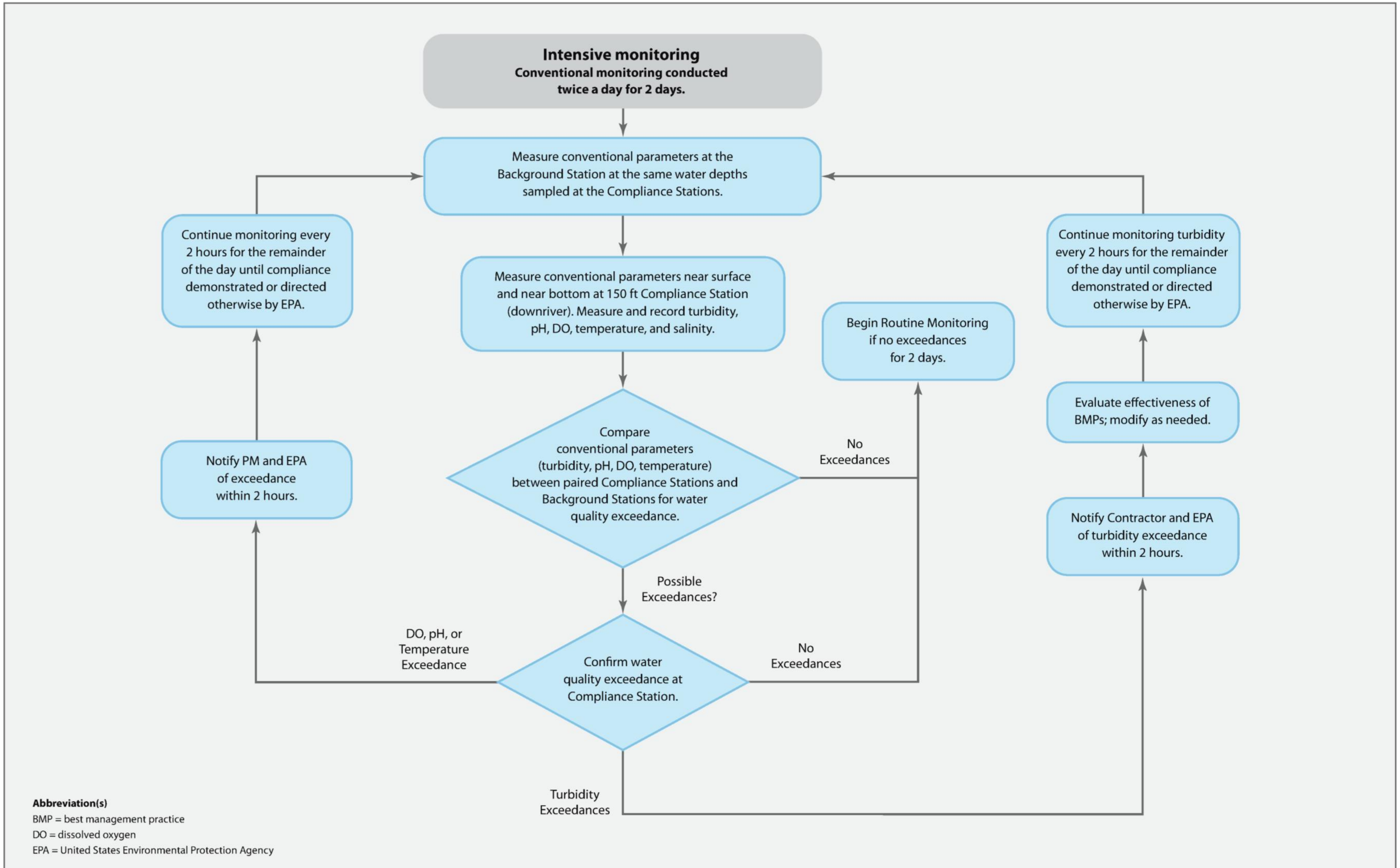
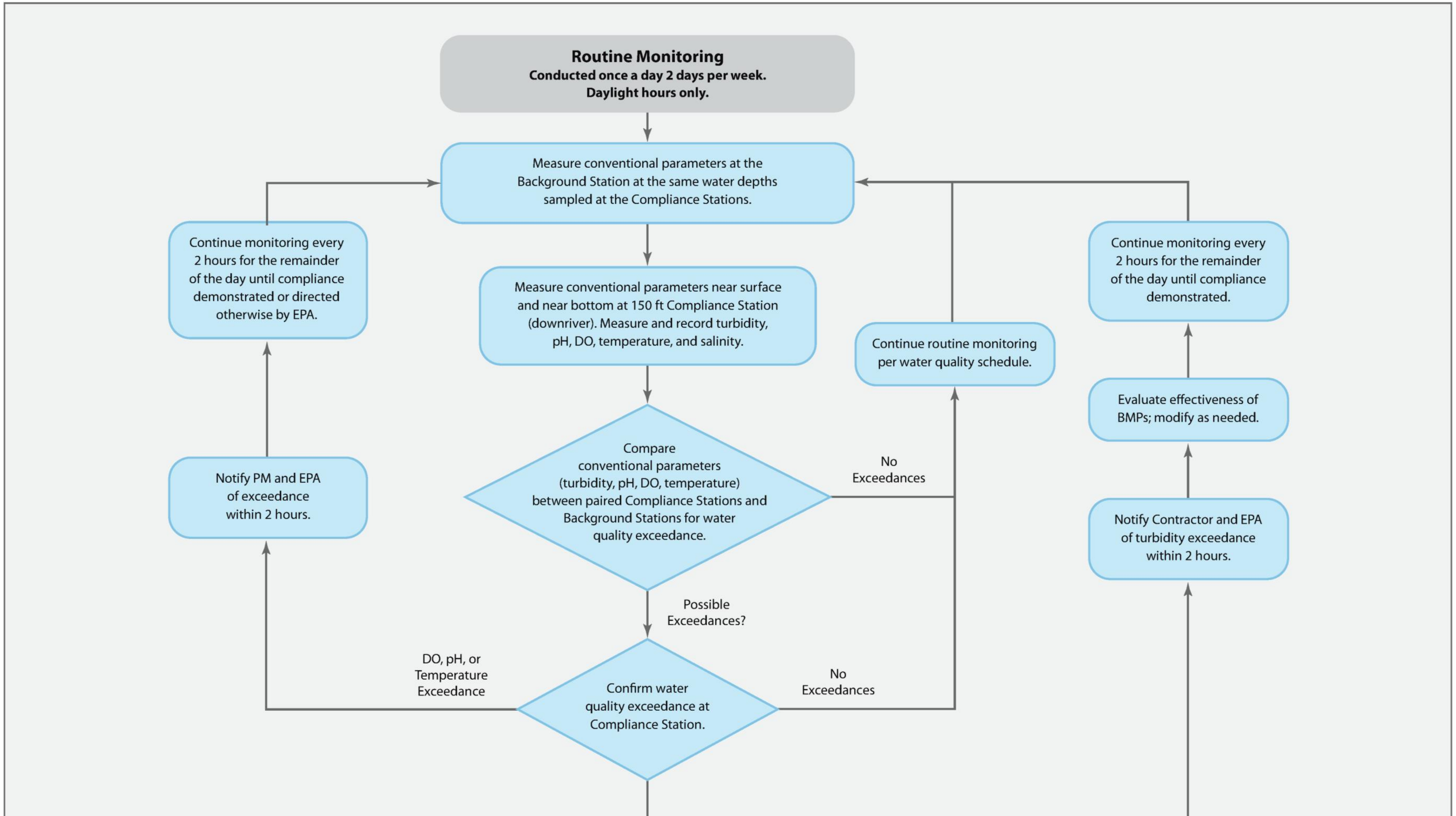


Figure A.3-2
Intensive Monitoring for Conventionals



Abbreviation(s)
BMP = best management practice
DO = dissolved oxygen
EPA = United States Environmental Protection Agency

Figure A.3-3
Routine Monitoring for Conventionals

90% Remedial Design Volume II, Part I

Appendix B
Construction Sediment Sampling Quality Assurance Project Plan

Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

90% Remedial Design Volume II, Part I

Construction Quality Assurance Plan for the Lower Duwamish Waterway - Upper Reach

Appendix B – Construction Sediment Sampling Quality Assurance Project Plan

For submittal to

The US Environmental Protection Agency
Region 10
Seattle, WA

July 24, 2023

Prepared by:

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TITLE AND APPROVAL PAGE

Construction Sediment Sampling Quality Assurance Project Plan

Project Owner's Project Manager

____________________ Name __________ Date

Environmental Quality Assurance Officer

____________________ Name __________ Date

Sediment Sampling Lead

____________________ Name __________ Date

EPA Project Manager

____________________ Name __________ Date

EPA Regional QA Manager

____________________ Name __________ Date

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ATTACHMENTS

ABBREVIATIONS

%RSD	relative standard deviation
BBP	butyl benzyl phthalate
BODR	Basis of Design Report
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CQAP	Construction Quality Assurance Plan
CRM	certified reference material
DQI	data quality indicator
DQO	data quality objective
DU	Decision Unit
dw	dry weight
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
EQAO	Environmental Quality Assurance Officer
ESD	Explanation of Significant Differences
GC/ECD	gas chromatography/electron capture detection
GC/MS	gas chromatography/mass spectrometry
HPAH	high-molecular-weight polycyclic aromatic hydrocarbon
HpCDD	heptachlorodibenzo-*p*-dioxin
HpCDF	heptachlorodibenzofuran
HRGC/HRMS	high-resolution gas chromatography/high-resolution mass spectrometry
HSP	health and safety plan
HxCDD	hexachlorodibenzo-*p*-dioxin
HxCDF	hexachlorodibenzofuran
ICP/MS	inductively coupled plasma
ID	identification
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LDW	Lower Duwamish Waterway
LPAH	low-molecular-weight polycyclic aromatic hydrocarbon
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
OC	organic carbon
OCDD	octachlorodibenzo-*p*-dioxin
OCDF	octachlorodibenzofuran
PAH	polycyclic aromatic hydrocarbon

PCB	polychlorinated biphenyl
PeCDD	pentachlorodibenzo-*p*-dioxin
PeCDF	pentachlorodibenzofuran
PM	Project Manager
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RAA	remedial action area
RAL	remedial action level
RAO	remedial action objective
RD	remedial design
RL	reporting limit
RMC	residuals management cover
ROD	Record of Decision
RPD	relative percent difference
SCUM	Sediment Cleanup User's Manual
SDG	sample delivery group
SM	Standard Method
SMA	Sediment Management Area
SOP	standard operating procedure
SVOC	semivolatile organic compound
TCDD	tetrachlorodibenzo-*p*-dioxin
TCDF	tetrachlorodibenzofuran
TEQ	toxic equivalent
TOC	total organic carbon
UCT-KED	universal cell technology/kinetic energy discrimination

1 Introduction

This Construction Sediment Sampling Quality Assurance Project Plan (Sediment QAPP) is an appendix to the Construction Quality Assurance Plan (CQAP) for the upper reach of the Lower Duwamish Waterway (LDW). The purpose of this Sediment QAPP is to outline the post-dredge sediment sampling and the associated sampling and analyses methods. Sediment samples, once post-dredge elevation requirements have been achieved, will be collected to assess generated residuals and potential missed inventory to determine if contingency actions are needed. In addition, this Sediment QAPP includes sediment sampling before and after dredging near public access areas to verify that dredging residuals have not contaminated these areas.

This QAPP provides the specific requirements for construction sediment sampling, including data quality objectives (DQOs), sampling design, and all methods and procedures needed to collect and analyze sediment samples. U.S. Environmental Protection Agency (EPA) guidance for QAPPs was followed in preparing this document (EPA 2002). The remainder of this QAPP is organized into the following sections.

- Section 2 – Project Objectives and Description
- Section 3 – Project Organization and Responsibilities
- Section 4 – Data Generation and Acquisition
- Section 5 – Assessment and Oversight
- Section 6 – Reporting
- Section 7 – References

This QAPP has three attachments. Attachment B.1 provides the field collection forms, Attachment B.2 presents standard operating procedures (SOPs), and Attachment B.3 presents the laboratory methods and the associated reporting limits (RLs). The Archaeological Monitoring and Inadvertent Discovery Plan for all construction-related activities (which applies to subsurface core samples) is provided in Appendix D of the CQAP. The health and safety plan (HSP), which is designed to protect on-site personnel from physical, chemical, and other hazards posed by the field sampling effort, is Appendix E of the CQAP. Attachment B.1 (field forms), Attachment B.3 (laboratory methods and RLs), and the HSP will be prepared after 100% remedial design (RD).

2 Project Objectives and Description

This section presents the DQOs for the construction sediment sampling, and an overview of the schedule/sequencing for how the sediment sampling fits with the rest of the construction work.

2.1 Data Quality Objectives

The primary purpose of the sediment sampling described in this QAPP is to collect sediment samples to assess generated residuals or potential missed inventory for each Sediment Management Area (SMA)[1] to determine if contingency actions are needed, as discussed in Section 5.2 of the CQAP. The DQOs for construction sediment sampling are provided below for both Decision Unit (DU)[2] sampling (DQOs 1 and 2) and perimeter[3] sampling (DQOs 3 and 4). The seven-step DQO process is summarized in Table B2-1 for each of the four DQOs.

- **DQO 1**: For each DU, determine if there is missed inventory within the toe of dredge[4] footprint.
- **DQO 2**: For each DU, assess whether there are generated residuals in surface sediment within the toe of the dredge footprint.
- **DQO 3**: Assess whether there are generated residuals in surface sediment in the outer perimeter of the dredge area.
- **DQO 4**: Assess whether there are generated residuals in the intertidal sediment adjacent to public access areas (applies only to SMAs adjacent to public access areas).

[1] As described in the Basis of Design Report (BODR), SMAs consist of grouped or subdivided remedial action areas (RAAs) with similar logistical considerations such as common construction methods, adjacent locations, and similar site conditions. SMAs are used to organize activities and to define discrete areas for construction management (e.g., construction sequencing).

[2] For the purposes of evaluating the removal actions and conducting construction sediment sampling, each SMA has been divided into DUs), such that there are approximately four to six DUs per acre within the compliance area (toe of cut). DUs are discussed further in Section 4.1.

[3] Perimeter sampling will be conducted in the outer perimeter area, which is a 20-foot-wide area outside of the inner perimeter boundary, except for downstream of the SMA, where the outer perimeter is 30 ft wide. The inner perimeter is the 20-ft-wide area (30 ft wide downstream) starting from the top of the dredge cut that will receive residuals management cover (RMC) placement (no sampling will occur in the inner perimeter). Perimeter areas are discussed further in Section 4.1.

[4] The toe of the dredge cut is the horizontal boundary surrounding the deepest elevation or thickness of dredging representing the target depth. Side slopes connect the toe of dredging to the existing mudline surface using either 2 horizontal to 1 vertical (2H:1V) or 3H:1V slope cuts, as described in the BODR.

Table B2-1
Construction Monitoring DQOs and Stepped Analysis

DQO Step	DU Sampling		Perimeter Sampling	
	DQO 1	**DQO 2**	**DQO 3**	**DQO 4**
STEP 1: State the problem	Data are needed to determine if there is missed inventory within the toe of the dredge footprint for a given DU.	Data are needed to assess whether there are generated residuals within the toe of the dredge footprint for a given DU.	Data are needed to assess whether there are generated residuals in the outer perimeter of the dredge area.	Data are needed to assess whether there are generated residuals in intertidal sediment adjacent to public access areas.
STEP 2: Identify the goals of the study	Determine if subsurface sediment in the post-dredge 0-30 cm interval has concentrations greater than thresholds (see Section 5.2 of the CQAP), and if yes, determine depth of contamination.	Determine if surface sediment (0-10 cm) concentrations within the dredge footprint are greater than thresholds (see Section 5.2 of the CQAP).	Determine if surface sediment (0-10 cm) concentrations within the outer perimeter are greater than thresholds (see Section 5.2 of the CQAP).	Determine if post-dredge surface sediment (0-10 cm) concentrations near public access areas are greater than thresholds (see Section 5.2 of the CQAP).
STEP 3: Identify the information inputs	Remedy design (drawings) will be used to determine DUs and sampling locations; surface and subsurface sediment data in the design dataset for the upper reach of the LDW will be used to determine analytes.			
STEP 4: Define the boundaries of the study	Within and adjacent to SMAs in the upper reach of the LDW that require dredging			
STEP 5: Develop the analytical approach	Analytes will be specific to each SMA based on the upper reach design dataset			
STEP 6: Specify performance or acceptance criteria	Performance or acceptance criteria are described in Sections 4.8 and 4.9, including field QC samples and laboratory QC samples. DQIs for laboratory analysis will be met, as described in Sections 4.8 and 4.9.			
STEP 7: Develop the detailed plan for obtaining data	Collect subsurface cores (approximately 0–120 cm [0–4 feet]) in each DU.[1] Cores will be sampled in 30-cm intervals.	Collect surface sediment samples (0–10 cm) within toe of dredge footprint in each DU.	Collect surface sediment samples (0–10 cm) around the outer perimeter of the dredge area.	Collect 0–10-cm composite sample adjacent to public access area

Notes:
1. The toe of dredge cut is the horizontal boundary surrounding the deepest elevation or thickness of dredging representing the target depth.
CQAP: Construction Quality Assurance Plan
DQO: data quality objective
DU: Decision Unit
LDW: Lower Duwamish Waterway
SMA: sediment management area

2.2 Project Approach and Schedule

This section provides an overview of the approach and schedule for sediment sampling during construction. The in-water components of the upper reach remedy will be conducted within the LDW-designated in-water work window, which is expected to occur between October 1 and February 15, annually. Scheduling will also take into account the tribal net fishery. Remedial construction for the upper reach is anticipated to require three construction seasons, as discussed in Section 13 of the BODR.

