EARTHJUSTICE

February 9, 2022

Kira Lynch
Remedial Cleanup Branch Chief
U.S. EPA, Region 10
1200 Sixth Avenue, Suite 155
Seattle, WA 98101

RE: East Waterway Remediation – Harbor Island Superfund Site

Dear Kira Lynch:

This letter is submitted on behalf of the Duwamish River Cleanup Coalition Technical Advisory Group ("DRCC/TAG") also doing business as Duwamish River Community Coalition. DRCC/TAG is a non-profit that seeks to amplify and lift up the voices of the Duwamish River Valley community members, specifically those most harmed by the combined impacts of climate change, health disparities, and environmental and economic inequities. DRCC/TAG's mission is to elevate the voices of those impacted by Duwamish River pollution and other environmental injustices to advocate for a clean, healthy, and equitable environment for people and wildlife. The Duwamish Valley is a "near port" and environmental justice community along the Duwamish River in Seattle.

The federal Superfund law ("CERCLA") requires that EPA develop a remediation plan for the East Waterway that is inclusive of affected communities. However, contrary to this congressional mandate, EPA has developed a draft plan[1] that relies heavily upon a supplemental feasibility study, which responsible parties including the Port of Seattle, City of Seattle, and King County prepared behind closed doors. EPA never engaged affected community residents in the Duwamish Valley in the remedial investigation or selection of alternatives for the East Waterway. **By failing to engage with and involve affected residents in decision-making, EPA violated the community engagement requirements of CERCLA.**

The lack of community engagement is reflected in the draft plan, which protects the polluter's bottom-line, but leaves hazardous substances in the East Waterway to endanger public health and the environment in perpetuity. The EPA's draft plan would leave hazardous pollution in sediments that contain 15 times more PCBs, 3 times more arsenic, and 5 times more dioxins/furans compared to the more health protective levels adopted for the Lower Duwamish

[1] EPA has not yet published its draft remediation plan for the East Waterway site. DRCC/TAG's technical advisor obtained a copy of EPA's draft plan through a public records act request.

Waterway Superfund Site.[2] To make matters worse, PCBs bioaccumulate in the tissue of fish that swim and live in and near the East Waterway.

EPA's draft plan is alarming because many Asian Pacific Islander, Latinx, and Tribal communities regularly consume fish that they catch from the Spokane Street Bridge in the East Waterway. People fishing at the Spokane Street Bridge often feed fish they catch to their families and friends—meaning both adults, children, and the elderly are exposed to contaminated fish.

Under EPA's draft plan, hazardous levels of PCBs, dioxins/furans, and arsenic contamination that exceed public health and safety standards would remain in riverbeds and sediments in perpetuity. This would leave future generations of fishing communities exposed to hazardous levels of PCB contamination, and would leave the East Waterway unfishable (meaning it would require a fish advisory forever) even after the final cleanup.

Disproportionately exposing Tribal, Asian, and Latinx community members and their children to high levels of hazardous contamination is racist. Under EPA's draft plan, tissue of rockfish and other pelagic fish that live in the East Waterway could contain 272 times more PCBs than the more health protective levels required for the adjacent and connected Lower Duwamish Superfund site.[3] Exposing Asian, Latinx, and Indigenous communities to hazardous contamination in the fish they eat poses a significant risk that they could contract debilitating and deadly diseases, including cancer. These individuals, their lives, and their cultural fishing traditions are not expendable—the health of children should not be sacrificed to limit the liability of the Port, City of Seattle, and King County for their cleanup obligations.

Further, EPA's proposal is inconsistent with and less protective than the remediation goals adopted for the Lower Duwamish Waterway Cleanup. The East Waterway is part of a single, interconnected tidal river that would carry contaminated sediments both up into the Duwamish River and downstream into Puget Sound itself. Likewise, fish exposed to toxic sediments in the East Waterway can swim up and down river. Movement of contaminated sediments and contaminated fish would compromise health protective water quality standards and remediation efforts in the Lower Duwamish Waterway and in Puget Sound, which both connect to the East Waterway. Weakening standards for the East Waterway could make it difficult or impossible to achieve cleanup standards in the Lower Duwamish Waterway—making it all the more imperative that EPA require a health protective Superfund cleanup in the East Waterway.

Lastly, EPA's plan would violate federal and state law governing hazardous waste remediation, because it would leave contamination in the East Waterway that continues to endanger human health and our aquatic resources. Adopting **the same** preliminary remediation goals and cleanup levels as the Lower Duwamish Waterway cleanup would avoid this problem and achieve a more health protective cleanup.

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[2] Ex. A, L. Gould, *East Waterway Sediment and Fish Comparisons to LDW*.

[3] *Id*.

Recommendations: EPA should take steps to ensure **consultation** with affected communities, **consistency** with the more health protective standards for the Lower Duwamish Waterway Superfund cleanup, and **concurrence** from Washington State by complying with state hazardous waste remediation standards set out in the Model Toxics Control Act ("MTCA"). We recommend that EPA adopt the following specific actions:

1. **Redress lack of meaningful community engagement and consultation:** Before approving a cleanup plan, EPA must first consult with impacted community members, particularly people who consume fish and shellfish from the East Waterway, to hear from them how they use the East Waterway and how an inadequate remediation would affect their health and their communities.

    a. **EPA should engage fishing communities, as well as individuals and communities who would like to fish in the East Waterway but cannot do so currently because of hazardous contamination:** Pollution in the East Waterway affects both current fishers and people who would like to fish and recreate in the East Waterway but currently refrain from doing so due to toxic contamination. Thus, meaningful consultation requires that EPA reach out to both representatives from the fishing communities and the wider Duwamish Valley Community.

    b. Prepare an environmental justice analysis: Given the disproportionate harms to Asian, Latinx, and Tribal communities, an environmental justice analysis must be conducted for this site.

2. Adopt standards consistent with the Lower Duwamish Waterway: Consistent standards will ensure better protection of human health and will protect the health of the entire Duwamish Waterway and the interconnected Puget Sound. Any technical difficulty achieving these cleanup standards can be addressed at a later date through an application for a technical impracticability waiver, if one becomes appropriate.

3. Achieve a cleanup that is protective of human health and the environment by complying with state and federal hazardous waste remediation law: EPA should correct its remediation plan for the East Waterway to comply with CERCLA's mandate to protect human health and the environment and abide by state hazardous substances remediation standards. Complying with CERLCA requires disregarding the 2021 Anthropogenic Background Memorandum that fails to comport with either federal or state hazardous waste remediation law. Further, EPA should adopt the same preliminary remediation goals and cleanup levels as the Lower Duwamish Superfund Cleanup—which have already been determined to comply with state and federal laws governing hazardous substance remediation.

We stand in solidarity with the Suquamish Tribe, which also raised concern with EPA using anthropogenic background to limit the extent of the cleanup in the East Waterway, and with EPA's lack of meaningful consultation with the Suquamish Tribe regarding the 2021 AB

Technical Memo.[4] Lack of meaningful consultation with the Suquamish Tribe is yet another reason why EPA should abandon the 2021 AB Memo.

We also note that while this letter focuses on public health impacts that could result from an inadequate cleanup in the East Waterway, leaving PCBs, arsenic, and dioxins/furans at proposed levels in the sediments will likely adversely affect the recovery of the whole Puget Sound ecosystem. We recommend that EPA conduct an evaluation to determine how limiting remediation in the East Waterway to anthropogenic background would cumulatively adversely affect aquatic resources and ecosystems in Puget Sound. In undertaking such an investigation, EPA must collaborate and consult with the Department of Fish and Wildlife and the Department of Ecology, as well as all natural resources trustees.

I. FACTUAL BACKGROUND

The Duwamish River is Seattle's only river; the East Waterway sits at its mouth, where it flows into the Puget Sound. The East Waterway is a popular fishing destination for local residents and tribal fishers, but industrial activities have left this waterway contaminated with hazardous toxins, including arsenic, dioxins, and PCBs, that cause cancer and other debilitating health harms. Weakening cleanup standards in the East Waterway will impose serious and significant health risks on fishing communities and directly undermine remediation efforts in the Lower Duwamish River.

While feasibility studies for the East Waterway remediation originally proposed mirroring the cleanup standards of the Lower Duwamish Waterway, EPA is now considering limiting remediation to what it considers to be anthropogenic background levels of pollution. Last year, the Port of Seattle prepared a new supplemental feasibility study ("2021 AB Technical Memo") that evaluated "anthropogenic background" sources of pollution from upriver. Subsequent to release of that supplemental feasibility study, DRCC/TAG's technical advisor obtained a copy of EPA's draft remediation plan for the East Waterway cleanup through a public records request.[5] In this draft cleanup plan, EPA, for the first time, proposes to cut short remediation of the East Waterway by setting new preliminary remediation goals that would limit final cleanup levels to the anthropogenic background concentrations described in the 2021 AB Technical Memo.

In January 2014, responsible parties, including the Port of Seattle and its contractors, prepared a Supplemental Remedial Investigation/Feasibility Study.[6] This 2014 study evaluated the human health risk posed by ongoing contamination and the extent of pollution in the East Waterway. It identified the major contaminants on site, including PCBs, dioxins/furans, and arsenic, and evaluated what sediment concentration levels would adequately protect public

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[4] *See* Ex. B, Comments of the Suquamish Tribe on East Waterway proposed plan. DRCC obtained these comments through a public records act request.

[5] Ex. C, U.S. Env'tl Prot. Agency, East Waterway Proposed Plan – Early Draft.

[6] Port of Seattle, Supplemental Remedial Investigation Report, East Waterway Operable Unit SRI/FS ES-2 060003-01.101 (Jan. 2014), https://semspub.epa.gov/work/10/100030307.pdf.

health. The 2014 study found that consumption of fish is a primary hazardous exposure pathway for community members. The Executive Summary stated that "[c]omparisons of [natural] background concentrations with risk-based goals in sediment (represented by sediment RBTCs) will be used in the [feasibility study] in the development of preliminary remediation goals and to provide support for risk management decisions by EPA[.]"[7]

A few years later in 2019, the Port of Seattle and its contractors finalized this feasibility study, and set preliminary remediation goals[8] and remedial action levels that would mirror the Lower Duwamish Cleanup.[9] It also evaluated remedial alternatives for the East Waterway Cleanup. EPA approved this study without seeking public engagement or comment. The 2019 Feasibility Study set the preliminary remediation goals at 2 ug/kg dry weight (dw) for PCBs, which reflect "natural background" concentrations in Puget Sound[10]—and incorporated the same preliminary remediation goals adopted for the Lower Duwamish River Cleanup. Preliminary remediation goals for arsenic (7 mg/kg dw) and dioxins/furans (2 ng TEQ/kg dw) were also set at natural background levels, again mirroring the Lower Duwamish River Cleanup.

Then, in a sudden about-face, the Port of Seattle issued a supplemental "feasibility study" and technical memorandum in 2021 that purported to establish an "anthropogenic background" level of hazardous pollution entering the East Waterway ("2021 AB Technical Memo").[11] This evaluated pollution in suspended solids (as opposed to sediments) found upstream of the Duwamish River. Based on its review, the 2021 AB Technical Memo claims that anthropogenic sources of upstream pollution would cause levels of PCBs and arsenic contamination significantly higher than natural background. The memo concluded that the anthropogenic background level for PCBs in the East Waterway is 31 ug/kg dw, an amount fifteen times higher than natural background levels, and proposed setting the anthropogenic background level for arsenic at 20 mg/kg dw, an amount three times higher than natural background levels.

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[7] *Id*. at ES-35.

[8] CERCLA defines preliminary remediation goals as "acceptable exposure levels that are protective of human health and the environment[.]" 40 C.F.R. § 300.430(e)(2)(i).

[9] Port of Seattle, *East Waterway Operable Unit Final Feasibility Study*, June 2019, https://semspub.epa.gov/work/10/100189627.pdf.

[10] PCBs are not a naturally occurring chemical in Puget Sound. Nevertheless, agencies set "natural background" concentrations for PCBs at 2 ppb, because atmospheric deposition, and possibly the recirculation of PCBs released from the carcasses of contaminated salmon have distributed low levels of PCBs throughout the Puget Sound. U.S Army Corps of Engineers, OSV Bold Summer 2008 Survey, (2009), https://usace.contentdm.oclc.org/utils/getfile/collection/p266001coll1/id/9332.

[11] Port of Seattle, *East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study Technical Memorandum: Final Anthropogenic Background Evaluation*, July 2021, https://semspub.epa.gov/work/10/100336344.pdf ("2021 AB Technical Memo").

With scant detail or explanation, the 2021 AB Technical Memo recommends substantially weakening the cleanup of the East Waterway by lowering the preliminary remediation goals for the East Waterway to these newly developed anthropogenic background contamination levels. In a single sentence in the report's conclusion, the 2021 AB Technical Memo states that the anthropogenic background levels should be "used in future [East Waterway] decision documents in place of the natural background-based [preliminary remediation goal] values presented in the [East Waterway Feasibility Study]."[12] In other words, without any explanation, the 2021 AB Technical Memo recommends setting preliminary remediation goals for the East Waterway at anthropogenic background concentrations—which would expose fishing communities to debilitating and deadly health risks, including cancer.

In the table below, we compared preliminary remediation goals for the Lower Duwamish Waterway Cleanup with the anthropogenic background levels developed in in the 2021 AB Technical Memo. Setting cleanup levels at anthropogenic background in the East Waterway would mean leaving 15 times more PCBs in the East Waterway sediments, compared with the Lower Duwamish Waterway.

East Waterway to Lower Duwamish Waterway Sediment Background Comparisons

Chemical	Units (dry weight)	East Waterway Anthropogenic Background	Minimum Lower Duwamish Cleanup Levels	Basis for Lower Duwamish Cleanup Level	Ratio of East Waterway to Lower Duwamish Waterway
Polychlorinated biphenyls (PCBs)	ug/kg	31	2	Natural background	15.5
Arsenic	mg/kg	20	7	Natural background	2.9
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) Toxic Equivalency Quotient (TEQ)	ug/kg	no value	90	Beach play	--
Dioxin/furan TEQ	ng/kg	9.6	2	Natural background	4.8

[12] 2021 AB Technical Memo at 28, https://semspub.epa.gov/work/10/100336344.pdf.

Sources:

1. East Waterway Draft Cleanup Plan (2021)

2. Lower Duwamish Waterway (LDW) Record of Decision (2014)

In the 2021 draft "East Waterway Proposed Plan" obtained by DRCC/TAG's technical advisor through a public records request, EPA departs from the 2019 Feasibility Study and for the first time proposes to limit the cleanup's sediment preliminary remediation goals to anthropogenic background levels for PCBs, arsenic, and dioxins/furans.[13] The primary pathway for human exposure to these hazardous chemicals is through consumption of fish and shellfish. EPA used an old food web model to calculate the expected concentrations of PCBs in sediments to the tissue of fish and shellfish, using weakened preliminary remediation goals set at anthropogenic levels.

Using data from EPA's draft plan, DRCC compared expected fish tissue concentrations in the East Waterway with the Lower Duwamish River.[14] The result is astounding. **DRCC found that people fishing for pelagic fish, such as rockfish, from the Spokane Street bridge could be exposed to 272 times more PCBs than allowed at the adjacent Lower Duwamish Waterway site** in the same tidal river**.**[15] The resulting fish tissue concentrations in pelagic fish mean that the Washington State Department of Health would have to post fish advisories and maintain institutional controls on both the East Waterway and Lower Duwamish Waterway in perpetuity because fish swim back and forth along the contiguous waterbody.

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[13] Ex. C, *supra* n. 4, Draft – East Waterway Proposed Plan, at 15, 25-26.

[14] Ex. A, *see supra* n.2, *East Waterway Sediment and Fish Comparisons to LDW*.

[15] *Id*.

Comparison of East Waterway (EW) to Lower Duwamish Waterway (LDW) Target Fish Tissue Concentrations

PCBs ug/kg wet weight	Tissue Type	Species	East Waterway (EW) Target Tissue concentration	Lower Duwamish Waterway (LDW) Target Tissue Concentration	Ratio EW to LDW
Benthic fish	Fillet	English sole	140	12	12
Pelagic fish	Whole body		490	1.8	272
Crab	Whole body	Dungeness and Red Rock crab	100	9.1	11
	Edible meat		15	1.1	14
Clams	Without shell	Various	20	0.42	48

Sources:

1. East Waterway Proposed Plan (2021)

2. Lower Duwamish Waterway (LDW) Record of Decision (2014)

Such high concentrations of cancer and noncancer causing toxins in the tissue of pelagic and benthic fish pose serious health risks to fishing families who regularly fish for resident seafood species from the Spokane Street Bridge in the East Waterway. The Fisher Study for the Lower Duwamish Waterway, prepared in 2016, found that the Spokane Street Bridge, located in the East Waterway, is one of the most popular fishing destinations in the Duwamish River, and the majority of interviews with fishers occurred there.[16]

[16] *Id*. at 12-15.

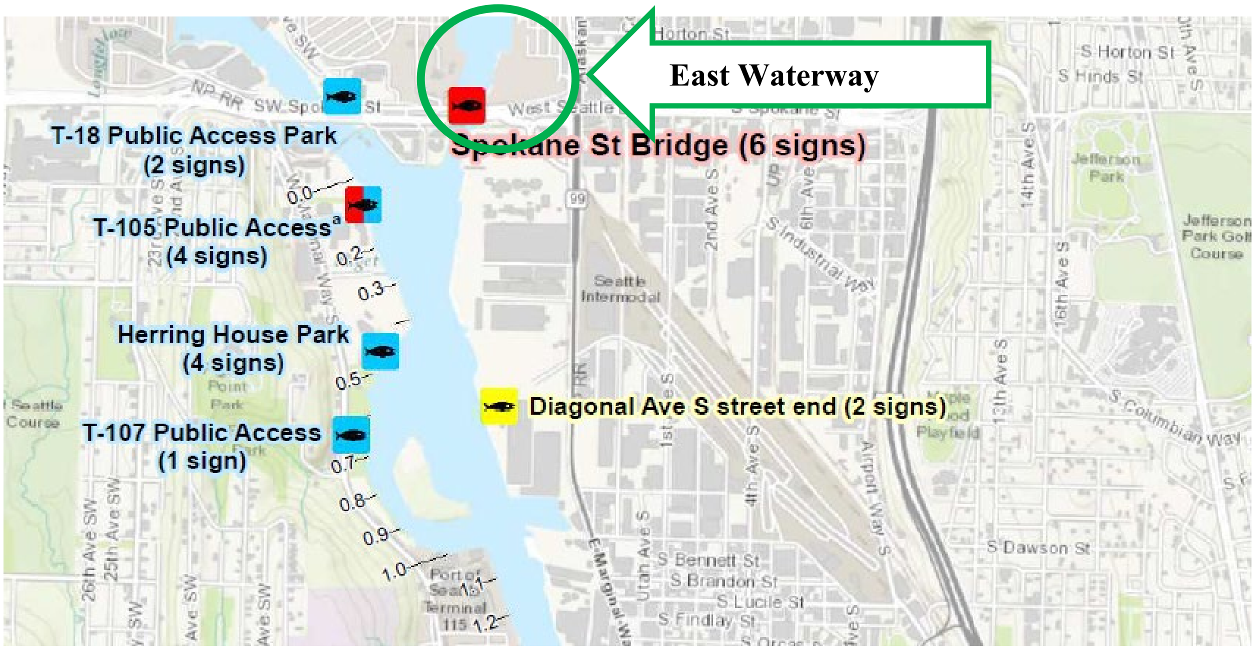

Figure: The 2016 Fisher Study documented the location of popular fishing destinations in the Duwamish River.

While the majority of people interviewed fished for salmon, many people still regularly fish for resident fish in the Duwamish River including sole, rockfish, and other benthic and pelagic fish species.[17] Many of the people surveyed reported regularly fishing on a weekly or even daily basis.[18] At least 25% of the Asian, Pacific Islander, and multi-racial fishers who were surveyed reported catching resident species.[19] Of the fishers who reported catching resident species, 59% reported that they ate their catch and 55% reported that they shared their catch with others.[20] In general, fishers who preferred non-English languages were more likely to report catching resident seafood, and sharing their catch with friends and family—and many/most of these residents live in the West/South Seattle area.[21] Of the fishers who shared their catch, 84% shared their catch primarily with family and 63% shared with friends.[22]

[17] *Id*. at ES-2.

[18] *Id*. at Appendix D, at 12.

[19] *Id*. at ES-3.

[20] *Id*. at ES-3.

[21] *Id*. at ES-3, 41.

[22] *Id*. at 52.

The study found that fishers generally considered wild caught fish as a healthier option than store bought fish.[23] Fishers evaluated risk based on the appearance of the fish and had difficulty understanding that resident fish could pose unseen chemical risks.[24]

In their own words, fishers described the importance of fishing in the Duwamish River to them: a Mienh fisher commented, "Sometimes I get big catch, I share with my family – my kids, sisters, aunt, and my mother-in-law," while a Cambodian fisher noted, "Fish I caught in the Duwamish is for food of my family[.]"[25] When asked how they would react if they heard that the Duwamish was closed and that its seafood unsafe to eat, the fishers responded emotionally, using words like: "sad," "disappointed," "awful," and "devastated[.]"[26] Further many of the fishers who were interviewed only fished in the Duwamish River, and live in the Duwamish Valley, in South and West Seattle.[27] Some people expressed concern at the thought of closing the Duwamish River to fishing because they relied on fish from the river to feed their families.[28]

Although EPA considers the East Waterway cleanup separate from the Lower Duwamish Waterway cleanup, these sites are physically and biologically interconnected because they are contiguous and both occur at or near the mouth of the Duwamish River. The Duwamish River is a tidal river, and water flowing through the Lower Duwamish Waterway flows into the East Waterway then out into the Puget Sound, and vice versa. Similarly, water traveling upriver and downriver can transport sediments in the water column—meaning that sediments from the East Waterway can travel into the Lower Duwamish Waterway through the movement of water, and vice versa. Additionally, fish that live in and around the East Waterway can swim a short distance upriver to the Lower Duwamish Waterway.

The physical and biological connection of the East Waterway to the Lower Duwamish Waterway means that failing to adequately cleanup the East Waterway Superfund Site jeopardizes the ability to achieve the more stringent remediation goals that EPA set to protect public health in the Lower Duwamish Waterway. Setting weakened preliminary remediation goals and cleanup levels in the East Waterway could hinder the ability to achieve the goals and cleanup levels required by in the Lower Duwamish Waterway Record of Decision. This in turn would mean leaving such high levels of contamination in the river that the Duwamish River would be unfishable in perpetuity.

Although EPA solicited robust community engagement for the Lower Duwamish Waterway cleanup, it failed to do the same for the East Waterway when crafting the feasibility studies and proposed remediation plan for the East Waterway cleanup.

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[23] *Id*. at ES-3.

[24] *Id*. at ES-4.

[25] *Id*. at 54.

[26] *Id*. at 60.

[27] *Id*. at 61.

[28] *Id*. at 61.

To date, EPA has held one public informational meeting about remediation efforts in the East Waterway on December 7, 2021 – years after the agency finalized feasibility studies for the East Waterway site. During this meeting EPA never solicited input from community residents about how they use the East Waterway, whether they fish at the Spokane Street Bridge, or what alternatives they would like to see considered for cleanup of the East Waterway. EPA scheduled this single public meeting without adequate public notice, or any attempt to engage affected fishers or Fisher Community Health Advocates who "protect the health of fishing communities, especially pregnant women, nursing moms and young children, from the contaminated seafood in the Duwamish River Superfund Site".

Lastly, EPA has provided confusing and misleading information about how it will consider "anthropogenic background" pollution levels in the East Waterway cleanup. At the December 2021 public meeting, community members directly asked EPA how it intends to consider anthropogenic background levels in the cleanup. EPA representatives provided evasive and confusing answers—at one point stating that preliminary remediation goals for the East Waterway are the same as for the Lower Duwamish Waterway cleanup. EPA later back-tracked, claiming the agency has not yet made any decisions. Further, the informational fact sheet published by EPA that same month **fails to provide any information** on "anthropogenic background."[29] Concerningly, information provided by EPA to the public during this meeting conflicted with information in the 2021 AB Technical Memo—which recommended that EPA set preliminary remediation goals for the East Waterway at anthropogenic background.

