Exhibit 3
Second Amendment to
Consent Decree Re: Whatcom
Waterway Site, Bellingham, WA

Second Amendment to EXHIBIT B Cleanup Action Plan

[The Cleanup Action Plan (CAP) is amended as follows:]

Table of Contents

[No change, except that Section 7.1.8 is deleted and the following new subsection 5.7 is inserted:]

5.7 Basis for Changes by the Second Amendment to the Cleanup Action

List of Figures

[No change, except the following new figures are inserted:]

Figure 6-6 Phase 1 and Phase 2 Site Areas

Figure 6-7 Cleanup Action for Phase 2 Site Areas

Figure 6-8 Anticipated Navigation and Land Uses

[And, Figure 7-2 is replaced with the following:]

Figure 7-2 Anticipated Implementation Schedule

List of Appendices

[Appendix B-1 is replaced with the following:]

Appendix B-1 Remedial Cost Evaluation – Second Amendment

[And the following new appendix is inserted:]

Appendix C Evaluation of Carcinogenic Polycyclic Aromatic Hydrocarbons and Dioxin/Furan Compounds in Surface Sediment – Second Amendment

1 Introduction

[No change, except to Section 1.2.]

1.2 Purpose and Scope

[No change, except for the following is inserted at the end of the subsection:]

Amendments to this CAP were made in 2023 to:

- Establish a cleanup standard for dioxin and furan compounds (D/F compounds) in response to regulatory changes
- Adjust the cleanup implementation schedule to expedite the removal of contaminated sediment from a portion of Unit 1C near the Bellingham Shipping Terminal (BST)
- Include a contingent cleanup action for Unit 3A based on the Port's ongoing effort to obtain grant funds for completion of habitat improvements in this area of the Site
- Revise the cleanup action for Unit 8 in response to changes in Port land use plans to include the construction of a reconfigured confined disposal facility (CDF) for management of Unit 8 contaminated sediments and disposal of contaminated sediments removed from other Phase 2 Areas of the Site

In 2013 the Sediment Management Standards (SMS; Ecology, 2013) regulation was revised to incorporate requirements for developing cleanup standards for bioaccumulative compounds to protect human and ecological health. Based on the revised SMS regulation and the accompanying revised guidance (Sediment Cleanup User's Manual [SCUM]; Ecology, 2021), the cleanup standard for D/F compounds is described in Section 3.

The Port has also proposed to expedite the removal of contaminated sediment from a portion of Unit 1C near the Bellingham Shipping Terminal. The Port has been awarded a federal grant to conduct this work. Section 5.7.1 presents the proposed cleanup work in Unit 1C and an updated project schedule is shown in Figure 7-2, and attached to the Decree as Exhibit C.

In addition, the Port is currently seeking grant funds to upgrade the cleanup action in Unit 3A from monitored natural recovery to partial dredging and capping. The Port's goal of funding and implementing this additional work is to improve habitat quality within the Whatcom Creek estuary for use by juvenile salmonids and forage fish while providing a more permanent cleanup

remedy within this area of the Site. Section 5.7.2 presents the proposed change in the remedy for Unit 3A, contingent on the Port's receipt of grant funding.

Lastly, the Port has updated its land use plans for Unit 8, also known as the Aerated Stabilization Basin (ASB); they no longer plan to develop a large marina over an in-water submerged CDF. The updated land use plans are defined in Port Resolution 1397 (executed November 2021) that updates the Port's Comprehensive Scheme of Harbor Improvements for the Marine Trades Area. Resolution 1397 directs that the ASB be reused to support multiple marine trade industries rather than be developed solely for marina purposes. This decision results from years of land use planning and fulfills the Port's four-fold objectives to 1) enhance economic opportunities for marine trades businesses, 2) complete the cleanup of the Whatcom Waterway and adjacent cleanup sites, 3) improve aquatic habitat for salmonids, and 4) provide additional shoreline public access opportunities in the marine trades area that includes and surrounds the ASB. The updated land use plans incorporate a reconfigured CDF for upland management of contaminated sediment generated by the cleanup. In comparison to the previously approved in-water submerged CDF, the reconfigured CDF has a smaller footprint and a larger volume, allowing additional contaminated sediment from the Whatcom Waterway and from other Port dredging projects to be cost-effectively managed within it. Under the updated land use plans about 14 acres of the ASB will be developed as usable upland property, and the other half will be cleaned up, deepened to approximately 25 feet below mean lower low water (MLLW), and connected to Bellingham Bay to provide additional commercial navigation, public access, and aquatic habitat areas. Section 5.7.3 revises the cleanup requirements for Unit 8, including reconfiguring the CDF previously planned for that area and using it for management of contaminated sediment to be removed from both Unit 8 and other Phase 2 Areas of the Site.

Section 7.2 describes the anticipated schedule for design and implementation of the cleanup action.

2 Site Background

[No change, except to Section 2.2.4.]

2.2.4 Exposure Pathways and Receptors

[No change, except that the following is inserted at the end of the subsection titled Protection of Human Health:]

Both cPAHs and D/Fs are bioaccumulative chemicals that are present within the Site. The 2013 SMS regulation and associated guidance (Ecology, 2021) provide the regulatory framework to develop cleanup standards for these compounds to protect human and ecological health. Section 3 determines that cPAHs are not a contaminant of concern at the Site and establishes a cleanup standard for D/Fs.

[And the following is inserted at the end of the subsection titled Protection of Ecological Health:]

cPAHs and D/Fs are bioaccumulative chemicals that are also present within the Site. The 2013 SMS and associated 2021 SCUM provide the regulatory framework to develop cleanup standards for these compounds to protect human and ecological health. Section 3 determines that cPAHs are not a contaminant of concern at the Site and establishes a cleanup standard for D/Fs.

3 Cleanup Requirements

[No change, except to subsections 3.1.1 and 3.2.]

3.1.1 Sediment Cleanup Levels

[No change, except for the following is inserted at the end of the subsection titled Protection of Human Health and Ecological Receptors:]

Under the 2013 updates to the SMS regulations, risk-based cleanup levels must be defined for bioaccumulative compounds that are present within a site. For mercury, the existing cleanup levels defined in the original CAP remain protective and comply with current SMS requirements. However, evaluation of cPAH and dioxin/furan compounds is required.

Under current SMS regulations, the long-term goal is the sediment cleanup objective (SCO). The SCO is established at either a risk-based concentration, the natural background concentration, or the practical quantitation limit (PQL), whichever is higher.

The Cleanup Screening Level (CSL) is established at either a risk-based concentration, the regional background concentration, or the PQL, whichever is higher. The sediment cleanup level for a site may be adjusted upwards from the SCO but cannot exceed the CSL. This determination is based on the technical possibility and net adverse environmental impacts associated with meeting and maintaining the sediment cleanup level (Ecology, 2021).

Cleanup levels for bioaccumulative compounds are applied as a surface weighted average concentration (SWAC) across the applicable exposure area.

cPAH Compounds

For cPAH compounds, a calculated human health risk-based SCO of 229 micrograms per kilogram (µg/kg; expressed as the benzo(a)pyrene toxicity equivalent or TEQ) was developed for the I&J Waterway site (Ecology, 2019) in Bellingham Bay. The I&J Waterway evaluation also concluded that this value is expected to be protective of ecological health. Ecology has determined that this calculated risk-based SCO is appropriate to consider in establishing an SCO for the Whatcom Waterway Site.

Since 229 µg/kg TEQ is higher than the PQL (7 µg/kg TEQ) and natural background (21 µg/kg TEQ; Ecology, 2021), 229 µg/kg TEQ is the SCO applicable to the Whatcom Waterway Site. However, as shown in Appendix C, the current SWAC for cPAHs in surface sediment within the Whatcom Waterway Site is 67.8 µg/kg TEQ. Since current concentrations are below

229 µg/kg TEQ, cPAHs are not a contaminant of concern at the Whatcom Waterway Site and a sediment cleanup level is not established.

D/F Compounds

For D/F compounds, calculated human and ecological health risk-based SCO and CSL values have not been developed; therefore, the SCO is the higher of PQL (5.0 ng/kg TEQ) or natural background (4.0 ng/kg TEQ; Ecology, 2021), and the CSL is the higher of PQL or regional background (15 ng/kg TEQ; Ecology, 2015). As a result, the SCO is 5.0 ng/kg TEQ and the CSL is 15 ng/kg TEQ.

As shown in Appendix C, it is not technically possible to maintain the SCO due to the presence of recontamination sources that are beyond the control of the Site PLPs. The evaluation in Appendix C forecasts that it is possible to maintain a cleanup level of 9.8 ng/kg TEQ. Therefore, the sediment cleanup level for D/F compounds is 9.8 ng/kg TEQ. This sediment cleanup level is applicable to a Sediment Cleanup Unit that is the same as the Whatcom Waterway Site boundary as determined for mercury. (see subsequent paragraph).

The Whatcom Waterway Site boundary was originally established based on the distribution of elevated mercury concentrations originating from the former GP chlor-alkali plant. D/F compounds are a regional contaminant, and the boundary of the Whatcom Waterway "Site" does not contain the full distribution of these compounds that exist above the SCO (5 ng/kg). Therefore, with respect to D/F compounds the Whatcom Waterway Site represents a "Sediment Cleanup Unit" (SCU) in accordance with the SMS.

3.2 Points of Compliance

[No change, except for the following is inserted at the end of the subsection:]

Under the SMS, cleanup levels for bioaccumulative compounds must be met across the applicable exposure area(s) as defined using a SWAC. For cleanup levels based on seafood consumption, the exposure area is the entire Site or, in the case of D/F compounds, the SCU.

4 Description of Remedial Alternatives Considered in the RI/FS

[No changes.]

5 Basis for Selection of the Proposed Cleanup Action

[No change, except the following new subsection 5.7 is inserted at the end of this section:]

5.7 Basis for Changes to the Cleanup Action by the Second Amendment

This section presents the basis for the changes to the cleanup action made by the Second Amendment to the CAP.

No changes to the cleanup action are required by the Second Amendment to address D/F compounds since the sediment cleanup level for D/Fs will be met at the points of compliance by the proposed cleanup action.

5.7.1 Unit 1C (Bellingham Shipping Terminal)

The Port has proposed to expedite the removal of contaminated sediment from a portion of Unit 1C located at the Bellingham Shipping Terminal (BST). This removal (Figure 6-6) will address an area where compliance monitoring shows sloughing of sediment has occurred from underneath the BST pier structure. Timely removal of this sloughed sediment and adjacent high spots will protect against potential vessel-related redistribution of contaminated sediment that could otherwise result in recontamination and will ensure continued navigational safety. Removed sediment will be disposed of at an off-site upland landfill facility.

The project schedule was adjusted to reflect the expedited implementation of this work. The updated project schedule is shown in Figure 7-2 and attached to the Decree as Exhibit C.

5.7.2 Unit 3A (Head of Waterway)

The original CAP (Ecology, 2007) identified Monitored Natural Recovery (MNR) for Unit 3A at the head of the Whatcom Waterway. The Port is currently pursing grant funding to change the remedy in this area to partial dredging and capping. This change would meet the Port's goal of improving habitat quality within the Whatcom Creek estuary for use by juvenile salmonids and forage fish.

The partial dredging and capping work would remove approximately 10,000 cubic yards of contaminated sediment (Figure 6-6), with disposal within the Unit 8 CDF (see Section 5.7.3). The remaining contaminated sediment would be capped with a layer of clean material, resulting in elevations more suitable

for use by aquatic vegetation, juvenile salmonids, and forage fish. Because the combination of dredging and capping is a more permanent cleanup than MNR, no further evaluation is required under MTCA and SMS.

The change in the Unit 3A cleanup is contingent on the Port's receipt of grant funding. If the Port is successful in obtaining grant funding, the details of this work will be defined in the EDR to be developed as described in the updated project schedule (Figure 7-2) and Exhibit C of the Decree.

5.7.3 Unit 8 (ASB) and Dredged Material Disposal

Under the First Amendment to the CAP (Ecology, 2011), contaminated sediments from within the ASB portion of the Site (Unit 8) were to be dredged and disposed of in an off-site upland landfill and dredged materials from remaining Phase 2 Site Areas were to be disposed of in a submerged 24-acre CDF. That CDF was to be constructed beneath Unit 8 with a top elevation of 14 to 15 feet below MLLW as necessary to support future use of the ASB as a small boat marina. This type of aquatic CDF is no longer compatible with the Port's updated land use plans for Unit 8.

As described in Section 1.2, the Port has updated its land use plans for Unit 8. Port Resolution 1397 directs that, rather than using Unit 8 as the location for a 24-acre CDF and future marina, the Unit 8 CDF be reconfigured to create both usable upland property and navigable marine waters within the ASB. The reconfigured CDF would occupy about half of the ASB and would create approximately 14 acres of usable upland property. The other half would be deepened to a water depth approximately 25 feet below MLLW and connected to Bellingham Bay to provide additional commercial navigation and aquatic habitat areas. This land use decision resulted from years of planning and fulfills the Port's objectives to enhance economic opportunities for marine trades businesses, complete the cleanup of the Whatcom Waterway and adjacent cleanup sites, improve aquatic habitat for salmonids, and provide additional shoreline public access opportunities in the marine trades area that includes and surrounds the ASB.

The Port's updated land use plans result in the following alternative for addressing contaminated sediments in Unit 8 and for disposing of contaminated sediments dredged from other Phase 2 Site Areas:

- Construct a containment wall down the center of Unit 8 to enclose an approximately 14-acre area adjacent to the existing uplands to create a CDF.

- Dredge contaminated sediments from the outer portions of Unit 8 (the areas outside of the CDF footprint) and dispose of them in the CDF.

- Dispose of contaminated sediments dredged from other Phase 2 Site Areas in the CDF.

- Raise the final grade of the CDF to align with the ASB berm and surrounding land areas and cap the CDF with a minimum of 2 feet of clean material. Dredged sediments from other Port cleanup sites or dredging projects may also be placed in the CDF to help achieve the final grade of the CDF.

- Provide interim stormwater management for the clean, final surface of the CDF pending future redevelopment for marine trades related uses.

However, there is an alternative that is consistent with the Port's land use plans and that would provide a more permanent solution for addressing Unit 8 contaminated sediments and for disposing of dredged contaminated sediments from Phase 2 Site Areas. That alternative is as follows:

- Dredge all contaminated sediments from Unit 8 and dispose of them in an upland, off-site landfill.

- Dispose of contaminated sediments dredged from other Phase 2 Site Areas in an upland, off-site landfill.

These two remedial alternatives are evaluated below against MTCA and SMS remedy evaluation criteria.

Evaluation of Alternatives

Evaluation of Alternatives Against MTCA/SMS Minimum Requirements		
	Alternatives for Unit 8 Sediments and Disposal of Sediments Dredged from Other Phase 2 Site Areas	
Minimum Requirements	Unit 8 Half Dredge/ Unit 8 CDF Disposal and Capping	Unit 8 Full Dredge/ Off-site Landfill Disposal
Protection of Human Health and the Environment	Complies with cleanup standards	Complies with cleanup standards
Compliance with All Applicable Laws	Complies with applicable state and federal laws	Complies with applicable state and federal laws
Compliance with Sediment Cleanup Standards	Complies with cleanup standards described in Section 3	Complies with cleanup standards described in Section 3
Uses Permanent Solutions to the Maximum Extent Practicable	Determined through a Disproportionate Cost Analysis. See evaluation in next table.	
Provisions for a Reasonable Restoration Timeframe (the time required to meet cleanup standards)	Estimated 3 years for construction. Will meet cleanup standards immediately following construction.	Estimated 4 years for construction. Will meet cleanup standard immediately following construction.
Provisions for Adequate Monitoring	Provides for compliance monitoring for all areas where contamination remains within the Site	Provides for compliance monitoring for all areas where contamination remains within the Site
Considers Concerns Identified in Comments from Affected Landowners and the Public	Issuance of this CAP amendment for public review is intended to solicit any concerns. Concerns provided will be considered.	Issuance of this CAP amendment for public review is intended to solicit any concerns. Concerns provided will be considered.

Evaluations of Alternatives Using Disproportionate Cost Analysis (DCA)		
	Alternatives for Unit 8 Sediments and Disposal of Sediments Dredged from other Phase 2 Site Areas	
	Unit 8 Half Dredge/ Unit 8 CDF Disposal and Capping	Unit 8 Full Dredge/ Off-site Landfill Disposal
Contaminated Sediments Dredged	626,000 cubic yards (196,000 half ASB and 430,000 other Phase 2 areas)	822,000 cubic yards (392,000 ASB and 430,000 other Phase 2 areas
Contaminated Sediments Capped in Unit 8 CDF	822,000 cubic yards (196,000 dredged from half of the ASB, 196,000 from within the CDF footprint, and 430,000 dredged from other Phase 2 areas)	0 cy
Core Costs for Contaminated Sediment Handling and Disposal [1]	$54.4 million (2022$) [1]	$189.3 million (2022$) [2]
Environmental Benefit Criteria		
Protectiveness, Permanence, and Long-term Effectiveness	Medium ranking – Uses on-site CDF disposal	High ranking – Uses off-site landfill disposal
Short-term Risk Management	Medium ranking –extensive material handling required	Medium ranking – extensive material handling required
Implementability	High ranking – work is implementable	High ranking – work is implementable
Consideration of Public Concerns	Medium ranking– consistent with land use plans but uses on-site CDF disposal	High ranking – consistent with land use plans and uses off-site landfill disposal

Notes:

1. Costs include those necessary to create the CDF, transfer and dispose of Site sediment in the CDF, and cap the filled CDF with clean material.
2. Costs include those necessary to transport, offload, solidify, and dispose of dredged contaminated sediments from all Phase 2 Site Areas (including Unit 8) using a commercial landfill for sediment disposal.

As shown in the DCA evaluation above, the use of an off-site upland landfill for disposal of Unit 8 contaminated sediments and for disposal of contaminated sediments dredged from other Phase 2 Site Areas provides greater environmental benefits. However, the associated sediment handling and disposal costs are more than three times higher than those for use of the on-site Unit 8 CDF. The incremental costs for off-site disposal are substantial and disproportionate to the increase in environmental benefits. As a result, the alternative using Unit 8 CDF for sediment disposal and capping is permanent to the maximum extent practicable and is the preferred alternative for addressing Unit 8 contaminated sediments and for disposing of contaminated sediments dredged from other Phase 2 Site Areas.