Construction sediment sampling will be conducted separately for each SMA (or group of SMAs) for which removal actions have been conducted. The sampling sequence is summarized below.

- **Collect samples prior to dredging (for SMAs near public access areas)** – A public access area composite sample will be collected and archived prior to dredging if a public access area is within 150 ft of the SMA to be dredged (DQO 4)[5].
- **Conduct dredging** – The Remedial Action Contractor (Contractor) will conduct dredging in accordance with project specifications and drawings. Once the Contractor has completed dredging an SMA, the Contractor will conduct a survey to verify that post-dredge elevations/thicknesses have been accepted.
- **Collect sediment samples** – After the required dredge elevations/thicknesses have been accepted, the construction sediment sampling will be conducted (DQOs 1 through 4). These samples will be submitted to the laboratory for analysis (with an expedited turnaround time) and used to determine if contingency re-dredging is needed.
- **Determine if contingency re-dredging is needed** – The target timeline to determine whether contingency re-dredging is needed is 15 calendar days, which includes sample collection, laboratory analysis, data processing, and consultation with EPA.
- **Conduct contingency re-dredging (if needed)** – If the results of the first round of sampling indicate that contingency re-dredging is needed (as described in Section 5.2 of the CQAP), the following steps will be taken on a DU-specific basis:
    - **Complete contingency re-dredging** – The Contractor will complete the specified contingency re-dredging. The contingency re-dredging will be considered complete once required contingency re-dredge elevations/thicknesses have been accepted.

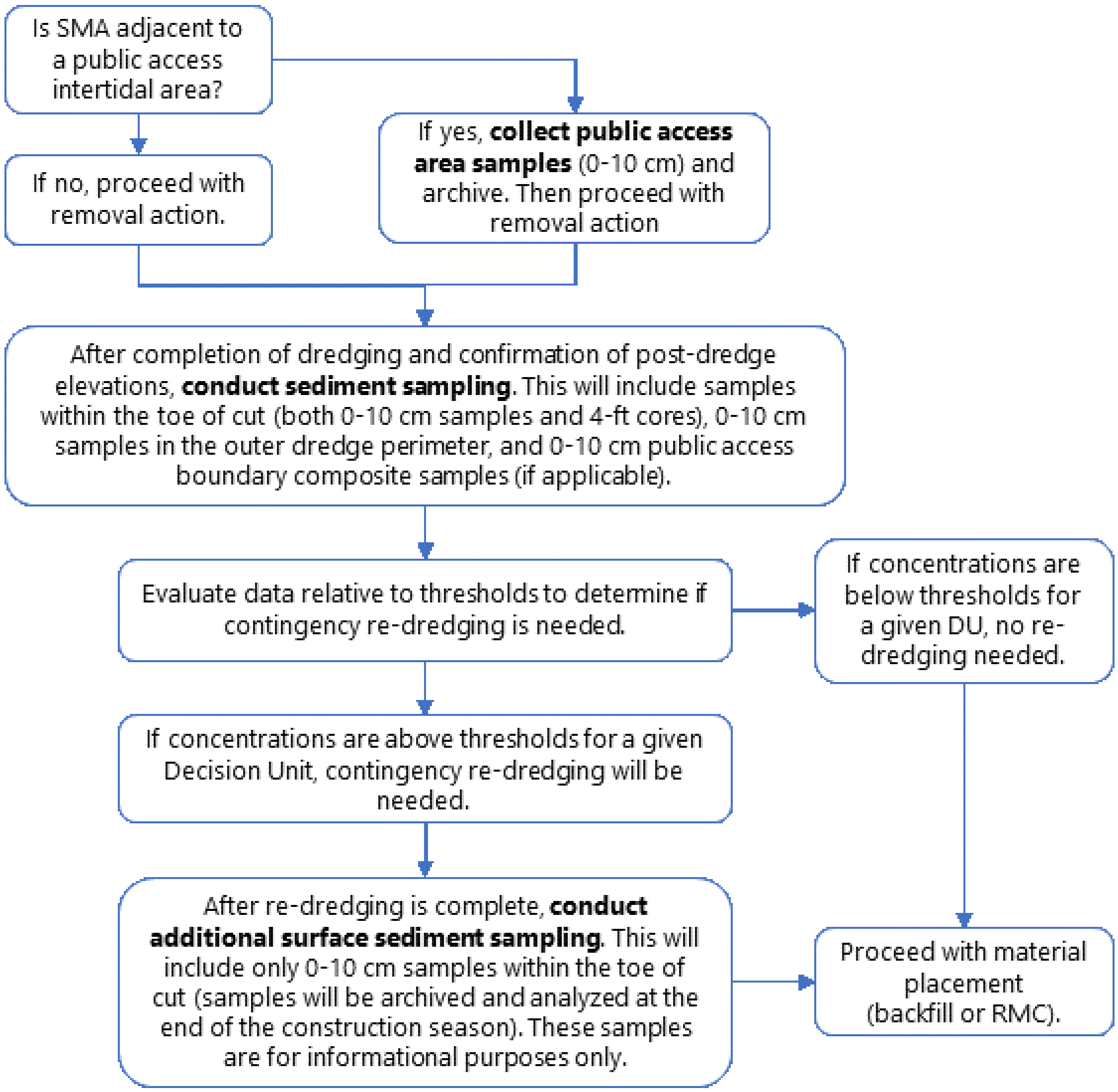
[5] Public access area composites will be collected near Duwamish Waterway Park (SMAs 17 and 18) and Duwamish People's Park (SMAs 14, 15, and 16), as described in Section 4.1.

    - **Collect an additional round of surface sediment samples** – After the contingency re-dredging has been completed and accepted, an additional round of surface sediment sampling within the toe of dredge in DUs where re-dredging was conducted will be conducted for informational purposes. These samples will be archived and analyzed at the end of each construction season. Results of from these samples will be presented in the Annual Construction Summary Technical Memorandum.

- **Place backfill or RMC –** Material will be placed as determined by the Project Representative and EPA.

This process is summarized in Figure B2-1.

Figure B2-1
Sequencing of Construction Sediment Sampling



3 Project Organization and Responsibilities

Overall project organization and team responsibilities are described in Section 2 of the CQAP. The following sections describe the responsibilities of key project team members involved in the construction sediment sampling work.

3.1 Project Representative

The Project Representative (TBD) will be assigned by the Owner to oversee the entire construction QA program. The Project Representative will be the only person authorized to direct the Contractor and will be kept updated on sediment sampling results. The Project Representative will work with the Environmental Quality Assurance Officer, Designer, and EPA to determine whether contingency actions are needed.

3.2 Environmental Quality Assurance Officer

The Environmental Quality Assurance Officer (EQAO) (TBD) will be responsible for coordinating, reviewing, and reporting all environmental monitoring activities, including construction sediment sampling. Key responsibilities related to construction sediment sampling will include the following:

- Reviewing field reports to verify that appropriate field methods and QC procedures are being implemented in accordance with the procedures specified in this QAPP
- Overseeing coordination of the field sampling and laboratory programs and supervising data review, including coordination with the analytical laboratories and the EPA QA chemist
- Reporting sediment sampling results to the Project Representative and EPA

3.3 Sediment Sampling Lead

The Sediment Sampling Lead (TBD) will be responsible for implementing sediment sampling activities. Key responsibilities associated with sediment sampling will include the following:

- Managing field sampling activities, field personnel, and general field and quality assurance/quality control (QA/QC) oversight related to sample collection
- Overseeing sample collection, preservation, and holding times, and coordinating delivery of environmental samples to the designated laboratories for chemical analyses.
- Verifying that station, sample collection, and field measurement results are properly recorded and forms are completely filled out
- Coordinating with the analytical laboratories (a laboratory coordinator may be identified prior to the implementation of the QAPP to assist with this coordination)
- Coordinating with additional individuals involved in sediment sampling (e.g., boat captains), who will be identified prior to the implementation of this QAPP
- Notifying the EQAO and Project Representative of sediment sampling results and providing all necessary supporting field documentation

3.4 Sampling Personnel

Under the Sediment Sampling Lead's oversight, field personnel will be responsible for conducting field activities, QA/QC procedures, and documentation of results.

3.5 Analytical Laboratory

The analytical laboratory (TBD) will perform all chemical analyses. The laboratory will meet the following requirements:

- Adhere to the methods outlined in this QAPP, including those methods referenced for each procedure
- Adhere to documentation, custody, and sample logbook procedures
- Implement QA/QC procedures defined in this QAPP
- Meet all reporting requirements
- Deliver electronic data files as specified in this QAPP
- Meet turnaround times for deliverables as described in this QAPP
- Allow EPA and the EQAO, or a representative, to perform laboratory and data audits.

3.6 Data Management

The Data Manager (TBD) will oversee data management; they will ensure that analytical data are incorporated into the LDW database with appropriate qualifiers following review of the data.

3.7 Special Training/Certification

The Superfund Amendments and Reauthorization Act of 1986 required the Secretary of Labor to issue regulations through the Occupational Safety and Health Administration providing health and safety standards and guidelines for workers engaged in hazardous waste operations. Accordingly, 29 Code of Federal Regulations 1910.120 requires that employees be given the training necessary to provide them with the knowledge and skills to enable them to perform their jobs safely and with minimum risk to their personal health. All sampling personnel will have completed the 40-hr HAZWOPER training course and 8-hr refresher courses, as necessary, to meet Occupational Safety and Health Administration regulations. The Sediment Sampling Lead will also have completed the eight-hour HAZWOPER supervisor training.

In addition, all analytical laboratories will have current environmental laboratory accreditation from the Washington State Department of Ecology (Ecology) and other accreditation agencies for the analytical methods to be used. Any exceptions will be identified prior to implementation of this QAPP.

3.8 Documentation and Records

Field observations and laboratory records will be documented following the protocols described in this section. In addition, this section provides data reduction rules and data report formats.

3.8.1 Field Observations

All field activities will be recorded in a field logbook maintained by the Sediment Sampling Lead or designee. The field logbook will provide a description of all sampling activities, conferences among the Sediment Sampling Lead, EQAO, and EPA oversight personnel associated with field sampling activities, sampling personnel, and weather conditions, as well as a record of all modifications to the procedures and plans identified in this QAPP and the HSP (Appendix E of the CQAP). The field logbook will consist of bound, numbered pages, and all entries will be made in indelible ink. Photographs will provide additional documentation of the sample collection activities. The field logbook is intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

The project team will use the following field forms (Attachment B.1) to record pertinent information after sample collection:

- Surface sediment collection form
- Sediment core collection form
- Sediment core processing log
- Protocol modification form
- Chain of custody form.

The project team will document information regarding equipment calibration and other sampling activities in the field logbook.

3.8.2 Laboratory Records

3.8.2.1 Chemistry Records

The analytical laboratories will be responsible for internal checks and data verification pertaining to sample handling and analytical data reporting, and will correct errors identified during the QA review. The analytical laboratories will submit data packages electronically, including the following as applicable:

- **Project narrative**: This summary, in the form of a cover letter, will present any problems encountered during any aspect of sample analyses. The summary will include, but not be limited to, discussion of QC, sample shipment, sample storage, and analytical difficulties. The project narrative will document any problems encountered by the laboratory and their resolutions. In addition, the summary will provide operating conditions for instruments used for the analysis of each suite of analytes and definitions of laboratory qualifiers.
- **Records**: The data package will include legible copies of the chain of custody forms. This documentation will include the time of receipt and the condition of each sample received by the laboratory. These records will also document additional internal tracking of sample custody by the laboratory.
- **Sample results**: The data package will summarize the results for each sample analyzed. The summary will include the following information, as applicable:
    - Field sample identification (ID) code and corresponding laboratory ID code
    - Sample matrix
    - Date of sample extraction/digestion
    - Date and time of analysis
    - Weight used for analysis
    - Final dilution volumes or concentration factor for the sample
    - Instruments used for analysis
    - Method detection limits (MDLs)[6] and RLs[7]
    - All data qualifiers and their definitions.
- **QA/QC summaries:** These summaries will contain the results of all QA/QC procedures. Each QA/QC sample analysis will document the same information required for the sample results (see previous bullet). The laboratory will make no recovery or blank corrections, except for isotope dilution method correction prescribed by EPA. The required summaries will include the following, as applicable:

[6] The term MDL includes other types of detection limits, such as estimated detection limits calculated for dioxins/furans.
[7] RL values are consistent with the lower limit of quantitation values required under EPA-846.

  - The calibration data summary will contain the concentrations of the initial calibration and daily calibration standards and the date and time of analysis. This summary will also list the response factor, percent relative standard deviation (%RSD), relative percent difference (RPD), and retention time for each analyte, as appropriate, as well as standards analyzed to indicate instrument sensitivity.
  - The internal standard area summary will report the internal standard areas, as appropriate.
  - The method blank analysis summary will report the method blank analysis associated with each sample and the concentrations of all compounds of interest identified in those blanks.
  - The surrogate spike recovery summary will report all surrogate spike recovery data for organic analyses, and it will list the names and concentrations of all compounds added, percent recoveries, and QC limits.
  - The labeled compound recovery summary will report all labeled compound recovery data for EPA method 1613b, and it will list the names and concentrations of all compounds added, percent recovery, and QC limits.
  - The matrix spike (MS) recovery summary will report the MS or MS/matrix spike duplicate (MSD) recovery data for analyses, as appropriate, including the names and concentrations of all compounds added, percent recoveries, and QC limits. The MS recovery summary will also report the RPD for all MS and MSD analyses.
  - The matrix duplicate summary will report the RPD for all matrix duplicate analyses and will list the QC limits for each compound or analyte.
  - The certified reference material (CRM) analysis[8] summary will report the results of the CRM analyses and compare these results with published concentration ranges for the CRMs.
  - The LCS analysis summary will report the results of the analyses of LCSs, including the QC limits for each compound or analyte.
  - The relative retention time summary will report the relative retention times for the primary and confirmational columns of each analyte detected in the samples and the percent differences between the columns, as appropriate.
  - The ion abundance ratio summary for samples analyzed by EPA method 1613b will report computed ion abundance ratios compared to theoretical ratios listed in the applicable method.
- **Original data**: The data package will include legible copies of the original data generated by the laboratory, including the following:
  - Sample extraction/digestion, preparation, and cleanup logs
  - Instrument specifications and analysis logs for all instruments used on days of calibration and analysis

[8] CRMs will be analyzed for polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCB) Aroclors, and dioxins/furans. All other analyses will include a laboratory control sample (LCS). Specific information is listed in Section 4.10.

- Reconstructed ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, LCSs, and CRMs
- Enhanced and unenhanced spectra of target compounds detected in field samples and method blanks, with associated best-match spectra and background-subtracted spectra, for all gas chromatography/mass spectrometry (GC/MS) analyses
- Enhanced and unenhanced spectra of target performance reference compounds detected in field samples, day zero blanks, field blanks, and method blanks, with associated best-match spectra and background-subtracted spectra, for all GC/MS analyses
- Quantitation reports for each instrument used, including reports for all samples, blanks, calibrations, MSs/MSDs, laboratory replicates, LCSs, and CRMs.

The analytical laboratories will submit data electronically in EarthSoft EQuIS® standard four-file or EZ_EDD format, or in an alternative format to be specified prior to the implementation of this QAPP. Guidelines for electronic data deliverables for chemical data will be communicated to the analytical laboratories by the EQAO. All electronic data submittals must be tab-delimited text files, or in a format specified prior to implementation of this QAPP, that include all results, MDLs (as applicable), and RLs consistent with those provided in the laboratory report. If laboratory replicate analyses are conducted on a single submitted field sample, the laboratory sample identifier must distinguish among the replicate analyses.