II. EPA VIOLATED THE COMMUNITY ENGAGEMENT REQUIREMENTS OF CERCLA.

"Understand that community engagement does not happen when we [EPA] need it to happen. If that is your approach, you have failed before you even began."[30] CERCLA requires EPA to extensively engage with communities harmed by Superfund sites throughout the process of site investigation, remedy selection, and final cleanup. According to EPA's Community Involvement Handbook:

> In CERCLA, Congress was clear about its intent for the Agency to provide opportunities for members of affected communities to become active participants in the Superfund cleanup process and to have a say in the decisions that affect their communities. In establishing the Superfund program, **Congress wanted EPA to be guided by the people whose lives are affected by Superfund sites**.[31]

[29] *See* U.S. Envt'l Prot. Agency, *East Waterway Operable Unit Harbor Island Superfund Site, Cleanup Alternatives* (Dec. 2021), https://semspub.epa.gov/work/10/100373932.pdf.

[30] Matthew Tejada, "Action in a Pivotal Time for Justice," *The Magazine for Environmental Managers*, Feb. 2022, https://www.awma.org/emcurrentissue.

[31] U.S. Envtl. Prot. Agency, *Community Involvement Handbook*, at *14 (Jan. 2016), https://semspub.epa.gov/work/HQ/100000070.pdf ("*EPA Handbook*") (emphasis added).

CERCLA regulations require EPA to consult with the community, solicit community participation, and aid the community in understanding the technical components of the Superfund cleanup. Removal and remedial actions under CERCLA must comply with community relations requirements to "promote active communication between communities affected by discharges or releases and the lead agency responsible for response actions."[32] EPA must inform the public about the Superfund cleanup process, and advise the public about technical assistance opportunities.[33] The Superfund statute authorizes EPA to provide technical assistance grants to aid affected communities in interpreting information such as the nature of the hazard, or to interpret important documents such as the record of decision, remedial design, selection and construction of the remedial action, operation and maintenance, or removal action at a facility.[34]

EPA must prepare a community involvement plan[35] based on interviews with community members that specifies what activities the agency will undertake during the cleanup response action.[36] This community involvement plan should ensure public engagement opportunities in a wide variety of site-related decisions, including site analysis and characterization, alternatives analysis, and remedy selection.[37] The community involvement plan should be developed before EPA begins remedial investigation field activities.[38]

Further, CERCLA regulations specifically require that EPA "[c]onduct[] interviews with local officials, community residents, public interest groups, or other interested or affected parties, as appropriate, to solicit their concerns and information needs, and to learn how and when citizens would like to be involved in the Superfund process."[39] EPA should engage in this community outreach prior to engaging in remedial investigation.[40]

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[32] 40 C.F.R. § 300.155(c).

[33] 40 C.F.R. § 300.415(n); 40 C.F.R. § 300.430(c).

[34] 42 U.S.C. § 9617(e).

[35] EPA guidance suggests that this community relations plan be continuously updated to ensure EPA is responsive to the public. Further, the Community Involvement Plan should be reviewed and revised prior to initiating the remedial design. 40 C.F.R. § 300.435(c)(1). In particular, these plans are often updated at specific benchmarks during the cleanup such as after the Record of Decision is signed, at Explanation of Significant Differences or ROD amendments, before remedial action begins, at project completion, or at initiation of the five-year review. *EPA Community Involvement Plans* at 7.

[36] 40 C.F.R. § 300.430(c)(2).

[37] *Id.*

[38] U.S. Envtl. Prot. Agency, *Community Involvement Plans,* at 1, https://semspub.epa.gov/work/HQ/174739.pdf ("*EPA Community Involvement Plans*").

[39] 40 C.F.R. § 300.430(c)(2)(i).

[40] *Id*. § 300.430(c)(2).

For the East Waterway cleanup, EPA failed to conduct any of these requisite processes. EPA has not conducted any public process for the 2021 AB Technical Memo which it recently made publicly available on its website only a few months ago, after receiving a public records request for the document.[41] This study forms the backbone of EPA's draft proposal to allow for a weaker cleanup of PCBs, arsenic, and dioxins/furans because they believe that achieving natural background cleanup levels is not feasible. Yet, EPA never sought input from the community regarding whether setting preliminary remediation goals at anthropogenic background would adequately protect public health. EPA was not transparent in explaining that this change would result in leaving high levels of contaminants of concern in sediments, which in turn would increase the cancer and non-cancer health risks to tribal fishers, Asian and Latinx communities, and others who regularly fish in the East Waterway. Nor did EPA disclose that changing preliminary remediation goals to anthropogenic background would likely mean that the Department of Health could never lift its fish advisories. To make matters worse, EPA disregarded the Washington Department of Ecology's concerns about EPA's methodology for considering and measuring anthropogenic background. Finally, at the December 7, 2021 public meeting, EPA failed to provide a clear answer as to how it intended to use the 2021 AB Technical Memo, and instead vaguely stated that anthropogenic background levels could limit the responsible parties' liability under CERCLA.

Here, EPA's draft plan has rubber-stamped the 2021 AB Technical Memo prepared by the responsible parties—who clearly have a vested interest in limiting their liability for remediation of hazardous contamination in the Duwamish River. And, EPA reviewed and released this supplemental feasibility study without any community input. In doing so, EPA violated the letter and the spirit of CERCLA, which centers communities harmed by hazardous pollution and requires their active participation in all aspects of the remediation, including site investigation, alternatives analysis, and remedy selection. 40 C.F.R. § 300.430(c)(2) (requiring EPA to "[e]nsure the public appropriate opportunities for involvement in a wide variety of site-related decisions, including site analysis and characterization, alternatives analysis, and selection of remedy").

Further, although CERCLA requires EPA to regularly update its community involvement plans, EPA has not updated its plan since 2016—when the agency was considering a very different cleanup standard. In 2012, EPA prepared a feasibility study for the East Waterway that proposed adopting the most stringent preliminary remediation goals, considering both ARARs and risk based threshold concentrations.[42] In 2016, EPA updated its community engagement plan for the Harbor Island Superfund cleanup, and therein stated that a feasibility study had been completed for the East Waterway Site and that EPA anticipated adopting a record of decision for

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[41] Port of Seattle, *East Waterway Operable Unit Supplemental Remedial Investigation/ Feasibility Study Technical Memorandum: Final Anthropogenic Background Evaluation*, July 2021, https://semspub.epa.gov/work/10/100336344.pdf.

[42] Port of Seattle, East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study Final Remedial Alternative And Disposal Site Screening Memorandum, at 30 (Nov. 28, 2012), https://semspub.epa.gov/work/10/1429177.pdf.

the site in late 2017 or early 2018.[43] However, EPA has still not issued a proposed cleanup plan, a precursor to a record of decision. Instead, it issued several supplemental feasibility studies for the site – in 2019 and again in 2021. EPA never sought public input on these studies and it never revised its community engagement plan.

EPA conducted its first public informational meeting on the East Waterway remediation on December 7, 2021, years after EPA published the feasibility study for the site, and months after EPA published the 2021 AB Technical Memo. In other words, EPA "engaged" the public after-the-fact by informing them about decisions already reached by the agency. EPA never sought community input on how to craft remediation alternatives for the East Waterway in order to protect the health of affected communities.

Nor has EPA designated a Community Advisory Group or provided a Technical Assistance Grant for a group that would be responsible for informing the public about ongoing cleanup activities or concerns. Thus, EPA failed to comply with its obligation to consult with and engage the affected community when undertaking site investigation and remedial design.

Lastly, EPA does not appear to have conducted any interviews with affected residents about the East Waterway cleanup investigation or remedial alternatives, including people who fish from the Spokane Street Bridge, as required by CERCLA. EPA's 2016 update to the Community Engagement Plan notes that tribal fishers and immigrant fishers experience the greatest public health risk from hazardous pollution in the East Waterway and finds that harvesting seafood is the main exposure pathway.

> The potential sources of contaminants are both historical and from potentially ongoing sources. In these studies, the findings state that risks are lower to humans who touch sediment through activities such as clamming and net fishing. There is higher risk to humans who eat seafood. Resident seafood and shellfish have been found to be contaminated with PCBs, arsenic, carcinogenic PAHs and dioxins. In addition, contaminated sediments pose a concern to worms and other creatures that live in the mud and therefore affect the food chain. Elevated levels of PCBs, TBT and mercury are among the 30 contaminants that are of concern to bottom-dwelling animals.[44]

Yet, the 2016 Community Engagement Plan makes no mention of interviews with or any plans to engage local residents who fish and harvest shellfish in the area. If EPA has not conducted interviews with affected residents about its cleanup plans for the East Waterway, that is a violation of CERCLA's requirement to engage and communicate with the public.[45]

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[43] U.S. Envt'l Prot. Agency, Lockheed West Seattle and East Waterway Community Involvement Plan Autumn 2016 update, at 6 (2016) ("The EPA's proposed preferred cleanup option will be available for public comment in a Proposed Plan in late 2017/early 2018.").

[44] *Id.*

[45] 40 C.F.R. § 300.415(n)(3)(i)(ii).

Communities of color, low-income communities, and Tribes consume fish in greater quantities and rely on fish for cultural, traditional, and subsistence reasons more than the general population.[46] EPA cannot propose a remediation plan that would leave hazardous levels of PCB contamination in the East Waterway even after the final cleanup without actively engaging with and addressing the health risks to tribal fishers, communities of color, and low-income communities.

Community Centered Outreach and Engagement: Impacted community need to be involved at all stages of planning for cleanup. By promoting education and engagement of the community, we can help develop and advocate for solutions that will best protect and benefit impacted communities. We recommend making cleanup planning transparent, and accessible at the very beginning of any discussion of issues and decisions that directly impact the community. At the Lower Duwamish Waterway site, DRCC works side by side with educators, technical advisors, and translators to provide information and solicit input in culturally appropriate ways. For example, DRCC works with the local community and school (Concord International Elementary School) to provide curriculum for students, and with program administrators at middle school and high school levels in the Duwamish Valley, as well as with adult programs at the Community Center, Neighborhood Center, Library, etc., with the goal of ensuring that community members understand the depth and scope of the Superfund cleanup and its intersection with environmental justice issues. These programs do so in ways that are culturally relevant to the diverse local communities.

Provide Resources to Aid Community Engagement: A Technical Assistance Grant is necessary for the East Waterway so that Duwamish Valley communities have the much needed technical capacity to understand and actively engage in this crucial aspect of the Duwamish River cleanup. TAG grants are essential for meaningful community engagement, as has been demonstrated in the Lower Duwamish Waterway Cleanup.

Emulating successes from the Lower Duwamish Waterway: Protecting the health of fishers and the community in the East Waterway does not require reinventing the wheel: EPA can look to its own prior successful approaches in the Lower Duwamish Waterway. On the Lower Duwamish Waterway, successful elements of the enhanced community involvement plan agreed to by EPA and its Community Advisory Group (CAG) included: (1) advanced notification of the timing of key documents – both public release documents and interim building blocks; (2) the CAG receives draft copies of documents from potentially responsible parties at same time as EPA; the CAG can then provide EPA with preliminary comments for consideration before EPA provides written response to potentially responsible parties (i.e., CAG comments are incorporated into EPA's response to potentially responsible parties, as appropriate) (3) consultation with the CAG on the timing of public release of documents and the scheduling,

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[46] Nat'l Envtl. Justice Advisory Council, *Fish Consumption and Environmental Justice* at 14 (Nov.: A Report Developed from the National Environmental Justice Advisory Council Meeting of December 3–6, 2001 (revised November 2002) ("NEJAC Report"), https://www.epa.gov/sites/production/files/2015-02/documents/fish-consump-report_1102.pdf.").

number, language, and format of public meetings and hearings in order to ensure accessible, equitable, and meaningful public engagement. EPA should adopt this same approach to community engagement for the East Waterway cleanup.

Community-Centered Institutional Control Plan: While the Lower Duwamish Waterway Superfund Site's Institutional Controls "Fun to Catch, Toxic to Eat" program, managed by Public Health–Seattle & King County, has been running since 2017, interviews with fishers have not been updated and should be done to evaluate the impacts of the proposed cleanup alternatives and anthropogenic background levels. We insist on (1) an evaluation of the Institutional Control Plan for the Lower Duwamish Waterway in order to inform the East Waterway plan and (2) an Institutional Control Plan included in the East Waterway Record of Decision that builds and expands upon the existing LDW Institutional Control plan by addressing strategies requested by fishers but previously considered out of scope.

Recommendations on Steps to Achieve Meaningful Community Engagement:

1. Provide a briefing on the current (draft final) version of the Remedial Investigation/ Feasibility Study for the East Waterway. This briefing should explicitly include any changes to the Feasibility Study that have been made since a Draft Feasibility Study was last provided to the Tribes, Trustees, and Stakeholders and to the National Remedy Review Board in December 2018.

2. Provide a briefing on the 2021 AB Technical Memo. This briefing should explicitly include when, how, and why EPA determined that it should produce an AB Technical Memo for the East Waterway; details on the methodology used to develop the resulting AB levels; who reviewed drafts of the AB Technical Memo, their comments, and how or if those comments were resolved. We request that those parties be invited to participate in the briefing directly. DRCC may also request that additional Trustees and stakeholders, not previously included in EPA's distribution of the draft AB Technical Memo, be invited to attend the briefing as well, in order to provide a thorough understanding of the consequences of limiting cleanup to anthropogenic background levels' and as a transparent public engagement best practice.

3. Provide a briefing on the considerations that EPA intends to use to make a determination on its preferred remedy (Proposed Plan) for the East Waterway. Please include in this briefing how EPA is using its environmental justice policies to screen and select a remedy for the East Waterway.

4. Once the requested reviews and briefings are complete, DRCC requests consultation with EPA on how to ensure meaningful community involvement in review of the draft plan for the East Waterway Cleanup. This consultation should include:

    a. A determination of the lead time needed in order to ensure that the community has the technical support they need to independently assess the proposed (does the community need a Technical Advisor? How much lead time will a technical advisor need to review the documents and provide an assessment to the community?). Further, EPA should establish a community advisory group for the East Waterway and should issue a technical advisory grant, to enable the community to understand technically complex issues related to the cleanup and ensure open lines of communication between the affected community and EPA.

b. Sufficient time to inform the community so they can provide meaningful comments and feedback on the proposed plan for the East Waterway cleanup.
c. Revise the community engagement plan to ensure that impacted communities can actually participate in public meetings and hearings by coordinating times and holding meetings in forums that are accessible and have translation services available in all the languages used by affected communities. If the COVID-19 pandemic is still a public health threat and meetings cannot be held in person, *how will EPA address the digital divide to ensure access by all affected and interested members of the Duwamish Valley communities?*

III. EPA SHOULD PREPARE AN ENVIRONMENTAL JUSTICE ASSESSMENT FOR THE EAST WATERWAY REMEDIATION.

EPA has not conducted an environmental justice analysis regarding impacts of the East Waterway cleanup on low-income, immigrant, and tribal communities that fish at the Spokane Street Bridge or on the Duwamish River. EPA guidance documents have recognized that CERCLA's statutory requirement to protect the public health, welfare, and the environment means that EPA must consider the cumulative risks posed by hazardous pollution. Further, EPA should ensure fair treatment of and meaningful involvement by communities of color, low-income communities, and indigenous people that are disproportionately impacted by the hazardous pollution. Executive orders on environmental justice likewise require that an agency consider and evaluate whether any proposed federal action would have a disproportionately high and adverse human health or environmental impact on communities of color and low-income populations.

EPA's definition of environmental justice includes both "fair treatment" and "meaningful involvement" of disproportionately affected communities, because evaluating whether a cleanup is adequately protective of human health and welfare requires understanding people's particular exposure circumstances and susceptibilities. Such an understanding is often only possible if the impacted communities are meaningfully involved.

EPA guidance documents strongly encourage preparation of an environmental justice assessment if a Superfund site would disparately impact communities of color, indigenous people, or low-income communities. EPA guidance recognizes that CERCLA § 104's general authority to take actions "necessary to protect the public health or welfare or the environment" could be read to authorize EPA to "consider[] cumulative risks in taking response actions," and to "ensure fair treatment [of] and meaningful involvement in" decisions "for minority, low income, and indigenous populations that are disproportionately impacted."[47,48] The EPA's *Toolkit for Assessing Potential Allegations of Environmental Injustice* also cites CERCLA § 104(b) and (e) as authority for "information gathering" enabling EPA to "[c]onsider environmental justice issues in establishing 'investigations, monitoring, surveys, testing, and other information gathering'" and to "[e]nsure that information requests address issues of concern to the community and include environmental justice issues," respectively.[49]

More specifically, CERCLA § 121(b) states that EPA "in assessing alternative remedial actions, shall at a minimum take into account … short- and long-term potential for adverse health effects from human exposure" and "shall select a remedial action that is protective of human health and the environment …"[50] CERCLA § 121(d) further states that remedial actions selected "shall attain a degree of cleanup" that "at a minimum" "assures protection of human health and the environment" and for any contaminant that will remain onsite "at least" attains applicable or relevant and appropriate requirements (ARARs).[51] The NCP has elaborated nine criteria for remedy selection, the first two of which – overall protectiveness of human health and the environment, and compliance with ARARs – operate as "threshold criteria."[52] The last two criteria, including the ninth criterion – "community acceptance" – function as "modifying criteria."[53] The EPA's *Plan EJ 2014: Legal Tools* states that "many of" the nine factors considered in remedy selection, "including" the first (protectiveness of human health and the environment) and the ninth (community acceptance) "can accommodate environmental justice considerations relating to impacts on, and participation by minority, low-income, and indigenous

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[47] EPA, *Plan EJ 2014: Legal Tools* at 53 (citing CERCLA § 104(a)(1); *accord*, EPA, Toolkit for Assessing EJ at B-2 (citing CERCLA §§ 104(a)(1), 101(24), and 101(24) and 40 C.F.R. § 300 subpart E for authority to "[c]onsider environmental justice concerns, such as cumulative risk, vulnerability of sensitive populations").

[48] D. Sullivan, "3 Keys for Addressing Community Stress in Environmental Contamination," https://culturalexistential.lab.arizona.edu/sites/culturalexistential.lab.arizona.edu/files/3Keys_Report.pdf.

[49] EPA, *Toolkit for Assessing EJ* at B-6 (citing CERCLA § 117(b) and (e), and companion NCP provisions). Note that, while the general heading for the discussion of these provisions is "Information Gathering (Research, Monitoring, and Reporting)," their particular mention is, oddly, listed under "Monitoring."

[50] 42 U.S.C. § 9621(b)(1).

[51] 42 U.S.C. § 9621(b)(1).

[52] 40 C.F.R. § 300.430(e)(9)(iii). "Threshold criteria" means that only those alternatives that satisfy these two criteria will be among those considered for selection. The next five criteria serve as "primary balancing criteria," consideration of which affords a basis for weighing and choosing among the surviving alternatives.

[53] *Id.* Finally, "modifying criteria" are those that suggest ways in which the preferred alternative might be modified to address state and community concerns.

populations."[54] The EPA's *Toolkit for Assessing Potential Allegations of Environmental Injustice* encourages the agency to "[c]onsider environmental justice issues when developing and implementing remedy selection, under the nine selection criteria."[55] It cites CERCLA § 121(d) as authority permitting it to "ensure that ARARs are 'at least' protective of the affected community, including sensitive and vulnerable populations."[56]

In 2013, EPA Region 10 published its *Environmental Justice Analysis for the Lower Duwamish Waterway Cleanup*[57] – touted as the first ever EJA for a CERCLA remedy selection.[58] It cited Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* and EPA's commitment to environmental justice as set forth in its then-recent *Plan EJ 2014*, EPA's "strategic plan for addressing environmental justice in the agency's work."[59]

The Executive Order No. 12898 on environmental justice requires an environmental justice analysis when a proposed agency action will have a disproportionately high and adverse human health or environmental effects on minority populations and low-income populations:

> [E]ach Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations[.][60]

Further, the Biden-Harris administration has made clear its intent to center environmental justice among its most foundational principles. Executive Order No. 13985 announces an expanded and urgent commitment to various aspects of environmental justice throughout the federal government. Executive Order No. 13990, commits federal agencies to "listen to the science" in protecting human health and the environment and prioritizing environmental justice.

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[54] EPA, Plan EJ 2014: Legal Tools at 53.

[55] EPA, Toolkit for Assessing EJ at B-4.

[56] *Id*.

[57] EPA, Environmental Justice Analysis for the Lower Duwamish Waterway Cleanup (Draft, Feb. 2013).

[58] *See* CLIFFORD VILLA, ET AL., ENVIRONMENTAL JUSTICE: LAW, POLICY & REGULATION, AT 318 (3d. ed. 2020).

[59] *Id*. at 5-6. *See also*, id. at 63 (citing EO 12898's concern that "communities are meaningfully involved in the decision process as much as practicable" for cleanup decisions).

[60] Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, 59 Fed. Reg. 7629 (Feb. 16, 1994).

EO 13985, "On Advancing Racial Equity and Support for Underserved Communities Through the Federal Government"[61] states that "[t]he federal government should pursue a comprehensive approach to advancing equity for all." Section 1 declares that "affirmatively advancing equity, civil rights, racial justice, and equal opportunity is the responsibility of the whole of our government. Because advancing equity requires a systematic approach to embedding fairness in decision-making processes, executive departments and agencies (agencies) must recognize and work to redress inequities in their policies and programs that serve as barriers to equal opportunity." EO 13985 goes on in Section 2 to define broadly what it means by "equity" and who it means to include among "underserved communities." Section 8, titled "Engagement with Members of Underserved Communities," directs that:

> "In carrying out this order, agencies shall consult with members of communities that have been historically underrepresented in the Federal Government and underserved by, or subject to discrimination in, Federal policies and programs. The head of each agency shall evaluate opportunities, consistent with applicable law, to increase coordination, communication, and engagement with community-based organizations and civil rights organizations."

EO 13990, "Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis,"[62] announces its "policy" in Section 1:

> "Our Nation has an abiding commitment to empower our workers and communities; promote and protect our public health and the environment; and conserve our national treasures and monuments, places that secure our national memory. Where the Federal Government has failed to meet that commitment in the past, it must advance environmental justice. In carrying out this charge, the Federal Government must be guided by the best science and be protected by processes that ensure the integrity of Federal decision-making. **It is, therefore, the policy of my Administration to listen to the science; to improve public health and protect our environment; to ensure access to clean air and water; to limit exposure to dangerous chemicals and pesticides; to hold polluters accountable, including those who disproportionately harm communities of color and low-income communities**; to reduce greenhouse gas emissions; to bolster resilience to the impacts of climate change; to restore and expand our national treasures and monuments; and to prioritize both environmental justice and the creation of the well-paying union jobs necessary to deliver on these goals."

In Section 2, it directs that federal agencies "shall, as appropriate and consistent with applicable law, consider whether to take any additional agency actions to fully enforce [this] policy" … and "[i]n carrying out the actions directed in this section, heads of agencies shall seek input from the public and stakeholders, including State, local, Tribal, and territorial officials, scientists, labor unions, environmental advocates, and environmental justice organizations."

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[61] Executive Order 13985, *On Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*, 86 Fed. Reg. 7009 (Jan. 25, 2021).

[62] Executive Order 13990, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, 86 Fed. Reg. 7037 (Jan. 25, 2021) (emphasis added).

Together, these executive orders announce a heightened intent to "affirmatively advance equity … and racial justice" and "to prioritize … environmental justice;" a commitment to enlisting the best science in federal decisions to the end of "improv[ing] public health and protecting our environment;" and a recognition that "listen[ing] to the science" can only be accomplished by seeking the input of tribes and "environmental justice organizations."

Here, EPA has done exactly the opposite of what its own guidance documents and presidential executive orders require. Instead of holding polluters accountable, EPA worked directly with the parties responsible for the pollution to create a huge loophole in the final cleanup that would take them off the hook for ensuring a full remediation of toxic sediments in the East Waterway. Instead of engaging with environmental justice communities and working to understand the disproportionate harms to them, EPA shut them out of the process after preparation of the 2019 Feasibility Study. And instead of ensuring the East Waterway cleanup is protective of the affected community, including sensitive and vulnerable populations, EPA seems willing/poised to place the burden on community and fishers to avoid hazardous pollution by discouraging them from fishing in the East Waterway, including at the Spokane Street Bridge.