Additional description of the DCA benefits considered in the analysis is provided below:

- Protectiveness: Both alternatives use proven remedial technologies that have been applied previously at the Site and during similar cleanup actions. The reconfiguration of the CDF reduces its footprint and upgrades its protectiveness. Removal and upland disposal in an off-site landfill has an even higher degree of protectiveness.

- Permanence and Long-Term Effectiveness: Both alternatives rely on long-term dredged material containment, one in the reconfigured CDF and the other in an off-site commercial landfill. The use of an off-site commercial landfill has a higher degree of permanence and long-term effectiveness by using a commercial landfill facility located distant from the Site.

- Short-term Risk Management: Both alternatives require extensive material management that carries risks of sediment spillage or other environmental releases. These risks must be managed for the project to be performed safely. The CDF alternative reduces the long-distance transportation requirements associated with that transportation. It also reduces the greenhouse gas emissions associated with that long-distance transportation.

- Implementability: Both alternatives are consistent with the Port's land use plans as defined for the Site. Both alternatives can comply with applicable permitting and regulatory requirements.

- Consideration of Public Concerns: Both alternatives align with Port land use plans for the Site. Upland disposal at an off-site commercial landfill would fully remove contaminated sediments otherwise contained within a portion of Unit 8.

- Net Environmental Effects: The net environmental effects of the two alternatives are not significantly different, as both would support the Port's plans to enhance habitat within the Whatcom Waterway and adjacent harbor areas.

- Costs and Cost-Effectiveness: Most costs between the two alternatives will be the same. The primary difference in cost results from the differences in sediment transportation and disposal. Those costs are itemized in Appendix B-1 and are summarized below.

    - Costs for sediment handling, disposal, and capping within the reconfigured CDF assume the construction of a protective CDF retaining structure (a cell wall or coffer dam containing a thick core of clean soil), placement of the contaminated sediments within the prepared CDF, and capping and long-term monitoring and maintenance of the CDF. These costs are estimated at $54.4 million including applicable taxes and a 30-percent contingency (see Table B-1).

    - Costs for upland landfill disposal are based on an assumed barge haul to a suitable sediment transload facility with existing rail access and material handling areas, the addition of dewatering additives, and rail transportation of the solidified sediments to a permitted commercial landfill. These transportation, handling, and disposal costs are currently estimated to be approximately $200 per cubic yard prior to sales tax and contingency. The upland landfill disposal alternative also includes dredging of an additional 196,000 cubic yards of sediment from Unit 8. These costs total approximately $189.3 million including applicable taxes and a 30-percent contingency (see Table B-2).

5.7.4 Project Schedule

The project schedule has been adjusted to reflect the expedited work in a portion of Unit 1C at the BST and the estimated implementation timeframe for completion of cleanup actions in Phase 2 Areas of the Site. The updated project schedule is shown in Figure 7-2 and attached to the Decree as Exhibit C.

6 Description of the Proposed Cleanup Action

[No change, except to subsections 6.1, 6.2, and 6.4.]

6.1 Cleanup Actions by Site Area

[No change, except for adding the following paragraph:]

Figure 6-6 shows the Phase 1 and Phase 2 Site Areas. Figure 6-7 shows updates to the cleanup action to be implemented pursuant to the Second Amendment to the CAP in the Phase 2 Site Areas. These changes include 1) expedited removal and upland disposal of areas of shoaled sediments within a portion of Unit 1C, 2) contingent dredging and capping to improve habitat conditions and upgrade the remedy at the head of the Whatcom Waterway, and 3) creation of an upland CDF to be used for management of contaminated sediments dredged from Phase 2 Site Areas, including the Whatcom Waterway and the outer portions of Unit 8.

[And subsections 6.1.1, 6.1.2 and 6.1.7 are replaced in their entirety.]

6.1.1 Outer Whatcom Waterway (Unit 1)

[This subsection is replaced in its entirety.]

The cleanup of the Outer Whatcom Waterway (Unit 1) is intended to remove accumulated surface and subsurface contaminated sediments from deep draft waterway areas. This work is to be sequenced:

- The cleanup of Phase 1 Site Areas includes the removal and upland disposal of approximately 60,800 cubic yards of contaminated sediments from a portion of Unit 1C near the Bellingham Shipping Terminal. This work was completed in 2016 (Anchor QEA, 2018).

- Removal and off-site upland landfill disposal of up to 19,000 cubic yards of contaminated shoaled sediments in Unit 1C at the BST.

- The cleanup of remaining Phase 2 Site Areas will include removal of an estimated 236,000 cubic yards of contaminated sediments from Units 1A, 1B, and 1C. This total includes the removal of under-dock contaminated sediments at the BST to the extent practicable (estimated removal volume in this area 9,300 cubic yards). Under-dock sediment removal will need to address geotechnical and structural integrity limitations associated with existing piers and structures. Contaminated

sediments removed from the Phase 2 Site Areas of Units 1A, 1B, and 1C will be disposed of in the Unit 8 CDF.

A stable side-slope will be established in between Unit 1C and the sediments in the adjacent Inner Whatcom Waterway (Unit 2C) and the Log Pond (Unit 4). The design of that side-slope will be addressed as part of remedial design and will anticipate future navigation maintenance dredging within the channel and the effects of vessel prop wash and seismic effects on sediment stability.

No institutional controls are anticipated for the Unit 1 areas of the Site, with the possible exception (pending final remedial design) of some side-slope areas. Institutional controls will be required in Unit 2C and Unit 4 side-slope areas.

6.1.2 Inner Whatcom Waterway (Units 2 and 3)

[This subsection is replaced in its entirety.]

Contaminated sediments located within the Inner Whatcom Waterway that have a potential for disturbance will be partially removed and then contained using a thick sediment cap. Excluding the emergent tide flat area at the head of the waterway that is to be preserved, the majority of the Inner Whatcom Waterway will be managed to achieve an effective water depth of greater than 18 feet below MLLW, increasing in depth toward Unit 1C.

As shown in Figure 4-6, navigation areas of the waterway will be dredged to depths 5 feet below the planned effective water depth or to the base of the contaminated sediment. Where this dredging does not remove all contaminated sediments, a sediment cap will be applied with a nominal cap thickness of at least 3 feet.

When sediment caps are placed in navigation areas, the final cap surface elevation will be at least 2 feet below the planned effective water depth. This difference allows for future navigation dredging to be performed without disturbing the cap surface.

During design and permitting, cap design details will be finalized including the cap thickness and material type, and the side-slopes. Analyses of prop wash, wave erosion, and other potential cap disturbances will be conducted during remedial design, and appropriate measures will be included in design of the cap to protect against cap erosion or instability. Seismic stability and adjacent upland uses will be considered in the design of side-slopes.

In most areas of the Inner Whatcom Waterway, average side-slopes (as measured from the base of the channel to the top of bank) are expected to be 3H:1V or flatter. Slopes may be graduated or stepped, with flatter slopes present in intertidal and shallow subtidal areas exposed to wind waves and vessel wakes. Using flatter slopes in the intertidal and shallow subtidal areas also

preserves and enhances shallow-water nearshore habitat usable by juvenile salmonids.

This dredging and capping in the Inner Whatcom Waterway will be sequenced:

- The cleanup of Phase 1 Site Areas includes dredging and capping in the area between the outer edge of the emergent tide flat at the head of the waterway and Laurel Street. Sediments removed during this dredging will be barged to an offload facility and transferred to rail cars or trucks for transportation to a Subtitle D landfill facility. This work was completed in 2016 (Anchor QEA, 2018).

- During the cleanup of Phase 2 Site Areas, dredging and capping will be performed in the area between Laurel Street and Unit 1C, including side-slope areas between Unit 2C and Unit 4. Sediments removed during this dredging will be disposed of in the Unit 8 CDF.

- Following cleanup of the outer portion of Unit 8 (see Section 6.1.7), the Port will connect the outer portion of Unit 8 to the Whatcom Waterway by removing a section of the ASB berm to create a navigation access channel. The Port plans to fund and implement this work as part of mitigation activities to be completed in parallel with the cleanup. The Unit 2B access channel area will then be remediated by dredging and capping. Clean dredged sediments removed by the dredging will be beneficially reused within the project, and contaminated sediments will be disposed in the Unit 8 CDF. Unit 2B areas not otherwise dredged to clean native sediments will be capped.

- The emergent tide flat at the head of the waterway will be preserved, and shallow-water habitat areas along the sides of the waterway will be preserved and enhanced. The cleanup remedy assumes that the emergent tide-flat at the head of the Whatcom Waterway (Unit 3A) will be managed by monitored natural recovery. However, the Port is pursing grant funding to change the remedy in this area to partial dredging and capping. The contingent change would meet the Port's goal of improving habitat quality within the Whatcom Creek estuary for use by juvenile salmonids and forage fish. If implemented, this would include removal of approximately 10,000 cubic yards of contaminated sediment with disposal in the Unit 8 CDF. The remaining contaminated sediment would be capped with a layer of clean material, resulting in elevations more suitable for use by aquatic vegetation, juvenile salmonids, and forage fish. If implemented, this contingent work will be performed during the cleanup of Phase 2 Site Areas.

Institutional controls will be required for the Inner Whatcom Waterway areas of the Site to ensure the long-term integrity of the remedial action (Section 6.4).

6.1.7 ASB (Unit 8)

[This subsection is replaced in its entirety.]

A CDF will be constructed within Unit 8 to manage contaminated sediments from both Unit 8 and the remaining Phase 2 Site Areas. That CDF will be constructed within the inner portion of Unit 8. The cleanup includes the following elements:

- The ASB will be disconnected from upland stormwater and wastewater sources at the beginning of CDF construction. A containment wall will then be constructed down the center of Unit 8 to enclose an approximately 14-acre area adjacent to the existing uplands to create a CDF. The containment wall will utilize a cell wall or "coffer dam" construction. These methods include two outer metal and concrete walls enclosing a clean earthen core.

- Contaminated sediments and transition sands from the outer portion of Unit 8 (outside of the CDF) will be removed by dredging and will be placed within the prepared CDF.

- Dolphins will be constructed outside of the ASB along the Whatcom Waterway to provide a barge transloading location for contaminated sediments dredged from other Phase 2 Site Areas. Sediments removed from other Phase 2 Site Areas will be barged to the transloading location and pumped by enclosed pipeline over the ASB berm for placement within the prepared CDF.

- Following cleanup of the outer portion of Unit 8, the Port will remove a section of the ASB berm to connect that portion of Unit 8 to Bellingham Bay. The Port plans to fund and implement this work as part of mitigation activities to be completed in parallel with the cleanup. The Port will also install a fish passage structure in the western corner of the ASB at that time to enhance salmonid migration corridors between the Whatcom Creek estuary and existing eelgrass beds located between the ASB and the I&J Waterway. Sediment dredging and capping will then be performed as described in Section 6.1.2 to establish the final access channel between Unit 8 and the Whatcom Waterway and to deepen the outer ASB basin to -25 feet below MLLW. Clean sediments generated during these steps will be reused within the project for capping and backfill materials, and contaminated sediments generated from these steps will be disposed of within the Unit 8 CDF.

- At the conclusion of sediment placement from Phase 2 Site Areas, the final grade of the CDF will be raised to align with that of the ASB berm and surrounding land areas, and a cap will be placed on the CDF with a minimum of 2 feet of clean material. Dredged sediments from other Port cleanup sites or dredging projects within Bellingham Bay may also be placed in the CDF to help achieve the final grade of the CDF.

- Excess waters generated during sediment placement and offloading will be treated and then discharged to Bellingham Bay via the existing NPDES-permitted outfall. Pending future redevelopment of the CDF for marine trades related uses interim stormwater treatment and discharge methods will be provided for the clean working surface of the completed CDF.

Institutional controls and monitoring will be implemented within Unit 8 to monitor the integrity of the CDF.

6.2 Types, Levels and Amounts of Contamination Remaining On Site

[This subsection is replaced in its entirety.]

The information presented in the RI/FS documents conditions at the Site prior to implementation of the cleanup action. The principal contaminants understood to be present in Site sediments at that time included mercury, 4-methylphenol, and phenol. Updated information regarding the distribution of cPAH compounds and D/F compounds were developed during the design and permitting process and during environmental investigations performed throughout Bellingham Bay (see Appendix C).

Most surface sediments at the Site comply with applicable cleanup standards as measured using chemical and biological testing and comply with the Site-specific bioaccumulation screening level developed for mercury. The remedy contained in the Consent Decree, and as updated in the First Amendment and Second Amendment to the Consent Decree, addresses the few areas of remaining surface sediment contamination through dredging and/or capping. Subsurface sediment contamination will be addressed using a range of technologies, with dredging and capping used to address unstable sediments, and monitored natural recovery used to address contaminated sediments that are safely buried at depth.

With respect to D/F compounds, the cleanup action will reduce D/F concentrations to the extent technically possible, given the presence of ongoing, off-site sources of D/F contamination. The SWAC for D/F compounds is expected to decrease immediately following construction, and then increase due to recontamination from off-site sources to the sediment cleanup level 10 years

following construction. Compliance with the D/F sediment cleanup level will in part depend on compliance with the D/F sediment cleanup level established by Ecology for the RG Haley site, which is located within the Whatcom Waterway Site boundary and includes D/F-impacted sediment from a former wood treatment operation. That site is being cleaned up as described in Section 7.1.4.

The cleanup action will remove contaminated sediments from the Outer Whatcom Waterway (Unit 1) adjacent to the Bellingham Shipping Terminal, from an area off-shore of the ASB (Unit 5), and from the outer portion of the ASB (Unit 8). Contaminated sediments disposed of within the Unit 8 CDF will be capped in place. In other site units where hazardous substances will remain in stable, subsurface sediments they will be managed by capping and monitored natural recovery. Monitoring and institutional controls will be used to ensure the long-term stability of the sediments contained within the Unit 8 CDF and sediments in other site locations managed by capping and monitored natural recovery. These monitoring and institutional controls measures are described in Sections 6.3 and 6.4, respectively.

Figures 6-1, 6-2, and 6-3 summarize the RI/FS subsurface sediment data for areas of the Site where contaminated subsurface sediments will be managed on site using monitored natural recovery or capping. Subsurface sediment conditions vary according to site unit. Figures 6-1 and 6-2 provide a summary of the average subsurface sediment quality, expressed as the average sediment quality at depths of 0.4 to 4 feet below the sediment mudline. To provide the reader with a better overall sense of subsurface contaminant distribution throughout the Site prior to initiation of remedial efforts, the Log Pond area is shown prior to completion of the Interim Remedial Action. Figure 6-3 summarizes discrete sampling data for subsurface mercury within the Whatcom Waterway. The estimated dredge and cap elevations are shown on the cross-section, subject to final remedial design and permitting.

Figure 6-5 depicts the Unit 8 CDF that had been proposed in the First Amendment to the Consent Decree, along with the average contaminant concentrations in the sediments that were to be placed and capped within Unit 8.

Figure 6-7 depicts the Unit 8 CDF as reconfigured in the Second Amendment to the Consent Decree. It also shows the average contaminant concentrations in the sediments to be placed and capped within the Unit 8 CDF.

6.4 Institutional Controls

[No change, except to subsection 6.4.1.]

6.4.1 Use Assumptions

[No change, except to replace the second-to-last bullet with the following:]

- ASB (Unit 8): Consistent with Port Resolution 1397, the ASB is to be reused to support multiple marine trade industries rather than be developed solely for marina purposes. About half (approximately 14 acres) of the ASB will be developed as usable upland property supporting marine trades uses, and the other half will be deepened to approximately 25 feet below MLLW and connected to Bellingham Bay to provide additional opportunities for commercial navigation, public access, and aquatic habitat enhancement. Figure 6-8 shows the updated navigation and land uses of Unit 8 and adjacent areas, as outlined in this Second Amendment to the CAP. Other anticipated navigation and land uses defined in Figure 6-4 remain unchanged.

7 Implementation of the Cleanup Action

[No change, except to subsections 7.1 and 7.2.]

7.1 Coordination with Other Actions

[No change, except to subsections 7.1.6 and 7.1.8.]

7.1.6 Marine Trades Area Redevelopment

[This subsection is replaced in its entirety.]

The Port is currently leading a land use programming effort to evaluate potential future uses for Unit 8 and adjacent property within the Marine Trades Area. This effort is being implemented consistent with Port Resolution 1397. Future use actions are not part of the Site cleanup but are expected to occur following implementation of the cleanup action. Development of future use redevelopment actions will be subject to permitting and environmental review requirements under applicable state, local, and federal laws. Those actions will also need to comply with institutional controls established as part of the Site cleanup.

As part of Marine Trades Area redevelopment, the Port plans to implement a series of habitat mitigation activities in parallel with the cleanup. As shown in Figure 6-8, these activities include connection of the ASB to Whatcom Waterway, installation of a fish passage structure and habitat benches, and implementation of additional removals of creosote-treated pilings within multiple portions of the Site. These actions will be funded and implemented by the Port in parallel with the cleanup to optimize the timing of habitat mitigation work and to minimize construction disturbances to fisheries resources.

7.1.8 Over Water Walkway Project

[This subsection is deleted in its entirety.]

7.2 Anticipated Schedule for Design and Implementation

[This subsection is replaced in its entirety.]

The design and implementation of the cleanup action is being sequenced to address Phase 1 and Phase 2 Site Areas. Cleanup actions in Phase 1 Site Areas were completed in 2015 and 2016 (Anchor QEA, 2018).

The anticipated schedule for design and implementation of the cleanup action for Phase 2 Site Areas is illustrated in Figure 7-2 and attached to the Decree as Exhibit C.

- **Unit 1C Dredging:** As described in Section 5.7.1, early dredging of a portion of Unit 1C will remove sloughed under-dock contaminated sediment and adjacent high-spot areas. This work is expected to begin the summer of 2023 and end in early 2024 (within the permit specified "fish window", see next bullet), following Ecology approval of an EDR and issuance of required permits. Compliance monitoring will be performed and documented in an As-Built Report.