3.8.3 Data Reduction

Data reduction is the process by which original data (i.e., analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which the appropriate project personnel will then subject to further review and reduction. The laboratory will generate the data in a format amenable to review and evaluation. Data reduction may be performed manually or electronically.

3.8.4 Data Storage and Backup

All electronic files related to the project will be stored on a secure server, with server contents backed up regularly.

4 Data Generation and Acquisition

This section presents an overview of data generation and acquisition for the construction sediment sampling program.

4.1 Sediment Sampling Design

This section presents the sampling design for the construction sediment sampling program. The final QAPP will include specific sampling locations, which cannot be determined until completion of 100% RD; thus, this draft QAPP presents the rationale for the sampling design that will be applied to each SMA once RD is final.

4.1.1 Sample Types and Placement

Sediment sampling conducted as part of the construction sediment sampling program will include the collection of samples to evaluate post-dredge conditions within each DU (DQOs 1 and 2), perimeter conditions (DQOs 3), and conditions near public access areas (DQO 4). These post-dredge samples will address generated residuals (i.e., post-dredge surface sediment contamination) and missed inventory (i.e., contamination remaining below the required dredge elevations/thicknesses). Comparison of these results with the specified thresholds will allow for a determination of whether a contingency action is needed (Section 5.2 of the CQAP).

For the purposes of evaluating the removal actions and conducting construction sediment sampling, each SMA has been divided into DUs, such that there are approximately four to six DUs per acre. The division of each SMA into DUs will be done such that the DU boundaries follow dredge prism boundaries, when possible, and generally represent regular rows of samples with approximately equal areas. One surface sample and one subsurface core will be collected in the approximate center of each DU to characterize sediment quality in that DU. In addition, surface sediment samples will be collected along the outer perimeter of the SMA and between the SMA and the two public access areas. The two public access intertidal areas identified as adjacent to SMAs with dredging are:

- Duwamish Waterway Park for SMA 17 and 18
- Duwamish Peoples Park for SMA 14, 15, and 16

These areas will warrant special consideration because of their proximity to dredging. A composite sample will be collected adjacent to each of these areas before and after dredging in order to evaluate dredge residuals. The public access composite sample will consist of three surface sediment grabs collected from the intertidal area between the outer perimeter of the SMA and the public access area. Material from each of the individual grabs will also be archived.

An overview of each sample type and planned sample placement to satisfy each of the four DQOs is provided in Table B4-1.

Table B4-1
Overview of Sample Types and Approach

DQO	Sample Type	Sample Placement
DU Sampling		
DQO 1: Determine if there is missed inventory within the toe of the dredge footprint.	Subsurface cores (approximately 0–120 cm [0–4 ft]), sampled in 30-cm increments resulting in 4 samples per core.[1]	Cores will be collected with a density of no fewer than 4 cores per acre within the toe of cut of the dredge area, each sample corresponding to 1 DU. The resulting sampling density will be between 4 and 6 locations per acre within the toe of cut.
DQO 2: Assess generated residuals in surface sediment within the toe of the dredge footprint.	Surface sediment samples (0–10 cm)	Surface sediment samples will be collected with a density of no fewer than 4 per acre within the toe of cut of the dredge area (i.e., approximately co-located with the cores for DQO 1). The resulting sampling density will be between 4 and 6 locations per acre within the toe of cut.
Perimeter Sampling		
DQO 3: Assess whether there are generated residuals in surface sediment in the outer perimeter of the dredge area.	Surface sediment samples (0–10 cm)	Surface sediment samples will be collected within the outer perimeter of the dredge area. Sample spacing will be approximately every 150 ft, except for the downstream end of the area where additional samples will be placed for tighter spacing.[2]
DQO 4: Assess whether there are generated residuals in the intertidal sediment adjacent to public access areas (applies only to SMAs adjacent to public access areas).	Composite consisting of surface sediment samples (0–10 cm)[3]	One composite sample will be created from three surface sediment samples collected in the intertidal area adjacent to a given public access area.

Notes:
1. As described in Section 4.2.3, fewer than four samples per core may be collected if native material is encountered.
2. The tighter spacing of sampling locations at the downstream end of each SMA provides better coverage in the direction of the predominant flow of the LDW, where generated residuals are more likely.
3. Material from each individual grab will also be archived.
DQO: data quality objective
DU: decision unit
LDW: Lower Duwamish Waterway

4.1.2 SMA-specific Analytes

Analytes for construction sediment sampling are specific to each SMA. Analytes for each SMA are determined based on remedial action level (RAL) exceedances (for surface or subsurface sediment) in the design dataset for the upper reach, as shown in Table B4-2. Total organic carbon (TOC) analysis will be conducted for all samples.

Table B4-2
SMA-specific Analytes

SMA[1]	RAA[1]	SMA-specific Analyte(s)[2]	
		Generated Residuals	Missed Inventory[3]
1	32, 34/35 (thin cut)	PCBs	not applicable
2	30, 31	PCBs	PCBs
3	29	PAHs	PAHs
4	28	PCBs	PCBs
5, 6	27	PCBs, mercury, dioxins/furans	PCBs, dioxins/furans
7	24/25/26	PCBs, dioxins/furans, BBP	PCBs, dioxins/furans; also BBP for DUs in RC1 areas
9	22	PCBs, mercury, lead, zinc, dioxins/furans, BBP	PCBs, dioxins/furans; also mercury, lead, zinc, BBP for DUs in Recovery Category 1 areas
11	19/20	PCBs	PCBs
12	14/15/16	PCBs	PCBs
	17 (thin cut)	PCBs, mercury	not applicable
14, 15, 16	4/5/6, 8	PCBs	PCBs
	12 (thin cut)	PCBs	not applicable
17, 18	1/2/3	PCBs	PCBs

Notes:
1. RAAs within an SMA for which dredging is not the selected cleanup technology are not included in this table.
2. All samples will also be analyzed for TOC. Chemicals that are transient in nature have been excluded from the analyte list because a RAL exceedance for these chemicals would not drive the need for contingency actions. This applies to benzoic acid in SMA 1 and phenol in SMAs 5 and 6.
3. Missed inventory sampling is not applicable for thin cut dredge areas. Consistent with the pre-design investigation sampling, missed inventory core samples will only be analyzed for chemicals with subsurface sediment RALs in a given area.
BBP: butyl benzyl phthalate
DU: Decision Unit
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
RAA: remedial action area
RAL: remedial action level
SMA: sediment management area
TOC: total organic carbon

4.1.3 Sampling Design Example

To illustrate the sampling design described in Sections 4.1.1 and 4.1.2, this draft Sediment QAPP presents an example of the preliminary sampling plan for SMAs 17 and 18 based on 90% RD and the sampling design outlined above. The final sampling design for these SMAs will be updated as needed in the final version of this Sediment QAPP.

The first step in applying the sampling design is to determine sampling location placement (Figure B4-1). The application of the sampling design for SMAs 17 and 18 is as follows:

- **SMA 17 DU samples** – SMA 17 has a total area of 1.41 acres based on the SMA boundary and an area of 0.98 acres within the toe of cut of the dredge prism. Based on its size, SMA 17 has been divided into six DUs, which represent a density of 6.1 samples per acre within toe of cut.
- **SMA 18 DU samples** – SMA 18 has a total area of 1.17 acres based on the SMA boundary and an area of 0.79 acres within the toe of cut of the dredge prism. Based on its size, SMA 18 has been divided into five DUs, which represent a density of 6.3 samples per acre within toe of cut.
- **Outer perimeter samples** – A total of 12 surface sediment sampling locations have been placed in the outer perimeter of SMAs 17 and 18, which are approximately 1,800 feet (Figure B4-1). This equates to approximately 1 sample every 150 feet, except on the downstream end of the area, where several additional sampling locations have been placed for tighter spacing. As shown in Figure B4-1, for SMAs that are connected (e.g., SMAs 17 and 18) or located close to one another (e.g., SMAs 16 and 17), there is no outer perimeter area and thus, there are no outer perimeter samples between these SMAs.
- **Public access boundary samples** – SMAs 17 and 18 are adjacent to Duwamish Waterway Park, so the surface sediment in the intertidal area will be characterized to assess if generated residuals are present. A composite sample consisting of three grabs from sampling locations between the edge of the outer perimeter boundary of SMAs 17 and 18 and the park will be collected and archived prior to dredging. A second composite sample will be collected after dredging is complete (Figure B4-1). This sampling approach will provide data to evaluate if generated residuals are present.

Based on the described sampling location placement, Table B4-3 summarizes the numbers of samples that will be collected for SMAs 17 and 18. Each of these samples will be analyzed for polychlorinated biphenyls (PCBs), as described in Section 4.1.2 and Table B4-2.

Figure B4-1
Example of Sample Placement for SMA 17 and 18 based on 90% Design

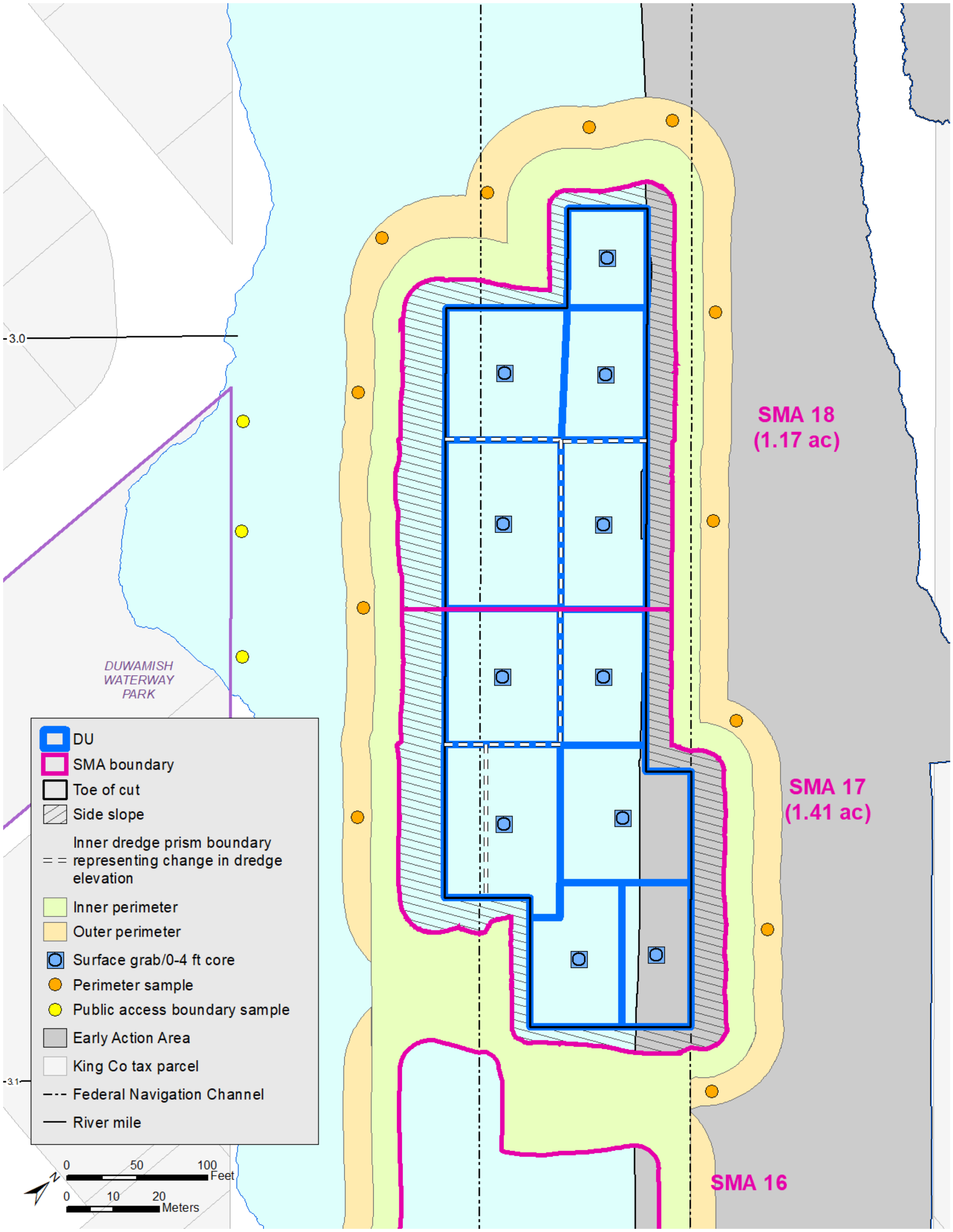


Table B4-3
Overview of Samples for SMAs 17 and 18 based on 90% RD

Sample Type	SMA 17	SMA 18	Total
DU Samples			
DQO 1: DU subsurface sediment cores	6 cores (24 samples)	5 cores (20 samples)	11 cores (44 samples)
DQO 2: DU surface sediment locations	6 samples	5 samples	11 samples
Perimeter Samples			
DQO 3: Outer perimeter locations	12 surface samples around outer perimeter		12 samples
DQO 4: Public access area samples	1 composite sample collected prior to dredging and 1 composite sample collected after dredging (each composite sample consisting of 3 surface grabs)[1]		2 composite samples

Notes:
1. Material from each individual grab will also be archived.
DQO: data quality objective
DU: Decision Unit
RD: remedial design
SMA: sediment management area

From a sequencing perspective, a public access area composite sample will be collected prior to the start of dredging and archived for potential future analysis if there is an exceedance in the post-dredge composite sample. Once dredging is complete and the required dredge elevations have been accepted, construction sediment sampling will be conducted. This will include DU surface and subsurface sediment sampling, outer perimeter sampling, and post-dredge composite sampling near the public access area. These samples will be submitted to the analytical laboratory for expedited analysis.

When received, sample results will be compared with the decision framework for determining contingency actions (Section 5.2 of the CQAP), and a meeting will be held within a day or two with key project representatives and EPA to determine if there is a need for contingency re-dredging.

If contingency re-dredging is needed, the Contractor will proceed as directed by the Project Representative. Once the contingency re-dredging has been completed and accepted, an additional round of sediment sampling will occur in the applicable DU, during which only surface sediment samples will be collected. These samples will be archived for analysis at the end of the construction season for informational purposes (results will be presented in the construction report).

4.2 Sampling Methods

This section provides methods to locate and collect surface and subsurface sediment samples. Detailed sediment sampling methods are included as SOPs in Attachment B.2.

4.2.1 Target Sampling Locations

Target sampling locations will be determined prior to construction. Sample collection will first be attempted within 3 m (10 ft) of the target coordinates. If this is not possible (e.g., due to an obstruction), the field crew will attempt sample collection by moving the sampling location to within a maximum distance of 10 m (32 ft) of the original location. For sampling locations where both surface (i.e., 0- to 10-cm) and subsurface sediment (i.e., 120-cm [4-ft] core) samples will be collected, the field crew will attempt to collect the samples as close together as possible.[9] For DU samples, the field crew will verify that the final sampling location remains within the targeted DU. Similarly, for the perimeter and public access boundary samples, the field crew will verify that the sampling locations remain within the outer perimeter area (or within the specified intertidal area for public access area samples).

If the initial attempt and three subsequent attempts (i.e., a total of four attempts) do not result in a sample that meets the appropriate acceptance criteria, a different sampling location may be selected in consultation with EPA, the EQAO, and the Project Representative.

4.2.2 Surface Sediment Collection

Surface sediment (0- to 10-cm) samples will be collected primarily using a power grab sampler deployed from a sampling vessel. When collection from a boat is not possible, sample collection from land may occur. Surface sediment grab sample collection and processing[10] will follow standardized procedures described in Ecology's Sediment Cleanup User's Manual (SCUM) (Ecology 2021). SOPs for the collection of surface sediment by boat and from land are presented in Attachment B.2. Sediment volumes are discussed in Section 4.8.

4.2.3 Subsurface Sediment Collection and Processing

Subsurface sediment core samples will be collected using a vibracorer deployed from a sampling vessel. The target depth for all cores will be 120 cm (approximately 4 ft). Each core will be processed as four 30-cm intervals (i.e., 0–30 cm, 30–60 cm, 60–90cm, and 90–120 cm); all material

[9] Surface sediment samples cannot be collected from the cores because insufficient volume for analysis would be available in the 0- to 10-cm section of the core.

[10] If samples are observed to contain more than 50% gravel (i.e., based on field observations), samples will be size-fractionated in the laboratory, consistent with methods used in the activated carbon pilot study, to ensure the analysis of a representative sample.

from deeper than 120 cm will be discarded.[11] All intervals will be recovery corrected following the procedures in the subsurface sample collection SOP (Attachment B.2). Cores will be logged using the Sediment Core Processing Log (Attachment B.1), and any key changes in stratigraphy will be noted. If native material is encountered, sample intervals will be adjusted as described in the SOP (intervals containing native material will not be collected).