Increasing reliance on fish advisories instead of actually cleaning up pollution shifts the burden from the polluter to the people exposed to the health risks, contrary to Superfund's polluter pays principle. Such risk avoidance strategies ask impacted communities to "refrain from eating the fish, drinking the water, playing at the field down the hill, working outdoors, and undertaking a host of other heretofore ordinary, healthful, and even cherished human activities[.]"[63] Studies have found that people of color, people with low incomes, limited English proficiency, or relatively little education are less likely to be aware of fish consumption advisories.[64] The pollution in the river should be cleaned-up to ensure the health and well-being of these communities. It is unacceptable that other more privileged communities should be able to fish at Lincoln Park in West Seattle only five miles away, while Duwamish Valley residents risk exposure to hazardous contamination when they seek to fish and recreate at the Spokane Street Bridge.

An institutional controls program in the East Waterway must do more than ask fishers to change their behavior. The current Institutional Control plan for the Lower Duwamish Waterway expects fishers to avoid the most contaminated fish by only consuming salmon (for which there is also a health advisory). The agency continues to perpetuate environmental racism by failing to incorporate community recommendations into regulation and policy. It must incorporate recommendations made by fishers to address barriers to consuming contaminated seafood that include but are not limited to transportation support to other fishing sites and discount options to buy a diversity of seafood at supermarkets, as well as multilingual

[63] Catherine O'Neill, "No Mud Pies: Risk Avoidance as Risk Regulation," 31 Vt. L. Rev. 273, 274-275 (2006).

[64] Nat'l Envtl. Justice Advisory Council, *Fish Consumption and Environmental Justice* at 107 (Nov. 2002) https://www.epa.gov/sites/production/files/2015-02/documents/fish-consump-report_1102.pdf. ("*NEJAC Report*").

education about fishing rules. Environmental justice is about more than just briefing communities on decisions the agency has already made—these empty gestures do not effectuate change. EPA should review and amend its processes for incorporating local and cultural knowledge into policy and decision-making.

Relying on fish advisories is particularly misplaced when environmental justice communities are involved, as studies have shown that "it may be impractical or impossible for those who are affected by contaminated aquatic environments to give up or alter their fish consumption practices. This may be so for economic, geographic, historical, traditional, cultural, religious, and/or legal reasons."[65] As the National Environmental Justice Advisory Council recommended in its Fish Consumption and Environmental Justice Report, "EPA needs to refrain from falling back on 'institutional controls' (e.g., put a fence around the site and post 'No Fishing' signs) and undertake aggressive cleanups where the sites are past or present locations for fishing and other activities that expose communities of color, low-income communities, tribes, and other indigenous peoples to contamination."[66] The draft plan for the East Waterway cleanup ignores NEJAC's advice. By opting for a less aggressive final cleanup, EPA's draft plan would exacerbate the nutritional deficits and other health detriments that disproportionately affect environmental justice communities.

The EJ analysis for the LDW was the first EJ analysis for a Superfund cleanup conducted in the nation by EPA. DRCC was central in shaping this emerging and important process. While there have been important and significant advances in EJ analysis methodology since then, we outline a few things that were successful in the LDW process:

Without access, community involvement will not be meaningful. In the LDW EJ analysis, DRCC helped EPA understand the accessibility needs of the community (language, food, childcare, cultural diversity in meeting accessibility). This is central in ensuring that a diverse set of community perspectives are included. How can a single mother with two kids leave her home for a two-hour session, when she must find and pay for childcare and arrange dinner for her children during her absence? DRCC provided these necessary accommodations when EPA failed to do so. DRCC would also host meetings and invite EPA to participate when EPA did not meet the needs DRCC had identified. Going forward, EPA should follow DRCC's lead and find ways to provide these reasonable accommodations at the East Waterway cleanup meetings or enlist the PRPs to do so.

DRCC also made sure that EPA would accept a wide range of languages and formats as formal public comment (written, spoken, photographs, drawings, petitions) – whatever communicated the commenters' input in whatever formats were most accessible and comfortable to them. Notably, EPA's current format of online commenting only is a giant step backwards.

Recommendation: EPA should prepare an Environmental Justice Analysis because it would encourage fair treatment and meaningful involvement of environmental justice

[65] *NEJAC Report* at 98.

[66] *NEJAC Report* at 89.

communities, evaluate people's particular exposure circumstances and susceptibilities, and inform development of a meaningful, effective, and health protective institutional control plan until cleanup is complete. Through this process, EPA should provide recommendations on how to reduce or eliminate disproportionate adverse impacts to communities of color and tribal fishers. Disproportionate impacts to immigrant communities and tribal fishers from a weaker final cleanup in the East Waterway must be evaluated and EPA must incorporate feedback from impacted communities before it can proceed with remedy selection.

An EJ analysis was conducted on the adjoining LDW in 2013 and was the first in the country. However, at that time, there was no accepted methodology;[67] DRCC helped pioneer what an EJ analyses would entail, which has provided a precedent for the years to come. An EJ analysis on the EW should build on that precedent and account for more recent advances on how to conduct an EJ analysis that fully captures community knowledge and impacts.

The LDW ROD was issued in 2014 and fish advisories have been in effect even longer. Currently, EPA reports on the outreach metrics and the CHAs' own sense of empowerment, which is a crucial set of data. However, EPA should also be evaluating the effectiveness of institutional controls in protecting fisher's health, which it is not doing in the Lower Duwamish Waterway. EPA should conduct this analysis to inform an improved design for the East Waterway. Evaluating the effectiveness of institutional controls could include evaluating: changed demographics of fisher populations; whether or not the fishers are catching, distributing, and consuming resident seafood; whether they are suffering unintended consequences by *not* harvesting resident fish (*e.g*. quality of life, increased food insecurity, poorer diet). These evaluations must be central during the cleanup process and cannot wait until after the entire cleanup remedy has been implemented. We need to determine the effectiveness and impacts of the institutional controls at present in order to determine if improvements are needed for both the LDW and the East Waterway. An evaluation of how fish advisories and ICs are working should be completed as part of the EJ analysis for the East Waterway cleanup.

Recommendation – Compensation for Natural Resource Damages: Lastly, the East Waterway cleanup plan should provide restorative justice to the fishing community by requiring PRPs to compensate for the loss of natural resources. Responsible Parties, including the Port of Seattle, King County, and the City of Seattle, are liable for damages to natural resources.[68] These parties must pay "damages for injury to, destruction of, or loss of natural resources, including the reasonable costs of assessing such injury, destruction, or loss resulting from such a release [of hazardous contamination.]"[69] Leaving PCBs in the East Waterway that render resident pelagic and benthic fish too toxic to consume has directly damaged this important

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[67] EPA. "Appendix B: Environmental Justice Analysis for the Lower Duwamish Waterway Superfund Cleanup." (Feb. 2013). https://d10k7k7mywg42z.cloudfront.net/assets/512fbf027a507244640002ea/ej_analysis_ldw_feb_2013.pdf.

[68] 42 U.S.C. 9607(a)(4)(C).

[69] *Id*.

natural resource, which is a source of food and cultural meaning. Responsible parties have a legal obligation to compensate for this loss.

EPA is required to act on behalf of the public as a trustee of natural resources to recover damages and loss to natural resources.[70] Recoverable costs include damage to natural resources that occurred from the onset of the hazardous release through the recovery, the costs of emergency response, and the costs of assessing damages.[71] EPA should work with the Department of Fish and Wildlife, and other designated natural resources trustees to assess the harm caused to natural resources including resident fish and shellfish using the regulations promulgated by the Department of Interior.[72] This assessment should include a preliminary estimate of damages that documents the financial costs incurred by the public as a result of limiting their access to fishing in the East Waterway.[73] EPA should invite input from the community as to what types of restoration projects should be funded by natural resource damages, including, for example: providing the fishing community with transportation to other fishing sites, rebates to purchase fish from the grocery store, or development of local aquaculture. Any consent decree or settlement agreement discharging CERCLA liability entered into with the responsible parties must compensate for the harm to and loss of natural resource damages.

IV. LIMITING CLEANUP TO ANTHROPOGENIC BACKGROUND LEVELS VIOLATES THE STATUTORY AND REGULATORY REQUIREMENTS OF CERCLA.

EPA's approach for remediating hazardous substances in the East Waterway cleanup as described in its draft plan would violate CERCLA's statutory and regulatory mandates, which require EPA to pursue a final cleanup that will protect public health and the environment. EPA is considering limiting remediation in the East Waterway to anthropogenic background levels developed in the 2021 AB Technical Memo. Doing so, however, would mean exposing fishing communities to high levels of PCBs and other chemical contamination in fish tissue. Pursuing a remediation for the East Waterway that leaves this waterbody unfishable, even after the cleanup, violates EPA's duty to pursue a cleanup that protects public health and the environment.

CERCLA is a federal law that requires polluters to remediate hazardous contamination and spills that they caused. This law enshrines the principle of making the polluter pay for remediating their toxic wastes. CERCLA makes protecting public health and the environment the paramount concern, elevated above cost and other considerations, because of the deadly and debilitating harms caused by hazardous chemicals.

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[70] 42 U.S.C. § 9607 (f)(1) ("The President, or the authorized representative of any State, shall act on behalf of the public as trustee of such natural resources to recover for such damages.").

[71] 43 C.F.R. § 11.15.

[72] *See* 43 C.F.R. §§ 11.10 *et seq*.

[73] *See* 43 C.F.R. § 11.38.

The CERCLA statute requires that the chosen remedial action must at minimum "assure[] protection of human health and the environment[.]"[74] Similarly, CERCLA regulations require that EPA ensure that remedial actions protect public health and the environment by achieving health protective remediation standards set out under state and federal regulations. Compliance with state law and protecting public health are threshold criteria – meaning that when EPA develops the remediation plan, the plan must protect public health and achieve state ARARs.[75, 76]

A. CERCLA Does Not Allow EPA to Limit Remediation of Hazardous Substances to "Anthropogenic Background" Levels.

Limitations on cleanup liability set out in the CERCLA statute and its regulations **do not** allow EPA to limit hazardous cleanups to "anthropogenic background" levels of pollution. CERCLA requires EPA to conduct a removal or remedial action in response to the release of any hazardous substance.[77] However, Congress imposed "[l]imitations on response[,]" and prohibited EPA from conducting a removal or remedial action "in response to a release or threat of release … of a *naturally occurring* substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is *naturally* found[.]"[78] Thus, with limited exception,[79] CERCLA prohibits EPA from remediating hazardous materials beyond naturally occurring background levels of pollution. Congress enumerated three other limits on liability including prohibiting remediation of products which are part of the structure of buildings, or contamination of public or private drinking water supplies due to deterioration of the system through ordinary use.[80] Notably, however, **"anthropogenic background" is not**

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[74] 42 U.S.C. 9621(d)(1).

[75] 40 C.F.R. § 300.430(f)(1)(i)(A).

[76] Federal regulations do describe a waiver process that would allow the agency to adjust cleanup goals in the future if engineering problems arise during the remediation process that prevent the agency from achieving them. In the Lower Duwamish Waterway 2014 Record of Decision, EPA cannot accept a technical impracticability waiver for several years - until the site is cleaned up, the ongoing sources of pollution are controlled, and technical impracticability can be assessed meaningfully.

[77] CERCLA requires EPA to conduct a cleanup when whenever "any hazardous substance is released or there is a substantial threat of such a release into the environment, or there is a release or substantial threat of release into the environment of any pollutant or contaminant which may present an imminent and substantial danger to the public health or welfare[.]" 42 U.S.C. § 9604(a)(1).

[78] *Id*. § 9604(a)(3).

[79] "Notwithstanding [the enumerated limited exceptions] …, the President may respond to any release or threat of release if in the President's discretion, it constitutes a public health or environmental emergency and no other person with the authority and capability to respond to the emergency will do so in a timely manner." *Id*. § 9604(a)(4).

[80] *Id*.

listed as a recognized limit to liability, indicating Congress intended to exclude it as a limit on liability.[81]

Interpreting CERCLA in a manner that would limit remediation to anthropogenic background contamination levels in order to limit polluters' cleanup liabilities would create a giant and illegal loophole in the law. Limiting liability to anthropogenic background would allow EPA to do exactly what it is trying to do here—let responsible parties leave hazardous contamination that endangers the public in the East Waterway in perpetuity.

Creating a giant loophole to CERCLA's mandate to remediate hazardous pollution is contrary to the plain language of the CERCLA statute and its fundamental remedial purpose. The limits on liability described in CERCLA § 104 are statutory exceptions to the mandate to remediate hazardous substances that endangers the public. Such statutory exceptions should be "narrowly [construed] in order to preserve the primary operation of the provision[.]"[82] Here, the CERCLA statute explicitly lists three limits on liabilities, and no others.

Creating a loophole that limits remediation to "anthropogenic background" pollution levels would undermine the fundamental purpose of CERCLA to "protect the public health or welfare" and remediate releases that pose a "public health threat[.]"[83] Doing so would prevent EPA from achieving its primary statutory obligation to mandate that polluters undertake a remedial action plan that "assures protection" of human health and the environment.[84] EPA does not have discretion to interpret the CERCLA statute in a way that is contrary to its plain language and fundamental purpose. EPA is not ensuring protection of human health if it blesses a remediation plan that would **expose fishing families to 272 times more PCBs** than the more health protective levels established in the adjoining reach of the Duwamish River.

EPA's regulations likewise do not allow EPA to limit remediation to "anthropogenic background" levels. In its regulations, EPA codified the three limits on liabilities described in CERCLA § 104: (1) naturally occurring background contamination, (2) contamination of building structures, and (3) wear and tear on public drinking water systems.[85] None of CERCLA's regulations even mention "anthropogenic background" or "anthropogenic sources of

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[81] *United States v. Crane*, 979 F.2d 687, 691 n. 2 (9th Cir.1992) ("The maxim of statutory construction, 'expressio unius est esclusio alterius' provides that '[w]hen a statute limits a thing to be done in a particular mode, it includes the negative of any other mode.' ") (*quoting Botany Worsted Mills v. United States*, 278 U.S. 282, 289 (1929)).

[82] *See Maracich v. Spears*, 570 U.S. 48, 60 (2013) (internal quotation marks omitted).

[83] *See* 42 U.S.C. 9604(a)(1).

[84] *See* 42 U.S.C. § 9621(d)(1) ("Remedial actions selected under this section or otherwise required or agreed to by the [EPA] … shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further release at a minimum which *assures protection* of human health and the environment.") (emphasis added).

[85] 40 C.F.R. § 300.400(b).

pollution" as a basis for limiting liability under CERCLA.[86] This omission of "anthropogenic background" is especially telling because interim guidance documents proposed including this concept as a limit on liability.[87] Yet, the final regulations adopted by EPA do not mention or include "anthropogenic background" as a limit on CERCLA liability.[88]

The CERCLA statute and regulations do provide for a waiver process, but EPA must demonstrate satisfaction of specific criteria including whether a waiver would (1) help achieve long term compliance, (2) better protect public health and the environment, (3) whether achieving ARARs is impracticable from an engineering perspective, (4) the alternative will achieve an equivalent standard of protection, and (5) the relevant state ARAR has not been consistently applied.[89] EPA is not purporting to apply a technical waiver for the East Waterway cleanup and would need to demonstrate satisfaction of these factors should EPA seek to waive ARARs. Further, should EPA later consider a waiver, it should do so only once remediation is well underway and technical difficulties might actually arise—just as provided for in the Lower Duwamish Waterway ROD.

B. EPA's Preliminary Remediation Goals Fail to Protect Public Health.

Nor can EPA consider "anthropogenic background" because of costs or technical difficulty when setting remediation goals. The CERCLA regulations describe a specific set of criteria that EPA must consider when setting its preliminary remediation goals—costs or administrative or technical difficulties are not listed amongst these factors.[90] The statute does allow EPA to consider cost and technical difficulties later when choosing between remedial action alternatives, but it can only do so after meeting two health-protective threshold criteria: (i) the proposed action protects human health and the environment, and (ii) the plan achieves ARARs.[91] Setting preliminary remediation goals that prioritize cost and technical difficulty over and above protecting human health is contrary to CERCLA and its implementing regulations.

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[86] 40 C.F.R. Part 300.

[87] *See* U.S. Envt'l Prot. Agency, *Risk Assessment Guidance for Superfund Volume I*

Human Health Evaluation Manual (Part A), Doc. No. EPA/540/1-89/002 at 4-5 (defining "anthropogenic" background levels as "concentrations of chemicals that are present in the environment due to human-made, non-site sources (e.g., industry, automobiles).") ("*RAGS Part A*").

[88] *See* 40 C.F.R. § 300.400(b); U.S. Envt'l Prot. Agency, *National Oil and Hazardous Substances Pollution Contingency Plan*, 53 FR 51394, (Dec. 21, 1988) (draft proposed rule for the National Contingency Plan).

[89] 40 C.F.R. § 300.430(f)(1)(ii)(C).

[90] 40 C.F.R. § 300.430(e)(2)(i).

[91] 40 C.F.R. § 300.430(f)(1)(i)(A); 40 C.F.R. § 300.430 (e)(9)(iii).

When developing feasibility studies and cleanup plans, EPA must identify remedial action objectives that specify contaminants, media of concern, and remediation goals.[92] CERCLA defines preliminary remediation goals as **"acceptable exposure levels that are protective of human health and the environment**[.]"[93] The whole purpose of a Superfund cleanup is to clean up hazardous materials to the health protective cleanup levels set out in the preliminary remediation goals and the remedial action objectives.

Preliminary remediation goals are different from remedial action levels or "RALs". RALs are the maximum allowable concentration of hazardous contaminants that can be left at a site without requiring remediation. If contaminant levels exceed remedial action levels, then EPA must require the polluter to clean up the contamination. In other words, RALs determine whether EPA will take action to require a cleanup in a certain area in the first place, and once remediation commences, preliminary remediation goals determine how clean a site must be when the action is complete.

When developing health protective remediation goals, CERCLA and its implementing regulations require that EPA must consider the following criteria:[94]

(1) Chemical specific applicable relevant or appropriate requirements (ARARs) set by state or federal law.[95] If state law sets standards that are more stringent than federal standards, and EPA is timely informed of such standard, then EPA must require that the cleanup achieves that more stringent state standard.[96]

(2) "For systemic toxicants, acceptable exposure levels shall represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety;"[97]

(3) For known or suspected carcinogens, exposure levels should be determined. For preliminary remediation goals "[t]he 10^{-6} risk level shall be used as the point of departure for determining remediation goals for alternatives when [applicable relevant or appropriate requirements] are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure;"[98]

(4) Maximum contaminant level goals established under the Safe Drinking Water Act;

(5) Water quality standards under §§ 303 or 304 of the Clean Water Act.

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[92] 40 C.F.R. § 300.430(e)(2)(i).

[93] *Id*. (*emphasis added*).

[94] *See* 40 C.F.R. § 300.430(e)(2)(i).

[95] 40 C.F.R. § 300.430(e)(2)(i); see 42 U.S.C. 9621(d)(2)(A).

[96] 42 U.S.C. 9621(d)(2)(A)(ii).

[97] 40 C.F.R. § 300.430(e)(2)(i)(A).

[98] *Id*.

(6) "Environmental evaluations shall be performed to assess threats to the environment, especially sensitive habitats and critical habitats of species protected under the Endangered Species Act."[99]

Background contamination, whether naturally occurring or anthropogenic, *is not listed* amongst the criteria that EPA should consider when setting preliminary remediation goals for a facility.[100]

Setting the preliminary remediation goals at anthropogenic background levels described in the 2021 AB Technical Memo would mean leaving fifteen times more PCBs, three times more arsenic, and nearly five times more dioxins/furans in the East Waterway sediments than the more health protective levels in set in the Lower Duwamish Waterway ROD.[101] Since contaminants like PCBs bioaccumulate in fish tissue, rockfish and other pelagic fish caught in the East Waterway from the Spokane Street Bridge would contain 272 times more PCBs.[102] These same fish can easily swim into the adjacent Lower Duwamish Waterway site as well, undermining the cleanup standards required by the LDW ROD.

PCBs can cause cancer, such as Hodgkins lymphoma. Further, non-carcinogenic effects of PCBs include immune system suppression, persistent and significant deficits in neurological development, including visual recognition, short-term memory and learning, disruption of thyroid hormone levels critical for normal growth and development, and other dermal and ocular effects.[103] Elevated PCBs contamination poses unacceptable health risks to Asian, Latinx, and Tribal fishing communities who regularly fish from the Spokane Street Bridge in the East Waterway to provide food for their families.

EPA's proposed approach in its draft plan also conflicts with the 2019 Feasibility Study for the East Waterway. The 2019 Feasibility Study proposed adopting the same preliminary remediation goals as the Lower Duwamish Waterway cleanup.[104] The 2019 Feasibility Study then evaluated different remedial action alternatives, assuming each of these alternatives would strive to achieve these more health protective preliminary remediation goals.[105] In contrast, for the first time in its draft plan, EPA is considering significantly weakening the preliminary remediation goals for the East Waterway, without any revision to the previously prepared feasibility studies.

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[99] 40 C.F.R. § 300.430(e)(2)(i)(G)

[100] *See* 40 C.F.R. § 300.430(e)(2)(i).

[101] *See supra.*

[102] *See supra.*

[103] U.S. Envt'l Prot. Agency, *Learn about Polychlorinated Biphenyls (PCBs)*, https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls-pcbs#a2

[104] Port of Seattle, *East Waterway Operable Unit Final Feasibility Study*, at 13 (June 2019) https://semspub.epa.gov/work/10/100189627.pdf.

[105] *Id*. at 21-32.

Setting preliminary remediation goals such that they would allow astronomic levels of PCBs to bioaccumulate in fish tissue violates the plain language of EPA's regulations that require the agency to set remediation goals at "acceptable exposure levels that are protective of human health and the environment[.]"[106] Further, EPA regulations do not allow the agency to consider anthropogenic background when developing preliminary remediation goals. Limiting liability in this manner is contrary to the CERCLA statute, its implementing regulations, and conflicts with previously prepared feasibility studies for the East Waterway.

C. EPA Cannot Rely on Guidance Documents to Justify Leaving Hazardous Sediments in the East Waterway.

While EPA guidance documents state that the agency can consider "anthropogenic background," these guidance documents conflict with the CERCLA statute and its implementing regulations—making them unlawful. EPA guidance documents state that EPA can limit polluter's remediation liabilities to "anthropogenic background" contamination levels:

> Contamination at a CERCLA site may originate from … other sources, including natural and/or anthropogenic sources not attributable to the specific site releases under investigation … Background information is important to risk managers because the CERCLA program, generally, does not clean up to concentrations below natural or anthropogenic background levels.[107]

Another guidance document more directly states: "When background levels are higher than risk-based cleanup levels or applicable or relevant and appropriate requirements (ARARs), background may be used to set remediation goals."[108]

EPA cannot rely on these guidance documents as a basis for limiting the extent of the East Waterway final cleanup to anthropogenic background contaminant levels, because they fabricate new exemptions to CERCLA liability that violate the statute. Both the *Role of Background Guidance* and the *Background FAQ* purport to make "anthropogenic background" contamination a limit on the extent of a polluter's liability under CERCLA. For the reasons described in Part III(B), no such limit on liability exists under either the CERCLA statute or its implementing regulations.[109]

At the East Waterway site, setting remediation goals at anthropogenic background levels means leaving hazardous PCB contamination in the East Waterway at levels that will poison

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[106] 40 C.F.R. § 300.430(e)(2)(i).

[107] U.S. Envt'l Prot. Agency, *Role of Background in the CERCLA Cleanup Program*, OSWER Doc. No. 9285.6-07P, at 5 (2002) ("*Role of Background Guidance*").

[108] U.S. Envt'l Prot. Agency, *Frequently Asked Questions About the Development and Use of Background Concentrations at Superfund Sites: Part One, General Concepts*, OLEM Directive 9200.2-141 A, at 6 (2018) ("*Background FAQ*").

[109] *See* 42 U.S.C. § 9621(d)(1); and *supra* Part IV(A), (B).

tribal children, tribal communities, and Asian Pacific Islander and Latinx communities in perpetuity. Setting goals in this manner would directly conflict with 40 C.F.R. 300.430(e)(2)(i), which requires EPA to establish remediation goals at "acceptable exposure levels that are protective of human health and the environment" based on health risk assessments and "applicable or relevant and appropriate requirements under federal environmental or state environmental or facility siting laws[.]"[110] EPA cannot rely on guidance documents to weaken remediation goals for the East Waterway when the statute and its regulations prohibit it.