- **Cleanup of Remaining Phase 2 Site Areas:** Following completion of the EDR for the Unit 1C dredging, details of the cleanup action for remaining Phase 2 Site Areas will be documented in an EDR for Ecology review and approval. The design and permitting process for these remaining areas is estimated to take 2 to 3 years to complete. Once initiated, construction activities are expected to require three construction seasons to complete. Timing of most in-water construction activities will be limited by permit-specified "fish windows" to appropriate time-periods when those activities are least likely to affect migrating juvenile salmonids and other fish species. These time limitations will affect the amount of work that can be completed within a given construction season, and particularly affect the overall time required to complete dredging, capping, and parallel habitat mitigation activities. Other work does not require in-water activity (e.g., site preparation, wall construction, and dredging within the interior of Unit 8 prior to berm opening) but is subject to other logistical constraints. Monitoring during and after the work will be performed consistent with the Compliance Monitoring and Contingency Response Plan, to be prepared as part of the EDR.

Restrictive covenants will be recorded upon completion of the active cleanup measures required by the CAP. These controls will remain in place indefinitely unless removal is approved by Ecology.

The above-described schedule may be affected by the time required for permitting and to complete construction within permit-required "fish windows." Requests for an extension of schedule in the event of delays will be governed by Section XVI of the Consent Decree.

8 References Cited

[No change, except for the following added references:]

Anchor QEA, 2015. Final Engineering Design Report, Whatcom Waterway Cleanup in Phase 1 Site Areas. Prepared for the Port of Bellingham. February 2015.

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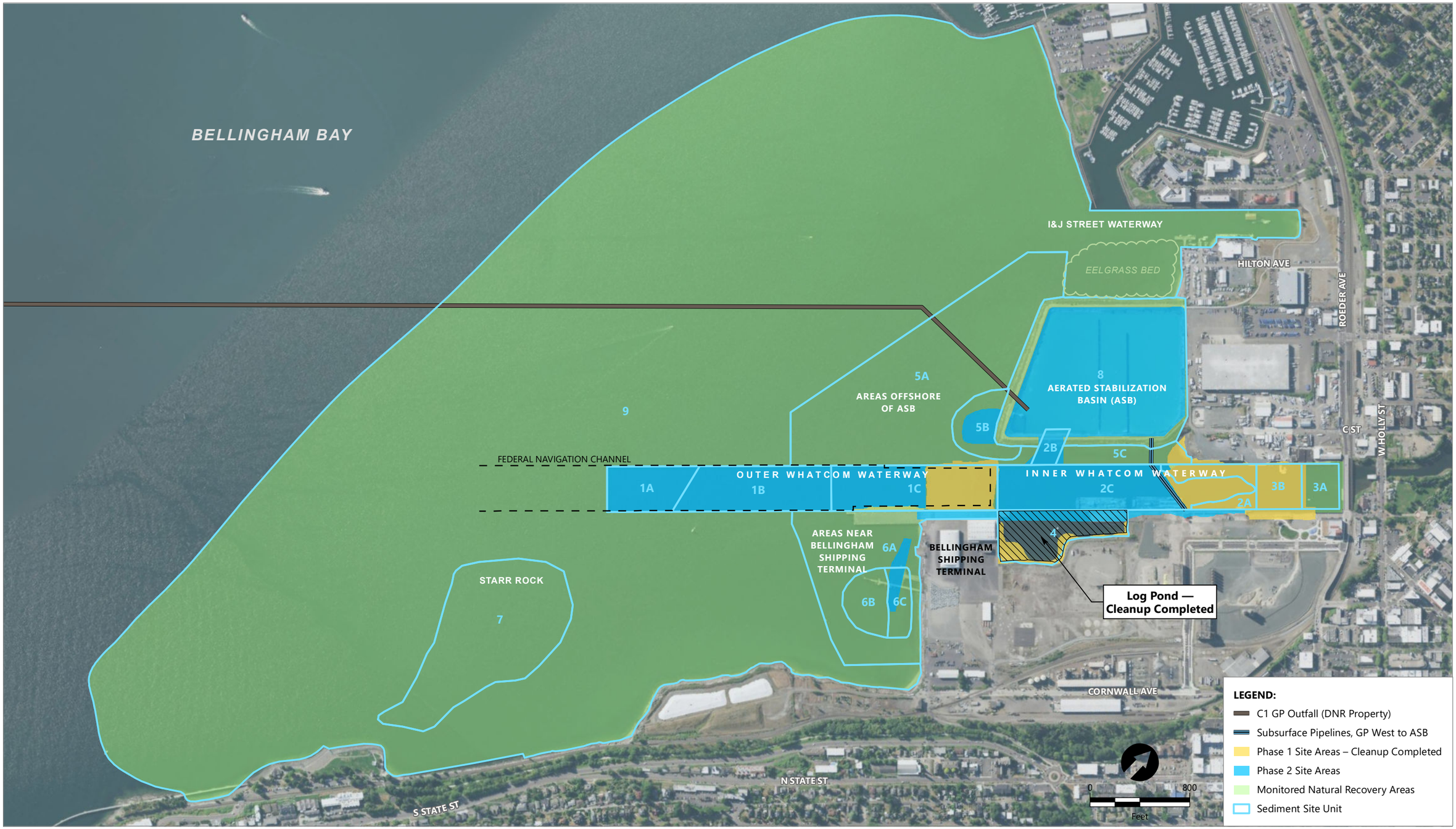
Ecology, 2021. Sediment Cleanup User's Manual II (SCUM II), Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC. Publication No. 12-09-057. December 2021.

Port of Bellingham, 2021. Resolution No. 1397. A Resolution of the Board of Commissioners of the Port of Bellingham Authorizing the Area Commonly Known as the Aerated Stabilization Basin (ASB) Be Reused to Support Multiple Marine Trade Industries Rather than Solely for A Marina Purposes. November 2021.

Figures



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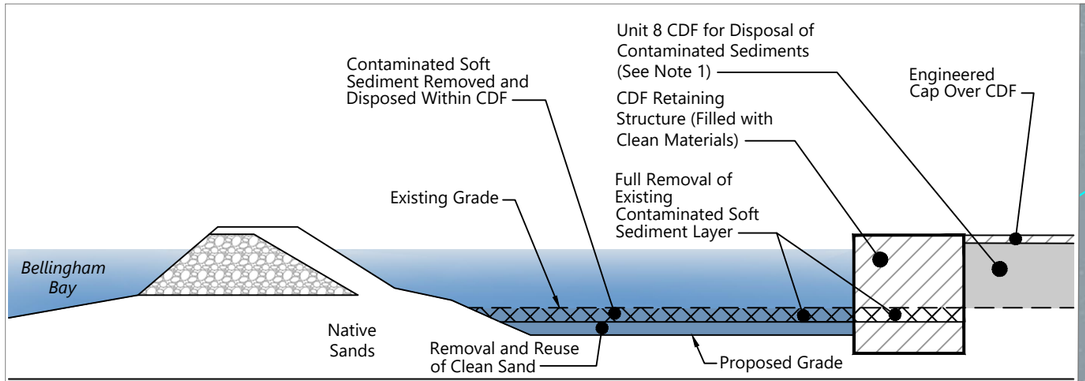
ANCHOR QEA

Figure 6-6
Phase 1 and Phase 2 Site Areas
Cleanup Action Plan – Second Amendment
Whatcom Waterway Cleanup



CONCEPTUAL CROSS-SECTION A-A'

Not to Scale

Cross-section is conceptual, the final elevation, composition, and thickness are to be determined during engineering design.

NOTES:

1. Average mercury concentrations within the CDF will be 7.5 mg/kg and average D/F concentrations will be 100 ng/kg.

SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019. Image from ESRI.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)

NOTES:

1. If the Port obtains grant funding to support the work, the remedy in the MNR area in Unit 3A will be upgraded to partial dredging and capping with disposal of the removed dredged material in the Unit 8 CDF.
2. Size and shape of the Unit 8 CDF and ASB access channel (Unit 2B) may be adjusted during final design.
3. The installation of the fish passage structure and the removal of a section of the ASB berm will be performed separately by the Port in coordination with the cleanup action.
4. The Unit 2B boundary will be adjusted during final engineering design and permitting to align with the final ASB access channel.
5. The expedited dredging in Unit 1C involves the removal of sloughed sediment and high spots. Additional work will be performed during the final cleanup in Phase 2 areas to address remaining contaminated underpier sediment.

LEGEND:

- Existing Dock or Wharf
- Site Unit
- Expedited Dredging of a Portion of Unit 1C with Disposal in Commercial Landfill
- Unit 8 Upland Confined Disposal Facility (CDF)
- Approximate Location and Extent of CDF Retaining Structure
- Partial Dredge and Cap with Disposal in Unit 8 CDF
- Full Dredge to Clean Contact with Disposal in Unit 8 CDF

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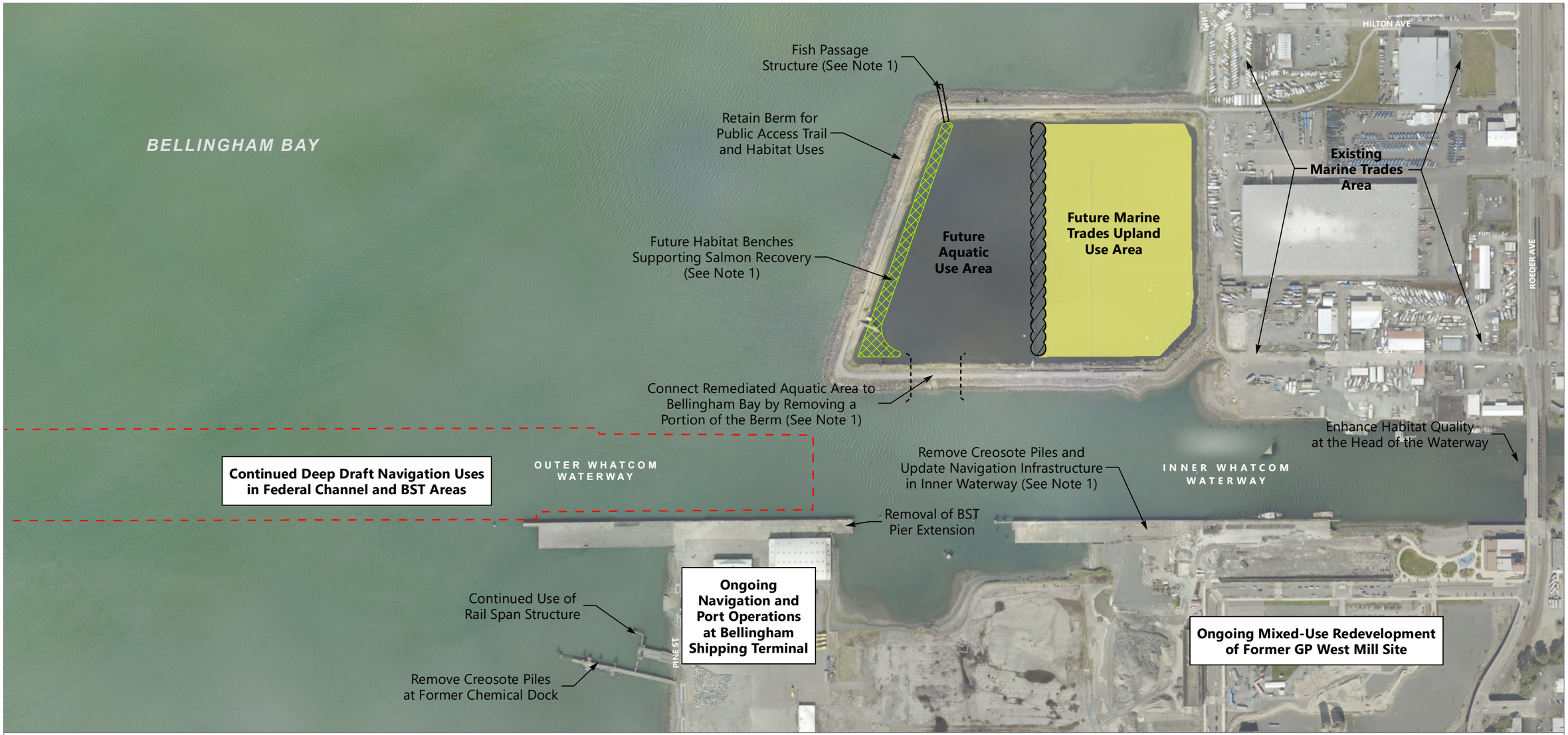
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-037.dwg Figure 6-7 (Plan)

ANCHOR QEA

Figure 6-7
Cleanup Action for Phase 2 Site Areas

Cleanup Action Plan – Second Amendment
Whatcom Waterway Cleanup



LEGEND:

- Federal Navigation Channel
- Upland Confined Disposal Facility (CDF)
- CDF Retaining Structure
- Future Habitat Beaches

NOTES:

1. In parallel with the cleanup of Phase 2 Site areas the Port plans to reconnect the ASB to the Whatcom Waterway, install a fish passage structure, develop habitat benches in the ASB to support salmonid recovery, and remove unneeded creosote pilings from various portions of the Site.
2. Horizontal datum: Washington State Plane North, NAD 83 U.S. Survey Feet.
3. Aerial imagery from Whatcom County GIS, collected March to June 2022.

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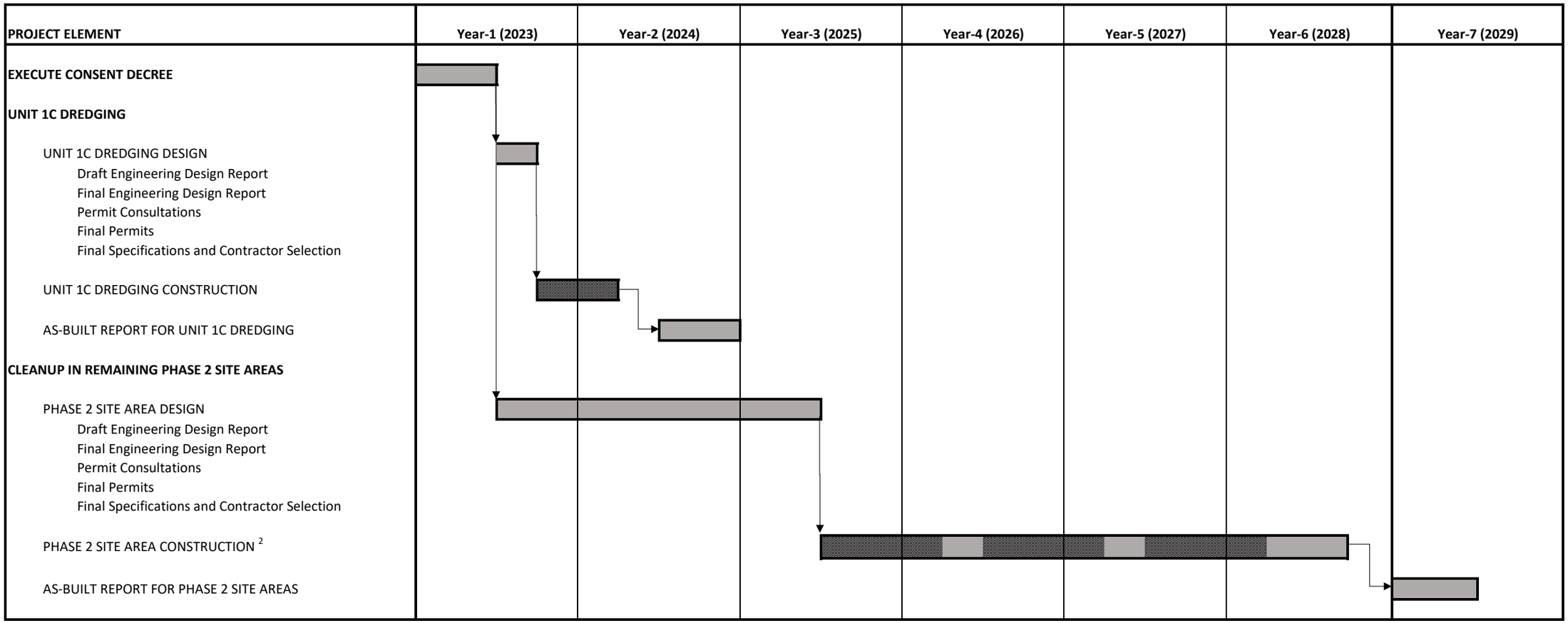
Figure 6-8
Anticipated Navigation and Land Uses
Cleanup Action Plan – Second Amendment
Whatcom Waterway Cleanup

Figure 7-2. Anticipated Implementation Schedule [1]



Notes:

1. This figure illustrates anticipated schedule for design, permitting, and construction activities. Actual durations will be subject to change based on the time required for procurement of project permits, and final construction sequencing and durations as specified in project permits.
2. The cleanup activities in Phase 2 site areas are expected to require three construction seasons to complete. The Port anticipates completing certain mitigation actions in parallel with the cleanup construction, including reopening the ASB to Whatcom Waterway, construction of a fish passage structure within the ASB berm, development of habitat benches within the ASB, and removal of creosote-treated pilings from multiple areas of the Site.
3. Most construction activities will be limited to appropriate seasonal "fish windows" specified in project permits to avoid impacts to sensitive fish species. Some work (i.e., construction in upland areas, ASB areas prior to connection with Bellingham Bay, and over-water work) may be performed outside of fish windows.
4. Long-term monitoring activities are not shown.
5. Restrictive covenants will be filed for cap and monitored natural recovery areas following completion of the As-Built Report for Phase 2 Site Areas.