Specific details regarding the collection and processing of subsurface sediment cores are provided in the subsurface sediment SOP, which is presented in Attachment B.2. Sediment volumes are discussed in Section 4.8.

4.3 Sample Identification

Unique alphanumeric IDs will be assigned to each sample. The IDs for individual sediment samples will include the following:

- Project area ID (i.e., LDW) and two-digit year (e.g., 25 for samples collected in 2025)
- SMA ID (i.e., SMA and two-digit number)
- Sample type:
  - MS – monitoring surface sediment grabs collected within each DU (0–10 cm)
  - MC – monitoring subsurface sediment core collected within each DU (120-cm [approximately 4-ft] core, analyzed in 30-cm intervals)
  - PS – perimeter surface sediment grab sample (0–10 cm)
  - PA – public access surface sediment grab sample (0–10 cm)
- Location number (two-digit number), beginning at 01 for each SMA and corresponding to the DU, perimeter sampling station number, or public access station number
- For all cores (MC), a sequential letter (e.g., A, B, etc.) will be used to identify the interval. The letter A will be used to indicate the targeted 0–30-cm interval, with B, C, etc. used to indicate each subsequent deeper interval.

For example, a 2025 surface sediment sample collected from DU 1 in SMA 17 would be labeled LDW25-SMA17-MS01. The subsurface sediment core samples from that DU would be labeled LDW25-SMA17-MC01A (first core interval), LDW25-SMA17-MC01B (second core interval), etc.

For the public access composite samples, the three individual grab samples will be combined to create the composite sample. The individual grab samples to be archived will be labeled with sequential numbers (i.e., PA01, PA02, and PA03 will be the pre-dredge samples, and PA04, PA05, and PA06 will be the post-dredge samples). The pre-dredging composite sample will be labeled as Comp1 and the post-dredging composite sample will be labeled as Comp2. For example, if

[11] If samples are observed to contain more than 50% gravel (i.e., based on field observations), samples will be size-fractionated in the laboratory, consistent with methods used in the activated carbon pilot study, to ensure the analysis of a representative sample.

sampling is conducted for SMA 18 in 2026, the two composites for the public access area would be LDW26-SMA18-PA-Comp1 and LDW26-SMA18-PA-Comp2. The pre-dredge individual grab samples will be LDW26-SMA18-PA01, -PA02, and -PA03. The post-dredge individual grab samples will be LDW26-SMA18-PA04, -PA05, and -PA06.

Any field duplicate sample collected will have the same sample ID as its parent sample but will be appended with "-FD" to identify it as a field duplicate.

4.4 Sample Custody and Shipping Requirements

Sample custody is a critical aspect of environmental investigations. Sample possession and handling must be traceable from the time of sample collection, through laboratory and data analyses, to delivery of the sample results to the recipient. Procedures to be followed for sample custody and shipping are detailed in this section.

4.4.1 Sample Custody

Samples will be considered to be in custody if they are: 1) in the custodian's possession or view, 2) in a secured place (under lock) with restricted access, or 3) in a container and secured with an official seal(s) such that the samples cannot be reached without breaking the seal(s). Custody procedures, described below, will be used for all samples throughout the collection, transportation, and analytical processes, and for all data and data documentation, whether in hard copy or electronic format. Custody procedures will be initiated during sample collection.

A chain of custody form will accompany all samples to the analytical laboratory. Each person who has custody of the samples will sign the chain of custody form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include:

- Sample location, project name, and unique sample ID
- Sample collection date and time
- Any special notations on sample characteristics or problems
- Name of the person who initially collected the sample
- Date sample was sent to the laboratory
- Shipping company name and waybill number, if applicable

The Sediment Sampling Lead or designee will be responsible for all sample tracking and custody procedures and final sample inventory and will maintain sample custody documentation. The Sediment Sampling Lead or a designee will complete chain of custody forms prior to removing samples from the sample collection area. At the end of each day, and prior to sample transfer, chain of custody entries will be made for all samples. Information on the sample labels will be checked against sample log entries, and sample tracking forms and samples will be recounted.

Chain of custody forms, which will accompany all samples, will be signed at each point of transfer. Copies of all chain of custody forms will be retained and included as appendices to QA/QC reports and data reports. Samples will be shipped in sealed coolers.

The analytical laboratories will ensure that chain of custody forms are properly signed upon receipt of the samples, and they will note questions or observations concerning sample integrity on the chain of custody forms. The laboratories will contact the Sediment Sampling Lead or EQAO immediately if discrepancies are discovered between the chain of custody forms and the sample shipment upon receipt.

4.4.2 Sample Shipping

All samples will be shipped or transported via courier in a cooler to the analytical laboratory. The original signed chain of custody forms for all samples will be placed in a sealed plastic bag and taped to the inside lid of the cooler. If samples are to be shipped, fiber tape will be wrapped completely around the cooler. On each side of the cooler, a "This Side Up" arrow label will be attached; a "Handle with Care" label will be attached to the top of the cooler, and the cooler will be sealed with a custody seal in two locations.

The temperature inside the cooler containing the samples will be checked by the laboratory upon receipt of the samples. The laboratory will specifically note any cooler that does not contain ice packs, or that is not sufficiently cold (≤4 ± 2°C)[12] upon receipt. All samples will be handled so as to prevent contamination or sample loss. Samples will be disposed of upon written notification by the PM. Holding times vary by analysis and are summarized in Section 4.7.2

4.5 Decontamination Procedures

Sampling requires strict measures to prevent contamination. Sources of extraneous contamination can include sampling gear, grease from ship winches or cables, spilled engine fuel (gasoline or diesel), engine exhaust, dust, ice chests, and ice used for cooling. All potential sources of contamination in the field will be identified by the Sediment Sampling Lead, and appropriate steps will be taken to minimize or eliminate contamination. For example, during retrieval of sampling gear, the boat will be positioned, when feasible, so that engine exhaust does not fall on the deck. Ice chests will be scrubbed clean with Alconox® detergent and rinsed with distilled water after use to prevent potential cross contamination. To avoid contamination from melting ice, wet ice will be placed in separate plastic bags.

[12] As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory with internal temperatures within the advisory range of ≤4 ± 2°C; however, if the transit distance and time from the site to laboratory is short, the samples may not have reached this temperature by the time they arrive.

All sediment sampling and homogenizing equipment, including the mixing bowl and stainless steel implements, will be decontaminated between sampling locations per Ecology guidelines (Ecology 2021) and the following procedures:

1. Rinse with site water and wash with a scrub brush until free of sediment
2. Wash with phosphate-free detergent
3. Rinse with site water
4. Rinse with distilled water.

Acid or solvent washes will not be used in the field because of safety considerations and problems associated with rinsate disposal and sample integrity, specifically:

- Use of acids or organic solvents may pose a safety hazard to the field crew
- Disposal and spillage of acids and solvents during field activities pose an environmental concern
- Residues of solvents and acids on sampling equipment may affect sample integrity for chemical testing.

Any sampling equipment that cannot be cleaned to the satisfaction of the Sediment Sampling Lead will not be used for further sampling activities.

4.6 Field-generated Waste Disposal

Excess surface sediment will be returned to each sampling location after sampling has been completed for that location. Excess subsurface sediment will be containerized (e.g., in steel drums) as non-hazardous waste, labelled, and secured for off-site disposal via a licensed waste disposal company.

Decontamination water[13] will not be contained. All disposable sampling materials and personal protective equipment used in sample processing, such as disposable coveralls, gloves, and paper towels, will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the site by sampling personnel and placed in a normal refuse container for disposal as solid waste.

4.7 Laboratory Methods

At each laboratory, a unique sample identifier (termed either project ID or laboratory ID) will be assigned to each sample. The laboratory will ensure that a sample tracking record follows each sample through all stages of laboratory processing. The sample tracking record must contain, at a

[13] Because decontamination water is an Alconox®/water solution (i.e., phosphate free), it can be returned to the sampling location for disposal.

minimum, the name/initials of individuals responsible for performing the analyses, dates of sample extraction/preparation and analysis, and types of analyses being performed.

The analytical laboratories will meet the sample handling requirements and follow the procedures described in this section and in Attachment B.3. In addition, analytical methods and data quality indicator (DQI) criteria are provided herein.

4.7.1 Laboratory Sample Handling

Samples will be stored at the analytical laboratory in accordance with the conditions specified in the methods. Archive samples will be stored, frozen, at the analytical laboratory. The analytical laboratories will preserve and store samples as described in Section 4.7.2. Samples will be disposed of after hold times expire, following written authorization from the PM.

4.7.2 Analytical Methods

The analyte list for each sediment sample is specific to each SMA and sample type, as discussed in Section 4.1.2 and summarized in Table B4-2. Chemical analysis of the sediment samples, which may include analytes listed in Table B4-4, will be conducted by the analytical laboratory and will be reported in dry weight (dw). Analytical methods and laboratory sample handling requirements for all measurement parameters are presented in Table B4-5.

Table B4-4
Sediment Analyses to be Conducted

Analyte Group	Individual Analytes
Conventionals	TOC
metals	arsenic, lead, zinc, mercury
PAHs	acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene
PCB Aroclors	Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260
SVOCs	BBP
Dioxin/furan congeners	2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, OCDD, 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, and OCDF

Notes:
BBP: butyl benzyl phthalate
HpCDD: heptachlorodibenzo-*p*-dioxin
HpCDF: heptachlorodibenzofuran
HxCDD: hexachlorodibenzo-*p*-dioxin
HxCDF: hexachlorodibenzofuran

OCDD: octachlorodibenzo-*p*-dioxin
OCDF: octachlorodibenzofuran
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PeCDD: pentachlorodibenzo-*p*-dioxin
PeCDF: pentachlorodibenzofuran
SVOC: semivolatile organic compound
TCDD: tetrachlorodibenzo-p-dioxin
TCDF: tetrachlorodibenzofuran
TOC: total organic carbon

Table B4-5
Analytical Methods and Sample Handling Requirements for Sediment Samples

Parameter[1]	Method	Reference[2]	Extraction Solvent	Cleanup	Laboratory	Container	Preservative	Sample Holding Time
TOC	High-temperature combustion	EPA 9060A	NA	NA	TBD	4-oz glass jar	Cool to ≤ 6°C; freeze to ≤ -18°C	28 days 6 months if frozen
Metals	ICP/MS	EPA 3050B EPA 6020B UCT-KED	NA	NA	TBD	4-oz glass jar	Cool to ≤ 6°C; freeze to ≤ -18°C	6 months 2 years if frozen
Mercury	Cold vapor-atomic fluorescence spectroscopy	EPA 7471B	NA	NA	TBD			28 days 1 year if frozen
PAHs/SVOCs	GC/MS	EPA 3546/ EPA 8270E	Lab specific	Lab specific	TBD	8-oz glass jar	Cool to 0–6°C; freeze to ≤ -18°C	1 year to extraction if frozen; 14 days to extraction if refrigerated; when thawed, 40 days after extraction; store extracts at ≤ 6°C and in the dark
PCB Aroclors	GC/ECD	EPA 3546 Mod EPA 8082A	Lab specific	Lab specific	TBD		Cool to 0–6°C; freeze to ≤ -18°C	1 year to extraction if frozen; 14 days to extraction if refrigerated; when thawed, 40 days after extraction; store extracts at ≤ 6°C and in the dark
Dioxins/ furans	HRGC/HRMS	EPA 1613b	Lab specific	Lab specific	TBD	8-oz amber glass jar	Cool to ≤ 4°C; freeze to ≤ -18°C	1 year until extraction and 1 year after extraction if stored in the dark at ≤ -18°C

Notes:
1. Individual analytes are listed in Table B4-4. All results will be reported by the analytical laboratory in dry weight.
2. Laboratory SOPs are confidential and will be available upon EPA request once the analytical laboratory has been identified.
cPAH: carcinogenic polycyclic aromatic hydrocarbon
EPA: U.S. Environmental Protection Agency
GC/ECD: gas chromatography/electron capture detection

GC/MS: gas chromatography/mass spectrometry
HRGC/HRMS: high-resolution gas chromatography/high-resolution mass spectrometry
ICP/MS: inductively coupled plasma/mass spectrometry
NA: not applicable or not available
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SM: Standard Method
SOP: standard operating procedure
SVOC: semivolatile organic compound
TBD: to be determined
TOC: total organic carbon
UCT/KED: universal cell technology/kinetic energy discrimination

4.8 Sediment Chemistry Analytical Data Quality Objective and Criteria

The analytical DQO for sediment samples is to develop and implement procedures that will ensure the collection of representative data of known, acceptable, and defensible quality. Parameters used to assess data quality are precision, accuracy, representativeness, completeness, comparability, and sensitivity. These parameters are discussed below.

Precision is the measure of reproducibility among individual measurements of the same property, usually under similar conditions, such as multiple measurements of the same sample. Precision is assessed by performing multiple analyses on a sample; it is expressed as an RPD when duplicate analyses are performed, and as a %RSD when more than two analyses are performed on the same sample (e.g., triplicates). Precision is assessed by laboratory duplicate analyses (e.g., duplicate samples, MSDs, and LCS duplicates) for all parameters. Precision measurements can be affected by the nearness of a chemical concentration to the detection limit, whereby the percent error (expressed as either %RSD or RPD) increases. The DQI for precision varies depending on the analyte. The equations used to express precision are as follows:

$$\%\ \text{Recovery} = \frac{(\text{measured conc} - \text{measured duplicate conc})}{(\text{measured conc} + \text{measured duplicate conc}) \div 2} \times 100 \qquad \textbf{Equation 1a}$$

$$\%\text{RSD} = {}^{\text{SD}}/_{\text{D}_{\text{ave}}} \times 100$$

Where:

$$SD = \sqrt{\left(\frac{\sum(D_n - D_{ave})^2}{(n-1)}\right)} \qquad \textbf{Equation 1b}$$

D	=	sample concentration
D_{ave}	=	average sample concentration
n	=	number of samples
SD	=	standard deviation

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Accuracy may be expressed as a percentage recovery for MS, LCS, or CRM analyses. The DQI for accuracy varies depending on the analyte. The equation used to express accuracy for spiked samples is as follows:

$$\%\ \text{Recovery} = \frac{\text{spike sample results} - \text{unspiked sample results}}{\text{amount of spike added}} \times 100 \qquad \textbf{Equation 2}$$

Representativeness is an expression of the degree to which data accurately and precisely represent an environmental condition. The sampling approach was designed to address the specific objectives described in Section 2. Assuming those objectives are met, the samples collected should be considered adequately representative of the environmental conditions they are intended to characterize.

Comparability is an expression of the confidence with which one dataset can be evaluated in relation to another dataset. Therefore, sample collection and chemical and physical testing will adhere to the most recent Puget Sound Estuary Program and SCUM QA/QC procedures (PSEP 1997; Ecology 2021) and EPA and Standard Methods (SMs) analysis protocols.

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. The equation used to calculate completeness is as follows:

$$\text{Completeness} = \frac{\text{number of valid measurements}}{\text{total number of data points planned}} \times 100 \qquad \textbf{Equation 3}$$

The DQI for completeness for all components of this project is 90%. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

Analytical sensitivity is the minimum concentration of an analyte above which a data user can be reasonably confident that the analyte was reliably detected and quantified. For this study, the MDL[14] or the lower limit of quantitation will be used as the measure of sensitivity for each analyte.

Table B4-6 lists specific DQIs for laboratory analyses of sediment samples.

Table B4-6
DQIs for Laboratory Analyses

Parameter[1]	Unit	Precision[2]	Accuracy[2]		Completeness
			CRM/LCS[3]	Spiked Samples	
TOC	%	± 20%	80–120%	75/125%	90%
Metals	mg/kg dw	± 20%	80–120%	75–125%	90%
Mercury	mg/kg dw	± 20%	80–120%	75–125%	90%
PAHs	µg/kg dw	± 35%	44–203% / 30–160%	30–160%	90%
PCB Aroclors	µg/kg dw	± 35%	50–150% / 56–120%	56–120%	90%

14 The term MDL includes other types of detection limits, such as estimated detection limits calculated for dioxin/furan congeners. Recent revisions to EPA SW-846 methods no longer require the calculation of MDLs.