Recommendation: EPA should revise its draft cleanup plan for the East Waterway to omit consideration of "anthropogenic background," as this is not a recognized limit to CERCLA liability under either the CERCLA statute or its implementing regulations. EPA does not need to reinvent the wheel to accomplish this goal. Instead, it can simply look to preliminary remediation goals, remedial action levels, and cleanup levels already established for the Lower Duwamish Waterway, which EPA previously adopted in the 2019 Feasibility Study for the East Waterway. These standards have undergone a rigorous public review process for the adjacent and contiguous Lower Duwamish Waterway and are more health protective.

V. EPA'S PROPOSED METHODOLOGY FOR CONSIDERING ANTHROPOGENIC BACKGROUND ALSO VIOLATES MTCA.

CERCLA requires that remediation activities, at minimum, achieve state hazardous substances remediation standards if those are more protective than federal standards. Any state standard that is more stringent than the federal standard with respect to remediating specific hazardous contaminants becomes the legally applicable cleanup standard.[111] The final cleanup for a Superfund site "shall require" a standard of control for such hazardous substance, pollutant, or contaminant that "at least attains" this applicable or relevant and appropriate standard "at the *completion* of the remedial action[.]"[112] "Overall protection of human health and the environment and compliance with ARARs[113] … are threshold requirements that each alternative must meet in order to be eligible for selection."[114]

For the East Waterway, EPA's proposed plan would end-run these clear statutory and regulatory mandates by proposing a remedial action plan that is hamstrung by weak preliminary remediation goals. EPA's proposed approach is illegal because it would fail to attain Washington State standards under the Model Toxics Control Act ("MTCA") at the completion of the East Waterway cleanup.

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[110] *See* 40 C.F.R. § 300.430(e)(2)(i).

[111] 42 U.S.C. 9621(d)(2)(A)(ii).

[112] 42 U.S.C. § 9621(d)(2)(A) (emphasis added).

[113] ARARs are defined as "applicable or relevant and appropriate requirements under federal environmental laws and state environmental or facility siting laws[.]" 40 C.F.R. § 300.430(e)(9)(iii)(B).

[114] 40 C.F.R. § 300.430(f)(1)(i)(A).

MTCA is Washington's complement to the federal Superfund law, setting governing standards for cleaning up hazardous waste sites within the state. Cleanup standards are set by regulations promulgated by the Department of Ecology. Sediment cleanup standards are set out in WAC Chapter 173-204. The sediment quality standards ensure that:

> [C]hemical concentration criteria, biological effects criteria, human health criteria, and other toxic, radioactive, biological, or deleterious substances criteria which identify surface sediments that have no adverse effects, including no acute or chronic adverse effects on biological resources and no significant health risk to humans, as defined in this regulation. The sediment quality standards provide a regulatory and management goal for the quality of sediments throughout the state.[115]

Similar to CERCLA's preliminary remediation goals, MTCA also has a process for identifying and setting goals for the cleanup.[116] For sediment remediation, MTCA requires that the initial cleanup level be set at the "sediment cleanup objective," which must be either health protective standards or the naturally occurring background level of contamination.[117] This cleanup goal can be adjusted upward and set at a less protective level only *after* considering the following factors:

> (A) Whether it is technically possible to achieve the sediment cleanup level at the applicable point of compliance within the site or sediment cleanup unit; and
> (B) Whether meeting the sediment cleanup level will have a net adverse environmental impact on the aquatic environment, taking into account the short- and long-term positive effects on natural resources, habitat restoration, and habitat enhancement and the short- and long-term adverse impacts on natural resources and habitat caused by cleanup actions;[118]

To the extent MTCA makes technical impossibility a factor, it puts in place backstops to protect public and environmental health. Cleanup levels can be adjusted only after considering the following three factors: whether it is "technically possible" to achieve sediment remediation standards, and "net adverse environmental impact … [and] the short- and long-term positive effects on natural resources[.]"[119] Further, the Washington Department of Ecology ("Ecology") can still set more stringent cleanup levels if "the department determines that such levels are necessary to protect human health and the environment."[120]

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[115] WAC 173-204-100(3).

[116] *See* WAC 173-204-560.

[117] WAC 173-204-560(3).

[118] WAC 173-204-560(2)(a)(ii).

[119] *Id*.

[120] WAC 173-204-560(2)(b).

EPA's reliance on anthropogenic background to weaken the remediation is not in compliance with MTCA and would allow a weaker cleanup goal than MTCA requires. While MTCA may in limited circumstances allow cleanup goals to be reduced based on "regional background" contamination, the 2021 AB Technical Memo does not evaluate any of the factors set out under MCTA for setting regional background. Nor has EPA satisfied MTCA's requirement to provide the public an opportunity to review and comment on the Regional Background standards—and instead has shut the public out from this process. EPA should therefore abandon the 2021 AB Technical Memo.

Recommendation: EPA should work collaboratively with the Department of Ecology to ensure that preliminary remediation goals and cleanup levels for the East Waterway, at minimum, achieve the health protective sediment remediation standards of MCTA. EPA has already undertaken this analysis for the Lower Duwamish Waterway and it can easily replicate that analysis for the East Waterway.

VI. CONCLUSION

EPA's failure to follow the law and best scientific as well as environmental justice practices in the planning of the East Waterway remediation is harmful to the communities most impacted by the pollution from the East Waterway Operable Unit of the Harbor Island Superfund site. In this era of renewed commitments to environmental justice—especially at the federal level—EPA must re-examine its strategies, solicit meaningful community engagement in development of the East Waterway cleanup plan, and adopt a remediation plan for the East Waterway that protects the health of the Duwamish Valley fishing communities. ***We must not forget a crucial history:*** environmental justice itself originated as a concept within historically marginalized communities to challenge environmental racism within government institutions, like the circumstances that led to this Superfund site. EPA must hold itself accountable to address this legacy, lest it undermine and undo the decades of work done by these communities, and, in so doing, further perpetuate harm.

Sincerely,

Jaimini Parekh
Senior Attorney
Earthjustice

Counsel for the
Duwamish River Community Coalition

Paulina López
South Park Resident
Executive Director,
Duwamish River Community Coalition

CC:

Michael Regan, Administrator
U.S. Environmental Protection Agency

Maria Cantwell, Senator
United States Senate

Adam Smith, Congressman
U.S. House of Representatives

Matthew Tejada
Director, Office of Environmental Justice
U.S. Environmental Protection Agency

Michelle Pirzadeh, Acting Regional Administrator
U.S. Environmental Protection Agency, Region 10

Calvin Terada, Director, Superfund & Emergency Management
Ravi Sanga, Project Manager, Harbor Island Cleanup
Kay Morrison, Community Involvement Coordinator
U.S. Environmental Protection Agency, Region 10

Lenford O'Garro
Emerson Christy
Washington State Department of Health

Jim West
Washington Department of Fish and Wildlife

Cecile Hanson
Duwamish Tribe

Denice Taylor
Alison O'Sullivan
Suquamish Tribe

Ryan Calkins, Commissioner
Sam Cho, Commissioner
Fred Felleman, Commissioner
Toshiko Grace Hasegawa, Commissioner
Hamdi Mohamed, Commissioner
Port of Seattle

Brenda Mallory, Chair
Counsel of Environmental Quality

Patty Murray, Senator
United States Senate

Pramila Jayapal, Congresswoman
U.S. House of Representatives

Carlton Waterhouse
Deputy Assistant Administrator of OLEM
U.S. Environmental Protection Agency

Laura Watson, Director
Washington State Department of Ecology

Millie Piazza, EJ Coordinator
Bob Warren
Rick Thomas
Barry Rogowski
Washington State Department of Ecology

Erika Shaffer
Wash. Department of Natural Resources

Bill Sherman
Jonathan Munro-Hernandez
Elizabeth Harris
Washington State, Office of the Attorney General

Glen St Amant
Muckleshoot Tribe

Andrew Lee, Deputy Director
Seattle Public Utilities

Lisa Herbold, Councilmember
Seattle City Council

Jim McDermott, Council Vice Chair
King County Council

Kamuron Gurol, Director of the WTD
King County

Exhibit A

East Waterway Sediment and Fish Comparisons to LDW

Background Sediment and Target Fish Tissue Concentration Comparisons for PCBs between East Waterway and Lower Duwamish Waterway

Lower Duwamish Waterway

Sediments/mud =
2 ug/kg dry weight

Fish =
1.8 ug/kg wet weight

East Waterway

Sediments/mud =
31 ug/kg dry weight

Fish =
490 ug/kg wet weight

East Waterway to Lower Duwamish Waterway Sediment Background Comparisons

Chemical	Units	East Waterway Anthro. Bknd.[1]	Minimum LDW CUL	Basis for LDW[2]	Ratio EW to LDW
PCBs	ug/kg DW	31	2	Natural bknd	15.5
Arsenic	mg/kg DW	20	7	Natural bknd	2.9
cPAH TEQ	ug/kg DW	no value	90	Beach play	--
Dioxin/furan TEQ	ng/kg DW	9.6	2	Natural bknd	4.8

Sources:

1. East Waterway Waterway Proposed Plan (2021)
2. Lower Duwamish Waterway (LDW) Record of Decision (2014)

Comparison of East Waterway Target Tissue concentrations to Lower Duwamish Waterway Target Tissue Concentrations

PCBs ug/kg wet weight	Tissue Type	Species	East Waterway Target Tissue concentration[1]	Lower Duwamish Waterway Target Tissue Concentration[2]	Ratio EW to LDW
Benthic fish	Fillet	English sole	140	12	12
Pelagic fish	Whole body		490	1.8	272
Crab	Whole body	Dungeness and Red Rock crab	100	9.1	11
	Edible meat		15	1.1	14
Clams	Without shell	Various	20	0.42	48

Sources:

1. East Waterway Waterway Proposed Plan (2021)
2. Lower Duwamish Waterway (LDW) Record of Decision (2014)

Exhibit B

East Waterway Suquamish comments

These comments were submitted on the draft stakeholder review copy more than a year ago -- all the issues we are raising and more:

Below are the Suquamish Tribe comments on the Stakeholder Draft of the Harbor Island East Waterway Proposed Plan (Early review with the Tribal Governments and Trustee Agencies).

General - The Tribe needs clarification on whether an interim ROD is being proposed. Upward adjustment of cleanup levels does not seem justified at this time. Once the selected remedy is implemented and long term monitoring shows a steady state has been achieved discussion of practicable limitations can be discussed.

General - Typically an Interim ROD is prepared when (1) quick action to protect human health and the environment from an imminent threat is necessary, or (2) when a temporary measure to stabilize the site and/or prevent contamination migration has been determined to be appropriate. Neither of these situations seems to apply to East Waterway. In addition it is our understanding that with Interim RODs compliance with ARARs may be waived until the final ROD which is unacceptable. Interim site wide RODs cannot be used to avoid difficult, more expensive or controversial aspects of a Superfund cleanup. Clarify if this is an interim or final ROD and if interim, what is the process and rationale that is being used to get to final.

Page 28 - The proposed use of anthropogenic background is not consistent with the RODs from the adjacent Lower Duwamish West Waterway or Lockheed clean-up sites. EPA has been in discussions with the EWG for the better part of a year discussing the potential use of anthropogenic background concentrations for East Waterway. The Tribe has not been involved in these discussion and involving the Tribe following issuance of the ROD seems to be an after the fact briefing vs. meaningful consultation.

General - Although EPA does have some flexibility to allow cleanup to anthropogenic background levels vs. natural background remedies under CERCLA must meet substantive requirements of applicable or relevant and appropriate federal or state environmental laws and regulations (ARARs). Before EPA commits to an interim ROD there must be some certainty that using anthropogenic background will meet these criteria. There is no detailed discussion of this in the text.

General - Regional and anthropogenic background are not necessarily the same thing yet are used interchangeably. Please use anthropogenic background, add a definitions section, define it and be consistent.

General - If an Interim ROD is being proposed a discussion needs to be included that specifically addresses how the interim ROD and potential use of anthropogenic background will have on ARARs. What impacts will there be? Will use of an anthropogenic background as final cleanup levels have an impact on time to complete remediation or meet RAOs? Will there be adverse impacts to the environment? This needs to be clearly stated.

General - EPA has stated that the change to anthropogenic background levels will not change the RALs. However it should be noted that RALs are protective of ecological receptors and not human health. How will the proposed remedy meet RAO1 if not using RBTCs or natural background? The necessity of risk-based cleanups levels defaulting to natural background rather than area or anthropogenic background is defined in 173-340-700 (6)(d).

General - Although there will be a reduction in risks to human health Institutional Controls and/or limitations on consumption will be required. Consumption of 1 meal/month does not meet the threshold for protection of seafood consumption for Tribal members. EPA cannot use ICs as a permanent measure to achieve clean up. EPA needs to ensure that any modification to background levels is based on best available science and protective of human health.

General - It appears that there are uncertainties and potential exaggeration regarding contaminant loading from the upstream Green Duwamish River. It is unclear how source control measures factor into this. If sources from the Green River are suspected of recontaminating the site then perhaps a closer, more comprehensive look at source control is needed.

Section 2.1 – replace *"The Suquamish Tribe and the Muckleshoot Indian Tribe have usual and accustomed food harvesting areas that include the EW OU"* with the following:
Treaty rights retained by the Suquamish and Muckleshoot Tribes include the immemorial custom and practice to hunt, fish, and gather within their usual and accustomed grounds and stations, which was the basis of the Tribe's source of food and culture. Treaty-reserved resources situated on and off reservation include, but are not limited to, fishery resources situated within each Tribes usual and accustomed (U and A) fishing area. The EW OU is within the Suquamish Tribe and Muckleshoot Indian Tribe U and A fishing areas.

Section 5.1 - Human Health risks do not include any discussion of risks to Suquamish Tribal members. Add text identifying and describing those risks.

Section 6.3 and Table 6 - Please provide a copy of the memo to the administrative record referenced regarding background tissue concentrations. There is no date or author mentioned. We have checked our records and do not appear to have a copy. Was this discussed with Tribes?

Section 8.3.2 – There is no discussion of subsurface contamination resuspension from under pier areas. The East Waterway will be deepened to accommodate mega vessels. How will this affect contamination left in place (construction impacts, maintenance dredging, vessel scour, etc.)? Will clean-up activities and channel deepening be coordinated?

General – Throughout the document there are references to other documents/reports/memos with no brief summary of that information. The Proposed Plan is a stand-alone document and should at least include a brief summary.

If you have any questions regarding the comments provided please contact Alison O'Sullivan at aosullivan@suquamish.nsn.us or Denice Taylor dtaylor@suquamish.nsn.us.

Sincerely,

Alison O'Sullivan
Senior Biologist, Suquamish Tribe

Denice Taylor
Environmental Scientist, Suquamish Tribe

Exhibit C

Click or tap here to enter text.

East Waterway Proposed Plan

Harbor Island Superfund Site, King County, Washington

AUGUST 2020

U.S. Environmental Protection Agency, Region 10

Proposed Plan for Public Comment

1 Introduction

The United States Environmental Protection Agency (EPA) is issuing this Proposed Plan as part of its public participation requirements under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The objective of this Proposed Plan is to present EPA's Preferred Alternative for remedial action for the East Waterway Operable Unit (EW OU), Operable Unit 10 of the Harbor Island Superfund Site ("Site") in the City of Seattle, King County, Washington (Figure 1). EPA's Preferred Alternative is intended to address unacceptable risks to human health and the environment associated with contaminated sediments and surface water.

Industrial discharges, marine-related industrial activities, storm drains, and combined sewer overflows have resulted in the contamination of sediments and surface waters of the East Waterway (EW). Hazardous substances are present in sediments at concentrations that pose unacceptable risks to humans through consumption of fish and shellfish, and through direct exposure when clamming or netfishing. Sediment contamination also poses an ecological risk to bottom-dwelling organisms and fish.

Public Comment Period:
August & September 2020:

EPA will accept comments on the Proposed Plan during the public comment period (May XX, 2021 to June XX, 2020). Comments may be submitted three ways:

1. By Mail:

Attn: East Waterway Comments
Ravi Sanga

USEPA Region 10
1200 Sixth Avenue, Suite 900
MS ECL-111
Seattle, WA 98101

2. By email: XXXXXX

3. During public meetings:

- EPA will hold a public meeting on XXXX at XXXX.
- EPA will present the Proposed Plan. There will be an opportunity to provide written or oral comments during this meeting.
- You can find links to the Proposed Plan and supporting documents in the Administrative Record on our website (XXXXX) and in the locations listed on page 8.

This Proposed Plan provides background information on the EW and the Superfund cleanup process, describes the cleanup alternatives that were evaluated, and presents EPA's Preferred Alternative for remedial action. The proposed action pertains to cleanup of the existing contamination in the EW OU and addresses all contaminated sediments that require remedial action. Source control actions are being conducted separately by public and private entities (see page 12) and are ongoing.

This Proposed Plan is based on the Supplemental Remedial Investigation (SRI; Windward and Anchor QEA, 2014) and Feasibility Study (FS; Anchor QEA and Windward, 2019) reports prepared by the Port of Seattle (Port) with assistance from the City of Seattle (City) and King County (County). These documents are in the Administrative Record and provide more information regarding all the alternatives and EPA's Preferred Alternative.

Together, the Port, City, and County make up the East Waterway Group (EWG) that has been performing the SRI/FS for the EW OU. EPA, as the lead agency, has been overseeing the performance of the work with support from the Washington State Department of Ecology (Ecology), Washington State Department of Natural Resources (DNR), Suquamish Tribe, and Muckleshoot Indian Tribe.

EPA is seeking comments on this Proposed Plan. Comments can be made on the Preferred Alternative, other alternatives considered, and on the supporting analyses and information which can be found in the Administrative Record. Information on how to provide comments to EPA is presented in the inset on page 1 and on page 8.

Inside this Proposed Plan:

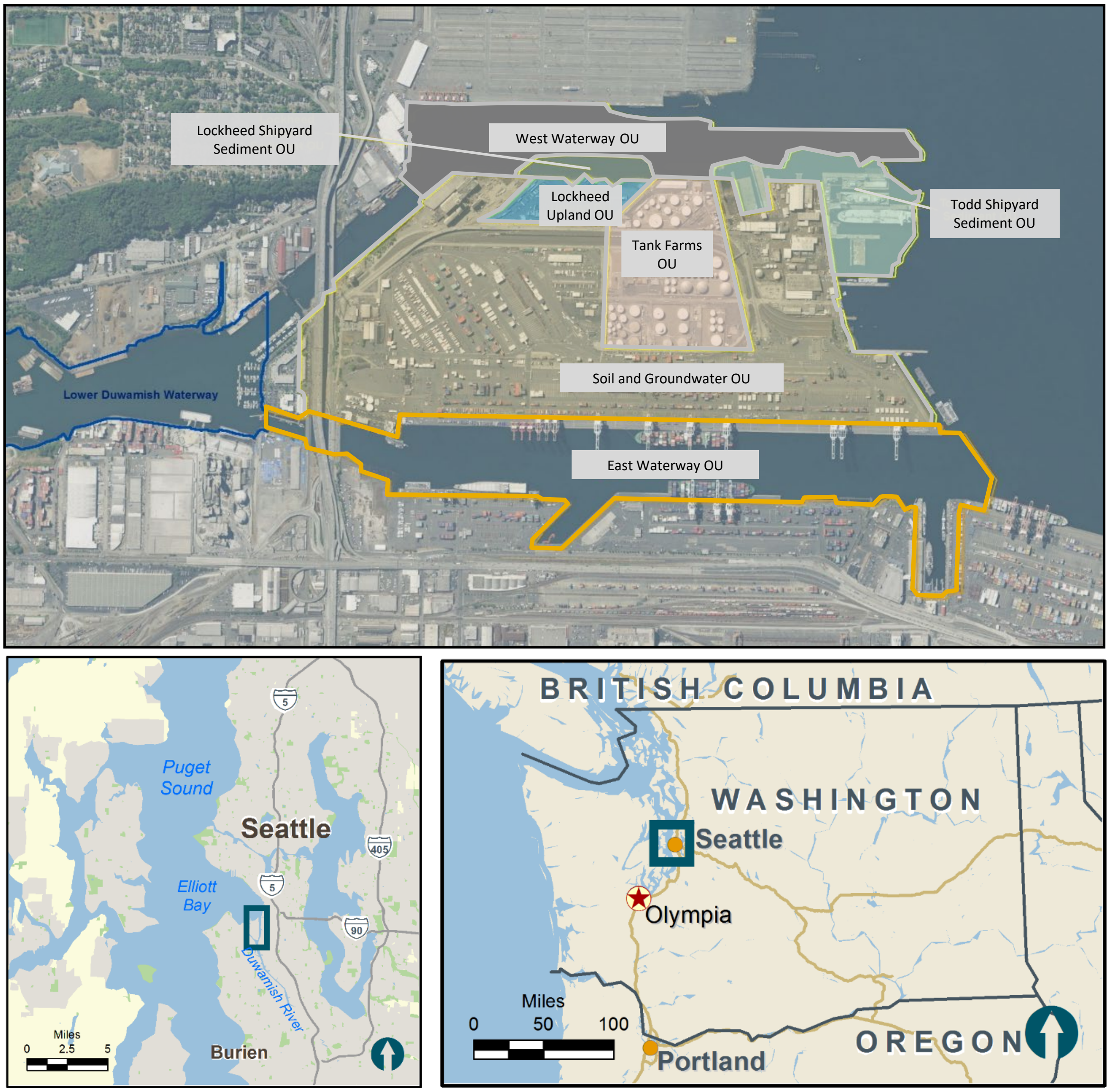

Figure 1. Location of the East Waterway Operable Unit

1.1 The Superfund Process

The Superfund process is established by CERCLA and the NCP to guide the cleanup of contaminated sites. The process includes various steps, illustrated in Figure 2, starting with the discovery of a site and continuing through investigation, remedy selection, and remedy implementation and site completion.

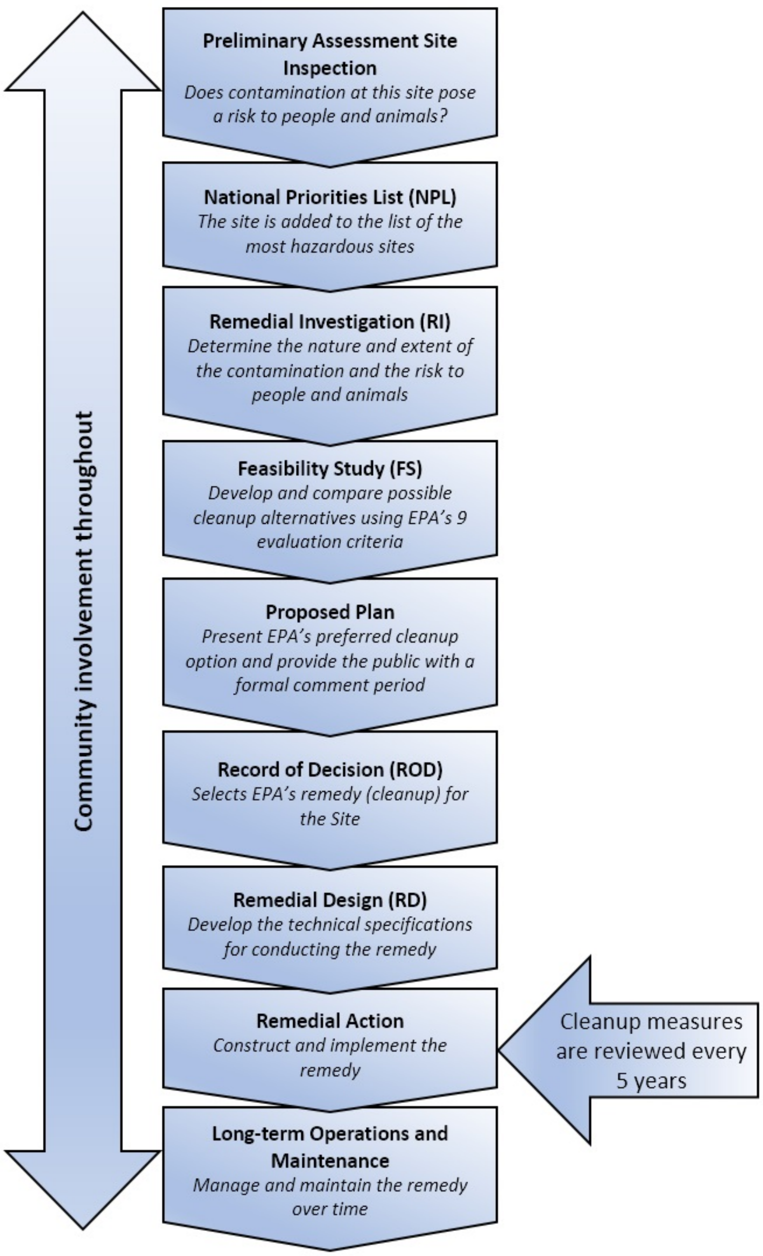

Figure 2. Steps in the Superfund Process

The NCP provides procedures, expectations, and program management principles to guide the CERCLA remedial process. In addition, EPA has developed technical guidance and policy on a range of issues to ensure that decisions are based on well-established science and cleanup actions are protective of human health and the environment.