Appendix B-1

Remedial Cost Evaluation – Second Amendment

Appendix B-1. Remedial Cost Evaluation - Second Amendment

Table B-1. Estimated Core Costs for Unit 8 Half Dredge with Unit 8 CDF Disposal and Capping

Task ID	Task Description	Unit 8 Half Dredge with Unit 8 CDF Disposal and Capping			
		Quantity	Unit	Probable Unit Cost ($)	Probable Total Cost ($)
1	**Prepare Confined Disposal Facility in Unit 8**				
1 a	Installation of Sediment Transloading Dolphins w/Access Walkway	1	LS	$1,924,036.00	$ 1,924,036
1 b	Mobilization/demobilization of Equipment for Retaining Structure	1	LS	$1,943,222.00	$ 1,943,222
1 c	Construct CDF Retaining Structure	1	LS	$18,515,225.00	$ 18,515,225
1 d	Procurement of Imported Sand for Wall	105,043	TON	$13.00	$ 1,365,564
1 e	Fill Wall with Imported Sands	75,031	CY	$8.00	$ 600,248
2	**Dredging Within Unit 8 (West Half)**				
2 a	ASB Soft Sediments	158,000	CY	$22.83	$ 3,606,693
2 b	ASB Transition Sands	38,000	CY	$18.59	$ 706,587
3	**Sediment Handling and Disposal - Unit 8 Sediments**				
3 a	ASB Water Management/Treatment	1	LS	$500,000.00	$ 500,000
3 b	Toyo Pump, Crane Barge, and Spreader Barge	1	LS	$583,000.00	$ 583,000
3 c	Transfer of ASB Soft Sediments/Transition Sand Materials to CDF	196,000	CY	$8.00	$ 1,568,000
4	**Season 1 Waterway Sediment Placement Within CDF**				
4 a	ASB Water Management/Treatment	1	LS	$500,000.00	$ 500,000
4 b	Toyo Pump, Crane Barge, and Spreader	1	LS	$583,000.00	$ 583,000
4 c	Transfer of Contaminated Sediment Materials to CDF	264,000	CY	$8.00	$ 2,112,000
5	**Season 2 Waterway Sediment Placement Within CDF**				
5 a	ASB Water Management/Treatment	1	LS	$500,000.00	$ 500,000
5 b	Toyo Pump, Crane Barge, and Spreader	1	LS	$583,000.00	$ 583,000
5 c	Transfer of Contaminated Sediment to CDF	166,000	CY	$8.00	$ 1,328,000
6	**Capping of CDF**				
6 a	Procurement of Capping Soil for CDF Footprint (2ft Thickness)	75,178	TON	$13.50	$ 1,014,898
6 b	Placement of Capping Soil for CDF Footprint (2ft Thickness)	46,411	CY	$12.00	$ 556,938
	Construction - Subtotal Costs				**$ 38,490,411**
7	**Sales Tax**	8.80	%	-	$ 3,387,156
	Season 3 Construction - Subtotal Costs (Including Sales Tax)				**$ 41,877,567**
8	**Project Contingency**	30.00	%	30	$ 12,563,270
	Total Project Construction Costs (Including Sales Tax)				**$ 54,440,838**

Notes:

Only sediment dredging, handling and disposal costs that differ between the alternatives are shown. Other project costs are consistent between the two alternatives and include the following:

- Costs for design, permitting and construction management
- Overall remedy mobilization and demobilization costs
- Dredging and residuals management costs for the Phase 2 waterway areas
- Capping, excavation backfill and residuals management costs (other than backfill/capping associated with the CDF and retaining structure)
- Monitoring and surveys during construction
- Site preparration costs common to each alternative
- Costs associated with remediation of Unit 8 common to both alternatives
- Costs associated with long-term monitoring and contingency response actions applicable to the overall Site

ASB: Aerated Stabilization Basin
CDF: confined disposal facility
CY: cubic yard
EA: each
LS: lump sum

1. Probable total costs for the modified remedial approach are presented in year 2022 dollars.
2. Quantities and costs presented are preliminary and subject to change; they are based on the pre-design evaluations and for planning purposes only.

Appendix B-1. Remedial Cost Evaluation - Second Amendment

Table B-2. Estimated Core Costs for Unit 8 Full Dredge with Offsite Landfill Disposal

Task ID	Task Description	Unit 8 Full Dredge with Offsite Landfill Disposal			
		Quantity	Unit	Probable Unit Cost ($)	Probable Total Cost ($)
1	**Dredging Within Unit 8 (West and East Halves)**				
1 a	ASB Soft Sediments	316,000	CY	$22.83	$ 7,213,386
1 b	ASB Transition Sands	76,000	CY	$18.59	$ 1,413,174
2	**Sediment Handling, Transportation and Disposal - Unit 8 Sediments**				
2 a	Season 1 Sediment handling, transportation and Subtitle D disposal	196,000	CY	$200.00	$ 39,200,000
3	**Sediment Handling and Disposal - Waterway Sediments**				
3 a	Season 2 Sediment handling, transportation and Subtitle D disposal	264,000	CY	$200.00	$ 52,800,000
3 b	Season 3 Sediment handling, transportation and Subtitle D disposal	166,000	CY	$200.00	$ 33,200,000
	Construction - Subtotal Costs				**$ 133,826,560**
4	**Sales Tax**	8.80	%	-	$ 11,776,737
	Season 3 Construction - Subtotal Costs (Including Sales Tax)				**$ 145,603,297**
5	**Project Contingency**	30.00	%	30	$ 43,680,989
	Total Project Construction Costs (Including Sales Tax)				**$ 189,284,286**

Notes:

Only sediment dredging, handling and disposal costs that differ between the alternatives are shown. Other project costs are consistent between the two alternatives and include the following:

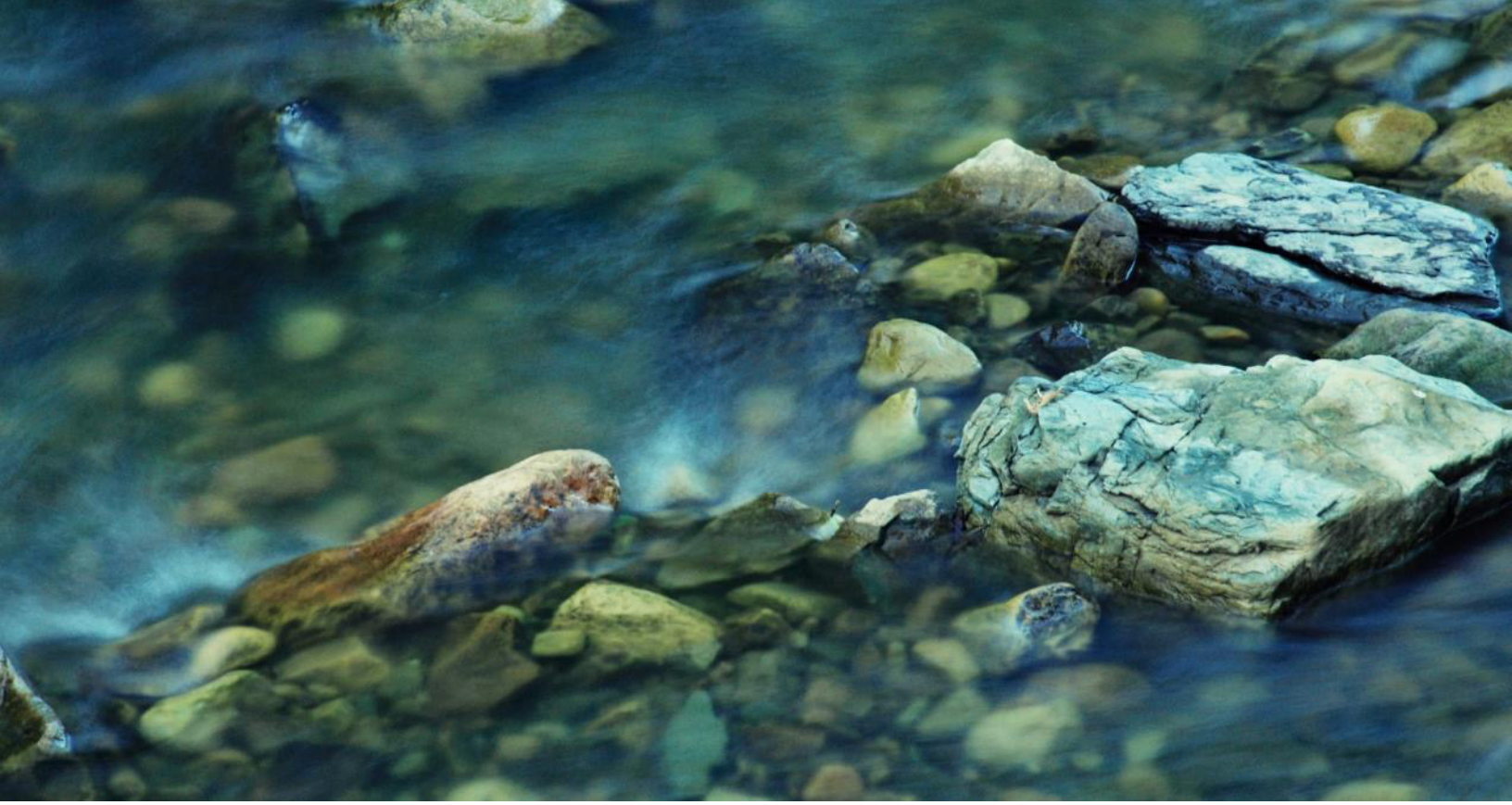
- Costs for design, permitting and construction management
- Overall remedy mobilization and demobilization costs
- Dredging and residuals management costs for the Phase 2 waterway areas
- Capping, excavation backfill and residuals management costs (other than backfill/capping associated with the CDF and retaining structure)
- Monitoring and surveys during construction
- Site preparration costs common to each alternative
- Costs associated with remediation of Unit 8 common to both alternatives
- Costs associated with long-term monitoring and contingency response actions applicable to the overall Site

ASB: Aerated Stabilization Basin
CDF: confined disposal facility
CY: cubic yard
EA: each
LS: lump sum

1. Probable total costs for the modified remedial approach are presented in year 2022 dollars.
2. Quantities and costs presented are preliminary and subject to change; they are based on the pre-design evaluations and for planning purposes only.

Appendix C

Evaluation of Carcinogenic PAH and D/F Compounds in Surface Sediment



March 2023
Whatcom Waterway Site Cleanup

ANCHOR QEA

Evaluation of Carcinogenic Polycyclic Aromatic Hydrocarbon and Dioxin/Furan Compounds in Surface Sediment

Prepared for the Port of Bellingham

March 2023
Whatcom Waterway Site Cleanup

Evaluation of Carcinogenic Polycyclic Aromatic Hydrocarbon and Dioxin/Furan Compounds in Surface Sediment

Prepared for
Port of Bellingham
1801 Roeder Avenue
Bellingham, Washington 98225

Prepared by
Anchor QEA
1605 Cornwall Avenue
Bellingham, Washington 98225

Project Number: 190007-01.01

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ATTACHMENTS

ABBREVIATIONS

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
ASB	Aerated Stabilization Basin
BSL	Bioaccumulation Screening Level
BST	Bellingham Shipping Terminal
cm	centimeter
cm/yr	centimeters per year
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSL	cleanup screening level
D/F	dioxin/furan
Ecology	Washington State Department of Ecology
EMPC	estimated maximum potential concentration
Evaluation	Evaluation of cPAH and Dioxin/Furan Compounds in Surface Sediment
GIS	geographic information system
GP West	Georgia-Pacific West, Inc.
mg	milligram
mg/kg	milligrams per kilogram
MGP	manufactured gas plant
MNR	monitored natural recovery
MTCA	Model Toxics Control Act
ng/kg	nanograms per kilogram
PAH	polycyclic aromatic hydrocarbon
Port	Port of Bellingham
PQL	practical quantitation limit
PRDI	Pre-Remedial Design Investigation
Project	Whatcom Waterway Cleanup in Phase 1 Site Areas
RAU	remedial action unit
Report	Whatcom Waterway Year 5 Compliance Monitoring Report
SCO	sediment cleanup objective
SCU	sediment cleanup unit
Site	Whatcom Waterway Site
SMS	Sediment Management Standards
SWAC	surface-weighted average concentration
TEQ	toxic equivalency quotient
WAC	Washington Administrative Code

GLOSSARY

Whatcom Waterway Site (Site)	The overall Model Toxics Control Act (MTCA) cleanup site addressed by the Whatcom Waterway Consent Decree. This area includes both Whatcom Waterway and adjacent aquatic lands impacted by historical mercury discharges from the former Georgia-Pacific chlor-alkali plant wastewater discharges. The Site includes both Phase 1 and Phase 2 cleanup areas and additional areas being addressed by monitored natural recovery. The Whatcom Waterway Site boundary was initially determined based on the distribution of mercury. With respect to D/F compounds, the Whatcom Waterway Site represents a Sediment Cleanup Unit within Bellingham Bay areas impacted by regional D/F contamination.
Whatcom Waterway	The physical waterway extending from Roeder Avenue to deep water. Whatcom Waterway includes both the Inner Waterway and Outer Waterway areas.
Inner Waterway	The inner portion of Whatcom Waterway, extending from Roeder Avenue to the beginning of the Federal Navigation Channel at Waterway Station 29+00. The Inner Waterway includes Site Units 2 and 3 of the Whatcom Waterway Site.
Outer Waterway	The outer portion of Whatcom Waterway, extending from Station 29+00 into deep water. The Outer Waterway includes Site Units 1A, 1B, and 1C of the Whatcom Waterway Site. The Federal Navigation Channel that was updated in 2007 is located within the Outer Waterway.
Federal Navigation Channel	The Whatcom Waterway federal navigation project as currently authorized in existing Water Resources Development Act legislation. The authorized project includes a 30-foot-deep navigation channel (plus applicable overdredge allowances) extending from Station 29+00 of Whatcom Waterway into deep water. The Federal Navigation Channel is maintained by coordinated actions of the U.S. Army Corps of Engineers and the Port of Bellingham as the local sponsor.
Central Waterfront Site	The MTCA site located on certain properties between Whatcom Waterway and I&J Waterway. Design of the cleanup action is in progress under a MTCA agreed order.
GP West Site	The MTCA site located on upland property on the south side of Whatcom Waterway. The Georgia-Pacific West, Inc. (GP West) Site is divided into two remedial action units (RAUs), the Pulp and Tissue Mill RAU and the Chlor-Alkali RAU. The RAUs are in different stages of the cleanup process under MTCA.

Log Pond	Site Unit 4 of the Whatcom Waterway Site. The Log Pond is located between Whatcom Waterway and the GP West Site. The Log Pond was capped in 2001 as part of an Interim Action. Additional capping was completed as part of the Whatcom Waterway Phase 1 cleanup.
Chlor-Alkali Remedial Action Unit	The Chlor-Alkali RAU comprises the western portion of the GP West Site adjacent to the Log Pond and Cornwall Avenue. Design of the cleanup action is in progress under a MTCA agreed order.
Pulp and Tissue Mill Remedial Action Unit	The Pulp and Tissue Mill RAU comprises the eastern portion of the GP West Site adjacent to Whatcom Waterway and Roeder Avenue. The final cleanup of this RAU was completed in 2016 under a MTCA consent decree.
Whatcom Waterway Cleanup in Phase 1 Site Areas (Project)	The construction and monitoring activities completed to implement the final cleanup of Phase 1 Areas of the Whatcom Waterway Site.
Phase 1 Site Areas	Whatcom Waterway Site Units 3B, 2A, and 4, and portions of Units 1C and 2C. Cleanup of these units has been completed.
Phase 2 Site Areas	Whatcom Waterway Site Units 1A, 1B, 2B, and 8, and portions of Units 1C, 2C, 5B, 6B, and 6C. These areas will be cleaned up as part of a future phase of construction, consistent with the requirements of the First Amendment to the Whatcom Waterway Consent Decree.
Monitored Natural Recovery Areas (MNR Areas)	Whatcom Waterway Site Units 3A, 5A, 5C, 6A, 7, and 9, and portions of Units 5B, 6B, and 6C. Clean sediment is naturally accumulating in these areas, and they are subject to long-term compliance monitoring requirements.
Central Waterfront Shoreline	The upland properties located between Whatcom Waterway and I&J Waterway and between Roeder Avenue and the aerated stabilization basin (wastewater treatment lagoon). The Central Waterfront Shoreline includes the properties within and outside of the Central Waterfront Site.
South Shoreline	The length of shoreline located along the GP West Site from the former GP West dock to the west end of the Central Avenue pier.

1 Introduction

This document supports the Washington State Department of Ecology's (Ecology's) establishment of sediment cleanup levels for carcinogenic polycyclic aromatic hydrocarbons (cPAH) and dioxin/furan (D/F) compounds at the Whatcom Waterway Site (Site) that are protective of human and ecological health. This document was prepared in compliance with the current Sediment Management Standards (SMS) regulations (Washington Administrative Code [WAC] 173-204) and applicable Ecology guidance (Ecology 2021).

1.1 Site Background

The Site location and vicinity are shown in Figure 1. The primary contaminants of concern (COCs) at the Site, as determined in the remedial investigation and feasibility study (RI/FS; Retec 2006), include mercury, phenol, and 4-methylphenol compounds (Ecology 2007a). Other contaminants including PAH compounds are also known to be present.

The Site boundary was defined by the extent of surface and subsurface sediment impacted by mercury discharges from the former Georgia-Pacific West, Inc. (GP West) chlor-alkali plant. GP West wastewater facilities were updated in the 1970s, and the chlor-alkali plant operations were discontinued in 1999. The chlor-alkali plant was subsequently demolished, eliminating the plant as a source of mercury to the Site and to Bellingham Bay. The Site boundary includes and overlaps with other sediment cleanup sites undergoing remediation pursuant to agreements with Ecology:

- I&J Waterway Site
- RG Haley Site
- Cornwall Avenue Landfill Site
- South State Street MGP Site

Sources of phenolic compounds within the Site boundary include wood waste and degradation products from historical log rafting activities and phenolic compounds from pulp and tissue mill wastewater discharges. The pulp and tissue mills have both been discontinued and demolished, eliminating them as potential ongoing sources of these contaminants.

The Port assumed leadership of the Site cleanup in 2005 after purchasing GP West's waterfront properties. Cleanup requirements for the Site are defined in a Consent Decree (CD; Ecology 2007a) between Ecology, the Port, the Washington Department of Natural Resources (DNR), the City of Bellingham (City), and a private party, Meridian Pacific, LLC. The Cleanup Action Plan (CAP) for the Site described in the CD complies with the requirements of the Model Toxics Control Act (MTCA; WAC 173-340) and SMS (WAC 173-204) regulations. The CD was initially executed in 2007 and amended in 2011 (Ecology 2011a).

The CD includes cleanup levels for the COCs known to be present in Site sediments at that time. For most COCs, the cleanup levels were developed to be protective of benthic receptors. For mercury, the CD also included a site-specific sediment cleanup level for mercury that was developed to be protective of human and ecological health considering the potential for mercury bioaccumulation through the consumption of contaminated seafood.