Parameter[1]	Unit	Precision[2]	Accuracy[2]		Completeness
			CRM/LCS[3]	Spiked Samples	
SVOCs	µg/kg dw	± 35%	10–160%	10–160%	90%
Dioxins/furans	ng/kg dw	± 25%	50−150% / 63–170%	63−170%[4]	90%

Notes:
1. Individual analytes are listed in Table B4-4.
2. Values listed are example method limits; values will be updated by selected laboratory. The percentages provided represent the recovery range for each parameter. Individual compound recoveries for PAHs and SVOCs are provided in Attachment B.3.
3. An LCS may be used to assess accuracy when CRM is unavailable. CRMs will be analyzed for PAHs, PCB Aroclors, and dioxins/furans only. The satisfactory acceptance limit for CRM recovery will include the uncertainty range around the CRM mean as well as the uncertainty of the method of measurement
4. Labelled compound percent recovery range.
CRM: certified reference material
DQI: data quality indicator
dw: dry weight
LCS: laboratory control sample
NA: not applicable
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SVOC: semivolatile organic compound
TOC: total organic carbon

The laboratory MDL and RL goals for each analytical method are compared to their respective minimum sediment RALs in Table B4-7. All the analytical methods are sufficiently sensitive.

Table B4-7
RL Goals and RALs for Sediment Samples

Parameter	Method	RL	Lowest RAL[1]
Metals (mg/kg dw)			
Arsenic	EPA 6020B	0.2	28
Lead	EPA 6020B	0.1	450
Zinc	EPA 6020B	6	410
Mercury	EPA 7471B	0.025	0.41
PAHs and SVOCs (µg/kg dw)			
Benzo(a)anthracene	EPA 8270E	20.0	2,200[2]
Benzo(a)pyrene	EPA 8270E	20.0	1,980[2]
Total benzofluoranthenes	EPA 8270E	40.0	4,600[2]
Chrysene	EPA 8270E	20.0	2,200[2]
Dibenzo(a,h)anthracene	EPA 8270E	20.0	240[2]
Indeno(1,2,3-cd)pyrene	EPA 8270E	20.0	680[2]
Anthracene	EPA 8270E	20.0	4,400[2]
Acenaphthene	EPA 8270E	20.0	320[2]
Acenapthylene	EPA 8270E	20.0	1,320[2]

Parameter	Method	RL	Lowest RAL[1]
Benzo(g,h,i)perylene	EPA 8270E	20.0	620[2]
cPAH TEQ[3]	EPA 8270E	18.1[4]	5,500[5]
Fluoranthene	EPA 8270E	20.0	3,200[2]
Fluorene	EPA 8270E	20.0	460[2]
Naphthalene	EPA 8270E	20.0	1,980[2]
Phenanthrene	EPA 8270E	20.0	2,000[2]
Pyrene	EPA 8270E	20.0	20,000[2]
Total HPAHs[6]	EPA 8270E	40.0	19,200[2]
Total LPAHs[7]	EPA 8270E	20.0	7,400[2]
2-methylnaphthalene	EPA 8270E	20.0	760[1]
Butyl benzyl phthalate	EPA 8270E	20.0	98[2]
PCBs (µg/kg dw)			
PCBs	EPA 8082A (Aroclors)	4.0	240[2]
Dioxins/Furans (ng/kg dw)			
Dioxin/Furan TEQ[8]	EPA 1613b	1.59	25

Notes:
1. RAL is the minimum value for each chemical listed in ROD Table 27 or Table 28 (EPA 2014b), except for cPAHs, which is listed in Explanation of Significant Differences Table 3 (EPA 2021).
2. OC-normalized RAL was converted to dry weight value for this table using 2% TOC (average LDW sediment TOC). This value, which is less than the dry weight apparent effects thresholds in Table 8-1 of SCUM (Ecology 2021), is presented herein as a dry weight value only for the purpose of comparison to RLs.
3. Per the ROD (EPA 2014a), cPAHs consist of a subset of seven PAHs that EPA has classified as probable human carcinogens: benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene
4. The RL for the cPAH TEQ value was calculated using one-half the RL for each of the cPAH compounds and the appropriate toxic equivalency factor values (California EPA 2009).
5. The cPAHs RAL is based on the Explanation of Significant Differences (EPA 2021).
6. HPAH compounds include fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3 cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.
7. LPAH compounds include naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, and 2-methylnaphthalene.
8. The RL for the dioxin/furan TEQ value is based on the minimum calibration level from the selected laboratory; the dioxin/furan mammalian TEQ value was calculated using one-half the RL for each dioxin/furan compound and appropriate mammal toxic equivalency factor values (Van den Berg et al. 2006).

cPAH: carcinogenic polycyclic aromatic hydrocarbon
dw: dry weight
EPA: US Environmental Protection Agency
HPAH: high-molecular-weight polycyclic aromatic hydrocarbon
LDW: Lower Duwamish Waterway
LPAH: low-molecular-weight polycyclic aromatic hydrocarbon
OC: organic carbon
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
RAL: remedial action level
RAO: remedial action objective
RL: reporting limit
ROD: Record of Decision
SCUM: Sediment Cleanup User's Manual
SVOC: semivolatile organic compound
TEQ: toxic equivalent

TOC: total organic carbon

Standard mass requirements are specified to meet RL goals for each particular analytical method. Table B4-8 summarizes the sample volume needed for each sample type. The masses listed include those required for QC samples.

Table B4-8
Sample Mass Required per Analysis

Parameter	Sediment Mass (wet weight)	Container Size
TOC	6 g	4-oz jar
Metals	3 g	4-oz jar
Mercury	1 g	
PAHs	60 g	8-oz jar
PCB Aroclors	75 g	
SVOCs	60 g	
Dioxins/furan congeners	40 g	8-oz jar
Archive	NA	8-oz jar

Notes:
NA: not applicable
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SVOC: semivolatile organic compound
TOC: total organic carbon

For all locations and intervals, following homogenization in the field, sediment for chemistry analysis will be dispensed into jars as required for the SMA-specific analytes (Section 4.1). In addition, one 8-oz jar from each location/interval will be archived in the event that issues arise (e.g., jar is lost or broken). All jars containing sediment for potential chemistry analysis will remain archived until one month after the end of the construction season, and until written authorization for disposal is received from the EQAO.

4.9 Sediment Chemistry Quality Assurance/Quality Control

The types of samples to be analyzed and the procedures to be conducted for QA/QC in the field and laboratory are described in this section.

4.9.1 Field Quality Control Samples

Field QA/QC samples, such as field duplicate samples, are generally used to evaluate the variability attributable to sample handling and processing. For surface and subsurface samples, a minimum of

1 duplicate sample[15] for every 20 samples will be collected. Field duplicate samples will be analyzed for the same analytes as the parent sample.

4.9.2 Laboratory Quality Control

Before analyzing the samples, the laboratory must provide written protocols for the analytical methods to be used, calculate RLs for each analyte in each matrix of interest as applicable, and establish an initial calibration curve for all analytes. The laboratory must also demonstrate its continued proficiency by participation in inter-laboratory comparison studies, and by repeated analysis of calibration checks, laboratory reagent blanks, and spiked samples.

4.9.2.1 Sample Delivery Group

Project- and/or method-specific QC measures, such as MSs and MSDs or laboratory duplicates, will be used per SDG preparatory batch or per analytical batch, as specified in Table B4-9. An SDG is defined as no more than 20 samples or a group of samples received at the laboratory within a 2-week period. Although an SDG may span two weeks, all holding times specific to each analytical method will be met for each sample in the SDG.

[15] Field duplicates are defined as samples from a parent sample for which twice as much volume as necessary to fill the sample containers has been collected. Following homogenization, aliquots of this parent sample are equally distributed in two sets of sample containers. Field duplicate results are used to measure and document the repeatability of sample handling procedures and heterogeneity of the sample matrix (PSEP 1997).

Table B4-9
Laboratory QC Sample Analysis Summary

Analysis Type	Method	Initial Calibration	Initial Calibration Verification (2nd source) and Calibration Blank	Continuing Calibration Verification and Calibration Blank	CRM or LCS[1]	Laboratory Replicates	MS	MSD	Method Blanks	Internal Standards/ Surrogate Spikes
TOC	EPA 9060A	Prior to analysis	After initial calibration	Every 10 samples	1 per 20 samples or per batch	1 per 20 samples or per batch	1 per 20 samples or per batch	NA	1 per 20 samples or per batch	NA
Metals	EPA 6020A UCT-KED	Daily, prior to analysis	After initial calibration; interference check standard and spectral interference check at beginning of analytical run; spectral interference check every 12 hours	Every 10 samples and at end of analytical sequence	1 per prep batch	1 per batch or SDG	1 per batch or SDG	NA	1 per prep batch	Each sample (internal standard only)
Mercury	EPA 7471B	Prior to analysis	After initial calibration	Every 10 samples and at end of analytical sequence	1 per prep batch	1 per batch or SDG	1 per batch or SDG	NA	1 per prep batch	NA
SVOCs/ PAHs	EPA 8270E	Prior to analysis	After initial calibration	Before and after sample analysis, and every 12 hours	1 per prep batch[2]	NA	1 per batch or SDG	1 per batch or SDG	1 per prep batch	Each sample
PCB Aroclors	Mod EPA 8082A	Prior to analysis	After initial calibration	Before and after sample analysis, every 10–20 analyses or 12 hours	1 per prep batch[3]	NA	1 per batch or SDG	1 per batch or SDG	1 per prep batch	Each sample

Analysis Type	Method	Initial Calibration	Initial Calibration Verification (2nd source) and Calibration Blank	Continuing Calibration Verification and Calibration Blank	CRM or LCS[1]	Laboratory Replicates	MS	MSD	Method Blanks	Internal Standards/ Surrogate Spikes
Dioxins/ furans	EPA 1613b	Prior to analysis	After initial calibration	Before and after sample analysis and every 12 hours	1 CRM and LCS/LCSD per prep batch[3]	NA	NA	NA	1 per prep batch	Each sample

Notes:
A batch is a group of samples of the same matrix analyzed or prepared at the same time, not exceeding 20 samples.
1. An LCS may be used to assess accuracy when CRM is unavailable.
2. A laboratory-specified CRM will be used to assess accuracy for cPAHs and PAHs.
3. Puget Sound sediment reference material will be used to assess accuracy for PCB Aroclors and dioxins/furans.
cPAH: carcinogenic polycyclic aromatic hydrocarbon
CRM: certified reference material
EPA: U.S. Environmental Protection Agency
LCS: laboratory control sample
LCSD: laboratory control sample duplicate
MS: matrix spike
MSD: matrix spike duplicate
NA: not applicable or not available
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
QC: quality control
SDG: sample delivery group
SM: Standard Method
SVOC: semivolatile organic compound
TOC: total organic carbon
UCT-KED: universal cell technology-kinetic energy discrimination

4.9.2.2 Laboratory Quality Control Samples

The analyst will review the results of QC analyses from each sample group immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine whether control limits have been exceeded.

If control limits have been exceeded, then appropriate corrective action, such as recalibration followed by reprocessing of the affected samples, must be initiated before a subsequent group of samples is processed. The EQAO must be contacted immediately by the laboratory PM if satisfactory corrective action to achieve the DQIs outlined in this QAPP is not possible. All laboratory corrective action reports relevant to the analysis of project samples must be included in the data deliverable packages.

All primary chemical standards and standard solutions used in this project will be traceable to the National Institute of Standards and Technology, Environmental Resource Associates, National Research Council of Canada, or other documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparing them to independent standards. Laboratory QC standards are verified in a multitude of ways: Second-source calibration verifications (i.e., same standard, two different vendors) are analyzed to verify initial calibrations; new working standard mixes (e.g., calibrations, spikes, etc.) are verified against the results of the original solution and must be within 10% of the true value; newly purchased standards are verified against current data. Any impurities found in the standard will be documented.

The following sections summarize the procedures that will be used to assess data quality throughout sample analysis. Table B4-9 summarizes the QC procedures to be performed by the laboratory. The associated control limits for precision and accuracy are listed in Table B4-6.

4.9.2.3 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of 1 method blank will be analyzed for each SDG or for every 20 samples, whichever is more frequent.

4.9.2.4 Certified Reference Material

CRMs are samples of similar matrices and known analyte concentrations, processed through the entire analytical procedure and used as an indicator of method accuracy. A minimum of 1 CRM will be analyzed for each SDG or for every 20 samples, whichever is more frequent. CRMs will be analyzed for PAHs, PCB Aroclors, and dioxins/furans. An LCS sample can be used to assess accuracy if appropriate CRM is not available. An LCS will be analyzed for conventional, metals, and semivolatile organic compounds (SVOCs).

4.9.2.5 Laboratory Control Samples

LCSs are prepared from a clean matrix using the same process as the project samples that are spiked with known amounts of the target compounds. The recoveries of the compounds are used as a measure of the accuracy of the test methods. A laboratory control sample duplicate (LCSD) will be analyzed for dioxins/furans.

4.9.2.6 Laboratory Replicate Samples

Laboratory replicate samples provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Laboratory replicates are subsamples of the original sample that are prepared and analyzed as separate samples, assuming sufficient sample matrix is available. A minimum of 1 laboratory replicate sample will be analyzed for each SDG or for every 20 samples, whichever is more frequent, for metals and conventional parameters.

4.9.2.7 Matrix Spikes and Matrix Spike Duplicates

The analysis of MS samples provides information on the extraction efficiency of the method on the sample matrix. By performing MSD analyses, information on the precision of the method is also provided for organic analyses. For organic analyses, a minimum of 1 MS/MSD pair will be analyzed for each SDG or for every 20 samples, whichever is more frequent, when sufficient sample volume is available, with the exception of dioxins/furans. For inorganic analyses (i.e., metals), a minimum of one MS sample will be analyzed for each SDG, when sufficient sample volume is available.

4.9.2.8 Surrogate Spikes

All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds, as defined in the analytical methods. Surrogate recoveries will be reported by the analytical laboratories; however, no sample results will be corrected for recovery using these values.

4.9.2.9 Isotope Dilution Quantitation

All project samples analyzed for dioxin/furan congeners will be spiked with a known amount of surrogate compounds, as defined in the analytical methods. The labeled surrogate compounds will respond similarly to the effects of extraction, concentration, and gas chromatography. Data will be corrected for the recovery of the surrogates used for quantification.

4.9.2.10 Internal Standard Spikes

Internal standards may be used for calibrating and quantifying organic compounds and metals using MS. If internal standards are required by the method, all calibration, QC, and project samples will be spiked with the same concentration of the selected internal standard(s). Internal standard recoveries and retention times must be within method and/or laboratory criteria.

4.10 Instrument/Equipment Testing, Inspection, and Maintenance

Prior to each field event, measures will be taken to test, inspect, and maintain all field equipment. All equipment used, including the differential global positioning system unit and digital camera, will be tested for accuracy before leaving for the field event. The Sediment Sampling Lead will be responsible for overseeing the testing, inspection, and maintenance of all field equipment.

Laboratory instrument testing, inspection, and maintenance procedures are described in the laboratory SOPs.[16] The laboratory PM will be responsible for ensuring laboratory equipment testing, inspection, and maintenance requirements are met.

4.11 Instrument/Equipment Calibration and Frequency

Multipoint initial calibration will be performed on each analytical instrument at the start of the project, after each major interruption to the instrument, and when any continuing calibration does not meet the specified criteria. The number of points used in the initial calibration is defined in each analytical method. Continuing calibrations will be performed daily for organic analyses, every 10 samples for inorganic analyses, and with every sample batch for conventional parameters to ensure proper instrument performance.

Gel permeation chromatography calibration verifications will be performed at least once every seven days, and corresponding raw data will be submitted by the laboratory with the data package. In addition, florisil performance checks will be performed for every florisil lot, and the resulting raw data will be submitted with the data package.

Calibration of analytical equipment used for chemical analyses includes the use of instrument blanks or continuing calibration blanks, which provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately after the continuing calibration verification, at a frequency of 1 blank for every 10 samples analyzed for inorganic analyses, and 1 blank every 12 hours for organic analyses. If the continuing calibration does not meet the specified criteria, the analysis must stop. Analysis may resume after corrective actions have been taken to meet the method specifications. All project samples analyzed by an instrument found to be out of compliance must be reanalyzed.

[16] Laboratory SOPs are confidential and will be available upon EPA request once the analytical laboratory has been identified.

4.12 Inspection/Acceptance of Supplies and Consumables

The Sediment Sampling Lead or designee will gather and check field supplies daily for satisfactory conditions before each field event. Batteries will be checked daily and recharged as necessary. Supplies and consumables for the field sampling effort will be inspected upon delivery and accepted if the condition of the supplies is satisfactory.

4.13 Data Management

All field data will be recorded on field forms, which the Sediment Sampling Lead will check for missing information at the end of each field day and amend as necessary. A QC check will be done to ensure that all data have been transferred accurately from the field forms to the database. Field forms will be archived.

Analytical laboratories are required to submit data in an electronic format, as described in Section 3.7.2. The laboratory PM will contact the EQAO prior to data delivery to discuss specific format requirements.