The steps of the process that have been completed for the EW OU include the SRI/FS reports.

East Waterway Supplemental Remedial Investigation. The SRI report was completed in 2014. It describes the EW OU, presents a conceptual site model, characterizes the nature and extent of contamination, and provides findings on human health and ecological risks.

East Waterway Feasibility Study. The FS report was completed in 2019. It identifies and screens potential remedial options, identifies the most viable remedial alternatives, and evaluates the alternatives using the NCP criteria (see page 40).

This Proposed Plan initiates the next phase of the Superfund process, public participation. It presents information necessary to inform the public about the nature and extent of contamination, summarizes the potential health risks associated with contamination in the EW OU, describes the remedial alternatives under consideration, identifies EPA's Preferred Alternative for cleanup, and requests comments from the public. The key elements of the Preferred Alternative are shown on the next page; a complete description is presented in Section 9.

The Preferred Alternative:

The Preferred Alternative addresses the entire 157 acres of the EW OU and includes the following elements (see Section 7.2.1 for technology definitions):

- Approximately 121 acres of active cleanup of contaminated sediments, consisting of:
  - Dredging 99 acres in open water portions of the waterway (approximately 960,000 cubic yards would be dredged and disposed in an off-site landfill).
  - Capping 7 acres (may include pre-dredging to accommodate elevation needs).
  - In situ (on-site) treatment in 12 acres under docks and piers using activated carbon or other organic contaminant-sequestering agents.
  - Enhanced natural recovery in 3 acres under the West Seattle Bridge/Spokane Street Bridge corridor where there is limited access for barge-mounted dredges.
- Monitored natural recovery in 36 acres where there is no dredging or capping.
- Institutional controls (see Section 7.2.3) to prevent exposure and protect the integrity of the remedy.
- Short-term monitoring will be conducted during and after construction to measure the remedy's progress and until cleanup levels are achieved. Long-term monitoring will be conducted periodically after cleanup levels are achieved.
- Statutory 5-year reviews of the remedy will be conducted to assess whether the remedy remains protective.

EPA is seeking comment on the EPA's Preferred Alternative presented in this Proposed Plan. After considering public comments, EPA will issue its final decision on the selected remedial alternative in a decision document called a Record of Decision (ROD). The ROD will identify the selected remedy and provide the rationale for EPA's decision. The ROD will also include EPA's responses to comments received during the public comment period.

EPA may modify the Preferred Alternative or select another cleanup alternative for the EW OU after consideration of comments received on the Proposed Plan. Therefore, the public is encouraged to review and comment on any or all alternatives presented in this Proposed Plan. See Sections 7 and 8 for the alternatives and evaluations.

2 Site Background

The EW currently forms a portion of the Duwamish River estuary and is located at the river mouth where it joins with Elliott Bay. It was constructed by dredging and filling the former Duwamish River channel during the construction of Harbor Island.

Over the past 100 years, the EW has been substantially modified to support urban and industrial development. Historical activities along the EW have included marine terminals, shipyards, bulk fuel terminals, recycling and scrap metal yards, cement manufacturing, small boat marinas, and boat manufacturing and repair. Today, the EW remains an active industrial waterway and is used primarily as a container ship terminal. Land use, zoning, and land ownership along the EW are consistent with active industrial uses.

The intertidal areas of the EW are dominated by hardened shorelines with extensive overwater structures. Outfalls discharge into the EW, including 39 storm drains and 3 combined sewer overflows (CSOs). Localized and upstream sources from both upland and aquatic activities have polluted EW OU surface water and sediments. Data from the EW OU investigations demonstrate that surface sediment, subsurface sediment, fish and shellfish tissue, and surface water in the EW OU contain contaminants that pose a potential risk to human health and the environment.

Contaminants frequently detected in surface sediments include polychlorinated biphenyls (PCBs), carcinogenic polycyclic aromatic hydrocarbons (cPAHs), dioxins/furans, metals, and other organic compounds. See the inset for a description of the contaminants of concern (COCs).

WHAT ARE THE "CONTAMINANTS OF CONCERN"?

EPA has identified many hazardous substances, pollutants, and contaminants in the sediment, fish tissue, and water in the EW OU. Of the contaminants detected in the EW OU, the following represent the greatest risks to human health and the environment.

Polychlorinated biphenyls (PCBs) are man-made chemicals banned from further production in the U.S. in 1979. However, they persist in the environment and can accumulate in fish and shellfish. PCBs are known to affect the immune system and may cause cancer in people. PCBs can also affect learning abilities in children.

Arsenic is a naturally occurring element that is widely distributed in the Earth's crust. It is found in water, air, food, and soil. Arsenic compounds have been widely used as wood preservatives and as pesticides. These uses and other industrial activities can result in much higher concentrations of arsenic in sediment than would be present simply through natural processes. Exposure to arsenic can increase the risk of skin, bladder, and other cancers.

Mercury is a naturally occurring metal that can accumulate in the tissues of fish, wildlife, and humans from their diet. Mercury can be harmful in its most toxic form, methylmercury, primarily affecting people's nervous and reproductive systems, and is particularly harmful during early child development.

Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) are formed during the burning of substances such as coal, oil, gas, wood, and garbage, and during the charbroiling of meat. Exposure to cPAHs may increase a person's life-time risk of cancer.

Dioxins and furans are by-products of burning (either in natural or industrial settings), chemical manufacturing, and metal processing. Dioxins are persistent in the environment can accumulate in fish and fatty tissues of humans. Specific toxic effects related to dioxins include reproductive problems, problems in fetal/early childhood development, immune system damage and cancer.

Tributyltin (TBT) is a chemical that was used in paints to prevent and slow the growth of algae and other organisms that attach to the hulls of boats. It is toxic to aquatic life and is a hormone-disrupting chemical that interferes with reproduction in marine organisms, such as snails.

Additional COCs including metals and organic chemicals that are in sediments at concentrations that are considered to have the potential to affect marine organisms that live in the sediments of the EW.

The EW is one of seven operable units that were established at the Harbor Island Superfund Site. EPA manages cleanup on each OU through a separate action and the EW OU is the last to have a cleanup decision made. The EW OU is located immediately downstream of another Superfund Site, the Lower Duwamish Waterway (LDW).

Since initial discovery of contamination at the EW OU, a number of remedial investigations have been completed. Most recently, the EWG, under the oversight of EPA, completed an SRI and FS. A timeline of activities for the Harbor Island Superfund Site and those activities specific to the EW are presented in Table 1. In 1998, the Port, under EPA's oversight, sampled the EW OU as part of a sediment characterization for a navigational improvement dredging project along Terminals 18, 30, and 25. This characterization revealed areas of the EW OU that were most contaminated. EPA conducted additional sampling and analysis as part of a supplementary remedial investigation.

In 2004 and 2005, the Port conducted a non-time-critical removal action under EPA's oversight, removing 206,000 cubic yards (cy) of contaminated sediment from the deep main body of the EW OU and an area bounded on the west by Terminal 18 and on the east by Terminals 25 and 30, with disposal in an off-site landfill. An additional 67,330 cy of dredged sediment were deemed suitable for open water disposal. A 9-inch-thick layer of clean sand was placed over the dredged surface to provide protection for bottom-dwelling organisms. While there has been some recontamination in this area, concentrations remain less than those prior to the removal action.

Table 1. East Waterway Operable Unit History

Action at East Waterway Operable Unit	Date
Harbor Island Superfund Site listed on National Priorities List.	1983
Initial remedial investigation of marine sediments around Harbor Island.	1994
Remedial investigation to further characterize the sediment contamination in the Harbor Island Superfund Site.	1995-1996
East Waterway OU designated	1996
Dredge characterization study for EW Terminals 18, 25, and 30 completed.	1998
Sediment sampling shows sediment contamination remaining after maintenance dredging.	2000 - 2002
Phase 1 removal of 273,330 cubic yards of contaminated sediments.	2004 - 2005
Settlement Agreement for Final SRI/FS.	2006
Sediment and tissue sampling for SRI/FS completed.	2009
SRI completed.	2014
FS completed.	2019

2.1 Tribal and Community Involvement

In addition to the marine-related industries, Tribal fishers and recreational users also frequent the EW OU. There are no residential neighborhoods in the immediate vicinity of the EW.

Treaty rights retained by the Suquamish Tribe and the Muckleshoot Indian Tribe include the immemorial custom and practice to hunt, fish, and gather within their usual and accustomed grounds and stations, which was the basis of the Tribe's source of food and culture. Treaty-reserved resources situated on and off reservation include, but are not limited to, fishery resources situated within each Tribe's usual and accustomed (U and A) fishing area. The EW OU is within the Suquamish Tribe and Muckleshoot Indian Tribe U and A fishing areas. Throughout the history of the EW OU, these Tribes, as sovereign nations, have engaged in coordination with EPA on the cleanup process. The Tribes have also actively participated in meetings determining the course of the cleanup. Coordination with the Tribes will continue throughout the planning, construction, and monitoring process for the remedial action.

Recreational uses of the waterway, such as swimming and kayaking, are possible but are limited due to restricted public access and a high concentration of commercial shipping activity. Recreational fishing is known to occur in the EW despite a prominent education campaign informing the public about the Washington State Department of Health (WSDOH) fish consumption advisory warning individuals not to consume contaminated resident fish and shellfish (Figure 3). Because salmon are not known to live in the EW year-round, fish consumption advisories for salmon are not based on EW contamination.

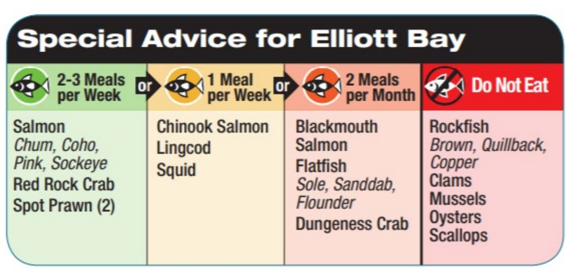

Figure 3. Fish Consumption Advisory for Elliott Bay

EPA, along with Washington State and the potentially responsible parties have conducted public involvement activities throughout the EW OU history. Fact sheets, emails, informational signs, public meetings, and a website that provides the history and current cleanup activities at the Harbor Island Superfund Site have been implemented to communicate with the community, local businesses, and other stakeholders. The Community Involvement Plan for the EW was updated in 2016.

EPA will accept written comments on this Proposed Plan beginning May 5, 2021 and ending on June 6, 2021. EPA will make its final decision on the cleanup only after considering public comments. EPA will respond to the comments in a responsiveness summary in the ROD. EPA will place all written comments in the Administrative Record for the EW OU.

The Administrative Record for the EW OU contains the documents that have been used to make decisions on cleanup of the EW OU. The documents in the Administrative Record can be viewed in person at the locations listed below or viewed or downloaded from the project webpage for the Site.

EPA Region 10 Superfund Records Center
1200 Sixth Avenue, Suite 900, MS ECL-076
Seattle, WA 98101
206-553-4494

West Seattle Branch Library
2306 42nd Avenue Southwest
Seattle, WA 98116
206-684-7444

3 Site Characteristics

The EW OU encompasses the entire East Waterway and includes both subtidal and intertidal portions of the waterway.

3.1 Physical Characteristics

The EW OU extends 8,250 feet (about 1.5 miles) from Elliott Bay to the southernmost point of Harbor Island, encompassing 157 acres. There is a federally authorized navigation channel extending from the northern tip of Harbor Island to the Spokane Street Bridge. The northern portion of the EW OU is dredged to depths currently needed for deep-draft container ship navigation, while the southern portion of the EW OU near the bridges is maintained to accommodate smaller vessels. Four bridges cross over the EW along the Spokane Street corridor, including the West Seattle Bridge and the lower Spokane Street Bridge. The shorelines are dominated by riprap and bulkhead structures, with nearly 60 percent of the shoreline covered by structures such as piers and docks.

Current depth measurements (Figure 4 and Figure 5) within the navigation channel shows depths of -51 feet mean lower low water (MLLW), with the exception of the Nearshore Area “Mound Area” near Slip 27. The MLLW is the average height of the lowest daily recorded tide over a 19-year recording period. The navigation channel is currently authorized to be 51 feet deep (-51 feet MLLW) in the northern portion (the “Deep Main Body Reach” in Figure 4 and Figure 5) and -34 feet MLLW in the southern portion (the “Shallow Main Body Reach” in Figure 4). At the southern end of the EW OU, bottom depths rise to between -13 and -6 feet MLLW in the Sill Reach and then drop to -25 feet MLLW through the Junction Reach. Under the piers and docks, elevations are between -37 and -50 feet MLLW. Sediments comprising the Sill Reach have never been dredged following original construction.

The EW OU is primarily salt water (marine) but receives freshwater flows from the Green/Duwamish River watershed. Salinity is controlled by tidal exchange from Elliott Bay, with a wedge of saltwater flowing southward underneath a layer of fresh water flowing northward from the Green/Duwamish River. The bottom substrates of the EW OU are typically mud, sand, gravel, cobble, or riprap.

Shallow groundwater (approximately 8 to 14 feet below ground surface) in the adjacent Nearshore Areas primarily flows toward the EW OU. The installation of sheet pile walls along much of the EW OU bulkheads has reduced but not eliminated the mixing of surface water and groundwater. The aquifer extends deeper than the walls, so the overall groundwater flow continues to be towards the EW. Contribution from groundwater and seeps is minimal.

For the purpose of cleanup, the EW OU has been divided into specific construction management areas that represent portions of the waterway with similar structural conditions, aquatic use, habitat, or water depth conditions. These areas were then grouped into six "technology areas" based on similarity of physical features and potential remedial actions (Figure 6). The FS evaluated remedial technologies for each of the six areas, identifying the technologies that are most suited for the specific area conditions. The open water portion of the waterway is divided into four technology areas: Deep Main Body and Berth Areas, Shallow Main Body, Nearshore Areas, and the Sill Reach – West Seattle Bridge. The limited access portions of the waterway are divided into two technology areas: the Under-pier Areas and the Sill Reach – Low Bridges. The six technology areas are identified on Figure 6 and are defined as follows:

- The Deep Main Body and Berth Areas consist of the northern-end Deep Main Body Reach, the eastern- and western-edge berth areas, and the southern-end Junction Reach. This technology area includes the deeper portions of the EW OU that are maintained to accommodate deep-draft vessels and are therefore subject to periodic erosion due to those vessels. This technology area also includes shallower portions of the waterway that are used as berth areas. Remedial action in these areas must maintain the depths required for marine traffic. The Communication Cable Crossing, which traverses the EW, is a portion of the Deep Main Body Reach where any deepening or remedial action is limited to protect buried cables.
- The Shallow Main Body Reach includes the area at the southern extent of the Federal navigation channel, where the maintained navigation elevation becomes shallower. The Former Pier 24 Piling Field, which is characterized by numerous old creosote-treated pilings in poor condition, is included in the Shallow Main Body reach.
- The Nearshore Areas consist of nearshore sediments and accessible sloped banks in Slip 27 and adjacent to Slip 36 operated by the U.S. Coast Guard. The higher-elevation Mound Area near Slip 27 is an area of contamination within a hardened substrate that is included in the Nearshore Areas.
- The Under-pier Areas are those areas located under aprons, docks, and overwater structures (generalized here by the term piers) along the east and west shorelines. There are challenges for addressing contaminated sediment residing underneath and adjacent to these structures due to sediment and structure stability, as well as restricted access due to support pilings.
- The Sill Reach is characterized by a naturally occurring shallow area, or "sill", at the southern end of the EW OU, with hardened river bottom. The Sill Reach is divided into two technology areas, as follows:

  The Sill Reach – West Seattle Bridge is that area of the Sill Reach underneath the high-decked West Seattle Bridge.

  Sill Reach – Low Bridges is the Sill Reach area underneath the low-decked Spokane Street and Railroad Bridges. Marine traffic is limited to very small watercraft.

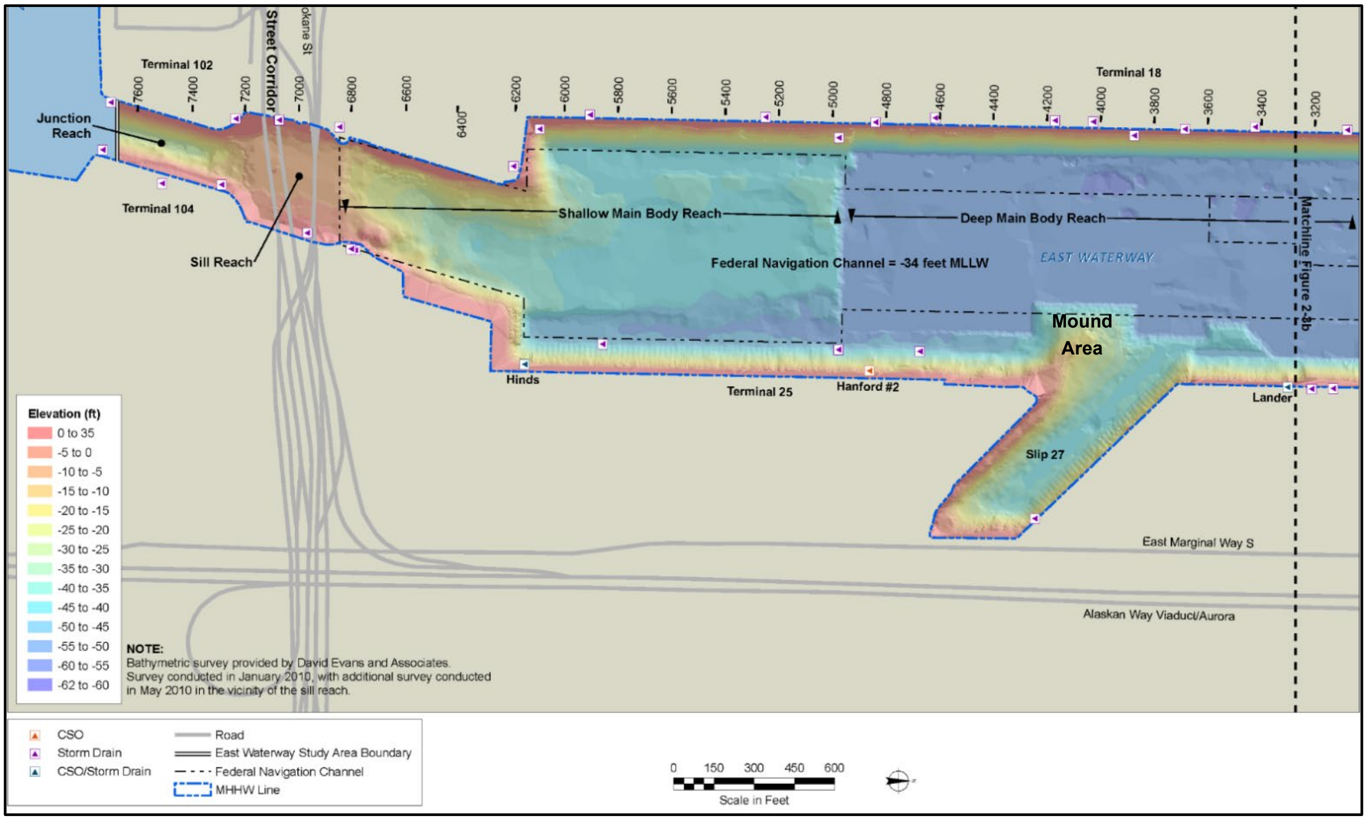

Figure 4. Existing Bathymetry - Southern Portion of East Waterway Operable Unit

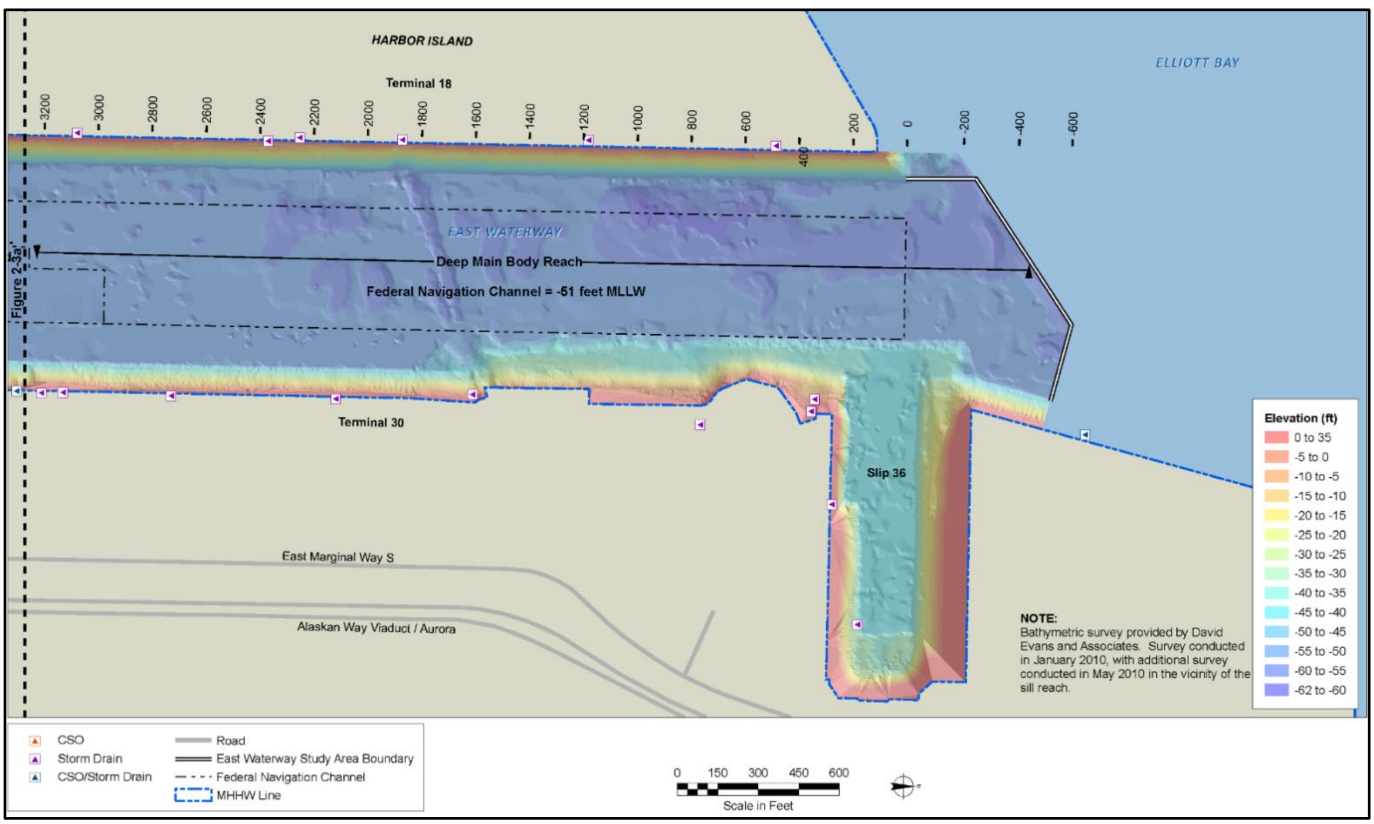

Figure 5. Existing Bathymetry - Northern Portion of East Waterway Operable Unit

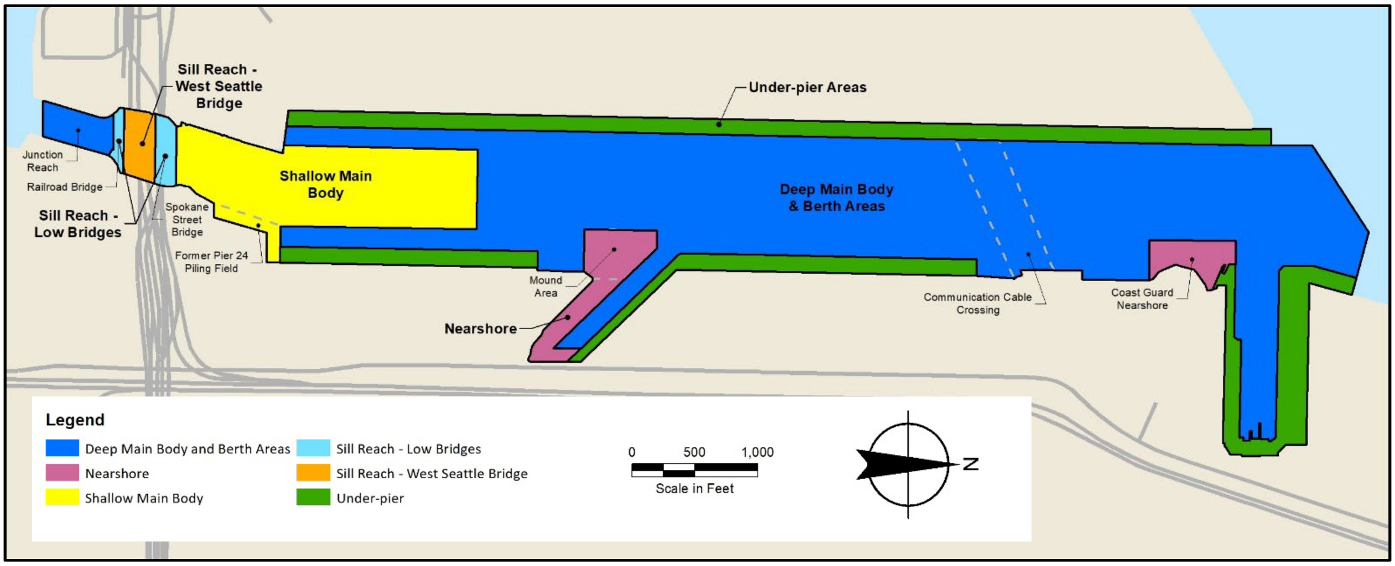

Figure 6. Technology Areas

Note that open water areas include the Deep Main Body, Shallow Main Body, Nearshore Areas, and the Sill Reach – West Seattle Bridge. The limited access areas include the Under-pier Areas and the Sill Reach – Low Bridges.