Information regarding the presence and distribution of D/F compounds within the Site was developed as part of the Pre-Remedial Design Investigation work (Anchor QEA 2010) required under the CD. The 2011 First Amendment to the CAP acknowledged the presence of D/Fs within the Site, but Ecology was completing a broader evaluation of D/F compounds throughout Bellingham Bay and Puget Sound at the time. As a result, the First Amendment anticipated the potential for a future amendment to add D/Fs, pending the outcome of these evaluations (Ecology 2011a).

In 2013 Ecology revised the SMS regulations to include a framework to specifically address human health and environmental risks associated with bioaccumulative chemicals. Then in 2015 Ecology completed a bay-wide evaluation of bioaccumulative chemicals in surface sediment throughout Bellingham Bay. The bay-wide evaluation identified elevated regional background concentrations of cPAH and D/F compounds throughout the inner portions of Bellingham Bay from multiple legacy and ongoing sources (Ecology 2015).

Potential historical sources for cPAH compounds within Bellingham Bay include the use of creosote-treated pilings and timbers for in-water construction, the widespread use and release of hydrocarbon fuels, combustion byproducts from both fixed and mobile pollution sources (including fossil-fuel powered vehicles, locomotives and vessels and wood and fossil fuel powered buildings and manufacturing facilities), operation of the South State Street Manufactured Gas Plant (SSSMGP) near Boulevard Park, discharges from former wood treating operations in multiple locations, and stormwater discharges. Potential historical sources for D/F compounds include lumber mills; hog fuel burners fired with salt-laden wood; wood-treating facilities; treated wood used in marine structures; air emissions from cement kilns, waste incineration, and open burning; urban stormwater and wastewater discharges; discharges from the former GP pulp and tissue mill (final operations closed in 2007); vessel and vehicle exhaust; redistributed D/F-contaminated sediments; atmospheric deposition of airborne pollutants onto the bay; and surface water drainages discharging to the bay.

In accordance with the CD, cleanup of a portion of the Site (Phase 1 Site Areas; Figure 1) was completed in 2016 (Anchor QEA 2018). Compliance monitoring for these areas and for the Site monitored natural recovery (MNR) areas is ongoing (Anchor QEA 2019, 2020, and 2022a). Remedial design for the remainder of the Site (Phase 2 Site Areas; Figure 1) is underway.

1.2 Purpose of this Document

The purpose of this document is to provide an evaluation to support Ecology's selection of sediment cleanup levels for cPAH and D/F compounds within the Site. This evaluation includes 1) identifying regulatory sediment cleanup objectives and cleanup screening levels, 2) calculating current surface weighted average concentrations (SWACs) for cPAH and D/F compounds, and 3) forecasting post-remediation SWACs for D/F compounds.

2 2013 SMS Regulatory Framework

This section presents the regulatory framework for establishing sediment cleanup levels for bioaccumulative chemicals at the Whatcom Waterway Site, as defined in SMS regulations (Ecology 2013) and associated guidance (Ecology 2021).

The SMS regulations were updated in 2013 to explicitly require sediment cleanup levels to be protective of human and ecological health for bioaccumulative chemicals that may accumulate in consumed seafood. For mercury, this was addressed as part of the original cleanup levels established in the CD. But the CD did not provide cleanup levels for cPAH or D/F compounds.

Under the SMS, human and ecological health-based cleanup levels for bioaccumulative compounds are applied as a surface weighted average concentration (SWAC) across the applicable exposure area. For cleanup levels based on seafood consumption, the exposure area is the entire Site or a sediment cleanup unit (SCU; see Section 4.2).

Under the SMS, cleanup levels for bioaccumulative compounds may be established within a range; the low end of the range is defined by the sediment cleanup objective (SCO), and the upper end of the range is defined by the cleanup screening level (CSL):

- Under current SMS regulations, the long-term goal is the SCO. The SCO is established at either a risk-based concentration, natural background concentration, or the practical quantitation limit (PQL), whichever is higher.
- The CSL sets the higher end of the potential range. The CSL is established at either a risk-based concentration, regional background concentration, or the PQL, whichever is higher.
- Where the SCO cannot be maintained due to recontamination sources beyond the control of the liable party at a site, the sediment cleanup level for the site may be adjusted upwards from the SCO to no higher than the cleanup screening level (CSL). This adjustment is based on technical possibility and net adverse environmental effects (Ecology 2021).

3 cPAH Compounds: SCO and Current Conditions

For cPAH compounds, a calculated human health risk-based SCO value of 229 micrograms per kilogram (µg/kg; expressed as the benzo(a)pyrene toxicity equivalent or TEQ) was developed for the I&J Waterway Site (Ecology 2019) in Bellingham Bay. The I&J Waterway evaluation also concluded that this value is expected to protect ecological health. Ecology has determined that this calculated risk-based SCO is appropriate to consider in establishing an SCO for the Whatcom Waterway Site.

Since 229 µg/kg TEQ is higher than the PQL (7 µg/kg TEQ) and natural background (21 µg/kg TEQ; Ecology 2021), 229 µg/kg TEQ is the SCO applicable to the Whatcom Waterway Site.

Current surface sediment cPAH concentrations within the Whatcom Waterway Site were determined using available recent sediment data (Figure 3 and Attachment A). The current Site-wide SWAC for cPAHs in surface sediment is 67.8 µg/kg TEQ. This includes contributions from other cleanup sites located within the Site boundary.

4 D/F Compounds: SCO, CSL, and Sediment Cleanup Unit

4.1 SCO and CSL

Calculated human and ecological health risk-based SCO and CSL values for D/F compounds have not been developed; therefore, the SCO is the higher of PQL or natural background, and the CSL is the higher of PQL or regional background.

For the SCO, the PQL is 5.0 ng/kg TEQ and natural background is 4.0 ng/kg TEQ (Ecology 2021). As a result, the SCO for D/F compounds is 5.0 ng/kg.

For the CSL, the PQL is 5.0 ng/kg TEQ and regional background is 15 ng/kg TEQ (Ecology 2015). As a result, the CSL for D/F compounds is 15 ng/kg TEQ.

To determine if it is technically possible to maintain SCO following construction, Ecology directed the Port to provide an evaluation of recontamination potential for D/F compounds. That evaluation is contained in Sections 5, 6, and 7 of this document. The recontamination evaluation determined that it is not technically possible to maintain the SCO of 5.0 ng/kg following cleanup construction due to the presence of ongoing regional D/F sources. These ongoing sources are expected to result in a D/F SWAC of 9.8 ng/kg TEQ 10 years following construction. This value is above the PQL-based SCO value of 5 ng/kg TEQ, but below the regional background-based CSL of 15 ng/kg TEQ.

4.2 Whatcom Waterway Site as a Sediment Cleanup Unit for D/F Compounds

The Whatcom Waterway Site boundary was initially developed based on the distribution of mercury concentrations originating from the former GP chlor-alkali plant. This boundary also encompasses the distribution of other Site-associated contaminants such as phenolic compounds.

D/F compounds are a regional contaminant, and the boundary of the Whatcom Waterway Site does not encompass the full distribution of these compounds. They are present at elevated concentrations throughout nearby portions of Bellingham Bay. Ongoing potential sources of these compounds exist both inside and outside of the Site boundary.

Because the Site boundary (Figures 1 and 2) does not encompass the full distribution of D/F compounds, the Site boundary represents a Sediment Cleanup Unit (SCU) for D/F compounds within Bellingham Bay in accordance with the SMS.

5 D/F Compounds: Current Conditions

This section summarizes available surface sediment data for the Whatcom Waterway Site[1] and vicinity. These data include recent D/F concentration data from throughout Bellingham Bay and upstream data collected within Whatcom Creek and the Whatcom Estuary.

5.1 Bellingham Bay Sediment Testing Data

Bellingham Bay sediment testing data for D/F compounds have been developed under various sediment investigations in Bellingham Bay over the last 15 years. These include investigations conducted by Ecology and other government agencies, site investigations conducted as part of work on sediment cleanup sites by project leads (e.g., Whatcom Waterway, I&J Waterway, RG Haley, South State Street MGP), testing conducted in support of source control and habitat restoration work, and Ecology's 2015 study documenting regional background D/F concentrations.

For the assessment of current conditions, Anchor QEA compiled all available surface sediment testing data for D/F compounds available in Ecology's Environmental Information Management database. Data were screened to ensure that all depth intervals were representative of the bioactive zone. Data older than 10 years were excluded, except where the exclusion of these data would have left significant gaps in the data distribution.

Recent available D/F data were then plotted in Figure 4. Non-detected analytes were assumed to be present at a concentration equal to one-half the detection limit. Data flagged as "EMPC" (estimated maximum potential concentration) due to matrix interference were treated as non-detects. Sample replicates were plotted individually to assist in visualizing data precision and reproducibility.

D/F concentration contours were defined using inverse distance weighting[2] consistent with Ecology guidance. The entire data set underwent geographic information system (GIS) interpolation, which resulted in a D/F TEQ concentration being assigned to each square foot of area encompassed by the data set. Then the concentration values for each square foot of the individual sub-units were "clipped" from the larger interpolation and used to calculate the SWAC for each of several different Evaluation Areas as shown in Figure 4. This was done to determine the contribution of each Evaluation Area to the overall SWAC outputs for the Whatcom Waterway Site.

For the Whatcom Waterway Site, the resulting D/F SWAC is currently 11.3 ng/kg TEQ. Values for each of the Evaluation Areas quantified are included in Table B-1 of Attachment B.

[1] The Whatcom Waterway Site boundary was initially determined based on the distribution of mercury. With respect to D/F compounds, the Whatcom Waterway Site represents a Sediment Cleanup Unit within Bellingham Bay areas impacted by regional D/F contamination.

[2] Interpolation was conducted using an inverse-distance weighted geospatial model, with a power of 5, maximum number of neighbors of 4, minimum number of neighbors of 2, four sectors rotated 45 degrees, and a 500-foot-diameter search area (reach).

5.2 Supplemental Source Control Testing Data

In addition to the D/F data available for Bellingham Bay, supplemental data have been collected defining D/F concentrations in upstream inputs located in Whatcom Creek and the Whatcom Estuary. These data were collected as part of the Pre-Remedial Design Investigation (PRDI) activities for the Whatcom Waterway cleanup project (Anchor QEA 2021, 2022b) and as part of a separate pre-design effort supporting a proposed restoration project located in the Whatcom Estuary between the Holly Street and Roeder Avenue bridges (Herrenkohl 2013).

During 2020 and 2021, surface sediments were collected at 33 locations in Whatcom Creek and the Whatcom Estuary. The locations were intended to provide information on the spatial distribution of D/F compounds throughout the transition area between Whatcom Creek and the head of Whatcom Waterway.

The 2020 and 2021 sediment data identified elevated D/F concentrations in creek sediments in the following three areas (Figure 4):

- **Upper Whatcom Creek:** Two locations above the falls at Dupont Street were sampled to provide information on upstream inputs, including the effects of urban discharges on sediment quality within Whatcom Creek. Sediment D/F concentrations in these samples ranged up to 10.2 ng/kg TEQ.
- **Upper Whatcom Estuary:** Samples were collected within the upper portion of the Whatcom Estuary, between the Holly Street bridge and the falls at Dupont Street. This area includes several former stormwater outfalls that are no longer active and the former Holly Street Landfill site. Sediment concentrations ranged up to 710 ng/kg TEQ in this area. The highest D/F concentrations were detected in two areas along the northern shoreline of the estuary.
- **Lower Whatcom Estuary:** Samples were collected in 2013 and 2020 in the Lower Whatcom Estuary, between the Holly Street and Roeder Avenue bridges. Concentrations of D/F compounds ranged up to 44.1 ng/kg TEQ.

These upstream data are not included in the Whatcom Waterway Site because they are beyond the boundary of the Site. But they provide important information on potential upstream contributions to sediment quality in the Site, as described in Section 6.

6 D/F Compounds: Sediment Equilibrium Processes

This section discusses sediment equilibrium processes active at the Whatcom Waterway Site[3] that affect the potential for D/F recontamination and natural recovery to occur during and shortly after implementation of the Whatcom Waterway sediment cleanup. Impacts of these processes on expected future sediment quality are estimated in Section 7.

6.1 Physical Processes Affecting Sediments

Physical processes affecting sediments within the Whatcom Waterway Site and vicinity have been defined during environmental site investigations performed over the past 30 years, augmented by hydrodynamic and coastal engineering data collected as part of other environmental, engineering, and scientific efforts.

6.1.1 Sediment Erosion, Resuspension, and Transport

Several natural forces can erode or resuspend and transport sediments on the harbor floor. Storm-generated waves erode shorelines and sediment in Bellingham Bay and cause transport of eroded materials. Breaking waves and the orbital velocities from storm waves have sufficient energy to resuspend and move sediment. Deep and shallow currents transport sediment either as suspended particles or bed load. Fine-grained sediment is frequently transported as suspended particles in currents, and coarse-grained sediments are often moved by these same currents along the bottom.

Bottom currents in Bellingham Bay are relatively consistent throughout the year and range from 4 to 18 centimeters per second (cm/sec) with a maximum velocity of 40 cm/sec (Colyer 1998 [In] RETEC 2006). A velocity of 20 to 30 cm/sec is generally required to erode fine-grained (i.e., clay, silts, and fine sands) sediment particles (Downing 1983). Based on the regional background study and Whatcom Waterway Site investigations, sediment in most areas of the Whatcom Waterway Site and vicinity are dominated by fine-grained sediments within the clay and silt range.[4] These fine-grained sediments are susceptible to periodic erosion and subsequent transport by bottom currents. See Section 6.1.2 for further discussion of resuspension.

Once they are suspended, fine-grained sediment particles can be transported by weaker currents. Transport distances depend on the size of the particles and the strength and direction of the current.

Typical shallow surface currents in the inner bay are much slower, ranging from 2 to 10 cm/sec with a maximum of 16 cm/sec (Colyer 1998 [In] RETEC 2006). The slower shallow surface currents typical of

[3] The Whatcom Waterway Site boundary was initially determined based on the distribution of mercury. With respect to D/F compounds, the Whatcom Waterway Site represents a Sediment Cleanup Unit within Bellingham Bay areas impacted by regional D/F contamination.

[4] Thirty of 34 surface sediment samples were characterized as greater than 90 percent fines.

the inner bay allow the deposition and accumulation of fine-grained sediment in this portion of the bay including the Whatcom Waterway Site. Hydrodynamic modeling studies (CHE 2020) estimate deeper tidal currents in the Whatcom Waterway Site and vicinity do not exceed 6 cm/sec.

The forces created by storm-generated waves are primarily responsible for shoreline and nearshore erosion in Bellingham Bay. Winds from the prevailing storms typically originate from the south/southwest, creating waves up to 3 meters high near the shore. Shoreline erosion from storm waves is evidenced by the historical migration of shorelines in Bellingham Bay and the need for shoreline armoring throughout much of the inner bay.

Wave analysis and numerical modeling to support cap design for the RG Haley Marine Unit (CHE 2020) showed that disturbance and transport of fine-grained sediment from storm-generated waves could occur up to the depths evaluated (up to approximately -20 feet North American Vertical Datum of 1988).

6.1.2 Resuspension and Sedimentation

There is additional evidence of sediment erosion, resuspension, and transport based on the sedimentation and resuspension evaluation conducted as part of the 2000 Remedial Investigation and Feasibility Study for Whatcom Waterway (Anchor and Hart Crowser 2000). Several sediment traps (HC-ST-100 and HC-ST-101) were deployed within the Whatcom Waterway Site for three 4-month periods to evaluate gross sedimentation rates under various conditions. Gross sedimentation ranged from 7.85 to 21.8 centimeters per year (cm/yr) and averaged 13.8 cm/yr.[5]

Two cores (HC-NR-100 and HC-NR-101) co-located with the sediment traps were used to measure net sedimentation. Rates of sediment accumulation over time were based on the decay rates of two radioisotopes (lead-210 and cesium-137). Mercury depth profiles and depth to native sediment in historical dredging prisms were two other lines of evidence evaluated to determine rates of accumulation. Results among the first three methods (two radioisotope dating methods and chemical profiling) to measure net sedimentation had reasonable agreement, so the results were averaged. Net sedimentation estimates ranged from 1.1 to 3.4 cm/yr and averaged 1.6 cm/yr.

Resuspension rates (as a percentage) were calculated using both gross sedimentation rates and net sediment accumulation over time measured at the co-located traps and cores, using the following equation:

[5] Based on five data points.

Equation 1

$(gross - net)/gross = percent\ resuspension$

Resuspension rates ranged from 81% to 93% and averaged 88%. These results confirm that the upper portion of harbor floor sediments in the Whatcom Waterway Site are likely to be resuspended and transported to other locations under storm conditions.

6.1.3 Hydrodynamics and Sediment Transport

The direction of shallow and deep currents in Bellingham Bay is variable. Tidal exchanges[6]; wind direction, duration, magnitude, and fetch; riverine discharges; water depth; and shoreline configuration all influence the complex circulation of water in Bellingham Bay. Deep flow generally oscillates from inbound to outbound based on the tide, and nearshore currents flow clockwise and counterclockwise along the shorelines depending on winds and river flows.

The dominant current direction has been reported to be not only an oscillating north–south longshore flow (USACE 1997) but also a dominant clockwise flow (Colyer 1998). Eddies have been reported to form, particularly in the inner bay, depending on wind speed and direction, freshwater input, and strength of the tidal exchange (Colyer 1998).

Hydrodynamic modeling studies (CHE 2020) indicate current reversals with ebb and flood tides in the vicinity of the Whatcom Waterway Site. The modeling indicates that a component of the current in and adjacent to the Whatcom Waterway Site oscillates in a north–south longshore flow as a result of tides. Winds from the south and southwest entrain water at and near the surface, pushing it to the north-northeast toward the inner bay, causing return flows that typically flow counterclockwise. Winds from the west and northwest cause surface currents to flow clockwise along the eastern shoreline (Shea et al. 1981 [In] RETEC 2006). As a result of the oscillating current directions observed in Bellingham Bay, sediment is expected to be transported at times into the Whatcom Waterway Site from surrounding areas of Bellingham Bay.