A library of routines will be used to translate typical electronic output from laboratory analytical systems and to generate data analysis reports. The use of automated routines will ensure that all data are consistently converted to the desired data structures, and that operator time is kept to a minimum. In addition, routines and methods for quality checks will be used to ensure such translations are correctly applied.

Written documentation will be used to clarify how field and analytical laboratory duplicates and QA/QC samples were recorded in the data tables, and to provide explanations of other issues that may arise. The data management task will include keeping accurate records of field and laboratory QA/QC samples so that project team members who use the data will have appropriate documentation. All data management files will be stored on a secure server. Data management procedures will be provided prior to implementation of this QAPP.

5 Assessment and Oversight

EPA or its designees may observe field activities during each sampling event, as needed. If situations arise wherein there is a significant inability to follow the QAPP methods precisely, the EQAO will determine the appropriate actions, or will consult EPA if the issue is significant.

5.1 Compliance Assessments

Laboratory and field performance assessments will consist of on-site reviews conducted by EPA of QA systems and equipment for sampling, calibration, and measurement. EPA personnel may conduct a laboratory audit prior to sample analysis. Any pertinent laboratory audit reports will be made available to the EQAO upon request. Analytical laboratories will be required to have written procedures addressing internal QA/QC. All laboratories and the EQAO will be required to ensure that all personnel engaged in sampling and analysis tasks have appropriate training.

5.2 Response Actions for Field Sampling

The Sediment Sampling Lead or a designee will be responsible for correcting equipment malfunctions throughout field sampling, and for resolving situations in the field that may result in nonconformance or noncompliance with this QAPP. All corrective measures will be immediately documented in the field logbook, and protocol modification forms will be completed.

5.3 Corrective Action for Laboratory Analyses

Analytical laboratories will be required to comply with their current written SOPs, laboratory QA plan, and analytical methods. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data. The analysts will identify and correct any anomalies before continuing with sample analysis. The laboratory PMs will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP.

The EQAO will be notified immediately if any QC sample exceeds the DQIs provided in Attachment B.3 and the exceedance cannot be resolved through standard corrective action procedures. A description of the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and re-extraction) will be submitted with the data package using the case narrative or corrective action form.

6 Reporting

Reporting of sediment sampling results is required for this project and is described in the following subsections.

6.1 SMA-specific Reporting

After the conclusion of sampling for each SMA, a progress update and a list of any deviations will be prepared and provided to the EQAO for submittal to EPA as part of the Annual Construction Summary Technical Memorandum. EPA will also be notified: 1) after sampling has been completed and samples have been submitted for analysis for a given SMA, and 2) when data for a given SMA are received from the laboratory[17]. Chemistry data will be prepared for use by the EQAO, Project Representative, and EPA in determining whether contingency actions are needed (Section 5.2 of the CQAP).

6.2 Final Report

All sediment sampling data will be included as part of the Annual Construction Summary Technical Memorandum prepared for each season. In addition to documenting chemistry results, comparison to thresholds, and resulting corrective actions (if applicable), the report's appendices will include key materials from the sediment sampling efforts for each SMA (i.e., field logs, final sampling locations, chain of custody forms, laboratory reports, and electronic data deliverables).

[17] No validation is planned for the construction sediment samples. A review of QC data will be conducted when data are received from the laboratory.

7 References

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Appendix B – Construction Sediment Sampling Quality Assurance Project Plan

Attachment B.1
Field Forms

To be completed after 100% RD.

Appendix B – Construction Sediment Sampling Quality Assurance Project Plan

Attachment B.2
Standard Operating Procedures

STANDARD OPERATING PROCEDURE

SUBSURFACE SEDIMENT COLLECTION

A Introduction

Subsurface sediment core samples will be collected primarily from a sampling vessel (using a vibracorer), or they will be manually collected from shore in intertidal areas where access from a vessel is not possible. Procedures for these two access options are described below.

B Sample Collection by Boat

B1 Collect Sediment

When sampling from a boat, most of the sediment cores will be collected using a vibracorer. The vibracorer will be deployed from the sampling vessel using an A-frame with a hydraulic winch system. The vibracorer consists of a vibrating power head attached to a 4-in.-diameter core barrel (length to be dependent on the target core depth). Once the sample depth is reached, the cpore tube or barrel will be advanced to the target depth, and then retrieved for sample processing. Continuous sediment cores will be collected using the vibracorer.

Sediment core samples will be collected and processed according to the following procedures:

1. The sampling vessel will be maneuvered to the proposed sampling location using a differential global positioning system (DGPS)[1] with sub-meter accuracy, positioned such that the DGPS receiver (located on top of the sampling frame) is within 3 m (10 ft) of the target sampling location.
2. If it is not possible to access the target location due to obstructions or difficult substrate (e.g., presence of riprap or other debris), the vessel may be relocated within 10 m (32 ft) of the proposed location.
3. The vibracorer with decontaminated[2] core tube will be deployed.
4. Continuous core samples will be collected to the project depth requirement or until refusal.
5. The depth of core penetration will be measured and recorded.
6. The sample core tube will be extracted, and the assembly will be retrieved aboard the vessel.

[1] A Trimble© SPS461 or similar DGPS receiver unit will be employed for the various sampling methods outlined in the quality assurance project plan. The DGPS receiver will be calibrated daily to ensure that it is accurately recording positions from known benchmarks and functioning within the individual unit's factory specifications.
[2] All equipment will be decontaminated following procedures described in Section D.

7. The core sample will be evaluated at the visible ends of the core tube to verify retention of the sediment in the core tube.
8. If the sediment core is acceptable (see criteria below), the core will be capped, labelled, and held vertically pending transfer to a processing crew.
9. The top of the core will be decanted and the top of the mudline will be marked on the core tube when possible.

Acceptance criteria for a sediment core sample are as follows:

- The material is collected to the target depth within the first three attempts.
- Recovery is at least 75% of the penetration depth.
- The core appears to be intact without obstructions or blocking.

If sample acceptance criteria are not achieved, the sample will be rejected. If repeated deployment (i.e., maximum three attempts) does not result in a sample that meets the acceptance criteria, or if deployment hits refusal before reaching the target depth, the sample with the best penetration depth will be retained.

Field forms and notes for all core samples will be maintained as samples are collected. The following information will be included in the sediment core collection forms and field notes:

- Water depth and tidal elevation (i.e., raw data), as well as the calculated mudline elevation of each sediment core location relative to mean lower low water
- Location of each sediment core as determined using a differential global positioning system with sub-meter accuracy
- Date and time of collection for each sediment core
- Names of field supervisor and person(s) collecting and logging the sample
- Core penetration and recovery measurements
- Designation of each coring attempt as "accepted" or "rejected"
- Observations made during sample collection, including weather conditions, complications, ship traffic, and other details associated with the sampling effort
- Core type and location identification (ID)
- Photographs of anything of note
- Any deviations from the approved sampling plan (on a Protocol Modification Form)

B2 Process Core

Sediment cores collected from a boat will be processed as soon as possible after a core has been collected that meets the acceptance criteria. The steps for processing the samples are as follows:

1. Prior to processing, evaluate any additional amount of compaction that may have occurred after core acceptance and prior to core processing, and calculate the adjusted recovery percentage (ARP) to be applied during core processing.

   - Measure the core processing recovery depth (i.e., the compacted core depth prior to processing).
   - To calculate the ARP, divide the processing recovery depth by the penetration depth (i.e., the depth recorded during core collection and acceptance).
   - Example: If the core processing recovery depth (i.e., adjusted depth) at the time of processing is 2.55 ft, and the core penetration depth (i.e., at the time of collection) was 3.00 ft, the ARP would be 85.0% (e.g., 0.85).

2. Carefully cut along the core tube or liner to expose the sediment core for processing and photograph each core.
3. The core will be examined for major stratigraphic boundaries and to evaluate if "native" material is present in the core. This information will be documented on the sediment core processing log.
4. Record the description of each core on the sediment core processing log, including the following parameters, as appropriate, and take photographs of anything of note.

   - Core penetration depth (from the sediment core collection form)
   - Processing recovery core depth and calculated ARP
   - Adjusted sample depth interval for each sample
   - Sediment grain size description following American Society for Testing and Materials (ASTM) visual-manual classification (ASTM D2488)
   - Odor (e.g., hydrogen sulfide, petroleum)
   - Vegetation
   - Debris
   - Biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
   - Presence of oil sheen
   - Any other distinguishing characteristics or features.

5. For each core, separate the material from each target depth interval, applying (i.e., multiplying) the ARP to the target sample depth that will constitute the sample for laboratory analysis. For example, if the ARP for a given core is 85.0% (e.g., 0.85), the sample material to collect for a 0- to 30-cm analysis will come from the 0- to 25.5-cm interval (i.e., 30 cm × 0.85 = 25.5 cm).
6. Transfer each sediment sample into a separate stainless steel bowl for homogenization.
7. Homogenize the sediment using clean stainless steel spoons until texture and color homogeneity have been achieved, removing large non-sediment items such as gravel, shells, wood chips, or organisms (e.g., clams) (Ecology 2021).
8. Affix a complete sample label to each individual sample jar. Sample labels will contain the project number, sampling personnel, date, time, and sample ID. Labels will be filled out as completely as possible prior to each sampling event.
9. Dispense sediment into clean and labelled jars.
10. Thoroughly check all sample containers for proper identification, analysis type, and lid tightness. The field coordinator will be responsible for reviewing sediment sample information recorded on field forms and will correct any improperly recorded information.
11. Pack each container carefully to prevent breakage and place inside a cooler with ice for storage at the proper temperature (≤ 4 ± 2°C) for delivery to the analytical laboratory.

C Sample Collection from Shore

If an intertidal sediment core cannot be collected from the boat due to site access conditions (e.g., too shallow), then the core may be manually collected from shore during a lower tide (although the full target depth may not be achieved in this situation). At the discretion of the field crew, one of the following three sampling options will be used, whichever is most suitable to the sampling location conditions. In addition, the field crew may use a combined or hybrid approach of the three methods, if necessary. The core locations may need to be adjusted in the field to account for site conditions, such as debris or armoring, that do not allow for sampling.

C1 Option 1: Use Shovel to Dig Hole

The first sampling option is to dig a hole using a shovel and collect the sample directly from the sidewall of the hole. The process for this option is as follows.

1. **Dig hole** – Using a transplanting spade (i.e., a shovel with a narrow blade), dig a hole to the target depth (or as deep as possible) at the identified location. If it is not possible to reach the target depth within three attempts, the deepest hole among the attempts will be sampled using the methodology described below, and the depth of refusal will be recorded

on the sediment core collection form. At least one side of the hole should be approximately vertical to allow for the collection of the sample. Record any necessary revisions of the sampling location.

2. **Prepare for sampling** – Divide the vertical extent of the hole into equal sections (e.g., for a 45-cm hole, there might be three 15-cm sections [i.e., 0-15 cm, 15-30 cm, and 30-45 cm]) to ensure that equal amounts of sediment are collected from each depth horizon. If possible, use a spoon to draw a line in the sidewall of the hole at these breakpoints. Sample the bottom section first to ensure that the sample is collected prior to the hole filling with water.

3. **Collect and homogenize sample** – Collect the same amount of sediment from each of the subsections along the vertical extent of the hole. Exclude any debris larger than approximately 5 mm in width. If differences in the hole are apparent (e.g., the presence of differently colored material), the resulting sample should proportionally represent all material in the hole. Once all material has been collected, homogenize the contents of the bowl with a stainless steel spoon until texture and color homogeneity have been achieved, and dispense the contents into clean and labelled jars.

The procedures for processing shore-collected cores are presented below.

C2 Option 2: Use Hand-core Tube to Collect Core

The second sampling option is to use a hand-core tube to collect a core, extrude the core, and then collect the sample from the interior of the core. This process for this option is as follows:

1. **Collect core** – Drive the decontaminated hand-core tube into the sediment to target depth (or refusal) at the identified location, or as near as possible based on the substrate and debris. Cap the top of the tube and pull the core out of the sediment. If it is not possible to reach the target depth on the first attempt, up to three attempts should be made in that area (initial attempts will be retained in the core tube or extruded onto a piece of foil). After the third attempt, sample the deepest core using the methodology described below, and record the depth of refusal on the surface sediment collection form. Record any necessary movement of the sampling location.

2. **Collect and homogenize sample** – Extrude the contents of the core into a pre-cleaned stainless steel bowl and homogenize with a clean stainless steel spoon until texture and color homogeneity have been achieved. Discard any debris wider than approximately 5 mm.

The procedures for processing shore-collected cores are presented below.

C3 Option 3: Use Land-based Drilling Methods

The third option is to use land-based drilling methods to collect a vertical core. Rotary sonic drilling methods will be used with a land-based drill rig. Continuous vertical samples will be collected and extruded from the drill rig core barrel. The process for this option is as follows:

1. **Collect core** – Advance the decontaminated core barrel into the sediment to the target depth at the identified location, or as near as possible based on access, substrate, and debris. Advance the outer casing to the same depth as the core barrel. Pull the core barrel out of the sediment.

2. **Extrude core** – Extrude the sample from the core barrel into a plastic liner. Log observed lithology and notable features, as described in Section B2.

3. **Collect and homogenize sample** – Subsample the core and place sampled materials in a pre-cleaned stainless steel bowl. Homogenize materials with a clean stainless steel spoon until texture and color homogeneity have been achieved. Discard any debris wider than approximately 5 mm.

The procedures for processing shore-collected cores are presented below.

C4 Processing Cores Collected from Shore

After sediment collection and homogenization have occurred, the following steps will be completed to process the sediment cores:

1. **Record information** – Record information regarding the depth of the core, sediment characteristics (e.g., color, smell, grain size, presence of debris, etc.), and necessary revisions to the sampling location on the sediment core collection and processing forms. Take photographs of anything of note and document any deviations from the approved sampling plan on a Protocol Modification Form.
2. **Dispense into jars** – Affix a complete sample label to each individual sample jar. Sample labels will contain the project number, sampling personnel, date, time, and sample ID. Labels will be filled out as completely as possible prior to each sampling event. Dispense sediment into labeled sample containers.
3. **QC jars and forms** – Thoroughly check all sample containers for proper identification, analysis type, and lid tightness. The field coordinator will be responsible for reviewing sediment sample information recorded on field forms and will correct any improperly recorded information.

4. **Prepare for delivery to the analytical laboratory** – Pack each container carefully to prevent breakage and place inside a cooler with ice for storage at the proper temperature (≤ 4 ± 2°C) for delivery to the analytical laboratory.

D Equipment Decontamination Procedures

All sediment sampling and homogenizing equipment, including the mixing bowl and stainless steel implements, will be decontaminated between sampling locations per Washington State Department of Ecology guidelines (Ecology 2021) and the following procedures:

1. Rinse with site water and wash with a scrub brush until free of sediment.
2. Wash with phosphate-free detergent.
3. Rinse with site water.
4. Rinse with distilled water.

Acid or solvent washes will not be used in the field because of safety considerations and problems associated with rinsate disposal and sample integrity, specifically:

- Use of acids or organic solvents may pose a safety hazard to the field crew.
- Disposal and spillage of acids and solvents during field activities pose an environmental concern.
- Residues of solvents and acids on sampling equipment may affect sample integrity for chemical testing.

Any sampling equipment that cannot be cleaned to the satisfaction of the field coordinator will not be used for further sampling activities.

E References

Ecology. 2021. Sediment cleanup user's manual. Guidance for implementing the cleanup provisions of the sediment management standards, Chapter 173-204 WAC. Third revision December 2021. Pub. No. 12-09-057. Toxics Cleanup Program, Washington State Department of Ecology, Olympia, WA.

STANDARD OPERATING PROCEDURE

SURFACE SEDIMENT COLLECTION

A Introduction

Surface sediment samples (0- to 10-cm) will be collected from a boat or from land and processed following standardized procedures as described in the Washington State Department of Ecology's Sediment Cleanup User's Manual (Ecology 2021) and Puget Sound Estuary Program. The applicable standard operating procedures are described below.

B Sample Collection by Boat

The primary method for surface sediment sample collection will be to use a pneumatic grab sampler deployed from a sampling vessel. Surface sediment samples will be collected as described in the following steps:

1. Using a differential global positioning system (DGPS)[1] with sub-meter accuracy, maneuver the sampling vessel to the sampling location.
2. Open the decontaminated grab sampler jaws to the deployment position.
3. Guide the sampler overboard until it is clear of the vessel.
4. Using DGPS, position the sampling vessel such that the DGPS receiver (located on top of the sampling frame) is within 3 m (10 ft) of the target sampling location.
5. Lower the sampler through the water column to the bottom at a speed of approximately 0.3 m/s.
6. Record the DGPS location of the boat when the sampler reaches the bottom.
7. Record the water depth and tidal elevation (i.e., raw data), as well as the calculated mudline elevation of each sampling location relative to mean lower low water.
8. Retrieve the sampler, raising it at a speed of approximately 0.3 m/s.
9. Guide the sampler aboard the vessel and place it on the work stand on the deck, taking care to avoid jostling that might disturb the integrity of the sample.
10. Examine the sample using the following sediment acceptance criteria:

   - Sample contains sediment; samples that are predominately gravel, rock, or debris will be rejected.