3.2 Conceptual Site Model

A conceptual site model was developed for the EW OU to show the relationships between the sources of contamination, the affected media, and the people and wildlife that are potentially exposed to contaminants. This conceptual site model serves as a basis for assessing the risks from contaminants and for developing cleanup strategies. The following sections summarize the different elements of the conceptual site model.

3.2.1 Sources of Contamination

The primary sources of contamination to the EW OU are associated with historical activities, including direct discharges from sanitary, storm, and industrial waste streams and past commercial and industrial uses of the waterway. Ongoing sources are considered to be minor and include contaminated upland sites, spills and leaks, bank erosion, deterioration of treated-wood structures, and urban pollution that enters the EW OU directly through stormwater runoff and CSOs, and indirectly from the upstream Green River watershed. The contribution from groundwater and seeps is minimal.

The EWG has conducted studies to identify and control potential sources of contamination. A source control team was created by the EWG to help ensure coordination of activities between members and inform EPA of the team's progress. EPA is working with the EWG to develop source control plans that address chemical sources directly discharging to the EW OU.

The County and City have reduced the frequency and volumes of discharges to EW OU by conducting source tracing and cleanup programs in upland facilities and properties. These include cleaning and maintaining storm drains, tracking actionable sources of pollution to the storm system and CSOs discharging into the EW, as well as reducing the number of discharge points. The control of upstream sources in the Green/Duwamish River watershed is being conducted in conjunction with State and Federal programs. Upstream source control efforts, as described on page 12, are expected to reduce future contaminant concentrations. Prior to implementing this proposed action, EPA will ensure that major sources are sufficiently managed to minimize the risk of recontamination.

SOURCES OF CONTAMINATION

Most of the direct sources of contamination to the EW are historical sources and are no longer present. Current sources are primarily those that migrate from to the site through surface water and sediment transport. These offsite sources include two types of discharge: lateral loads from adjacent activities and upstream sources from the Green/Duwamish River watershed.

The Green/Duwamish River watershed includes the more heavily industrialized and residential areas of the Duwamish River (including the LDW) and Lower Green River, as well as the more rural, light industrial, and residential areas of the Middle Green River watersheds.

Contaminants originating from developed land across the watershed are associated with diffuse sources that are more difficult to identify [such as mobile transportation sources of polycyclic aromatic hydrocarbons (PAHs) and metals] and require a long-term management strategy. The Clean Water Act's National Pollutant Discharge Elimination System permit program for stormwater, coupled with State of Washington chemical-specific actions such as product bans, are key aspects of this long-term management strategy. EPA and Ecology are identifying actionable sources in the Green River and are working with municipalities, businesses, and landowners to control known sources. Activities include contaminated site cleanup, removal of underground storage tanks, and stormwater management actions. Ecology and EPA are also developing a Pollutant Loading Assessment for the watershed to support future source control actions. These studies, while not developed specifically for the EW OU, are anticipated to reduce contaminants entering the EW.

3.2.2 Sediment Transport

Sediment enters the EW OU from the Green/Duwamish River watershed and the Lower Duwamish Waterway (LDW) Superfund Site (upstream sources) (Figure 7). Lateral sources discharge into the EW OU and can include solids that become sediments in the EW OU. An estimated 32,000 to 54,000 metric tons of sediment enters the EW OU each year. Of that, 40 to 75 percent is estimated to settle or accumulate in the EW OU. Of the total sediment load entering the EW OU, an estimated 99 percent originates from the Green/Duwamish River watershed above the LDW; less than 1 percent originates from the upstream LDW Superfund Site, including the LDW bed and LDW storm drains and CSOs; less than 0.3 percent originates from storm drains and CSOs within the EW OU; and a negligible amount originates from Elliott Bay. The contaminant concentrations in sediment from each source differ, with lower concentrations from the Green/Duwamish River watershed and higher concentrations from the adjacent LDW Superfund Site and in CSO and stormwater discharges.

The EW OU is generally net depositional (overall more sediment settles out onto the bottom than resuspends off the bottom). Sediment is predicted to accumulate at a rate of approximately 0.5 to 1.5 centimeters (cm) per year. However, the amount of deposition varies greatly throughout the EW OU. Limited or no deposition is predicted to occur in portions of the Shallow Main Body Reach and along the west side of the Deep Main Body Reach. While portions of the Deep Main Body Reach nearest to Elliott Bay are considered net depositional, this area is also influenced by localized mixing or erosion events due to propwash from vessel operations. The Sill and Junction Reaches are not net depositional.

Deposition of sediment from upstream and lateral sources is expected under piers. Sediment in these areas is also likely to be subject to periodic erosion and resuspension due to propwash and vessel thrusters, which can cause relocating and redistributing of contaminated sediments. In some portions of the EW OU, propwash may affect sediment as deep as 5 feet below the sediment surface.

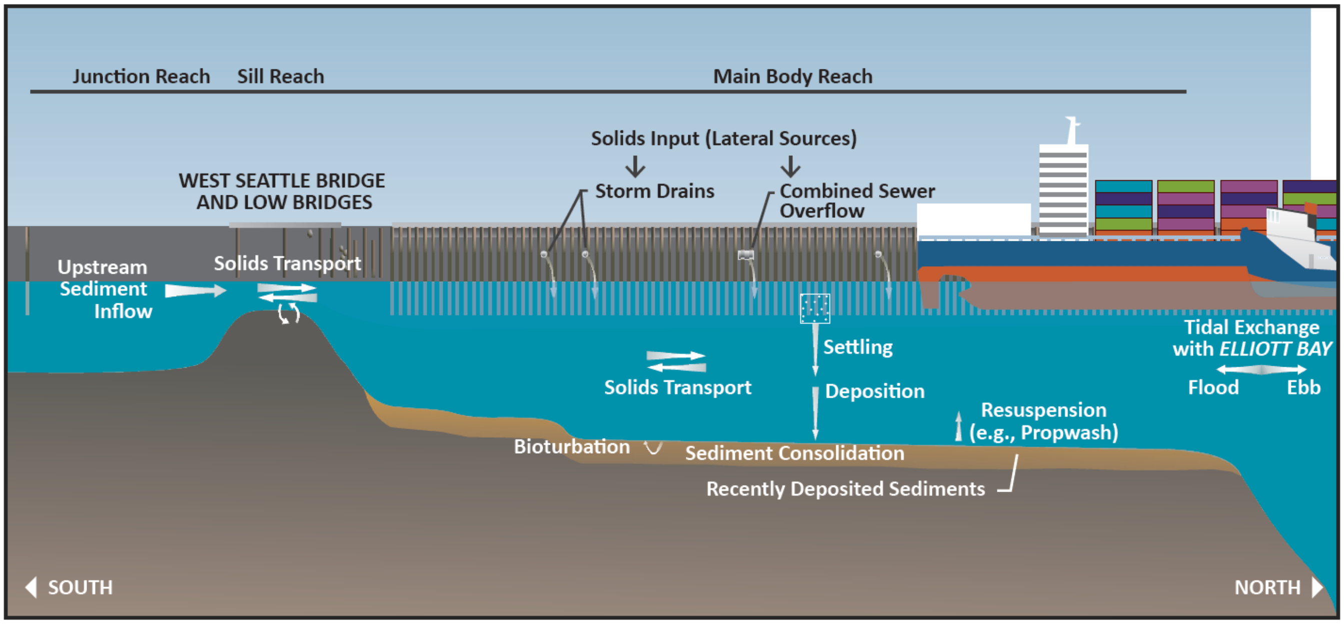

Figure 7. Conceptual Site Model of Sediment Transport

3.2.3 Distribution of Contamination

Historical and ongoing sources of contamination have impacted EW sediment, porewater (the water in sediment), surface water, and the tissue of the animals that live in the EW.

Most contamination in the EW OU is associated with the surface sediments (approximately 10 cm in depth), which are the sediments most occupied by benthic communities. PCBs, cPAHs, and metals (such as arsenic) are frequently detected in locations throughout the EW OU (Figure 8). Tributyltin (TBT) and dioxins/furans are also found in surface sediment samples but are more limited in distribution. In general, the areas with higher surface sediment contaminant concentrations are in the portions of the EW OU that have not been recently dredged.

The contaminants that are most frequently observed at elevated concentrations in subsurface sediment (deeper than 10 cm) are PCBs and mercury. In areas recently dredged, concentrations of these contaminants in subsurface sediment are generally lower than those observed in surface sediments. However, in portions of the Shallow Main Body Reach and Deep Main Body Reach that have not been recently dredged, the depth of contamination is 5 to 15 feet, and contaminant concentrations are generally greater than the surface sediment concentrations.

Contaminant concentrations have been measured in fish (English sole, shiner surfperch, brown rockfish, juvenile Chinook salmon) and invertebrates (red rock and Dungeness crabs, clams, mussels, geoduck, shrimp, and marine worms) from the EW. Average total PCB and dioxin/furan concentrations are highest in fish and lowest in shellfish. Average cPAH concentrations are highest in clams, mussels, and bottom-dwelling invertebrates. Inorganic arsenic concentrations are highest in intertidal clams and other shellfish (geoduck and mussels). TBT concentrations are highest in brown rockfish and bottom-dwelling invertebrates. Table 2 presents the concentrations of COCs that were observed in fish and invertebrates during the SRI.

PCBs, arsenic in the dissolved phase, and TBT are also present in EW surface water. TBT and volatile organic compounds, such as naphthalene, benzene, and *cis*-1,2-dichloroethene have been detected in porewater.

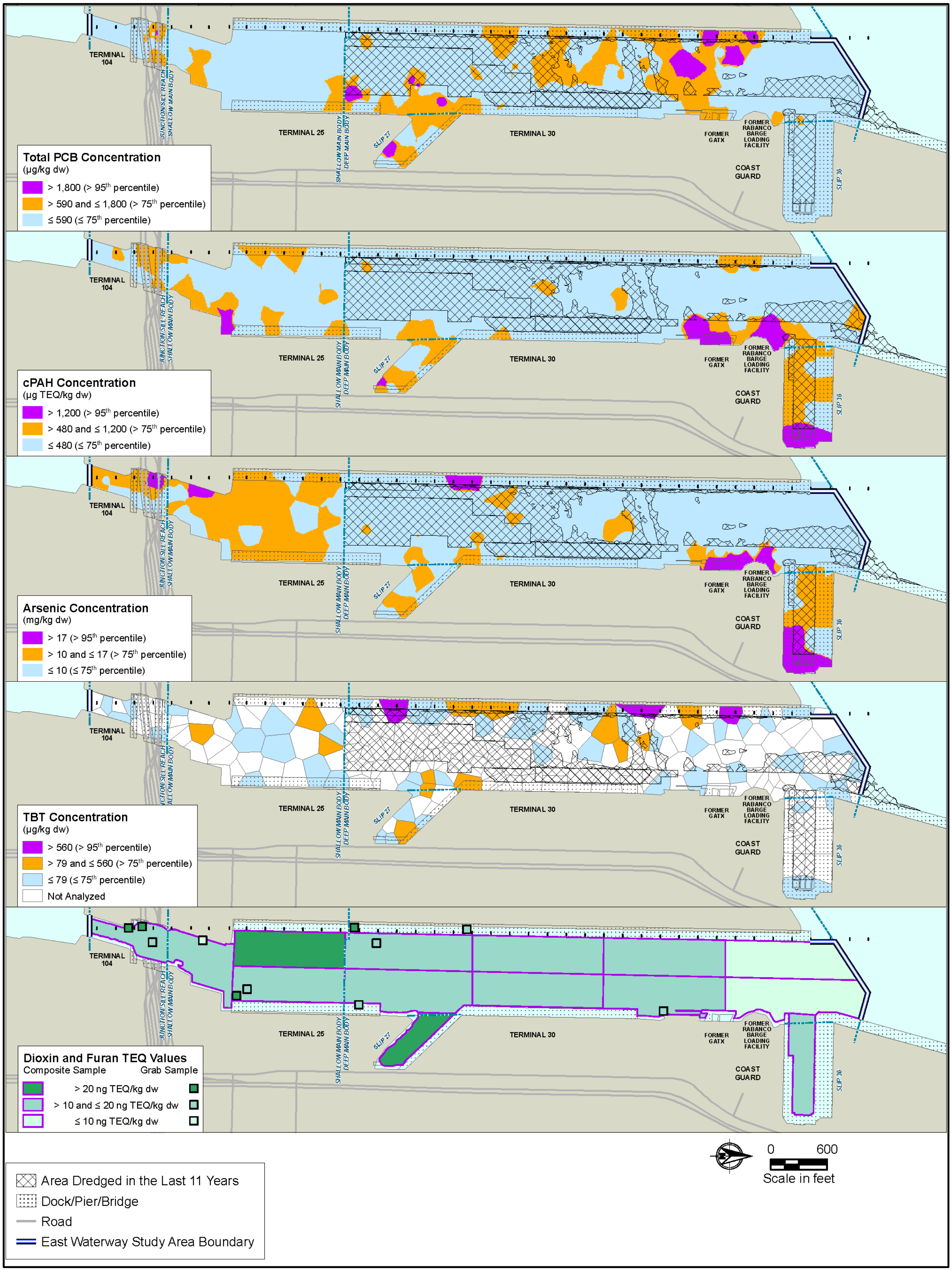

Figure 8. Contaminant Distribution in Surface Sediment

DIFFERENT WAYS TO REPORT CHEMICAL CONCENTRATIONS

Wet weight (ww) is the concentration of a chemical in tissue as measured in a wet (not dried) sample with the moisture included in the weight.

Dry weight (dw) is the concentration of a chemical in sediment based only upon the weight of the sediment particles (i.e., dried sediment without water). This is useful when comparing sediment samples that contain different ratios of sediment particles and water.

Organic carbon (OC) is a form of carbon associated with organic matter (such as leaf litter) that is found in sediment. Organic carbon binds certain chemicals influencing bioavailability (the amount of a chemical absorbed into an animal's body) and the potential toxicity. To compare sediment samples that have different amounts of organic carbon, sediment concentrations are normalized to the amount of organic carbon present (labeled as mg/kg OC).

Toxic equivalencies (TEQ) are used to express the concentration dioxins/furans and certain PCBs based on the relative toxicity of 2,3,7,8-TCDD. The concentration of each chemical is scaled to the concentration of the reference by multiplying the concentration by the toxic equivalent of each compound. These equivalent concentrations are then summed to give the total TEQ value.

Table 2. Average Contaminant Concentrations in Fish and Invertebrates

	Average Concentrations [a]				
	Total PCBs	**Dioxins/ Furans**	**cPAHs**	**Arsenic**	**TBT**
	µg/kg ww	ng TEQ/kg ww	µg BaP-eq/kg ww	mg/kg ww	µg/kg ww
Fish					
Rockfish	2,000	26.9	12	0.008	420
Sole	540 to 3,200	13.6 to 36.8	0.29 to 11	0.032	14 to 38
Perch	155 to 1,500	14.3	1.2	0.021	31 to 67
Invertebrates					
Crab	130 to 590	2.1 to 12.2	0.6 to 1.3	0.03 to 0.06	13 to 23
Mussel	26	NA	20	0.078	92.8
Clam	19 to 66	0.36 to 0.88	1.6 to 16	0.03 to 0.17	9.8 to 140
Bottom-dwelling (Benthic) Invertebrates	210	NA	170	NA	390

Notes:

NA: not available
ww: wet weight
TEQ: Toxic equivalent
mg/kg: milligram per kilogram
µg/kg: microgram per kilogram
ng/kg: nanogram per kilogram

a. These values originate from data that was presented as average concentrations for various species or collection efforts during the SRI. Where data was available for multiple species or more than one collection effort, the range of average concentrations is presented.

3.2.4 Anthropogenic Background

EPA defines anthropogenic background (AB) as "natural and human-made substances present in the environment as a result of human activities (not specifically related to the CERCLA site in question)" (EPA, 2002a, 2002b). Anthropogenic background concentrations in sediments entering the EW OU were calculated for total PCBs, dioxins/furans, and arsenic to support the development of preliminary remediation goals (PRGs; Section 6).

Approximately 99 percent of the suspended sediment load in the EW OU comes from the Green River. For this reason, suspended sediment data from River Mile 10.4 of the lower Green River (at the Foster Links Golf Course) was used calculate AB values, as this location is upstream of the Lower Duwamish Waterway and Harbor Island Superfund Sites. AB values were calculated for total PCBs, the four dioxin/furan congeners that were most closely associated with human health risk, and arsenic (Anchor QEA 2021; Table 3).

Table 3. Anthropogenic Background Concentrations

Chemical of Concern	Concentration	Units
Total PCBs	31	µg/kg
Arsenic	20	mg/kg
2,3,7,8-TCDD	0.71	ng/kg
2,3,7,8-TCDF	1.2	ng/kg
1,2,3,7,8 PeCDD	2.1	ng/kg
2,3,4,7,8-PeCDF	1.1	ng/kg
Dioxin/Furan TEQ*	9.6	ng/kg

*Presented only to allow comparison to risk-based threshold concentrations (RBTCs) and remedial action levels.

3.3 Current and Future Land Uses

The EW OU and adjacent upland areas have served as Seattle's major marine terminal and shipyards since the LDW and Harbor Island were created. Commercial vessels routinely utilize the EW north of the Spokane Street corridor. Most vessel traffic consists of container vessels and assorted tugboats moving into and out of the EW. The main waterway is utilized by the Port, the USCG, and to a lesser extent, the U.S. Navy. South of the Sill Reach, recreational and commercial boats may access Harbor Island Marina from the LDW. The low bridges in the Spokane Street corridor physically prohibit passage from the LDW to the EW except at low tide by small, shallow-draft boats such as kayaks and skiffs.

Future use of the EW OU includes shipping via larger vessels, and the U.S. Army Corps of Engineers (USACE), through the Seattle Harbor Navigation Improvement Project (SHNIP) (USACE, 2017b), is proposing to deepen the Deep Main Body Reach from the existing depth of -51 feet MLLW to -57 feet MLLW. This is expected to be implemented following cleanup of the EW OU and will not affect the cleanup.

The EW is also used for recreational activities, including boating, kayaking, and fishing, although these activities are minimal due to limited public access and the amount of commercial shipping activity. Jack Perry Memorial Park and a public fishing pier are located along the north side of the Spokane Street Bridge. The EW OU is part of the U and A fishing area for both the Muckleshoot Indian Tribe and the Suquamish Tribe. The Tribes conduct a commercial fishery for salmon, as well as ceremonial and subsistence shellfish harvest (typically occurring in intertidal areas of the Shallow Main Body and Junction Reach). Tribal fishers may also engage in geoduck harvesting in subtidal areas. Both Tribes have had fisheries and harvest opportunities limited by sediment contamination in the EW OU. The landowners and community surrounding the EW OU include marine-related industries, marine-dependent businesses that lease property from the Port, Tribal fishers, and recreational users. There are no residential neighborhoods in the immediate vicinity. The Port is the primary landowner of the upland areas adjacent to the EW OU. Other landowners include the City, County, USCG, DNR, and Duwamish Properties LLC. DNR owns most of the aquatic bottom lands in the EW OU. The BNSF Railroad also owns nearby property, with right-of-way ownership immediately south of the lower Spokane Street Bridge.

3.4 How People and Wildlife May Be Exposed

The ways in which people and wildlife may be exposed are summarized in Figure 9. In addition to the commercial activities described in Section 3.3, people may be exposed to EW-related contaminants during recreational activities, including boating, kayaking, and fishing.

The Washington State Department of Health has issued advisories against consuming any resident fish or shellfish harvested from Elliott Bay. Tribal members' potential exposure to contaminants in the EW is primarily through consumption of resident fish and shellfish, and this has been a primary factor shaping the human health risk assessment and in developing risk-based cleanup goals.

Ecological communities in the EW include animals dwelling in and on the sediment and in the water column, as well as birds and marine mammals at the water's surface. Numerous small benthic (bottom-dwelling) species typical of Puget Sound inhabit the subtidal substrates of the EW, including worms, crustaceans, and mollusks (for example, clams). Larger, more motile invertebrates (crabs) and bottom fish (such as sole and rockfish) live in close association with bottom substrates. The EW also has a diverse population of pelagic fish that live in the water column, including resident species (for example, shiner surfperch) and migratory species, such as salmon. Because the EW connects Puget Sound to the Green/Duwamish River watershed, it is an important migratory pathway for both juvenile and adult salmon. Juvenile salmon primarily feed in suitable nearshore habitats. Aquatic and semi-aquatic wildlife that use the EW include river otter, raccoons, and a variety of marine birds and ducks.

Sixteen aquatic and aquatic-dependent species reported in the vicinity of Elliott Bay area are listed under either the Endangered Species Act or by the Washington Department of Fish and Wildlife as candidate species, threatened species, endangered species, or species of concern. Of these species, Chinook salmon, Coho salmon, steelhead salmon, brown rockfish, bald eagle, western grebe, and Pacific herring are commonly observed in the EW.