6.2 Potential Ongoing Sources of D/F Compounds

Mercury is the primary contaminant of concern for the Whatcom Waterway Site. The main sources of mercury contamination are historical discharges from the former Georgia Pacific chlor-alkali plant. These controlled discharges were eliminated between the 1970s and the 1999 shutdown of the chlor-alkali plant. Subsequent cleanup and source control actions have addressed—and continue to address—secondary sources associated with sediment, soil, and groundwater contamination. Source

[6] The tidal range (the difference between the highest high tide and lowest low tide) in Bellingham Bay is approximately 12 feet.

tracing and source control efforts have not identified other regional or ongoing mercury sources, and natural recovery processes have dramatically reduced mercury concentrations in surface sediments and in the tissue of aquatic sea life over time (see Section 6.4).

There are many historical and ongoing sources of D/F compounds. Historical sources include lumber mills; hog fuel burners fired with salt-laden wood; wood-treating facilities; treated wood used in marine structures; air emissions from cement kilns, waste incineration, and open burning; urban stormwater and wastewater discharges; discharges from the former GP pulp and tissue mill (closed in 2007); vessel and vehicle exhaust; redistributed D/F-contaminated sediments; atmospheric deposition of airborne pollutants onto the bay; and surface water drainages discharging to the bay. Some sources have been eliminated or controlled, but source tracing and source control investigations have concluded that multiple known or suspected sources of D/F compounds remain.

Table 1 and Figure 5 identify potential ongoing source inputs for D/F compounds that may affect sediment quality within the Whatcom Waterway Site. Available D/F concentration data for each potential source are listed in Table 1. These potential ongoing sources are summarized in the following subsections.

6.2.1 RG Haley Cleanup Site

The RG Haley cleanup site is located north of the Cornwall Avenue Landfill site within the Site boundary (see Figure 6-6). Former wood-treating operations, as well as lumber, coal, and wharf facilities, have resulted in soil, groundwater, and sediment contamination. Contaminants include wood waste, diesel fuel, pentachlorophenol, D/F, and PAHs. An emergency action was taken in 2001 to contain oil releases to Bellingham Bay, including building a sheet pile wall, installing oil-recovery wells, and removing some sediment. In 2013, a sand/clay layer was placed on a portion of the shoreline to address an oil seep (Ecology 2015). The final cleanup action is currently undergoing design and permitting. The cleanup is expected to achieve a D/F sediment cleanup level of 13 ng/kg TEQ as measured on a SWAC basis throughout the Marine Unit of the RG Haley site.

Table 1
Potential Ongoing Sources of D/F Compounds

Type and Name of Source	Description	Concentration Range (ng/kg TEQ)
Other Cleanup Sites		
RG Haley Site	The RG Haley Site is located within the boundaries of the Whatcom Waterway Site.[1] The cleanup action is mainly driven by D/F compounds.	11.6 to 198.6
Upstream Sources		
Whatcom Creek Sediments	Sediment D/F concentrations in Whatcom Creek upstream of Dupont Street include detected concentrations above natural background but below regional background. The creek is a significant source of solids to the Whatcom Waterway Site.[1]	2.1 to 10.2
Holly Street Landfill Sediments	Sediment D/F concentrations are nearly all above the regional background level along the north shore of Whatcom Creek along the former Holly Street Landfill. This area is subject to the risk of scour during flood events. D/F concentrations are much lower along the southern shore of Whatcom Creek.	5.3 to 710
Whatcom Estuary Sediments	Sediment D/F concentrations are above natural background, and a few samples are above regional background concentrations. This area is prone to periodic scour during storms or flood events.	2.8 to 44.1
Stormwater Sources		
C Street Outfall	Sediment D/F concentrations have been monitored adjacent to the C Street outfall since completion of the first phase of Whatcom Waterway site remediation. Sediment D/F concentrations in this area have increased over time, reaching concentrations above 50 ng/kg TEQ, higher than in surrounding areas.	11 to 50.1
Laurel Street Outfall	Sediment D/F concentrations are above the regional background level immediately in front of the outfall.	25.1 to 35
Other Stormwater Outfalls	Numerous stormwater outfalls discharge to Whatcom Creek and to the Whatcom Waterway Site. They are not being monitored to quantify their potential for recontamination.	Data Not Available
Other D/F Sources		
Sediment Redistribution within Regional Background Area	The area of regional background contamination overlaps with portions of the Site boundary[1]. Fine-grained sediments within these areas can redistribute, impacting conditions within the Site boundary.[1]	1.4 to 15
Sediment Redistribution from beyond Site Boundary [1]	Sediments containing elevated D/F concentrations extend well beyond the Site boundary.[1] Fine-grained sediments within these areas can redistribute and impact conditions within the Site boundary.[1]	1.6 to 12
Atmospheric Deposition throughout Bellingham Bay	No recent studies document current trends in atmospheric deposition of D/F compounds.	Data Not Available

Notes:

1. The Whatcom Waterway Site boundary was initially determined based on the distribution of mercury. With respect to D/F compounds, the Whatcom Waterway Site represents a Sediment Cleanup Unit within Bellingham Bay areas impacted by regional D/F contamination.

6.2.2 Upstream Sources

Several creeks that carry stormwater discharges and historically received industrial discharges may be historical or current sources of contaminants in Bellingham Bay. As shown in Figure 5, several storm drains discharge directly to Whatcom Creek, which itself discharges into Whatcom Waterway. There are three general areas within the creek:

- **Whatcom Creek Sediment:** Background samples from Whatcom Creek upstream of Dupont Street from the 2020 PRDI had D/F concentrations of 2.1 to 10.2 ng/kg TEQ (Table 1; Figure 4), indicating that sediment concentrations in Whatcom Creek (WC-12-SS) are above natural background. The creek drainage comprises downtown Bellingham, and the creek discharges solids directly to Whatcom Waterway. Therefore, the creek is considered a potential local source of D/F compounds to the Whatcom Waterway Site
- **Holly Street Landfill Sediment:** The former Astor Street outfall discharged along the northern shoreline of Whatcom Creek immediately upstream of the West Holly Street Bridge (Figure 4). This is also the site of the former Holly Street Landfill, a historical City of Bellingham municipal waste landfill bisected by Whatcom Creek as it enters Whatcom Waterway. A cleanup of the former landfill was completed in 2005, but the cap only extends down to approximately +6 feet mean lower low water. Therefore, lower intertidal sediments were not capped, and this area is prone to scour. Elevated sediment concentrations were observed in 2020, so additional sampling was conducted in 2021 and the outfall was investigated as a potential source. Two of the PRDI samples analyzed in 2021 along the northern shoreline (stations WC-06-SS and WC-10-SS) contained D/F concentrations above the regional background value of 15 ng/kg TEQ (Table 1; Figure 3). The WC-06-SS sample was recollected from the same sampling location, which had the highest D/F concentrations from the 2020 sampling effort. Results from 2021 (86.4 ng/kg TEQ) were lower than those measured during 2020 (562 ng/kg TEQ; average of two samples [710 and 400 ng/kg TEQ]), but remained well above the regional background concentration. Sample WC-10-SS was located just downstream of station WC-06-SS. Reported D/F concentrations in that sample were lower, at 27 ng/kg TEQ. The remaining Whatcom Creek sediment samples analyzed in 2021 contained D/F concentrations less than the regional background concentration of 15 ng/kg TEQ (all of the 2021 samples exceeded the natural background concentration). Results near the former discharge point of the Astor Street outfall ranged from 5.3 to 12.9 ng/kg TEQ. Results at the other former outfall along the north side of Whatcom Creek were 1.2 ng/kg TEQ, below both natural and regional background concentrations. Taken together with the results from 2020, the PRDI sampling data confirm there are elevated D/F concentrations in sediments at two locations along the northern side of Whatcom Creek upstream and downstream of the former Astor Street outfall. However, there is no indication that the Astor Street outfall is an ongoing source of contamination. The Astor Street outfall is no longer active, and sediment samples

taken immediately adjacent to the outfall were below the regional background concentration of 15 ng/kg TEQ (though they both still exceeded the natural background concentration). The wet weather stormwater inspection at the Astor Street outfall confirmed there was no discharge during rain events at the outfall.

- **Whatcom Estuary Sediment:** Similarly, the area between the bridges at the head of Whatcom Waterway is outside the Whatcom Waterway Site, but it serves as an upstream source of sediment (Figure 4). Supplemental samples were collected between the Roeder Avenue and West Holly Street bridges and upstream of the West Holly Street Bridge to assess the potential source of sediment depositing on top of the caps placed in the head of Whatcom Waterway. The samples were found to contain D/F concentrations exceeding the regional background concentration. The D/F concentration in the 2013 Focused Environmental Site Characterization for the WCE-SS-3 sample was 44.1 ng/kg TEQ (Herrenkohl 2013). Additionally, the D/F concentrations in the 2020 PRDI samples ranged from 2.8 to 18 ng/kg TEQ (Table 1; Figure 3), which are above natural background. This area is prone to scour from wave action and stream discharge, meaning it is a significant source of solids to the Whatcom Waterway Site. Therefore, the sediment between the bridges (i.e., the head of the waterway) is considered a potential local source of D/Fs to the Whatcom Waterway Site.

6.2.3 Stormwater Sources

Stormwater discharges in urban watersheds can represent historical or current sources of contaminants to Puget Sound. Stormwater outfalls in the urbanized portion of Bellingham Bay are shown on Figure 5. Monitoring and supplemental testing have shown that stormwater is a potential local and regional source of D/Fs to the Whatcom Waterway Site (Figure 5).

- **C Street Outfall:** The C Street outfall is an ongoing source of stormwater discharge and a combined sewer outfall. When the Astor Street outfall was disconnected, stormwater flows were routed to the C Street outfall. The PRDI sediment data show enrichment with D/F compounds offshore of the C Street outfall (sample location WW-P1CM-11; 50.1 ng/kg TEQ; Anchor QEA 2022b). Available data indicate that this outfall is an ongoing D/F source to the Whatcom Waterway Site. Sediment D/F concentrations near the C Street outfall increased significantly between 2019 (11 ng/kg TEQ) and 2021 (50.1 ng/kg TEQ).
- **Laurel Street Outfall:** The Laurel Steet outfall and associated conveyance have been reconstructed. This outfall discharges stormwater from portions of downtown Bellingham. Sediment data adjacent to the outfall show enrichment with D/F compounds (WW-01-SS; 35 ng/kg TEQ). Further evaluation of this outfall as a potential ongoing D/F source appears warranted.
- **Other Stormwater Outfalls:** In addition to the outfalls listed above, other outfalls and storm drains, both inside and outside of the Site boundary (Figure 5), are sources of contamination.

There are 18 recognized stormwater outfalls within the Whatcom Waterway Site, and 34 outfalls within Whatcom Creek and Whatcom Estuary. These outfalls have the potential to transport solids into Bellingham Bay. A study of residential soil in Bellingham as part of the Oeser Site cleanup (START 2002) reported concentrations of 2.7 ng/kg to 34.8 ng/kg TEQ in areas considered unaffected by the Oeser Site. These concentrations fall within the range (7.5 to 36 ng/kg) of D/F TEQs reported in residential soil from Seattle neighborhoods (Ecology 2011b). No publicly available testing data were identified for these other stormwater outfalls.

6.2.4 Other D/F Sources

In addition to the sources listed above, sediment redistribution from surrounding areas and from deposition of atmospheric pollutants may affect sediment quality within the Whatcom Waterway Site, as follows:

- **Sediment Redistribution within Regional Background Area:** Sediment redistribution can occur within the regional background area, which overlaps with portions of the Whatcom Waterway Site. Sediment D/F concentrations range up to 15 ng/kg TEQ in this area.
- **Sediment Redistribution from beyond the Site boundary:** Sediment redistribution can occur from beyond the regional background area. Sediment D/F concentrations range up to 12 ng/kg TEQ in this area.
- **Atmospheric Deposition throughout Bellingham Bay:** Atmospheric deposition of dust or aerosol pollutants can contribute D/F compounds directly to Bellingham Bay or to surface waters draining to the bay. No local studies of atmospheric deposition documenting potential loading rates for D/F compounds were identified.

6.3 Evidence of Ongoing Natural Recovery

Natural recovery of mercury has been established as an ongoing process throughout Bellingham Bay. Except for one shallow-water, wave exposed area to be addressed during the cleanup of Phase 2 Site Areas, natural recovery has resulted in compliance with the Site cleanup levels for mercury. The data documenting natural recovery for mercury-containing sediments includes the following:

- **Bellingham Bay as a Depositional Environment:** The majority of Bellingham Bay is a depositional environment dominated by fine-grained sediment. This means that new sediments tend to accumulate over time unless they are disturbed by anthropogenic activities such as dredging or prop wash.
- **Presence of Ongoing Clean Sediment Inputs:** Clean sediment inputs enter the bay from the Nooksack River, Squalicum Creek, Whatcom Creek, and other freshwater sources. Other sediments enter the bay from adjacent areas as suspended sediment in tidal currents. These sediment inputs have mercury concentrations within the range typical of natural background conditions, which means they support natural recovery by introducing new, clean sediment.

- **Successful Control of Mercury Inputs:** Anthropogenic inputs of mercury are predominantly associated with the former GP chlor-alkali plant and its wastewaters. Wastewater sources were controlled during the 1970s and the plant was closed in 1999. Secondary sediment, soil, and groundwater sources were and are being addressed through completed and ongoing cleanup actions. Although lower-level anthropogenic sources of mercury (e.g., stormwater and atmospheric deposition) remain, they are diffuse and have not interfered with the natural recovery processes.
- **Demonstrated Recovery in Geochronology Cores:** As described in Section 4.1, geochronology studies were performed as part of the remedial investigation/feasibility study (Anchor Environmental and Hart Crowser 2000a). These studies documented the net deposition rate for the harbor floor and the progressive improvement in sediment mercury concentrations since the primary wastewater sources of mercury contamination were controlled in the 1970s.
- **Demonstrated Recovery in Recent Sediment Monitoring:** Extensive sediment monitoring data have been collected at the Site. These data include the remedial investigation/feasibility study work performed between 1996 and 2004 (RETEC 2006) and pre-design and post-construction monitoring performed between 2008 and 2021. These monitoring data have shown progressive improvement in surface sediment quality at the Site as sediments approach natural background conditions for mercury.
- **Demonstrated Recovery in Sea Life Tissues:** Improvements in sediment quality have been mirrored by improvements in tissue testing data for Dungeness crab (*Cancer magister*). Mercury levels in Bellingham Bay crab tissue have decreased consistently over time, and they are now equal to those in clean reference areas. Mercury levels in flatfish have also been analyzed, and they are the same as those in clean reference areas.

The same natural recovery processes are at work for D/F compounds, but the sediment and source control data sets for D/F compounds are not as well developed as they are for mercury. Available information on MNR processes for D/F compounds includes the following:

- **Ongoing Monitored Natural Recovery Physical Processes:** The same depositional environment and clean sediment inputs from the Nooksack River are active in supporting natural recovery of D/F compounds in sediment. Fewer data are available to document the D/F concentrations in other surface water inputs in comparison to mercury.
- **Multiple Ongoing D/F Sources:** Source tracing data confirm that ongoing contamination sources remain for D/F compounds. Although many primary sources (wood treating, open burning, etc.) have been reduced or eliminated, there are still ongoing inputs of D/F compounds in stormwater and surface water, and there are secondary sources of D/F compounds in regional sediments and soils. Gaps in the source control data set limit the

reliability of recovery projections, particularly in the inner areas of the bay near ongoing source inputs.

- **Demonstrated Recovery in Sediment Data:** Despite the presence of ongoing source inputs for D/F compounds, there have been multiple empirical demonstrations that natural recovery of D/F compounds is occurring in surface and subsurface sediments in Bellingham Bay. During testing in 1999 (Anchor QEA 2000), an elevated D/F signature was present in surface sediments around the former GP wastewater outfall (outside of the Whatcom Waterway Site). In later testing, performed between 2010 and 2015, these concentrations had decreased more than 5-fold through MNR processes. The U.S. Army Corps of Engineers has also conducted subsurface sediment testing in the outer portions of the I&J Waterway (USACE 2012). These data showed that surface sediment D/F concentrations are on average 4 to 10 times lower than deeper subsurface sediment, confirming that sediment quality in this area has recovered over time. Both sets of results mirror observations for the natural recovery of mercury in the same locations.
- **Findings of Sea Life Tissue Testing:** Bottom fish tissue was tested for D/F compounds during Year 3 compliance monitoring for the Whatcom Waterway Site (Anchor QEA 2020). During that monitoring, D/F concentrations in starry flounder (*Platichthys stellatus*) tissue from Bellingham Bay were found to be very low and indistinguishable from D/F concentrations in the tissues of flounder collected from a clean reference site in Samish Bay. These results indicate that natural recovery processes are limiting the bioavailability of D/F compounds in sediment.

Taken together, the lines of evidence for D/F compounds confirm that MNR is occurring and is driving down sediment D/F concentrations over time. The existing information suggests that MNR performance may be greatest for offshore sediment areas in deeper water away from localized source inputs and in areas closer to the Nooksack River. Areas closer to potential ongoing D/F inputs within the urbanized portion of the bay may lag in MNR performance until those sources can be controlled. At present, the data on ongoing source inputs are insufficient to reliably predict the extent of MNR that can be achieved in these nearshore areas.

6.4 Observations Following Prior Remediation Efforts

Implementation of sediment remediation in the Phase 1 Site Areas provided an opportunity to assess whether and to what extent the presence of regional D/F contamination and ongoing source inputs will result in recontamination of newly remediated areas. Three Phase 1 Site Areas were remediated to address mercury contamination and other project requirements, including portions of the Inner Waterway, the Outer Waterway, and the Log Pond. Monitoring data collected following cleanup

implementation (Anchor QEA 2018, 2019, 2020, and 2022) included D/F compounds. Documented recontamination in these three areas included the following:

- **Inner Waterway Areas:** Clean cap materials were placed in portions of the Inner Waterway. At the time of placement, the caps were armored and without surficial sediment accumulations. A thin layer of sediment has accumulated over these capped areas since cleanup construction was completed. No exceedances of cleanup levels have been noted for other contaminants in the newly accumulated sediment. But the D/F concentrations have been elevated, ranging from 21.4 to 39.4 ng/kg TEQ. At the C Street outfall, concentrations increased steadily between the Year 1 and Year 5 monitoring events, suggesting that this outfall may represent an ongoing source of D/F compounds to the Inner Waterway.
- **Outer Waterway Areas:** Dredging and residuals management were performed as part of the cleanup in Phase 1 Site Areas in Site Unit 1C, which is located within the Whatcom Waterway adjacent to the Bellingham Shipping Terminal (BST; Figure 1). Immediately following construction, the D/F concentrations in this area averaged 4.28 ng/kg. But monitoring in the first (2017), third (2019), and fifth (2021) years following dredging and placement of the residual cap measured concentrations of 13.2 ng/kg TEQ, 13.8 ng/kg TEQ, and 15.7 ng/kg TEQ near the center of the previously dredged area adjacent to BST (Figure 4). These concentrations were very similar to pre-remediation conditions (15.1 ng/kg TEQ; Anchor QEA 2010) and were within the range of concentrations in surrounding areas. The results suggest that sediment transport is occurring from these adjacent areas, or that concentrations are being influenced by ongoing source inputs to the Inner Waterway. Concentrations appear to have reached equilibrium and are at levels similar to conditions prior to remediation.
- **Log Pond Area:** The Log Pond area was capped in two phases. The first phase was completed in 2000. The second phase was completed in 2016. Results of cap monitoring since that time have demonstrated compliance with Site cleanup levels for mercury and other Site contaminants. Concentrations of D/F compounds within the capped areas have ranged from 3.6 to 6.3 ng/kg TEQ. These concentrations are less than those observed in the Inner Waterway and the Outer Waterway, though some of the detected concentrations exceeded the PQL and natural background.