[1] A Trimble© SPS461 or similar DGPS receiver unit will be employed for the various sampling methods outlined in the quality assurance project plan. The DGPS receiver will be calibrated daily to ensure that it is accurately recording positions from known benchmarks and functioning within the individual unit's factory specifications.

- Sediment is not extruding from the upper face of the sampler (indicating sampler was advanced deeper than the target penetration depth).
- Overlying water is present (indicating minimal leakage).
- Sediment surface is relatively flat (indicating minimal disturbance or winnowing).
- A penetration depth of at least 11 cm has been achieved.

If these sample acceptance criteria are not met, the sample will be rejected. In addition, if there is any indication that the sediment has been recently disturbed, the grab sample will be rejected. If the initial attempt to collect a sample is not successful due to difficult substrate (e.g., presence of riprap or other debris), up to three subsequent attempts will be made within 10 m (32 ft) of the proposed location. If the initial attempt and three subsequent attempts do not result in a sample that meets the appropriate acceptance criteria, a different sampling location may be selected in consultation with the US Environmental Protection Agency and the Performing Parties.

After sample acceptance, the following observations will be noted in the field logbook or surface sediment collection form:

- Elevation of bed at sampling location
- DGPS location
- Depth as read by the boat's depth sounder and sample collection time
- Maximum penetration depth (nearest 0.5 cm)

C Sample Collection from Shore

For intertidal locations that cannot be sampled from a boat and must be manually sampled from the shoreline during a lower tide, sediment will be collected by scooping sediment directly from the 0- to 10-cm depth with a clean, stainless steel spoon into a clean, stainless steel bowl. If the sample cannot be collected at the target location (e.g., due to the presence of riprap or rocks, riprap or rocks), the field crew may identify a new location. If acceptable sediment cannot be located, no sample will be collected at that location.

The following observations will be noted in the field logbook or surface sediment collection form:

- DGPS location
- Sample collection time
- Depth of overlying material (for armored or discontinuously armored banks)

D Sample Processing

After sediment collection has occurred, the following steps will be completed to process the sediment samples:

1. **Record information** – Information will be recorded on the sediment collection forms regarding the depth of the sample (generally 10 cm), sediment characteristics (e.g., color, smell, grain size, presence of debris, redox layer [if visible], etc.), and any necessary revisions to the sampling location or comments relative to sample quality. Take photographs of anything of note and document any deviations from the approved sampling plan on a Protocol Modification Form.
2. **Collect and homogenize sample sediment** – The sediment at each location will be transferred directly from the grab sampler (or hole, if collected manually from shore) into a pre-cleaned stainless steel bowl or cauldron and stirred with a clean, dedicated, stainless steel spoon or spatula until texture and color homogeneity have been achieved (Ecology 2021). Any large non-sediment items, such as gravel, shells, wood chips, or organisms (e.g., clams), will be removed prior to homogenization.
3. **Dispense into jars** – Sediment will be dispensed into clean and labelled jars.
4. **Label jars** – A complete sample label will be affixed to each individual sample jar. Sample labels will include the project number, sampling personnel, date, time, and sample identification. Labels will be filled out as completely as possible prior to each sampling event.
5. **Quality control jars and forms** – All sample containers will be thoroughly checked for proper identification, analysis type, and lid tightness. The field coordinator will be responsible for reviewing sediment sample information recorded on field forms and will correct any improperly recorded information.
6. **Prepare for delivery to the analytical laboratory** – Each container will be packed carefully to prevent breakage and placed inside a cooler with ice for storage at the proper temperature (≤ 4 ± 2°C) for delivery to the analytical laboratory.
7. **A chain of custody form will accompany all samples to the analytical laboratory** – Custody procedures described in the quality assurance project plan will be followed.

E Equipment Decontamination Procedures

All sediment sampling and homogenizing equipment, including the mixing bowl and stainless steel implements, will be decontaminated between sampling locations per Washington State Department of Ecology guidelines (Ecology 2021) and the following procedures:

1. Rinse with site water and wash with a scrub brush until free of sediment.
2. Wash with phosphate-free detergent.
3. Rinse with site water.
4. Rinse with distilled water.

Acid or solvent washes will not be used in the field because of safety considerations and problems associated with rinsate disposal and sample integrity, specifically:

- Use of acids or organic solvents may pose a safety hazard to the field crew.
- Disposal and spillage of acids and solvents during field activities pose an environmental concern.
- Residues of solvents and acids on sampling equipment may affect sample integrity for chemical testing.

Any sampling equipment that cannot be cleaned to the satisfaction of the field coordinator will not be used for further sampling activities.

F References

Ecology. 2021. Sediment cleanup user's manual. Guidance for implementing the cleanup provisions of the sediment management standards, Chapter 173-204 WAC. Third revision December 2021. Pub. No. 12-09-057. Toxics Cleanup Program, Washington State Department of Ecology, Olympia, WA.

Appendix B – Construction Sediment Sampling Quality Assurance Project Plan

Attachment B.3
Analytical Data Quality Indicators

To be completed after 100% RD.

90% Remedial Design Volume II, Part I

Appendix C
Air, Noise, and Light Monitoring Plan

TABLE OF CONTENTS

TABLES

ABBREVIATIONS

ANL	air, noise, and light
ANLMP	Air, Noise, and Light Monitoring Plan
COCP	Community Outreach and Communications Plan
CQAP	Construction Quality Assurance Plan
dB(A)	A-weighted decibel
EPA	U.S. Environmental Protection Agency
EQAO	Environmental Quality Assurance Officer
H2S	hydrogen sulfide
IQAT	Independent Quality Assurance Team
LDW	Lower Duwamish Waterway
QA	quality assurance
QC	quality control
RAWP	Remedial Action Work Plan
RD	remedial design
SMA	Sediment Management Area
SMC	Seattle Municipal Code
T117	Terminal 117
TMC	Tukwila Municipal Code
TWA	time-weighted average
WAC	Washington Administrative Code

1 Introduction

This draft Air, Noise, and Light Monitoring Plan (ANMP) is a component of remedial design (RD) for the upper reach (river mile 3.0 to river mile 5.0) of the Lower Duwamish Waterway (LDW).. The RD approach has been prepared consistently with the sediment remedy outlined in U.S. Environmental Protection Agency's (EPA's) November 2014 Record of Decision (EPA 2014), as modified by the Explanation of Significant Differences (EPA 2021).

Nearly all remedial actions in the upper reach will be accomplished using water-based equipment (which is regularly employed throughout the LDW for other industrial activities) in the vicinity of upland properties that have mixed industrial, commercial, and residential uses. Therefore, residents in adjacent neighborhoods, live-aboard residents in marinas, marine users on the LDW, residents and businesses using roads shared with project truck traffic, and workers could potentially be affected by remedial action construction activities. The Remedial Action Contractor (Contractor) will be required to comply with all local, state, and federal regulations relevant to controlling construction impacts on air, noise, and light (ANL) criteria.

This ANLMP provides the means and methods to conduct field monitoring to assess potential impacts on the adjacent community during construction activities if there are community complaints with respect to ANL impacts. This ANLMP will be implemented by the Project Owner for quality assurance (QA) purposes. The Project Owner's Independent Quality Assurance Team will implement QA monitoring under this plan.

Review of a similar recent cleanup project located within the upper reach indicates that the potential for ANL impacts on the community during construction is low. The Port of Seattle's Terminal 117 (T117) Early Action Area remediation project was located within the upper reach and was a combined upland excavation and in-water remedial dredging project that was an early action for the LDW Comprehensive Environmental Response, Compensation, and Liability Act cleanup. The T117 project location was adjacent to residential properties and the South Park Marina, whereas the upper reach remedial actions will be located almost entirely on the waterway; only one shoreline excavation area will be located on the eastern shoreline at Container Properties (an industrial site). The upland excavation activities were located close to residential areas and used multiple pieces of diesel excavation equipment and trucks to transport excavated materials. The Port of Seattle conducted daily monitoring for ANL (including multiple air quality parameters) during upland excavation and only noise and light monitoring after upland excavation had been completed. Construction took place over 247 days during 2 construction seasons, and there were only 2 individual ANL criteria exceedances (for 1 of 5 air quality parameters [diesel particulate matter]) during upland excavation over that period[1]. There were no ANL criteria exceedances during dredging operations, nor were there any exceedances for noise or light standards. ANL monitoring results are documented in Appendix 19 of the T117 Phase 1 Removal Action Construction Report (AECOM 2016).

This ANLMP describes baseline monitoring for air and noise at the outset of construction activities to verify that the Contractor's general operations are compliant with applicable regulations for air and noise criteria. Baseline monitoring for light will not be conducted, since there is no measurable criteria for light; rather, light "monitoring" will be qualitative and complaint based. Following verification, any further air and noise monitoring for this project will be conducted on an as-needed basis; monitoring will be triggered by community feedback submitted via the project website or project hotline, as described in the Community Outreach and Communications Plan (COCP, Volume II, Part VIII). The COCP recognizes the potential for project impacts on the community and identifies a communication plan to document questions/complaints and provide responses. The Contractor's work is anticipated to occur during standard working hours (7:00 a.m. to 7:00 p.m.); the Contractor may propose to conduct some of its work outside of standard working hours, which have different criteria for noise. This ANLMP also describes optional monitoring equipment, general guidance for monitoring distances/locations, and monitoring frequency when a monitoring event is triggered.

1.1 Purpose

As with any construction project, construction equipment, trucks, tugboats, and other workboats may generate dust, odor, noise, and light that could impact normal quality of life near the work areas.

This plan addresses potential project-related quality of life impacts associated with air quality, noise, and light that may affect the community. This plan provides methods and procedures for monitoring air quality (including odors), noise, and light during the cleanup construction period. Baseline monitoring of air quality and noise is discussed. The specific goals of this plan are:

- Identify performance standards for air quality, noise, and light that apply to construction activities during standard working hours and outside of standard working hours.
- Outline monitoring protocols (methods, location, and frequency) that will be used to evaluate compliance with performance standards.
- Identify performance specifications for monitoring equipment to be used to perform field measurements.
- Document and report monitoring results.

[1] Diesel particulate matter was exceeded on 2 out of 166 days of daily upland excavation monitoring.

1.2 Project Organization and Communications

This section provides a description of the key roles and communications for the implementation of this plan. Additional details of these key roles are provided in Section 2 of Construction Quality Assurance Plan (CQAP) to which this is an appendix.

- **Project Representative**: The Project Representative (TBD), whose role is described in the CQAP, will be assigned by the Owner to oversee the entire construction QA program. The Project Representative will be the only person authorized to direct the Contractor and will be kept updated by the ANL Monitoring Lead on monitoring results. The Project Representative will work with the Environmental Quality Assurance Officer (EQAO), Designer, and EPA to determine when to conduct ANL monitoring during construction, and whether mitigation actions are needed to respond to community complaints.
- **Environmental Quality Assurance Officer**: The EQAO (TBD), whose role is described in the CQAP, will be responsible for coordinating, reviewing, and reporting all environmental monitoring activities, including ANL monitoring. The EQAO will report to the Project Representative and provide recommendations regarding the need for corrective actions in the event of monitoring exceedances and nonconformance with contract documents and the Contractor's approved Remedial Action Work Plan (RAWP).
- **ANL Monitoring Lead**: This person will be responsible for oversight and implementation of the ANLMP. The ANL Monitoring Lead will report to the EQAO.
- **COCP Lead**: This person will be responsible for implementing the COCP. The COCP Lead will coordinate directly with the Owner's Project Representative to communicate community input and complaints to the Project Coordinator and Independent Quality Assurance Team (IQAT).

The ANL Monitoring Lead will document and report monitoring results on a weekly basis (during weeks when monitoring is conducted), unless there is an exceedance of any performance standard. In that case, the ANL Monitoring Lead will report exceedances to the Project Representative immediately and to EPA within 2 hours of the exceedance (during standard working hours or the next day if exceedance occurs outside of standard working hours). These results will be included in the Owner's Weekly Field Activity Reports to EPA (see CQAP for descriptions of Daily and Weekly Field Activity Reports).

The Project Representative will be responsible for communicating with and directing the Contractor and coordinating with the EQAO and ANL Monitoring Lead to observe the implementation of mitigation actions.

2 Potential Impacts, Performance Standards, and Monitoring Scope

This section describes potential air quality, noise, and light impacts on the surrounding community that may originate from the project and potential prevention measures. It also defines the performance standards and proposed monitoring program for ANL. Qualitative monitoring relies on the observations of workers and the community to identify issues with air quality, noise, and light. This type of monitoring depends on human senses, such as visual, olfactory, and auditory signals; therefore, such monitoring is subjective. Quantitative monitoring using equipment and laboratory analysis is based on applicable regulations; such monitoring is objective and can be used to clearly demonstrate how the project does not impact the community.

When concerns are identified by the community, they will be reportable through any of the incoming communication mechanisms described in the COCP; this may trigger the quantitative monitoring defined in this section. Quantitative monitoring of ANL disturbances associated with this project will be implemented during baseline monitoring; after that, quantitative ANL monitoring will only occur in response to community feedback submitted in accordance with the COCP and as directed by the Project Representative and/or EQAO.

2.1 Air Quality

2.1.1 Potential Impacts and Prevention Measures

Because upper reach remedial actions will take place on the LDW, potential impacts are most likely to affect properties and people on or immediately adjacent to the LDW. While many of the properties around the upper reach are industrial/commercial, there are also private residences in parts of the upper reach, as well as live-aboard residents at marinas.

As discussed in Section 1, the T117 Early Action Area project conducted daily monitoring during upland excavation[2] and had minimal exceedances over two construction seasons. Although the potential for air quality impacts is considered low, the upper reach RD recognizes community concerns for potential air quality impacts and specifies air quality performance requirements to be met by the Contractor. These air quality performance requirements follow air emission standards defined in EPA's Tier System (EPA 2022) for fossil fuel consumption; the standards are intended to help reduce engine emissions from construction equipment. These specification requirements help projects achieve EPA's goals for green remediation and reduce the risk of air quality impacts. The

[2] Upland excavation is considered to be a significantly higher risk for air quality impacts than is dredging that takes place on the waterway.

upper reach RD considers potential air quality impacts on the adjacent community to include fugitive and visible dust and fugitive odors, as follows:

- Fugitive dust may be released when dry soil is disturbed during excavation (potential limited to one location at Sediment Management Area [SMA] 5), or when stockpiling or transporting dredged materials on uncovered trains or trucks[3]. Fugitive dust concerns include impacts on property and inhalation of dust and contaminants adhered to dust.
- Fugitive odors from construction present a potential quality of life nuisance issue. Dredging and excavation of wet sediment can potentially result in unusual odors, which can be a nuisance. Odors may be generated by dredged sediments that contain decaying organic matter (hydrogen sulfide [H2S]), during shoreline bank soils excavation, and from diesel emissions.

Dust particles from the project activities will be required to be controlled at all times (including when work is not in progress). Federal and state air quality requirements include those for dust control. To meet dust control requirements and reduce potential odor complaints, the Contractor may implement the following measures (as the Contractor determines applicable):

- Wetting excavation areas and sediment stockpiles (if necessary) for dust control[4]
- Covering truck and railcar loads to prevent the escape of dust-bearing materials
- Covering stockpiles with plastic sheeting when loading and stockpiling activities are not occurring (i.e., inactive for a specified period of time) or if nuisance odors are encountered prior to transportation off site
- Cleaning vehicles leaving the single upland work areas (SMA 5) to remove dirt or dust from wheel treads and exterior
- Using Work Site controls, such as ceasing above-water excavation during high winds or limiting the number and size of excavations open at the same time
- Sweeping any paved, on-site transload facility staging and stockpiling areas daily during dry weather
- Using water for dust suppression
- Transporting sediment emitting odors off site as soon as possible
- Not allowing equipment to idle for extended periods of time.

The Contractor's RAWP will be required to identify air quality prevention, mitigation, and control measures to be implemented during construction activities for federal and state criteria compliance.

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[3] Specifications require all trucks and railcars to be covered while transporting dredged material.
[4] The work will be conducted during the wet weather time of year and this control method is not anticipated to be necessary.