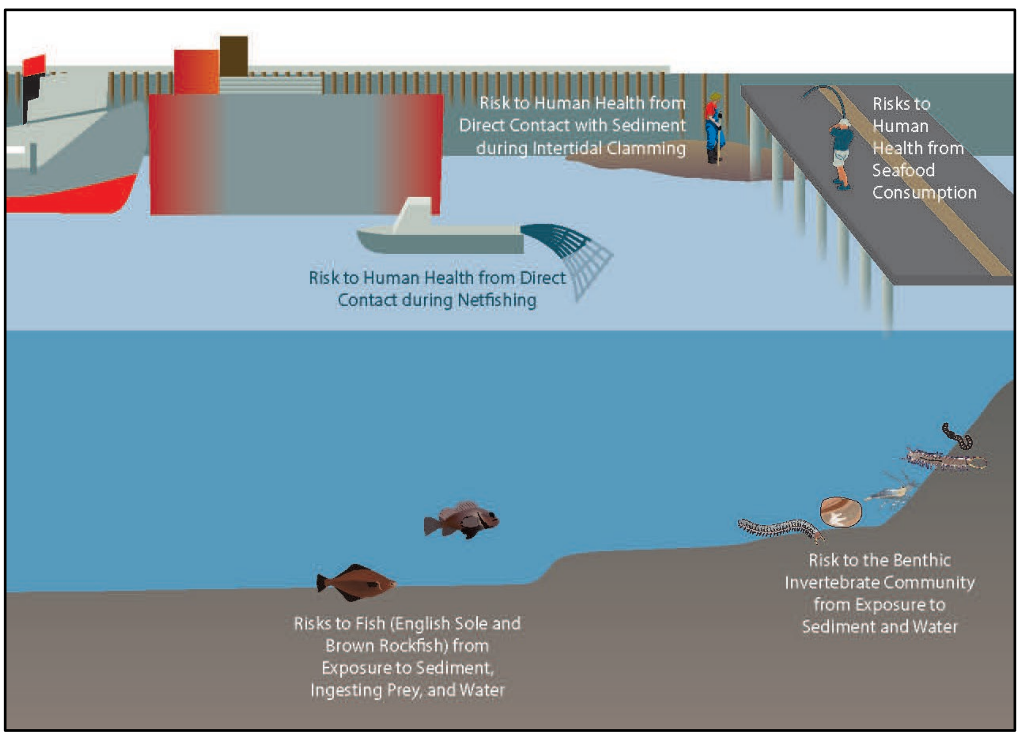

Figure 9. Conceptual Site Model for Human Health and Ecological Exposure Pathways

Note: This conceptual site model shows exposure pathways where the risk assessment estimated risks greater than EPA's acceptable risk range. Risks associated with other exposure pathways, such as swimming, were below EPA's acceptable risk range and are not shown.

4 Scope of the Remedial Strategy for the EW Operable Unit

The EW OU is one of seven operable units of the Harbor Island Superfund Site (see Figure 1). EPA initially divided the Site into 10 OUs; however, three were never carried forward through the CERCLA process. EPA has been working since 1983 to address the risks posed by the Harbor Island Site by addressing the risks associated within each OU. Final remedies have been selected and for the most part have implemented at six OUs. The EW OU is the last operable unit in the Harbor Island Superfund Site to be addressed. The following are brief summaries of the remedies at the other operable units shown on Figure 1:

OU-01 (Soil and Groundwater OU): The remedy was selected in 1993 and modified in 1994, 1996, and 2001. The selected active remedy (soil excavation, soil capping, and removal of liquid contaminants) was completed in 2012. Institutional controls, a component of the remedy, have been mostly implemented by EPA and the property owners, however, some controls remain to be addressed.

OU-02 (Tank Farms OU): This OU is managed by Ecology under the Washington State Model Toxics Control Act (MTCA) because it was a release of petroleum. Ecology issued Cleanup Action Plans for the three OU-02 facilities in 1999 and 2000. The selected remedies (soil excavation, in situ remediation via air sparging and soil vapor extraction, and institutional controls) are ongoing. Monitoring has indicated the remedy is performing as designed.

OU-03 Lockheed Upland OU: The remedy was selected in 1994. The selected active remedy (soil excavation, soil capping) was completed in 1995. The remedy also included institutional controls, and while most of these controls have been implemented by EPA and the property owners, controls in one area remain to be addressed.

OU-07 Lockheed Shipyard Sediments OU: The remedy was selected in 1996 and modified in 2002 and 2003. The selected remedy (removal of in- and over-water structures, sediment dredging, and sediment capping) was completed in 2005.

OU-08 West Waterway Sediments OU: The ROD was signed in 2003, indicating no further CERCLA action was necessary at this OU.

OU-09 Todd Shipyards Sediments OU: A ROD was signed in 1996 and modified in 1999 and 2003. The selected remedy (removal of over-water structures, sediment dredging, and sediment capping) was completed in 2007. Additional under-pier cleanup is expected in 2021, to be followed by habitat placement.

With the exception of OU-08, monitoring is ongoing for each of the remaining OUs.

The overall strategy for addressing contamination and the associated risks in the EW OU includes controlling sources of contamination to the EW OU and addressing the contaminated media that pose unacceptable risk (see Section 5). Source control for lateral inputs and for sources throughout the watershed is being conducted by EPA and members of the EWG under State and local jurisdictions. Contaminated sediment, biota, and surface water is being addressed through a CERCLA final action, proposed in this Plan. The primary objective of this proposed action is to reduce human and ecological exposure to contaminated sediment and to reduce contaminant concentrations in other media to levels that are protective of human health and the environment.

EPA is proposing a remedy in this Proposed Plan that includes a combination of technologies: dredging/excavation, capping, in situ treatment, enhanced natural recovery, monitored natural recovery, and institutional controls to address the entire site. EPA anticipates that actively addressing contaminated sediment will reduce contaminant concentrations in all media to acceptable levels.

5 Summary of Site Risks

Baseline human health and ecological risk assessments were conducted for the EW OU to estimate the risk associated with exposure to EW OU contaminants based on current and likely future uses of the EW OU. These baseline risk assessments are presented in Appendices A and B of the SRI.

5.1 Human Health Risks

The baseline human health risk assessment (BHHRA) (Windward, 2012b) evaluated cancer and non-cancer health hazards associated with exposure to EW OU-related contaminants that may occur during recreational, occupational, or cultural activities. The BHHRA considered contaminants in sediment, surface water, fish, and shellfish. Following CERCLA guidance, a reasonable maximum exposure (RME) that portrays the highest level of exposure that could reasonably be expected to occur was evaluated. Additionally, a central tendency exposure, considered representative of average exposure, was evaluated. As required in the NCP, remedial decisions will be based on an RME evaluation. In 2019, an addendum to the BHHRA was included with the EW OU FS that reevaluated cPAH risks based on an updated toxicity assessment for benzo[*a*]pyrene by EPA (Windward 2019).

Populations were identified that could potentially be exposed to EW OU-related contaminants through a variety of activities consistent with both current and future use of the EW. These activities included fishing, gathering shellfish along the shoreline, boating or swimming, and occupational exposures associated with the industrial activities in the EW OU. Given the industrial nature of the EW OU, young children are not expected to engage in recreational activities, such as beach play, in the area. Populations with the greatest potential for exposure to contaminated sediments were selected as a representative population for each activity. The routes of exposure included ingestion (oral exposures), inhalation (breathing), and dermal contact (contact with skin). The assumptions and populations and routes of exposure that were evaluated were estimated as follows:

Current/future Tribal exposures: Consumption of fish and shellfish by adults and children based on Tribal fish consumption rates for Puget Sound; direct exposure to sediment or water via incidental ingestion or skin contact while engaging in activities such as Tribal net fishing and clamming.

Current/future ethnic community exposures: Consumption of fish and shellfish for adults and children as represented by an Asian & Pacific Islander scenario (described below).

Current/future recreational exposures: Direct contact with surface waters for swimmers, including skin absorption and incidental ingestion of waters and sediments, and the consumption of fish and shellfish by recreational fishers, assuming one meal per month.

Current/future occupational exposures: Direct contact with sediment for habitat restoration workers, including incidental soil ingestion, dermal contact with sediment, and inhalation of dust.

Risks associated with consumption of fish and shellfish by Tribal members were based on data from a fish consumption survey of Tulalip Tribal practices (Toy et al., 1996). However, because the Suquamish Tribe's U and A fishing area includes the EW OU, the BHHRA also included an assessment of Tribal fish and shellfish consumption risks based on a Suquamish fish consumption survey (the Suquamish Tribe, 2000) for comparative purposes.

Exposure factors for evaluating direct contact during swimming, were based on information collected by King County (King County, 1999). Exposures associated with subsistence fishing by ethnic groups were based on fish consumption rates for Asian & Pacific Islander community in King County (EPA, 1999). There are no recreational fish consumption survey data of sufficient quality to assess risks to recreational anglers. Risks for this group were evaluated assuming consumption of one meal per month, to allow individuals to estimate risks based on their individual consumption rates. Actual risk results depend on the number of meals per month.

Included in this evaluation were resident fish and shellfish that spend most of their life in the EW OU, including sole, perch, rockfish, crabs, clams, geoduck, and mussels. While migratory fish such as salmon are an important food source, they were not considered to be an important contaminant pathway because they spend very little of their lifespan in the EW, and salmon do not acquire a significant amount of contamination from the EW OU (Windward, 2007).

WHAT IS HUMAN HEALTH RISK AND HOW IS IT CALCULATED?

A CERCLA baseline human health risk assessment (BHHRA) is an analysis of the potential adverse health effects caused by the hazardous substances released from a site in the absence of any actions to control or mitigate under current and future land uses. A four-step process is used for assessing site-related human health risks.

1. **Hazard Identification:** The first step is the identification of contaminants based on toxicity, fate and transport in the environment, and chemical concentration, mobility, persistence, and bioaccumulation.
2. **Exposure Assessment:** This step involves identifying the different exposure pathways through which people might be exposed to site-related contaminants. Examples include consumption of contaminated fish or shellfish or dermal contact with, or incidental ingestion of, contaminated sediment (Figure 9). For each pathway, factors needed to compute the dose of a chemical to which individuals may be exposed are estimated (exposure concentrations, rates at which humans come into contact with contaminated media [such as sediment ingestion rates], and the frequency and duration of that exposure). Using this information, contaminant doses are calculated for each receptor group (adult or child) and exposure pathway.
3. **Toxicity Assessment:** In this step, the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure (dose) and severity of adverse effects (response) are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health hazards. Some contaminants may cause both cancer and non-cancer health hazards.
4. **Risk Characterization:** This step combines output from the exposure and toxicity assessments to provide a quantitative assessment of site risks for each COC. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. Only risks associated with exposures from the site are considered; those risks are termed “excess” risk and do not include other health risks to which people may be exposed.

Cancer risks are expressed as the probability of an individual developing cancer over their lifetime. For example, a 10^{-4} cancer risk means a “1 in 10,000 excess cancer risk” or 1 additional cancer in a population of 10,000 people as a result of exposure to site contaminants. Superfund generally considers remedial action warranted when risks are greater than the “acceptable risk range” of 1 in 10,000 to 1 in 1,000,000 (1×10^{-4} to 1×10^{-6}).

Non-cancer health effects are evaluated using a “hazard quotient” (HQ) approach, calculated as the exposure concentration relative to a “reference dose” representing an exposure unlikely to cause adverse health effects. An HQ less than 1 indicates that adverse health effects are unlikely. In general, the higher the HQ is above 1, the greater the level of concern. However, the HQ is not a statistical probability, nor does the level of concern increase linearly. EPA also examines the hazards posed by groups of chemicals with the same non-cancer toxic endpoint using the “hazard index,” or HI. The HI is computed by summing the HQs of all chemicals with the same toxic endpoint. The significance of HI values is evaluated in a manner identical to that of HQ values.

Contaminants that exceed a 1×10^{-6} cancer risk or have HQ or HIs exceeding 1 are typically those that will require remedial action and are referred to as COCs in the ROD.

5.1.1 Risk Estimates

Cumulative risks for each receptor group and exposure pathway were compared to the EPA acceptable risk range of 1 in 10,000 (1×10^{-4}) to 1 in 1,000,000 (1×10^{-6}) for cancer risk and a hazard index (HI) of 1 for non-cancer hazard. The cumulative risk is derived by summing the cancer risks posed by all carcinogens found at a site. In general, total risks resulting from the consumption of fish or shellfish were orders of magnitude higher than risks resulting from direct contact with sediment or surface water.

Risks to subsistence Tribal fishers represented the highest risks for both the seafood consumption pathway and the direct contact pathway. The cancer and non-cancer risks for both the adult and child scenarios exceeded the acceptable risk range. Risk estimates based on the Suquamish Tribe fish consumption rates were generally an order of magnitude higher due to their higher fish consumption rates, with a total excess cancer risk for adults of 9×10^{-3}.

Risks associated with direct contact for recreational users and occupational exposures were less than EPA's acceptable risk range. The estimated cancer and non-cancer risk levels from consumption of fish and shellfish are primarily due to total PCBs, arsenic, cPAHs, and dioxins/furans; cancer risks for direct contact are primarily due to arsenic (Table 4).

Table 4. Human Health Risk Estimates for Selected Exposure Scenarios

Pathway and Population [a]	Contaminant of Concern				
	Total PCBs	Arsenic	cPAHs	Dioxins Furans	Total
Consumption of Fish and Shellfish					
Adult Tribal RME					
Cancer Risk based on Tulalip data	1×10^{-3}	2×10^{-4}	1×10^{-5}	1×10^{-4}	1×10^{-3}
Non-cancer Risk (HQ)	27	0.4	--	1	--
Child Tribal RME Based on Tulalip Data					
Cancer Risk	2×10^{-4}	4×10^{-5}	1×10^{-5}	2×10^{-5}	3×10^{-4}
Non-cancer Risk (HQ)	58	0.9	--	2	--
Asian Pacific ng/kg Islander RME					
Cancer Risk	4×10^{-4}	8×10^{-5}	7×10^{-6}	4×10^{-5}	5×10^{-4}
Non-cancer Risk (HQ)	24	0.4	--	0.9	--
One Meal per Month[d]					
Cancer Risk	4×10^{-4}	1×10^{-5}	1×10^{-6}	2×10^{-5}	4×10^{-4}
Non-cancer Risk (HQ)	21	0.08	--	0.4	--
Direct Contact [b,c]					
Tribal Netfishing RME Cancer Risk	6×10^{-7}	3×10^{-6}	3×10^{-7}	6×10^{-7}	5×10^{-6}
Tribal Clamming RME Cancer Risk	3×10^{-6}	1×10^{-5}	2×10^{-6}	1×10^{-6}	2×10^{-5}

Notes:

a. Risks for exposure to surface water were all less than 1×10^{-6}.
b. Risks to habitat workers through direct contact were less than 1×10^{-6}.
c. All direct contact hazard quotients were less than 1.
d. Assumes one meal per month, reported value is the highest level of risk for either bottom fish, clams, crab, rockfish or perch. Actual risks depend on the number of meals per month.

5.2 Ecological Risks

The Baseline Ecological Risk Assessment (BERA) (Windward, 2012a) evaluated the potential for adverse effects to ecological receptors from exposure to contaminants at the EW OU. The BERA evaluates risks to animals that are representative of the communities living in the EW. The BERA quantified risk to different potentially exposed ecological receptors as hazard quotients (HQs), the ratio of contaminant concentration to a given toxicological benchmark. If an HQ is calculated to be equal to or less than 1, then no adverse effects are expected as a result of exposure. If the HQ is greater than 1, adverse effects are possible. The following representative receptors and exposure pathways were evaluated in the BERA.

WHAT IS ECOLOGICAL RISK AND HOW IS IT CALCULATED?

A CERCLA Baseline Ecological Risk Assessment (BERA) is an analysis of the potential adverse effects to biota caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current and future land and resource uses. The process used for assessing site-related ecological risks includes:

1. **Problem Formulation:** In this step, the contaminants of potential ecological concern at the site are identified in a manner similar to the BHHRA.
2. **Exposure Assessment:** In this step, a quantitative evaluation is made of what plants and animals are exposed to and to what degree they are exposed.
3. **Ecological Effects Assessment:** In this step, literature reviews, field studies or toxicity tests are conducted to describe the relationship between chemical contaminant concentrations in sediment (toxicity reference values) or in tissue (critical tissue levels) and their effects on ecological receptors, on a media-, receptor- and chemical-specific basis.
4. **Risk Characterization:** In this step, the results of the previous steps are used to estimate the risk posed to ecological receptors. Individual risk estimates for a given receptor for each chemical are calculated as a hazard quotient (HQ), which is the ratio of contaminant concentration to a given toxicological benchmark. In general, an HQ above 1 indicates unacceptable risk.

The risk is then described, including the overall degree of confidence in the risk estimates, summarizing uncertainties, citing evidence supporting the risk estimates and interpreting the adversity of ecological effects.

Benthic Invertebrates: This group includes invertebrates that live in or on the sediment, including clams and worms that are food for larger predators. Exposure pathways included direct contact with sediment and surface water, ingestion of biota and sediment, and direct contact with porewater. Risk to these receptors was evaluated by comparing chemical concentrations in surface sediment (0-10 cm sediment depth) to regionally developed effects-based threshold response values. Exceedances of threshold response values were confirmed by conducting toxicity tests of EW OU sediments.

The Washington State Sediment Management Standards (SMS) were used to establish the chemical and toxicity thresholds for the benthic community. The SMS chemical criteria are based on relationships between sediment contaminant concentrations and adverse effects on benthic invertebrates as measured in toxicity testing for both short-term (acute) and long-term (chronic) exposures. The methods used to develop the SMS criteria are consistent with CERCLA ecological risk assessment methodology.

Benthic risks for TBT were assessed using tissue concentrations associated with adverse effects (critical tissue levels) from scientific literature, as there were no readily available sediment thresholds. Sediment thresholds were then derived using a sediment-tissue relationship developed from site-specific information for EW.

Crab: Risks to crabs were evaluated by comparing tissue concentrations of crabs collected from the waterway to literature-based screening levels.

Fish: Potential risk was evaluated for resident fish that live and feed in close association with sediment, as well as juvenile Chinook salmon. Pathways included direct contact with sediment and surface water, ingestion of contaminated prey, incidental ingestion of contaminated sediment, and direct contact with contaminated porewater. Risks to fish were evaluated by comparing tissue concentrations in fish collected from the waterway to literature-based effects levels and modeling potential exposure of fish to chemicals in food items and prey.

Birds and Mammals: Osprey, pigeon guillemot, river otter, and harbor seals represented larger wildlife potentially exposed to the EW OU. Pathways evaluated included ingestion of contaminated prey and incidental ingestion of sediment. These were evaluated by modeling the potential exposure of those receptors to chemicals ingested in food items and prey, which were then compared to literature-based effects thresholds.

The results of the ecological risk assessment are summarized in Table 5.

Table 5. Summary of Baseline Ecological Risk Assessment Results

Receptor Group	Media	HQ	Contaminants of Concern	Primary COCs
Benthic invertebrate community	Sediment	<1 – 355	29 COCs[a]	TBT [a]
	Tissue	3.3	TBT	TBT
Crab	Tissue	1.1 – 1.5	Cadmium, copper, zinc	None
Fish	Dietary Dose	1.0 – 2.5	Cadmium, copper, vanadium	None
	Tissue	1.6 – 12	Total PCBs, TBT	Total PCBs
Birds	Dietary Dose	<1	None	None
Mammals	Dietary Dose	<1	None	None

Notes:

a. The contaminants that posed the greatest risk to ecological receptors include: mercury, high molecular weight polycyclic aromatic hydrocarbons (HPAHs), low molecular weight polycyclic aromatic hydrocarbons (LPAHs), and total PCBs.

The following presents the primary conclusions of the BERA:

- 29 chemicals or groups of chemicals were identified as COCs for the benthic community, with HQ values greater than 1). Approximately 62 percent of the waterway was predicted to pose adverse effects to the benthic community based on sediment chemistry and confirmatory toxicity tests.
- Surface sediment also contained concentrations of TBT greater than a site-specific concentration determined to pose adverse effects on benthic organisms.
- Cadmium, copper, and zinc were identified as COCs for crab based on tissue residues.
- Risks to fish were low, with two exceptions. Risk associated with total PCBs were above the threshold for English sole and brown rockfish.
- No contaminants were found to pose unacceptable risk to bird or mammal receptors.
- A subset of COCs were identified as the COCs considered to be primarily contributing to for the overall risks at the site.

5.3 Basis for Taking Action

The Preferred Alternative identified in this Proposed Plan, or one or more of the other active measures considered in this Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances. This determination is based on the following:

- The cumulative cancer risks associated with human consumption of resident fish and shellfish pose unacceptable cancer risk and non-cancer hazards.
- The cumulative cancer risks associated with the direct contact with sediments during netfishing and clamming pose unacceptable cancer risk.
- Contaminants in sediment are present at concentrations that pose unacceptable risks to benthic organisms, crab, and resident fish.

6 Remedial Action Objectives and Remediation Goals

In accordance with the NCP, EPA developed remedial action objectives (RAOs) to describe what the cleanup is expected to accomplish to protect human health and the environment. RAOs help focus the development and evaluation of remedial alternatives and form the basis for establishing PRGs and were developed to incorporate each COC, exposure pathway, exposure route, and receptor. Final RAOs and cleanup goals will be included in the ROD.

6.1 Remedial Action Objectives

Four RAOs were developed for the EW OU.

Human Health

RAO 1: Reduce to protective levels risks associated with the consumption of contaminated resident EW fish and shellfish by adults and children with the highest potential exposure. PCBs, arsenic, cPAHs, and dioxin/furans are the primary COCs that contribute to the estimated unacceptable cancer risk and non-cancer hazard from the consumption of resident contaminated fish and shellfish.

RAO 2: Reduce to protective levels risks from direct contact (skin contact and incidental ingestion) by adults and children to contaminated sediments during netfishing and clamming. Arsenic is the primary COC that contributes to estimated unacceptable cancer risks from netfishing and clamming.

Ecological

RAO 3: Reduce to protective levels risks to benthic invertebrates from exposure to contaminated sediments.

RAO 4: Reduce to protective levels risks to crabs and fish from exposure to contaminated sediment, surface water, and prey.

6.2 Preliminary Remediation Goals

PRGs are used to develop the long-term contaminant concentrations needed to be achieved to meet RAOs by the remedial alternatives and achieve residual risk levels that satisfy the CERCLA requirements for the protection of human health and the environment. They are used during the initial development, analysis, and selection of cleanup alternatives. PRGs are based on applicable or relevant and appropriate requirements (ARARs); risk-based concentrations when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants or pathways of exposure, or background concentrations. New or different requirements may be identified during the public review process that may be used to modify the PRGs before they are established as final cleanup levels in the ROD.

6.2.1 Applicable or Relevant and Appropriate Requirements

CERCLA and the NCP[1] require remedial actions at CERCLA sites to meet ARARs including Federal environmental laws and promulgated state environmental or facility siting laws that are more stringent than Federal laws, unless such ARARs are waived by EPA. Federal or state advisories, criteria, and guidance that are not ARARs may still be factored into remedial actions and are called “to be considered” or TBCs.

[1]Section 121(d)(2) of CERCLA, 42 U.S.C § 9621(d)(2); 40 C.F.R. §§ 300.430(f)(1)(i)(A) &(ii)(B)

Portions of the following Federal and State laws were considered key ARARs during the development of the remedial goals for the EW OU:

- Washington State Model Toxics Control Act, Chapter 70.105D Revised Code of Washington (RCW).
- Sediment Management Standards (SMS), Chapter 173-204 Washington Administrative Code (WAC).
- Federal Clean Water Act National Recommended Ambient Water Quality Criteria (AWQC) established under Section 304(a)(1) of the Clean Water Act, 33 U.S.C. § 1314(a)(1); and federal water quality criteria under 40 CFR 131.45.
- Water Quality Standards (WQS) for Surface Waters of the State of Washington, Chapter 173-201A WAC.
- ARARs will be presented in detail in the ROD.

6.2.2 Preliminary Remediation Goals for Sediments

The sediment PRGs are based on the following:

- A risk-based concentration for the protection of human health representing an excess cancer risk of 1×10^{-6} and a non-cancer HQ of 1 (RAOs 1 and 2).
- The risk-based SMS sediment cleanup objectives (SCO) for protection of benthic invertebrates (RAO 3).
- Risk-based concentrations protective if ecological receptors for either direct contact with sediment or exposure via food-chain transfer and consumption of contaminated prey (RAO 4).
- Background concentrations when those are greater than the risk-based PRGs.

The CERCLA program does not generally set cleanup levels below natural or anthropogenic background concentrations (EPA, 1996; EPA, 1997; EPA, 2002b). Reasons for this approach include the potential for recontamination by surrounding areas, technical impracticability, and cost effectiveness.

PRGs for the EW OU and basis for each PRG are presented in Table 6. PRGs for many COCs were based on the SMS SCO values for the protection of the benthic community (RAO 3). Risk-based PRGs were developed for both RAO 3 (TBT) and RAO 4 (PCBs).