These empirical observations indicate that recontamination can be expected following sediment remediation. The extent of recontamination appears to vary from location to location within the Site. Recontamination risks are higher toward the Inner Waterway, where multiple ongoing D/F sources are located, lower in the Outer Waterway and lowest in the Log Pond.

The empirical observations discussed in this section are used in Section 5 to forecast future sediment quality following completion of remediation in Phase 2 Site Areas.

7 D/F Compounds: Forecasting Post-Remediation Conditions

This section summarizes forecasts of changes in sediment D/F concentrations expected to occur during the first 10 years following completion of planned remediation work in Phase 2 Site Areas. The planned remedial actions will address not only remaining areas of mercury contamination but also other cleanup objectives. They will also result in an initial decrease in D/F concentrations in the remediated areas.

Based on the presence of ongoing D/F source inputs and regional sediment contamination, the initial decrease in sediment D/F concentrations will be affected by subsequent recontamination. Remedial actions are expected to initially achieve compliance with the PQL (5.0 ng/kg TEQ) within the remediated areas at the time of construction. But these concentrations are expected to equilibrate (i.e., increase) over time due to the migration of fine sediment particulates and associated pollutants from surrounding areas. The level of impact of this recontamination on overall D/F SWACs in the Whatcom Waterway Site[7] were evaluated using estimated D/F replacement values.

Replacement values were used to simulate the change in sediment quality resulting from the Phase 2 remedial action. The first replacement value was applied to remediation areas to represent anticipated D/F concentrations in Year 0, immediately following construction. The D/F replacement value for the near-term (Year 0) prediction was assumed to be the PQL value of 5 ng/kg TEQ immediately following dredging and the placement of clean material. A second replacement value was applied to the remediation areas to simulate post-remediation equilibrium concentrations that reflect ongoing recontamination processes. For this purpose, ongoing source inputs were assumed to remain active at current levels. The replacement value of 13.5 ng/kg TEQ used for Phase 2 Site Areas was consistent with average observed sediment recontamination occurring in the Outer Waterway Phase 1 Site Areas during Year 1 through Year 5 monitoring.

The Port plans to open the ASB to Bellingham Bay, following its remediation as part of the cleanup of Phase 2 Site Areas, to support aquatic reuse for marine trades, public access, and habitat enhancement. This will convert part of the ASB to aquatic land, expanding the area of aquatic land comprising the Whatcom Waterway Site by about 14 acres. This expansion has been incorporated in forecasts of future sediment quality.

Forecast results are documented in Tables B-1 through B-3 of Attachment B and in Figures 4, 6, and 7. D/F concentration changes are forecast as follows:

- **Current Conditions:** The current SWAC for D/F compounds within the Whatcom Waterway Site is 11.3 ng/kg TEQ (Table B-1 and Figure 4). This includes contributions of D/F

[7] The Whatcom Waterway Site boundary was initially determined based on the distribution of mercury. With respect to D/F compounds, the Whatcom Waterway Site represents a Sediment Cleanup Unit within Bellingham Bay areas impacted by regional D/F contamination.

contamination at the RG Haley site which is located within the boundaries of the Whatcom Waterway Site.

- **Conditions at Completion (Year 0):** Following completion of remediation in Phase 2 Site Areas the SWAC for D/F compounds in the Whatcom Waterway Site is expected to be reduced to 9.2 ng/kg TEQ (Table B-2 and Figure 6). This assumes that Phase 2 Site Areas dredged or capped will exhibit a post-remediation D/F concentration of 5 ng/kg (Figure 6), and that the cleanup of the Marine Unit of the RG Haley site achieves its sediment cleanup level of 13 ng/kg TEQ.
- **Near-Term Equilibrium Conditions (Year 10):** Ten years following the completion of remediation in the Phase 2 Site Areas, recontamination processes are expected to result in higher equilibrium concentrations (replacement value of 13.5 ng/kg TEQ assumed in the remediated areas based on empirical recontamination observations). These processes will tend to drive up the D/F SWAC throughout the Whatcom Waterway site. The expected SWAC at Year 10 is 9.8 ng/kg TEQ (Table B-3; Figure 7). This value is a 13% reduction from pre-remediation conditions within the Site boundary. This value assumes that the cleanup of the Marine Unit of the RG Haley site achieves and maintains its sediment cleanup level of 13 ng/kg TEQ.

Results of remediation forecasting indicate that the PQL-based SCO value of 5 ng/kg TEQ cannot be maintained within the Whatcom Waterway Site during the decade immediately following construction. This conclusion results from potential regional and local sources of D/F recontamination (Section 6.2) and the associated limitations on natural recovery processes (Section 6.3). The expected SWAC at Year 10 is 9.8 ng/kg TEQ, assuming that the cleanup of the Marine Unit of the RG Haley site achieves and maintains its sediment cleanup level of 13 ng/kg TEQ.

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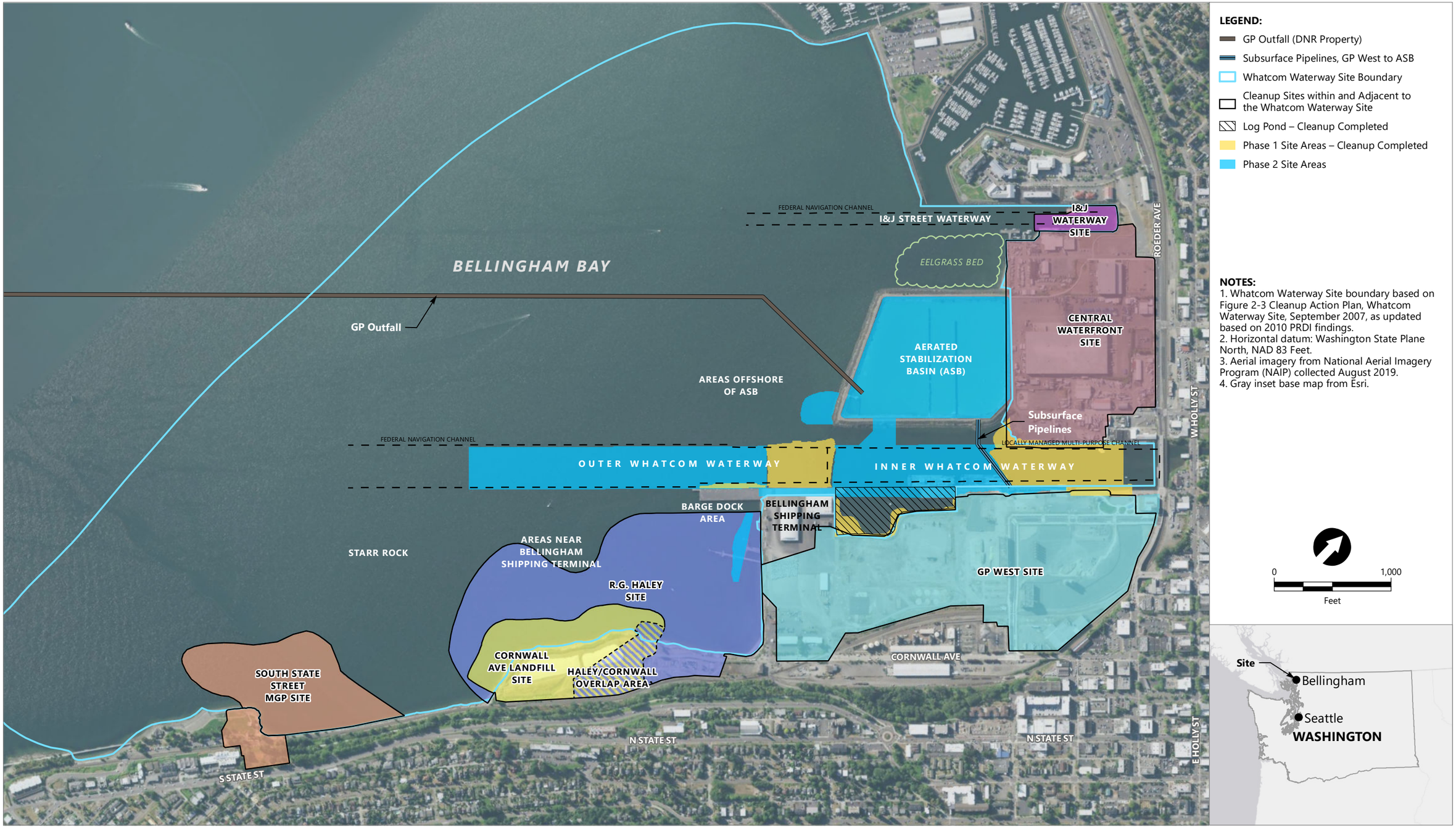
Figures



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ANCHOR QEA

Figure 1
Whatcom Waterway Site Boundary and Phase 1 and Phase 2 Site Areas
Evaluation of cPAH and D/F Compounds in Surface Sediment
Whatcom Waterway Site Cleanup

LEGEND:

- Regional Background Area
- Evaluation Area
- Whatcom Waterway Site Boundary[3]
- New Aquatic Land
- New Upland CDF

NOTES:

1. Horizontal datum: Washington State Plane North, NAD 83 Feet.
2. The Regional Background Area for Bellingham Bay was defined as a hydraulically connected marine environment that excluded areas directly influenced by known cleanup sites, potential sources (e.g., active or historical outfalls), dredged disposal sites, and areas more representative of natural background (Ecology 2015).
3. With respect to D/F compounds, the Whatcom Waterway Site represents a Sediment Cleanup Unit within Bellingham Bay areas impacted by regional D/F contamination.
4. When the Port connects the ASB to Bellingham Bay, it will convert about half of the ASB into aquatic land, expanding the area of aquatic land comprising the Whatcom Waterway Site.
5. Aerial imagery from National Aerial Imagery Program (NAIP) collected August 2019.

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ANCHOR QEA

Figure 2
Evaluation Areas for Surface Sediment cPAH and D/F Concentrations
Evaluation of cPAH and D/F Compounds in Surface Sediment
Whatcom Waterway Site Cleanup

LEGEND:

- Evaluation Area
- Surface Sediment Sampling Locations

cPAH TEQ (µg/kg, U=1/2)

- ≤ 16
- 17 - 86
- 87 - 229
- > 229

18 (19)
26
9.5

Concentrations for mulitple monitoring years with most recent data at the bottom. Results in parentheses are field duplicates collected on the same date or reanalysis results of the same sample.

NOTES:
1. Horizontal datum: Washington State Plane North, NAD 83 Feet.
2. Aerial imagery from National Aerial Imagery Program (NAIP) collected August 2019. Inset imagery from Whatcom County GIS collected March to June 2022.

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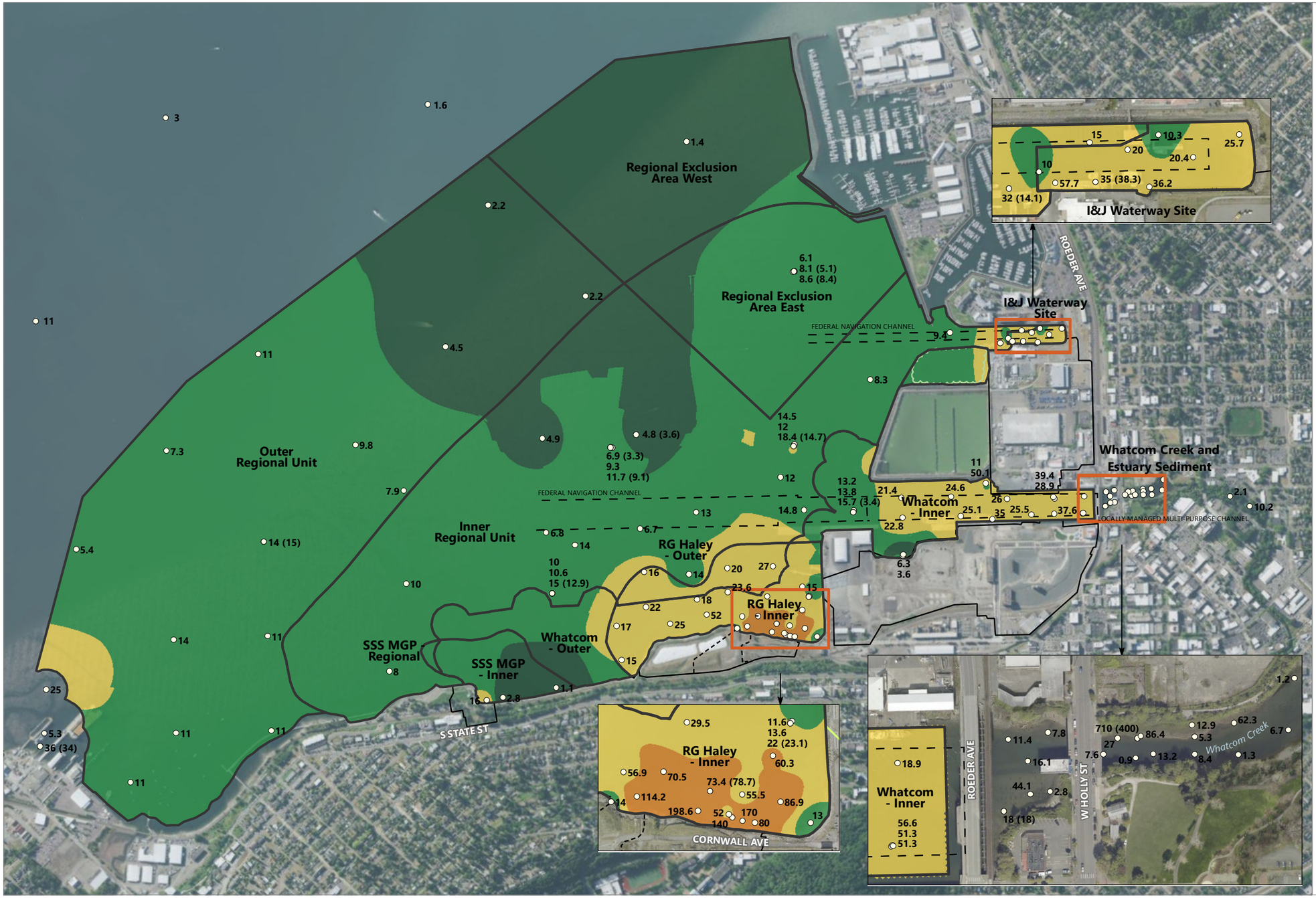
Figure 3
Current cPAH Concentrations in Surface Sediment
Evaluation of cPAH and D/F Compounds in Surface Sediment
Whatcom Waterway Site Cleanup



LEGEND:

- Evaluation Area
- Surface Sediment Sampling Locations

Dioxin/Furan TEQ (ng/kg, U=1/2)

- ≤ 5
- 5.1 - 15
- 15.1 - 60
- > 60

13.2
13.8
15.7 (3.4)

Concentrations for mulitple monitoring years with most recent data at the bottom. Results in parentheses are field duplicates collected on the same date or reanalysis results of the same sample.

NOTES:

1. Horizontal datum: Washington State Plane North, NAD 83 Feet.
2. Aerial imagery from National Aerial Imagery Program (NAIP) collected August 2019. Inset imagery from Whatcom County GIS collected March to June 2022.

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Figure 4
Current Dioxin/Furan Concentrations in Surface Sediment

Evaluation of cPAH and D/F Compounds in Surface Sediment
Whatcom Waterway Site Cleanup

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Figure 5
Potential Regional and Local Sources of Dioxin/Furans
Evaluation of cPAH and D/F Compounds in Surface Sediment
Whatcom Waterway Site Cleanup

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Figure 6
Expected Post-Remediation (Year 0) Dioxin/Furan Concentrations in Surface Sediment
Evaluation of cPAH and D/F Compounds in Surface Sediment
Whatcom Waterway Site Cleanup

LEGEND:

- Evaluation Area

Dioxin/Furan TEQ (ng/kg, U=1/2)

- ≤ 5
- 5.1 - 15
- 15.1 - 60
- > 60

NOTES:

1. Horizontal datum: Washington State Plane North, NAD 83 Feet.
2. Aerial imagery from National Aerial Imagery Program (NAIP) collected August 2019.