2.1.2 Performance Standards

The Contractor will be required, per the specifications, to comply with federal, state, and local air quality standards (Clean Air Act [42 U.S. Code 7401-7671q; 40 Code of Federal Regulations 50], National Ambient Air Quality Standards, the Washington Clean Air Act [Revised Code of Washington 70.94; Washington Administrative Code (WAC) 173-400], and Puget Sound Clean Air Agency [Sections 9 and 15] regulations). The Contractor will be required during construction activities to protect the surrounding community from diminished air quality. Performance standards will apply at the project perimeter. Because the upper reach remedial actions will take place over approximately 2 river miles, and adjacent to multiple properties, the project perimeter is defined as the shoreline boundary when the Contractor is working over water and upland property boundaries when the Contractor is working on land.

Specific requirements pertaining to fugitive dust and odor (H2S) are as follows:

- Fugitive dust
  - Qualitative criterion of "no visible dust" at the property perimeter to conform to Puget Sound Clean Air Agency Regulation I, Section 9.15
- Odor (H2S):
  - Odor is typically a nuisance issue but not a health issue. The potential source of odor for this project is H2S from anerobic sediments. H2S odors can be detected at very low levels by the human nose. The Agency for Toxic Substances and Disease Registry cites studies that demonstrate odor detection for H2S between 0.0005 and 0.3 parts per million (ATSDR 2006). WAC 173-460-150 sets the performance standard for H2S as a daily 24-hour time-weighted average (TWA) of 2 $\mu g/m^3$ at the project perimeter. Odor complaints will be an indicator that H2S concentrations may have reached a level that warrants monitoring during construction.

2.1.3 Baseline Monitoring

The purpose of conducting baseline air quality monitoring for H2S will be to demonstrate early during the construction process that the dredging activities are not causing an H2S criteria exceedance. This will be accomplished by monitoring the ambient baseline air quality condition twice: once before the start of construction (for ambient conditions) and once at the start of over-water dredging activities. Both instances of monitoring will occur during standard working hours, and both instances will last for approximately 3 days.

Ambient and baseline monitoring locations will be selected based on the Contractor's sequencing plan in its approved RAWP. The baseline monitoring location will be located downwind from planned dredging activity, approximately 100 feet away; this distance represents a conservative measurement, since most dredging activities will be more than 100 feet from the shoreline in the vicinity of receiving properties along the shoreline. The same locations will be used for both ambient (pre-construction) and construction baseline monitoring.

Air quality monitoring will be conducted on a vessel that can be positioned downwind of construction activities, near the shoreline. During baseline monitoring, monitoring staff will also document activities in the area that could impact monitoring results, such as other construction occurring in the vicinity.

2.1.4 Monitoring During Construction

It is anticipated that the baseline monitoring will record no exceedances of H2S concentration criteria. Due to the Work Site being located on the water within the LDW and the limited number of residences and live-aboard residents at marinas along the upper reach, daily air quality monitoring is not proposed. The specifications include requirements for the Contractor to comply with all applicable air quality regulations and meet air quality performance requirements (i.e., equipment use must meet a stricter standard than is typical for dredging projects: a minimum percent use of specific Engine Tier [II to IV], depending on construction equipment type).

Dust monitoring will be based on ongoing visual observations required of the Contractor for areas where dust generation may occur (e.g., upland excavation at SMA 5, stockpile management at the Transload Facility). The specifications require the Contractor to control dust; if the construction IQAT (i.e., Construction Management inspectors, environmental monitoring staff) observes fugitive dust, the Contractor will be notified by the Project Representative and directed to take corrective action to control the dust.

H2S concentrations will be monitored if there are multiple odor complaints, and if the Project Representative determines that the complaints are resulting from upper reach remedial actions, rather than from other activities that are not related to the upper reach cleanup. In the event of such monitoring, it will occur at the project perimeter in the general vicinity of the complaint(s). The human sense of smell will allow for recognition of the odor; recognition will be followed by quantitative measurements with field instruments and a comparison of the concentrations with performance standards. If monitoring indicates that H2S levels may exceed state criteria[5], mitigation measures will be implemented by the Contractor until H2S levels comply with performance standards (Section 2.1.2).

[5] The H2S criteria are a daily TWA value, so individual readings may need to be converted to a TWA value based on the duration of the Contractor's work in the area each day.

Background/upwind and performance air quality monitoring will be conducted at two stations in any instance of a triggered monitoring event. The background station will be located at least 100 feet upwind of construction activities; monitoring will occur during construction activities and H2S levels will be evaluated for compliance with project performance standards. The downwind monitoring station (to assess the air quality impacts from dredging) will be located at the project perimeter (previously defined) for that dredging location.

Data from the National Oceanic and Atmospheric Administration Boeing Field weather station (NOAA 2023) will be reviewed to determine wind direction for any monitoring event (i.e., which station is downwind, and which is upwind). Monitoring station locations may be adjusted based on changing weather conditions or movement of construction activities. The ANL Monitoring Lead or designee will be on-site to determine monitoring locations.

2.2 Noise

2.2.1 Potential Impacts and Prevention Measures

Construction activities use heavy equipment to dredge sediment, place clean materials, excavate bank sediment, and remove/install piles and temporary shoring; in addition, tugboats are used to move materials and barges around the site. Noise will be generated by both in-water and upland sources (dredging and excavation of one bank area [SMA 5]) in an industrial waterway; however, the locations receiving noise will include limited residential (including upland and marina live-aboard residents), commercial, and industrial locations. These construction activities may generate noise at levels greater than the ambient levels typically experienced in the project setting. The site is in an area with other significant background noise sources, such as airplane traffic from King County International Airport and Sea-Tac International Airport, adjacent industrial property operations, commercial and recreation vessel traffic, and roadway noise. Noise monitoring conducted during construction of the T117 Early Action Area project (located within the upper reach)—an upland remedial action area that used both upland and in-water heavy equipment, and that would have been expected to generate more noise than the forthcoming upper reach remedial actions—did not detect any noise standards exceedances. Therefore, it is expected that construction activities on the upper reach will be in compliance with noise standards.

For noise standards, the Seattle Municipal Code (SMC) defines daytime hours as between 7:00 a.m. and 10:00 p.m. on weekdays and 9:00 a.m. and 10:00 p.m. on weekends and legal holidays; Tukwila Municipal Code (TMC) has similar hours for its noise standards. The SMC, TMC, and King County Title 12 noise ordinances require lower sounds levels for any work conducted outside of these hours. In general, remedial construction work is anticipated to take place between the hours of 7:00 a.m. and 7:00 p.m. On occasion, the Contractor may propose to work outside of daytime hours (as defined by the noise ordinances). The specifications require the Contractor to obtain approval from the Project Representative and EPA to conduct work outside of standard working hours.

The project specifications define noise performance requirements to be met during construction based on the most stringent noise ordinance. Examples of best management practices that the Contractor may implement to prevent and mitigate noise impacts on the community include:

- Reduce vehicle speeds when transiting near residential areas (if applicable).
- Turn off engines when equipment is inactive for a period of time.
- Potentially limit work hours or work only during standard work hours in locations near residential or live-aboard residents.

The Contractor's RAWP will be required to identify noise control measures to be implemented during construction activities.

2.2.2 Performance Standards

The specifications will require the contractor to comply with noise criteria for the cities of Seattle and Tukwila and unincorporated King County when working close to residential areas (upland areas and live-aboard residential marinas) adjacent to the project site perimeter to limit the extent of potential noise impacts on the community.

All local ordinances (SMC Chapter 25.08 [Subchapters 410, 420, and 425], TMC Chapter 8.22, and King County Title 12.86) establish equally stringent maximum permissible sound levels from industrial sources to a receiving property (residential at daytime or nighttime, commercial, or industrial), as listed in Table C2-1. For construction activity within industrial zones, exterior sound level limits—measured at the project perimeter or at a distance of 50 feet from the construction equipment generating the sound, whichever is further—may be exceeded by no more than 25 A-weighted decibels (dB[A]).

Table C2-1
Maximum Permissible Sound Levels from All Local Ordinances

District of Sound-Producing Source	Maximum Permissible Sound Level in District of Receiving Property[1]			
	Residential, Daytime	Residential, Nighttime	Commercial	Industrial
Industrial	60 dB(A)[2]	50 dB(A)	65 dB(A)[2]	70 dB(A)[2]
Construction Equipment at Project Perimeter or 50-foot Distance from Equipment (whichever is further), Daytime Only[2]	Additional noise allowance of 25 dB(A)	N/A	Additional noise allowance of 25 dB(A)	Additional noise allowance of 25 dB(A)

Notes:

Maximum permissible sound levels applicable to sound sources within the limits of the Cities of Seattle and Tukwila and unincorporated King County.
1. The maximum permissible noise level is applied to a minimum measurement interval of 1 minute for a constant sound source or a 1-hour measurement for a non-continuous sound source.
2. Daytime is defined as the most stringent daytime period among all local ordinances: between 7:00 a.m. and 10:00 p.m. on weekdays and between 9:00 a.m. and 10:00 p.m. on weekends and legal holidays. This definition is also applicable to construction equipment used on public projects per SMC 25.08.425.
dB(A): A-weighted decibel
N/A: not applicable
SMC: Seattle Municipal Code

Additional specific maximum permissible sound levels and working hours associated with various types of impact equipment used at construction sites and for short-duration construction activities (up to 1 hour) are described in SMC Chapter 25.08.425C and TMC Chapter 8.22. For residential receiving properties, maximum permissible sound levels are more stringent for construction work occurring during nighttime hours, as unusual noise can cause annoyance, generate stress, and disturb sleep. Noise levels may be monitored as event-driven monitoring if there are multiple community complaints relating to noise-generating activities, and site activities will be assessed for any potential modifications in consultation with EPA.

2.2.3 Baseline Monitoring

The purpose of conducting baseline noise level monitoring will be to demonstrate early on during construction that the Contractor's dredging equipment is not exceeding noise criteria. This goal will be accomplished by monitoring the ambient baseline noise level twice: once before the start of construction (for ambient conditions) during daytime hours (see Table C2-1, Note 2) and once at the start of over-water dredging activities. Both monitoring efforts will occur over a period of approximately 3 days.

The baseline monitoring location will be positioned at the project perimeter along the shoreline or at a distance of 50 feet from the construction equipment producing the noise, whichever is further. During baseline monitoring, monitoring staff will also document activities in the area that could impact monitoring results, such as regular, on-going activities and other construction occurring in the vicinity.

Since the same type of equipment will be used to both dredge sediment and place clean materials, early noise level monitoring results will represent both types of remedial actions.

2.2.4 Monitoring During Construction

It is anticipated that the baseline monitoring will record no exceedances of noise level criteria caused by the Contractor's dredging equipment. Due to the Work Site being located on the water within the

LDW and the limited number of residences along the upper reach, daily noise level monitoring is not proposed. The specifications require the Contractor to comply with all applicable noise regulations.

Noise will be event-driven monitoring if there are multiple noise complaints, and if the Project Representative determines that the complaints are resulting from upper reach remedial actions, rather than from other activities that are not related to the upper reach cleanup. In the event of such monitoring, it will occur at the project perimeter along the shoreline in the general area of complaint. If monitoring indicates that the noise levels are exceeding criteria, mitigation measures will be implemented by the Contractor to bring its operations back into compliance with performance standards, as discussed in Section 2.2.2.

2.3 Light

2.3.1 Potential Impacts and Prevention Measures

It is anticipated that artificial lighting may be required for construction work conducted during the winter season to accommodate construction activities that need to be performed during low or high tides, or to facilitate meeting the construction schedule (i.e., progress of activities within the in-water work window). Lighting may be needed during the following activities:

- For general lighting at the beginning and end of each work day during fall and winter months, as even standard work hours will be outside of the fall/winter daylight periods
- For project vessels to ensure their safe passage during nighttime or early morning transport of materials
- For any extended work hours (e.g., 18- or 24-hour work days) for specific tasks, such as bank excavation, that may be necessary to meet the schedule or to do work at specific tide levels.

Artificial light provides worker and community safety but may present a nuisance to surrounding residences. When work is conducted outside of standard working hours (7:00 a.m. to 7:00 p.m.), light levels will be measured in response to multiple community complaints, and to assess compliance with performance standards for light at construction sites. Acceptable light performance best management practices are identified in the specifications (e.g., the contractor can use light shrouds or barriers to help direct light into the work areas, re-sequence work during the day, reposition lighting equipment to avoid directing light outside of immediate work areas).

The Contractor's construction methods to prevent quality of life impacts from lighting will include the selection and setup of equipment that complies with specification performance standards. If light levels do create a disturbance for residents or LDW users outside of standard work hours, actions may be taken, in consultation with EPA, to identify the source of the nuisance and mitigate the problem. Specific actions will be selected on a case-by-case basis and will only be used to the extent that they do not impede safe operations. Actions may include:

- Repositioning lights
- Re-sequencing work to avoid work outside of standard work hours in areas more sensitive to light disturbance
- Repositioning equipment, such as material barges or dredging equipment, relative to the lighting source.

2.3.2 Performance Standards

To limit the extent of potential light impacts on the community, project specifications will require the Contractor to comply with light requirements of the Cities of Seattle and Tukwila (SMC Chapter 23.50.046 and TMC Chapter 18.044.050) when working close to residential areas (residential shoreline private property owners and marina live-aboard residents) and commercial/industrial areas. Exterior lighting shall be shielded and directed away from lots in adjacent residential zones, per the SMC.

2.3.3 Monitoring During Construction

Light monitoring will be conducted if multiple community complaints are received when construction activities are taking place outside of standard work hours (7:00 a.m. to 7:00 p.m.), and if the Project Representative determines that the complaints are resulting from upper reach remedial actions, rather than from other activities that are not related to the upper reach cleanup. Light monitoring typically will be conducted using a hand-held light meter. Visual inspections of lighting may be conducted at appropriate locations; these locations will be determined based on community complaints, the location of the construction activity that is the cause of the complaints, and the location(s) of the impacted residents.

3 Monitoring Methods

This section discusses monitoring methods that may be used. The actual means and methods, equipment, and standard operating procedures will be finalized by the Independent Quality Assurance Team and implemented by the ANL Monitoring Lead and EQAO, as discussed in Section 2.

3.1 Air Quality

3.1.1 Fugitive Dust

Qualitative dust visual monitoring will occur on a daily basis around construction activities that may suspend dust. Monitoring for fugitive dust will be a Contractor responsibility, per the specifications.

3.1.2 Hydrogen Sulfide (H2S) Monitoring

H2S levels will be measured using a hand-held monitoring instrument, such as a Jerome® H2S analyzer or equivalent, and averaged over an 8-hour period in accordance with WAC 173-460-50.

3.2 Noise

Monitoring will be conducted using monitoring instruments, such as a Larson Davis Model 820 or equivalent, integrating sound level meters in protective, weather-resistant cases.

3.3 Light

Light monitoring will be conducted, as needed, by visual inspection to verify that construction lights are properly shielded to direct light away from residences, as required by the SMC.

4 Monitoring Quality Assurance/Quality Control

QA/quality control (QC) will be followed during implementation of this ANLMP to ensure consistent data collection and analysis procedures, and to ensure that data are representative of site conditions. The monitoring QA/QC procedures described herein will be led by the ANL Monitoring Lead and reported to the EQAO, as described in Section 1.2. The ANL Monitoring Lead will be responsible for maintaining communications, maintaining equipment, and reviewing field documentation.

4.1 Documentation

ANL monitoring personnel will record field conditions in a project logbook during monitoring events; document equipment inspection, calibration checks, and operation; and document instrument monitoring frequency, results, and readings. Any exceedances of performance standards and associated control measures will be documented, including the exceedance level, the time of the exceedance, the location measurements were taken, a description and implementation time of the control measure, the time the readings met criteria, and when the Project Representative and EPA were notified.

Equipment calibration and operational checks—along with any instrument problems such as, but not limited to, battery failures—will be recorded in the project logbook. The logbook will document instrument makes and models, serial numbers, and factory calibration data. The most recent factory calibration date will be compared to manufacturer-recommended criteria to ensure that calibration dates are valid. Any maintenance and repair operations required during the project will also be recorded.

Data will be downloaded from data logging instruments (if used) to a personal computer on a weekly basis. This will help minimize any potential loss of data from instrument failures. Monitoring data will then be summarized in the weekly monitoring report.

4.2 Equipment Calibration and Maintenance

Field maintenance and calibration will be performed according to manufacturer specifications prior to instrument use. Each piece of equipment will be carefully inspected and tested to check for any damage, and to ensure it is functioning properly when brought to the site. The operating manuals will specify equipment operating procedures.

5 References

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Appendix D
Monitoring and Inadvertent Discovery Plan

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Appendix E
IQAT Health and Safety Plan

The IQAT Health and Safety Officer will be responsible for preparing its HSP for the CQAP.