0 1,600

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Figure 7
Expected Post-Remediation (Year 10) Dioxin/Furan Concentrations in Surface Sediment

Evaluation of cPAH and D/F Compounds in Surface Sediment
Whatcom Waterway Site Cleanup

Attachment A
Current Surface-Weighted Average Concentrations of cPAHs in Surface Sediment

Attachment A

Table A-1. Current Surface-Weighted Average Concentrations of cPAH in Surface Sediment [1]

Evaluation Area (See Figures 2 and 3)	Surface Area		Current cPAH SWAC by Evaluation Area [1] (µg/kg TEQ, U = 1/2)	SWAC Calculation Areas							
	Area (sq ft)	Area (acres)		Total Whatcom Waterway Site (W) [2,3]	Whatcom Waterway Site Excluding Other Cleanup Sites [2,3]	I&J Waterway Cleanup Site (I)	RG Haley Cleanup Site (H)	SSS MGP Cleanup Site (S)	Regional Background Area (R)	Regional Background Exclusion Area (X)	All Evaluation Areas Together
I&J Waterway Site (W, I)	132,300	3.0	312	**Yes**	No	**Yes**	No	No	No	No	**Yes**
Inner Regional Unit (W, R)	17,902,800	411.0	39.2	**Yes**	**Yes**	No	No	No	**Yes**	No	**Yes**
Outer Regional Unit (R)	24,680,200	566.6	65	No	No	No	No	No	**Yes**	No	**Yes**
Regional Exclusion Area East (W, X)	5,157,100	118.4	20.5	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**
Regional Exclusion Area West (X)	7,478,200	171.7	13.6	No	No	No	No	No	No	**Yes**	**Yes**
RG Haley – Inner (W, H)	1,805,100	41.4	135	**Yes**	No	No	**Yes**	No	No	No	**Yes**
RG Haley – Outer (W, R, H)	777,900	17.9	55.7	**Yes**	No	No	**Yes**	No	**Yes**	No	**Yes**
SSS MGP – Inner (W, S)	909,300	20.9	566	**Yes**	No	No	No	**Yes**	No	No	**Yes**
SSS MGP – Regional (W, R, S)	49,700	1.1	138	**Yes**	No	No	No	**Yes**	**Yes**	No	**Yes**
Whatcom – Inner (W)	2,790,500	64.1	127	**Yes**	**Yes**	No	No	No	No	No	**Yes**
Whatcom – Outer (W)	1,488,400	34.2	61.1	**Yes**	**Yes**	No	No	No	No	No	**Yes**
Whatcom – ASB (W)	0	0.0	0.00	No	No	No	No	No	No	No	No
All Evaluation Areas Together	**63,171,500**	**1,450.2**	**60.3**								

Evaluation Summary	Total Whatcom Waterway Site (W) [2,3]	Whatcom Waterway Site Excluding Other Cleanup Sites [2,3]	I&J Waterway Cleanup Site (I)	RG Haley Cleanup Site (H)	SSS MGP Cleanup Site (S)	Regional Background Area (R)	Regional Background Exclusion Area (X)	All Evaluation Areas Together
Evaluation Area Acreage	712.0	627.6	3.0	59.3	22.0	996.6	290.1	1,450.2
cPAH SWAC (µg/kg TEQ; U=1/2)	**67.8**	**45.8**	**312**	**111.1**	**543.8**	**54.3**	**16.4**	**60.3**

Notes:
"Yes" indicates the evaluation area is included as part of the indicated SWAC calculations.
"No" indicates the evaluation area is not included as part of the indicated SWAC calculations.
1. The SWAC is based on use of the most recent data set. This data set includes available data from 2014 to the present unless data are no longer relevant (e.g., the area has been remediated or has recontaminated since that time). Earlier data have been included selectively to fill in gaps in more recent data. The older data included are from the I&J Waterway, the SSS MGP shoreline, the RG Haley shoreline, Whatcom Waterway Units 1A and 1B, and portions of the Regional Background D/F exclusion area.
2. The Whatcom Waterway Site boundary was initially determined based on the distribution of mercury. With respect to D/F compounds, the Whatcom Waterway Site represents a Sediment Cleanup Unit within Bellingham Bay areas impacted by regional D/F contamination. The Whatcom Waterway Site overlaps with multiple other sediment cleanup sites, including the I&J Waterway, the SSS MGP site, the Cornwall Avenue Landfill site and the RG Haley site.
3. The ASB portion of the Site is currently not connected with Bellingham Bay. But the Port has proposed to remediate the ASB and open a portion of it to Bellingham Bay for aquatic reuse. The aquatic area of the Whatcom Waterway Site will be larger after the ASB is opened to Bellingham Bay. SWACs for the proposed aqutic portion fo the ASB are not included current conditions.
ASB: Aerated Stabilization Basin
cPAH: carcinogenic polycyclic aromatic hydrocarbon
D/F: dioxin/furan
MGP: manufactured gas plant
sq ft: square feet
SSS MGP: South State Street Manufactured Gas Plant
SWAC: surface-weighted average concentration
U=1/2: concentration set to one-half the detection limit when not detected above detection limit
µg/kg TEQ: microgram per kilogram toxic equivalency based on benzo(a)pyrene toxicity equivalency factors

Attachment B
Current and Forecasted Surface-Weighted Average Concentrations of D/F in Surface Sediment

Table B-1
Current Surface-Weighted Average Concentrations of D/F Compounds in Surface Sediment

Evaluation Area (See Figures 2 and 4)	Surface Area		Current D/F SWAC by Evaluation Area [1] (ng/kg TEQ, U = 1/2)	SWAC Calculation Areas							
	Area (sq ft)	Area (acres)		Total Whatcom Waterway Site (W) [2,3]	Whatcom Waterway Site Excluding Other Cleanup Sites [2,3]	I&J Waterway Cleanup Site (I)	RG Haley Cleanup Site (H)	SSS MGP Cleanup Site (S)	Regional Background Area (R)	Regional Background Exclusion Area (X)	All Evaluation Areas Together
I&J Waterway Site (W, I)	132,300	3.04	24.4	**Yes**	No	**Yes**	No	No	No	No	**Yes**
Inner Regional Unit (W, R)	17,902,800	410.99	8.9	**Yes**	**Yes**	No	No	No	**Yes**	No	**Yes**
Outer Regional Unit (R)	24,680,200	566.58	8.8	No	No	No	No	No	**Yes**	No	**Yes**
Regional Exclusion Area East (W, X)	5,157,100	118.39	7.0	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**
Regional Exclusion Area West (X)	7,478,200	171.68	2.0	No	No	No	No	No	No	**Yes**	**Yes**
RG Haley – Inner (W, H)	1,805,100	41.44	34.6	**Yes**	No	No	**Yes**	No	No	No	**Yes**
RG Haley – Outer (W, R, H)	777,900	17.86	21.7	**Yes**	No	No	**Yes**	No	**Yes**	No	**Yes**
SSS MGP – Inner (W, S)	909,300	20.87	6.0	**Yes**	No	No	No	**Yes**	No	No	**Yes**
SSS MGP – Regional (W, R, S)	49,700	1.14	8.3	**Yes**	No	No	No	**Yes**	**Yes**	No	**Yes**
Whatcom – Inner (W)	2,790,500	64.06	18.5	**Yes**	**Yes**	No	No	No	No	No	**Yes**
Whatcom – Outer (W)	1,488,400	34.17	9.7	**Yes**	**Yes**	No	No	No	No	No	**Yes**
Whatcom – ASB (W) [3]	0	0.00	0.0	No [3]	No [3]	No	No	No	No	No	No [3]
All Evaluation Areas Together	**63,171,500**	**1,450.22**	**9.2**								

Evaluation Summary	Total Whatcom Waterway Site (W) [2,3]	Whatcom Waterway Site Excluding Other Cleanup Sites [2,3]	I&J Waterway Cleanup Site (I)	RG Haley Cleanup Site (H)	SSS MGP Cleanup Site (S)	Regional Background Area (R)	Regional Background Exclusion Area (X)	All Evaluation Areas Together
Evaluation Area Acreage	712.0	627.6	3.0	59.3	22.0	996.6	290.1	1,450.2
D/F SWAC (ng/kg TEQ; U=1/2)	**11.3**	**9.6**	**24.4**	**30.7**	**6.1**	**9.1**	**4.0**	**9.2**

Notes:
"Yes" indicates the evaluation area is included as part of the indicated SWAC calculations.
"No" indicates the evaluation area is not included as part of the indicated SWAC calculations.
1. The SWAC is based on use of the most recent data set. This data set includes available data from 2014 to the present unless data are no longer relevant (e.g., the area has been remediated or has recontaminated since that time). Earlier data have been included selectively to fill in gaps in more recent data. The older data included are from the I&J Waterway, the SSS MGP shoreline, the RG Haley shoreline, Whatcom Waterway Units 1A and 1B, and portions of the Regional Background D/F exclusion area.
2. The Whatcom Waterway Site boundary was initially determined based on the distribution of mercury. With respect to D/F compounds, the Whatcom Waterway Site represents a Sediment Cleanup Unit within Bellingham Bay areas impacted by regional D/F contamination. The Whatcom Waterway Site overlaps with multiple other sediment cleanup sites, including the I&J Waterway, the SSS MGP site, the Cornwall Avenue Landfill site and the RG Haley site.
3. The ASB portion of the Site is currently not connected with Bellingham Bay. But the Port has proposed to remediate the ASB and open a portion of it to Bellingham Bay for aquatic reuse. the aquatic area of the Whatcom Waterway Site will be larger after the ASB is opened to Bellingham Bay. SWACs for the aqutic portion fo the ASB are included in future SWAC forecasts, but not current conditions.
ASB: Aerated Stabilization Basin
D/F: dioxin/furan
ng/kg TEQ: nanogram per kilogram toxic equivalency
sq ft: square feet
SSS MGP: South State Street Manufactured Gas Plant
SWAC: surface-weighted average concentration
U=1/2: concentration set to one-half the detection limit when not detected above detection limit

Table B-2
Forecasted Surface-Weighted Average Concentrations of D/F Compounds (Year-0 Post-Remediation Conditions)

Evaluation Area (See Figures 2 and 6)	Surface Area		Current D/F SWAC by Evaluation Area [1] (ng/kg TEQ, U = 1/2)	SWAC Calculation Areas							
	Area (sq ft)	Area (acres)		Total Whatcom Waterway Site (W) [2,3]	Whatcom Waterway Site Excluding Other Cleanup Sites [2,3]	I&J Waterway Cleanup Site (I)	RG Haley Cleanup Site (H)	SSS MGP Cleanup Site (S)	Regional Background Area (R)	Regional Background Exclusion Area (X)	All Evaluation Areas Together
I&J Waterway Site (W, I)	132,300	3.04	24.4	**Yes**	No	**Yes**	No	No	No	No	**Yes**
Inner Regional Unit (W, R)	17,902,800	410.99	8.6	**Yes**	**Yes**	No	No	No	**Yes**	No	**Yes**
Outer Regional Unit (R)	24,680,200	566.58	8.9	No	No	No	No	No	**Yes**	No	**Yes**
Regional Exclusion Area East (W, X)	5,157,100	118.39	7.0	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**
Regional Exclusion Area West (X)	7,478,200	171.68	2.0	No	No	No	No	No	No	**Yes**	**Yes**
RG Haley – Inner (W, H) [4]	1,805,100	41.44	13.0	**Yes** [4]	No	No	**Yes**	No	No	No	**Yes**
RG Haley – Outer (W, R, H) [4]	777,900	17.86	13.0	**Yes** [4]	No	No	**Yes**	No	**Yes**	No	**Yes**
SSS MGP – Inner (W, S)	909,300	20.87	6.0	**Yes**	No	No	No	**Yes**	No	No	**Yes**
SSS MGP – Regional (W, R, S)	49,700	1.14	8.3	**Yes**	No	No	No	**Yes**	**Yes**	No	**Yes**
Whatcom – Inner (W)	2,790,500	64.06	14.3	**Yes**	**Yes**	No	No	No	No	No	**Yes**
Whatcom – Outer (W)	1,488,400	34.17	9.7	**Yes**	**Yes**	No	No	No	No	No	**Yes**
Whatcom – ASB (W) [3]	548,300	12.59	5.0	**Yes** [3]	**Yes** [3]	No	No	No	No	No	**Yes** [3]
All Evaluation Areas Together	**63,719,800**	**1,462.81**	**8.2**								

Evaluation Summary	Total Whatcom Waterway Site (W) [2,3]	Whatcom Waterway Site Excluding Other Cleanup Sites [2,3]	I&J Waterway Cleanup Site (I)	RG Haley Cleanup Site (H)	SSS MGP Cleanup Site (S)	Regional Background Area (R)	Regional Background Exclusion Area (X)	All Evaluation Areas Together
Evaluation Area Acreage	724.6	640.2	3.0	59.3	22.0	996.6	290.1	1,462.8
D/F SWAC (ng/kg TEQ; U=1/2)	**9.2**	**8.8**	**24.4**	**13.0**	**6.1**	**8.8**	**4.0**	**8.2**

Notes:
"Yes" indicates the evaluation area is included as part of the indicated SWAC calculations.
"No" indicates the evaluation area is not included as part of the indicated SWAC calculations.
1. The SWAC estimates are based on use of the most recent data set as defined in Table B-1, with post-remediation replacement values as described in Section 7.
2. The Whatcom Waterway Site boundary was initially determined based on the distribution of mercury. With respect to D/F compounds, the Whatcom Waterway Site represents a Sediment Cleanup Unit within Bellingham Bay areas impacted by regional D/F contamination. The Whatcom Waterway Site overlaps with multiple other sediment cleanup sites, including the I&J Waterway, the SSS MGP site, the Cornwall Avenue Landfill site and the RG Haley site.
3. The ASB portion of the Site is currently not connected with Bellingham Bay. But the Port has proposed to remediate the ASB and open a portion of it to Bellingham Bay for aquatic reuse. the aquatic area of the Whatcom Waterway Site will be larger after the ASB is opened to Bellingham Bay. SWACs for the aqutic portion fo the ASB are included in future SWAC forecasts, but not current conditions.
4. The RG Haley site cleanup includes a sediment cleanup level of 13 ng/kg TEQ. For this evaluation, a replacement value of 13 ng/kg TEQ was used to estimate RG Haley site post-remediation D/F concentrations.
ASB: Aerated Stabilization Basin
D/F: dioxin/furan
ng/kg TEQ: nanogram per kilogram toxic equivalency
sq ft: square feet
SSS MGP: South State Street Manufactured Gas Plant
SWAC: surface-weighted average concentration
U=1/2: concentration set to one-half the detection limit when not detected above detection limit

Table B-3
Forecasted Surface-Weighted Average Concentrations of D/F Compounds (Year-10 Post-Remediation Conditions)

Evaluation Area (See Figures 2 and 7)	Surface Area		Current D/F SWAC by Evaluation Area [1] (ng/kg TEQ, U = 1/2)	SWAC Calculation Areas							
	Area (sq ft)	Area (acres)		Total Whatcom Waterway Site (W) [2,3]	Whatcom Waterway Site Excluding Other Cleanup Sites [2,3]	I&J Waterway Cleanup Site (I)	RG Haley Cleanup Site (H)	SSS MGP Cleanup Site (S)	Regional Background Area (R)	Regional Background Exclusion Area (X)	All Evaluation Areas Together
I&J Waterway Site (W, I)	132,300	3.04	24.4	**Yes**	No	**Yes**	No	No	No	No	**Yes**
Inner Regional Unit (W, R)	17,902,800	410.99	9.0	**Yes**	**Yes**	No	No	No	**Yes**	No	**Yes**
Outer Regional Unit (R)	24,680,200	566.58	8.9	No	No	No	No	No	**Yes**	No	**Yes**
Regional Exclusion Area East (W, X)	5,157,100	118.39	7.0	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**
Regional Exclusion Area West (X)	7,478,200	171.68	2.0	No	No	No	No	No	No	**Yes**	**Yes**
RG Haley – Inner (W, H) [4]	1,805,100	41.44	13.0	**Yes** [4]	No	No	**Yes**	No	No	No	**Yes**
RG Haley – Outer (W, R, H) [4]	777,900	17.86	13.0	**Yes** [4]	No	No	**Yes**	No	**Yes**	No	**Yes**
SSS MGP – Inner (W, S)	909,300	20.87	6.0	**Yes**	No	No	No	**Yes**	No	No	**Yes**
SSS MGP – Regional (W, R, S)	49,700	1.14	8.3	**Yes**	No	No	No	**Yes**	**Yes**	No	**Yes**
Whatcom – Inner (W)	2,790,500	64.06	16.7	**Yes**	**Yes**	No	No	No	No	No	**Yes**
Whatcom – Outer (W)	1,488,400	34.17	9.7	**Yes**	**Yes**	No	No	No	No	No	**Yes**
Whatcom – ASB (W)	548,300	12.59	13.5	**Yes**	**Yes**	No	No	No	No	No	**No**
All Evaluation Areas Together	**63,719,800**	**1,462.81**	**8.5**								

Evaluation Summary	Total Whatcom Waterway Site (W) [2,3]	Whatcom Waterway Site Excluding Other Cleanup Sites [2,3]	I&J Waterway Cleanup Site (I)	RG Haley Cleanup Site (H)	SSS MGP Cleanup Site (S)	Regional Background Area (R)	Regional Background Exclusion Area (X)	All Evaluation Areas Together
Evaluation Area Acreage	724.6	640.2	3.0	59.3	22.0	996.6	290.1	1,462.8
D/F SWAC (ng/kg TEQ; U=1/2)	**9.8**	**9.5**	**24.4**	**13.0**	**6.1**	**9.0**	**4.0**	**8.5**

Notes:
"Yes" indicates the area of interest is considered as part of the indicated evaluation area calculations.
"No" indicates the area of interest is not included in the indicated evaluation area calculations.
1. The SWAC estimates are based on use of the most recent data set as defined in Table B-1, with post-remediation replacement values as described in Section 7.
2. The Whatcom Waterway Site boundary was initially determined based on the distribution of mercury. With respect to D/F compounds, the Whatcom Waterway Site represents a Sediment Cleanup Unit within Bellingham Bay areas impacted by regional D/F contamination. The Whatcom Waterway Site overlaps with multiple other sediment cleanup sites, including the I&J Waterway, the SSS MGP site, the Cornwall Avenue Landfill site and the RG Haley site.
3. The ASB portion of the Site is currently not connected with Bellingham Bay. But the Port has proposed to remediate the ASB and open a portion of it to Bellingham Bay for aquatic reuse. the aquatic area of the Whatcom Waterway Site will be larger after the ASB is opened to Bellingham Bay. SWACs for the aqutic portion fo the ASB are included in future SWAC forecasts, but not current conditions.
4. The RG Haley site cleanup includes a sediment cleanup level of 13 ng/kg TEQ. For this evaluation, a replacement value of 13 ng/kg TEQ was used to estimate RG Haley site post-remediation D/F concentrations.
ASB: Aerated Stabilization Basin
D/F: dioxin/furan
ng/kg TEQ: nanogram per kilogram toxic equivalency
sq ft: square feet
SSS MGP: South State Street Manufactured Gas Plant
SWAC: surface-weighted average concentration
U=1/2: concentration set to one-half the detection limit when not detected above detection limit