Risk-based concentrations for PCBs, arsenic, and dioxins/furans based on protection of human health (RAOs 1 and 2) are less than concentrations in suspended sediment coming into the EW OU from the Green River watershed. PRGs were therefore based on anthropogenic background (Section 3.2.4).

Although cPAHs are associated with unacceptable human health risk through consumption of shellfish, no direct correlation between cPAH concentrations in sediment and clams could be determined. Because there is no clear relationship, it is not possible to calculate risk-based sediment PRGs for the protection of shellfish. There are PRGs for several individual PAHs for the protection of benthic organisms.

Table 6. Sediment Preliminary Remediation Goals for Human Health and Ecological Contaminants of Concern

Contaminant of Concern	PRG		Purpose	Basis	Spatial Scale
Total PCBs	31	μg/kg dw	RAO 1 – Protection of Human Health for Seafood Consumption	Anthropogenic Background	EW-wide
	12	mg/kg OC [a]	RAO 3 – Protection of the Benthic Community	SMS -SCO	Point
	250	μg/kg dw	RAO 4 – Protection of Fish	Risk-Based: Brown rockfish	EW-wide
Arsenic	20	mg/kg dw	RAO 2 – Protection of Human Health for Direct Contact	Anthropogenic Background	EW-wide (netfishing) and clamming areas
	57	mg/kg dw	RAO 3 – Protection of the Benthic Community	SMS - SCO	Point
Dioxins/Furans			RAO 1 – Protection of Human Health for Seafood Consumption	Anthropogenic Background	EW-wide
2,3,7,8-TCDD	0.71	ng/kg dw			
2,3,7,8-TCDF	1.2	ng/kg dw			
1,2,3,7,8-PeCDD	2.1	ng/kg dw			
2,3,4,7,8-PeCDF	1.1	ng/kg dw			
Cadmium	5.1	mg/kg dw	RAO 3 – Protection of the Benthic Community	SMS - SCO	Point
Mercury	0.41	mg/kg dw			
Zinc	410	mg/kg dw			
2-Methylenaphthalene	38	mg/kg OC			
Anthracene	220	mg/kg OC			
Acenaphthene	16	mg/kg OC			
Benzo[*a*]anthracene	110	mg/kg OC			
Benzo[*a*]pyrene	99	mg/kg OC			
Benzo[*g*,*h*,*i*]perylene	31	mg/kg OC			
Total benzofluoranthenes	230	mg/kg OC			
Chrysene	110	mg/kg OC			
Dibenzo[*a*,*h*]anthracene	12	mg/kg OC			
Dibenzofuran	15	mg/kg OC			
Fluoranthene	160	mg/kg OC			
Fluorene	23	mg/kg OC			
Indeno[1,2,3-*cd*]pyrene	34	mg/kg OC			
Phenanthrene	100	mg/kg OC			
Pyrene	1,000	mg/kg OC			
Total HPAHs	960	mg/kg OC			
Total LPAHs	370	mg/kg OC			
Bis(2-ethylhexyl) phthalate	47	mg/kg OC			
Butyl benzyl phthalate	4.9	mg/kg OC			
Di-*n*-butyl phthalate	220	mg/kg OC			
1,4-Dichlorobenzene	3.1	mg/kg OC			
2,4-Dimethylphenol	0.029	mg/kg OC			
n-Nitrosodiphenylamine	11	mg/kg OC			
Phenol	0.42	mg/kg dw			
Tributyltin	7.5	mg/kg OC	RAO 3 – Protection of the Benthic Community	Risk-Based	Point

Notes:

μg/kg: microgram per kilogram
mg/kg: milligram per kilogram
dw: dry weight
OC: organic carbon normalized

a. 12 mg/kg OC is equivalent to 192 μg/kg dw based on the average EW OU organic carbon content of 1.6 percent.

6.3 Fish and Shellfish Target Tissue Concentrations

Target tissue concentrations (TTCs) in resident fish and shellfish (crab and clam) are values established to measure progress toward achieving RAO 1. They represent either a cancer risk of 1 x 10^{-6} excess cancer risk or HQ of 1, assuming a Tribal RME adult fish consumption rate, or a tissue concentration based on background, whichever is greater. Tissue concentrations in fish and shellfish associated with anthropogenic background concentrations in sediment were calculated using the Food-web model developed for the EW and described in Appendix C of the SRI and are presented in Table 7.

Table 7. Target Tissue Concentrations in Resident Fish and Shellfish

Species Group	Tissue	Species	Concentration
PCBs (μg/kg wet weight)			
Benthic fish	Fillet	English sole	140
Pelagic fish	Whole body	Rockfish	490
Crab	Whole body	Dungeness and Red Rock crab	100
	Edible meat		15
Clams	Without shell	Various	20
Dioxins/Furans (ng/kg wet weight)			
Species	**Tissue**	**Chemical**	**Concentration**
English Sole	Whole body	2,3,7,8-TCDD	0.47
		2,3,7,8-TCDF	0.38
		1,2,3,7,8-PeCDD	0.54
		2,3,4,7,8-PeCDF	0.17
Brown Rockfish	Whole body	2,3,7,8-TCDD	0.62
		2,3,7,8-TCDF	0.95
		1,2,3,7,8-PeCDD	0.59
		2,3,4,7,8-PeCDF	0.07
Crab	Whole body	2,3,7,8-TCDD	0.13
		2,3,7,8-TCDF	0.59
		1,2,3,7,8-PeCDD	0.29
		2,3,4,7,8-PeCDF	0.09

7 Summary of Remedial Alternatives

This section presents the remedial alternatives considered to address the risks at the EW OU and meet the RAOs. These alternatives were developed following the requirements established in CERCLA and the NCP.

7.1 Remedial Action Levels

Remedial action levels (RALs) are contaminant concentrations used to delineate areas and sediment depths that require active cleanup. The relative effect of remediating those areas exceeding RAL concentrations can be evaluated as part of the analysis of alternatives. RALs are not cleanup levels.

RALs were developed for each of the primary COCs posing unacceptable human health risk (total PCBs, arsenic, and dioxins/furans) and those contaminants posing unacceptable ecological risk (see Table 8). With the exception of PCBs, RALs were based on the lowest established preliminary remedial goals (PRGs) for each of these COCs. PCBs were evaluated using either a RAL of 12 mg/kg OC (equivalent to the remedial goals for RAO-3; the protection of benthic invertebrates) or 7.5 mg/kg OC to evaluate the effects of a lower PCB RAL on the remedial alternatives.

The method by which specific RALs were developed is further explained in the Section 6.1 of the FS.

Table 8. Remedial Action Levels

Contaminants of Concern	RAL	
Total PCBs[a]	12 or 7.5	mg/kg OC[b]
Arsenic	57	mg/kg dw
Dioxins/furans	25	ng TEQ/kg dw
Tributyltin	7.5	mg/kg OC
1,4-Dichlorobenzene	3.1	mg/kg OC
Butyl benzyl phthalate	4.9	mg/kg OC
Acenaphthene	16	mg/kg OC
Fluoranthene	160	mg/kg OC
Fluorene	23	mg/kg OC
Mercury	0.41	mg/kg dw
Phenanthrene	100	mg/kg OC

Notes:

a. Alternatives were developed using two PCB RALs.
b. Based on the average EW OU organic carbon content of 1.6 percent, 12 mg/kg OC is equivalent to 192 µg/kg dw, and 7.5 mg/kg OC is equivalent to 120 µg/kg dw.

7.2 Common Elements of the Alternatives

As required by CERCLA, a “No Action Alternative” is included for comparative purposes. The No Action Alternative would include only monitoring to evaluate changes in COC concentrations over time.

All other alternatives include some type of active remediation and are comprised of common elements including the remedial technologies, waste disposal options, methods for managing dredge residuals, institutional controls, and monitoring requirements. The differences between alternatives are defined by where each technology is applied.

7.2.1 Remedial Technologies Applied to Alternatives

With the exception of the No Action Alternative, each alternative includes one or more of the following remedial technologies that may be applied to one or more area (see Section 3.1 and Figure 6).

Monitored natural recovery (MNR): MNR relies on natural processes to reduce ecological and human health risks while monitoring natural recovery over time to determine remedy success. Within the EW, the primary natural recovery processes are sedimentation and mixing of incoming clean sediment.

Enhanced natural recovery (ENR): ENR refers to the placement of a thin layer of clean sand (or other suitable habitat material) on top of contaminated sediments. Over time, this cleaner surface material mixes with the underlying contaminated sediment to reduce contaminant concentrations more quickly than would occur with MNR. ENR may be used in conjunction with sediment dredging to maintain appropriate water depths for navigation. The alternatives include two types of ENR defined by location and thickness:

ENR-sill – ENR placed in the Sill Reach consists of a 9-inch layer of clean sand.

ENR-nav – ENR placed within the Deep Main Body and Berth Areas consists of an 18-inch layer of clean sand. A thicker layer of ENR is required due to propwash scour. Some ENR-nav areas would require partial dredging to accommodate navigational depths.

Removal of contaminated sediments: All action alternatives include the removal of contaminated sediment due to the need to maintain the current and future use of EW as a navigable waterway. For the purpose of the FS, the following assumptions were considered for purposes of cost estimates and feasibility evaluation:

Mechanical dredging to remove contaminated sediment is assumed for open water areas, using either articulated fixed-arm or cable-operated dredges situated on a barge or from the shore.

Diver-assisted hydraulic dredging to remove contaminated sediment is assumed in Under-pier Areas.

The footprint and depth of dredging is determined by the RAL in open water areas. In nearshore habitat areas, dredged areas would be backfilled to existing contours to maintain elevations suitable for habitat. Dredging is limited by existing underground utilities in the Communication Cable Crossing of the Deep Main Body and Berth Areas. Contaminated sediment removal would be conducted to the extent practicable and the area backfilled to protect the existing utilities.

Engineered Capping: Engineered caps contain contaminated sediments by placing layers of sand, gravel, or rock to isolate and prevent migration of contamination. Capping may be used in conjunction with dredging to maintain appropriate water depths for navigation or habitat. Cap composition and thickness will be determined during design and will consider maintaining habitat.

In situ treatment: In situ treatment is the placement of a layer of activated carbon (or other sequestering agent) on top of the contaminated sediment. The activated carbon mixes with the underlying contaminated material through bioturbation and propwash to reduce contaminant bioavailability of the surface sediments. In some cases, it may not be possible to treat all contaminated sediments in limited access areas due to obstructions or difficult to access areas. The impact of these untreated sediments will be evaluated during post-construction monitoring and may require additional treatment or other containment strategies if needed to assure that cleanup goals are attained.

Residuals Management Cover: Dredge residuals refers to material released during dredging, and redepositing on the dredged surface. This may be mitigated with the placement of a residuals management cover (RMC), consisting of approximately nine inches of clean sand that would be applied as soon as possible following the completion of dredging. The final thickness would be determined based on concentrations measured during post-remediation sampling. The RMC would be placed in all open water dredged areas and locations adjacent to dredged areas where residuals may have settled, providing a cleaner surface material that would mix with the underlying contaminated sediment to reduce contaminant concentrations.

7.2.2 Sediment Disposal

Dredged material would be transported, most likely by barge and rail, to a permitted off-site upland disposal facility. Data collected during the SRI/FS indicate that the dredged material is likely to be non-hazardous under the Resource Conservation and Recovery Act (RCRA) and can be disposed at a facility that accepts non-hazardous waste. If sampling of the dredged material indicates it to be hazardous waste, it will be disposed of at a permitted off-site facility. Some clean material may need to be dredged as part of the cleanup; for example, to maintain slope stability at the edges of the dredge area. Clean sediments that pass the Dredged Materials Management Program criteria for the State of Washington may be disposed at an open water disposal site.

7.2.3 Institutional Controls

Institutional controls are advisories, limitations, or restrictions put in place to protect human health and the environment by reducing exposure to contamination left in place, to ensure remedy protectiveness, and to protect the long-term integrity of the engineered components of the remedy. Below are potential institutional control mechanisms that may be used at the EW OU.

Fish advisories and educational outreach: Advisories and educational outreach programs would be implemented to inform the public of the risks associated with the consumption of contaminated fish and shellfish. Fish and shellfish consumption advisories specific to East Waterway would be implemented in coordination with WSDOH. Educational outreach programs may include informational meetings, development and distribution of informational materials such as brochures and maps, and installation and maintenance of advisory signs at known fishing locations.

Waterway use restrictions and regulated navigation areas: Where engineered caps would be utilized to contain contamination in navigable areas, waterway use restrictions may be implemented to ensure the long-term integrity of the cap. These measures may include restrictions on boat anchoring and keel dragging, vessel groundings in shallow areas, the use of spuds to stabilize vessels, structure and utility maintenance, and future maintenance dredging and/or deepening. Notifications such as signs and buoys may also be used to notify and warn the public. These restrictions would be implemented in coordination with the USCG.

Land use restrictions: Land use restrictions would be implemented in areas of in situ treatment to ensure the applied treatment material is not disturbed in the long-term.

7.2.4 Monitoring

Monitoring is an integral component of all the alternatives and would be conducted to ensure that the selected remedy is constructed to design specifications, achieves cleanup levels and RAOs, evaluate short- and long-term effectiveness, and determine protectiveness. Media monitored for these purposes include sediment, sediment porewater, surface water, stormwater, and fish and shellfish tissue.

7.3 Applicable or Relevant and Appropriate Requirements

ARARs for the remedial alternatives include certain provisions of RCRA, MTCA, SMS, and Washington Water Quality Standards, as well as Ambient Water Quality Criteria under the Clean Water Act (CWA) and dredge and fill requirements of the CWA. Endangered Species Act (ESA) requirements may affect remedy implementation to protect Chinook salmon migrating through the EW OU from in-water construction. Generally, in-water construction is restricted to a period between July 16 to February 15 (about 150 working days; USACE, 2017a). Additional reductions in construction windows (also known as “fish windows”) to a period between October 1 and February 15 may be required to accommodate Tribal treaty fishing rights. The construction duration estimated for each alternative was based on the shorter construction window (100 days); however, coordination with the National Marine Fisheries Service and the Tribes may allow for a longer construction window.

7.4 Remedial Alternatives

The FS evaluated 10 alternatives (Appendix L of FS) to actively address those areas with sediment concentrations greater than the RALs, varying the following three components.

Alternative Component 1: Open water areas. Open water areas do not have access limitations, yet these areas typically have increased potential for disturbance from marine vessel traffic (see Figure 6 and Table 9). The remedial technologies considered for areas above the RAL in the open water areas are as follows:

Option 1 Removal, capping, and ENR in the navigation and Sill Reach.

Option 2 Removal, capping, and ENR in the Sill Reach.

Option 3 Removal and capping.

Alternative Component 2: Limited access areas. The remedial technologies under bridges and piers is restricted by the limited access (see Figure 6). The remedial technologies considered for areas above the RAL in the limited access areas are summarized below:

Option A MNR in Under-pier Areas. MNR and ENR in the Sill Reach.

Option B In situ treatment in Under-pier Areas. ENR in the Sill Reach.

Option C+ Diver-assisted hydraulic dredging at Under-pier Areas with PCBs or mercury concentrations greater than the RALs, followed by in situ treatment for other Under-pier Areas. ENR in the Sill Reach.

Option E Diver-assisted hydraulic dredging followed by in situ treatment in all Under-pier Areas. ENR in the Sill Reach.

Alternative Component 3: RAL for Total PCBs. The remedial footprint was developed using all RALs. For total PCBs, two RALs were considered during alternatives evaluation:

12 mg/kg OC (192 µg/kg dry weight)

7.5 mg/kg OC (120 µg/kg dry weight)

The technology components that comprise each alternative are summarized in Table 9. The areal extent of construction is 121 acres (representing 77 percent of the EW) when using the PCB RAL of 12 mg/kg OC, and is 132 acres (representing 84 percent of the EW) when using the PCB RAL of 7.5 mg/kg OC. Beyond the areal extent, differences among the alternatives are due to the technologies that are used to address different portions of the EW.

Consistent with EPA guidance (EPA, 2000), a present value analysis was performed for the anticipated expenditures over the life of each alternative to enable a comparison of total project costs. This was done by using discount rates developed annually by the Office of Management and Budget (OMB). Typically, costs are discounted by 7 percent to account for economic growth. However, the Federal government has a different “cost of capital” than the private sector (the Federal government cannot invest money in the same way). As such, EPA (2000) guidance recommends that the most up-to-date discount rate be used. The EW OU project is primarily funded by public entities, including King County, the City of Seattle, and the Port of Seattle, and the project is unlikely to be transferred to private entities. The cost of capital for these agencies was considered by EPA to be similar to that of the Federal government. As such, the use of the current (2018) discount rate follows EPA (2000) guidance for the purposes of present value analysis presented in the FS. The up-to-date discount rates ranges from -0.8 percent for a 3-year project to 0.6 percent for a 30-year project (OMB, 2018). For comparative purposes, costs based on a discount rate of 7 percent were also calculated for each alternative and are presented in Section 8. Operations and maintenance (O&M) costs for all alternatives were estimated assuming a duration of 20 years.

The areas associated with each technology for each alternative are shown in Figure 10. The costs shown are the net present value.

Table 9. Remedial Alternatives

Alternative	Technologies for Open Water Areas[1,2]					Technologies for Limited Access Areas[1]			PCBs RAL (mg/kg OC)
	Option	Deep Main Body and Berth Areas	Shallow Main Body	Nearshore	Sill Reach – West Seattle Bridge	Option	Under-pier	Sill Reach – Low Bridges	
No Action	-	None				-	None		None
1A(12)	1	Dredging and ENR-nav	Dredging and Capping	Dredging and Capping	ENR-sill	A	MNR	ENR-sill and MNR	12
1B(12)						B	In situ treatment	ENR-sill	
1C+(12)						C+	Diver-assisted dredging in areas with elevated PCBs or mercury. Then, in situ treatment everywhere.	ENR-sill	
2B(12)	2	Dredging	Dredging and Capping	Dredging and Capping	ENR-sill	B	In situ treatment	ENR-sill	
2C+(12)						C+	Diver-assisted dredging in areas with elevated PCBs or mercury. Then, in situ treatment everywhere.	ENR-sill	
3B(12)	3	Dredging	Dredging	Dredging and Capping	Dredging	B	In situ treatment	ENR-sill	
3C+(12)						C+	Diver-assisted dredging in areas with elevated PCBs or mercury. Then, in situ treatment everywhere.	ENR-sill	
2C+(7.5)	2	Dredging	Dredging and Capping	Dredging and Capping	ENR-sill				7.5
3E(7.5)	3	Dredging	Dredging	Dredging and Capping	Dredging	E	Diver-assisted dredging followed by in situ treatment.	ENR-sill	

Notes:

1. Technology areas are shown in Figure 6.
2. Technologies address areas above the RAL; MNR is conducted in all areas below the RAL but above the PRG.

7.4.1 No Action Alternative

CERCLA requires that a No Action Alternative be considered as a baseline for comparison with other alternatives. Estimated costs for the No Action Alternative were based on conducting a review of EW conditions at 5-year intervals and monitoring sediment, water, and fish. These costs are included in the summary below.

Capital Costs:	$ 0
O&M Costs:	$ 950,000
Net Present Value (0%):	**$ 950,000**
Net Present Value (7%):	$ 650,000
Construction Timeframe:	N/A

7.4.2 Alternative 1A (PCB RAL= 12 mg/kg)

Alternative 1A(12) employs a combination of dredging sediment, capping, and ENR in open water areas, and ENR and MNR in limited access areas, as shown on Figure 11. This alternative addresses 121 acres by removing approximately 810,000 cy of contaminated sediment by dredging and placing of 290,000 cy of new clean material for capping, ENR, MNR, and an RMC layer. The total acres assigned each technology is shown on Figure 10.

Capital Costs:	$ 254,000,000
O&M Costs:	$ 1,910,000
Net Present Value (0%):	**$ 256,000,000**
Net Present Value (7%):	$ 192,000,000
Construction Timeframe:	9 years

7.4.3 Alternative 1B (PCB RAL= 12 mg/kg)

Alternative 1B(12) includes the same action for the open water areas as described in Alternative 1A(12). However, it includes in situ treatment of sediment in the Under-pier Areas, instead of MNR, as shown on Figure 11. This alternative addresses 121 acres by dredging approximately 810,000 cy of contaminated sediment and placing 290,000 cy of new clean material for capping, ENR, and in situ treatment and placing an RMC layer. The total acres assigned each technology is shown on Figure 10.

Capital Costs:	$ 261,000,000
O&M Costs:	$ 2,960,000
Net Present Value (0%):	**$ 264,000,000**
Net Present Value (7%):	$ 199,000,000
Construction Timeframe:	9 years

7.4.4 Alternative 1C+ (PCB RAL=12 mg/kg)

Alternative 1C+(12) includes all the work described in Alternative 1B(12) for open water but utilizes diver-assisted dredging in some Under-pier Areas. This alternative addresses 121 acres employing a combination of dredging, capping, and ENR in open water areas as shown on Figure 11. Alternative 1C+(12) removes 820,000 cy of contaminated sediment by mechanical dredging and places 290,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total area assigned each technology is shown on Figure 10.

Capital Costs:	$ 274,000,000
O&M Costs:	$ 2,960,000
Net Present Value (0%):	**$ 277,000,000**
Net Present Value (7%):	$ 209,000,000
Construction Timeframe:	9 years

7.4.5 Alternative 2B (PCB RAL=12 mg/kg)

Alternative 2B(12) employs a combination of dredging, capping, and limited ENR in the open water areas, and ENR and in situ treatment in the limited access areas, shown on Figure 12. This alternative addresses 121 acres by dredging approximately 900,000 cy of contaminated sediment and placing 280,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total area assigned each technology is shown on Figure 10.

Capital Costs:	$ 281,000,000
O&M Costs:	$ 2,900,000
Net Present Value (0%):	**$ 284,000,000**
Net Present Value (7%):	$ 210,000,000
Construction Timeframe:	10 years

7.4.6 Alternative 2C+ (PCB RAL=12 mg/kg)

Alternative 2C+(12) employs a combination of dredging, capping, and limited ENR in the open water areas, and ENR, diver-assisted dredging, and in situ treatment in the limited access areas as shown on Figure 12. This alternative addresses 121 acres by removing 910,000 cy of contaminated sediment through mechanical dredging and place 280,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total acres assigned each technology is shown on Figure 10.

Capital Costs:	$ 294,000,000
O&M Costs:	$ 2,900,000
Net Present Value (0%):	**$297,000,000**
Net Present Value (7%):	$ 220,000,000
Construction Timeframe:	10 years

7.4.7 Alternative 3B (PCB RAL= 12 mg/kg)

Alternative 3B(12) includes dredging for nearly all open water areas, with the exception of two nearshore locations near the Mound Area and Coast Guard nearshore that would be capped due to the technical infeasibility of dredging in these areas. Contaminated sediment in nearshore areas of the Sill Reach and former Terminal 25 would be removed and backfilled with clean material to the pre-dredge elevation as shown on Figure 12. This alternative addresses 121 acres by dredging approximately 960,000 cy of contaminated sediment, placing 270,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total acres assigned each technology is shown on Figure 10.

Capital Costs:	$295,000,000
O&M Costs:	$ 2,870,000
Net Present Value (0%):	**$298,000,000**
Net Present Value (7%):	$220,000,000
Construction Timeframe:	10 years

7.4.8 Alternative 3C+ (PCB RAL=12 mg/kg)

Alternative 3C+(12) employs a combination of dredging and capping in the open water areas; ENR, diver-assisted dredging, and in situ treatment in the limited access areas, as shown in Figure 13. This alternative addresses 121 acres by dredging 960,000 cy of contaminated sediment and placing 270,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total acres assigned each technology is shown on Figure 10.

Capital Costs:	$ 307,000,000
O&M Costs:	$ 2,870,000
Net Present Value (0%):	**$310,000,000**
Net Present Value (7%):	$ 230,000,000
Construction Timeframe:	10 years

7.4.9 Alternative 2C+ (PCB RAL= 7.5 mg/kg)

Alternative 2C+(7.5) employs a combination of dredging, capping, limited use of ENR in the open water areas; ENR, diver-assisted dredging, and in situ treatment in limited access areas, as shown on Figure 13. This alternative addresses 132 acres by dredging 1,010,000 cy of contaminated and placing 290,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total acres assigned each technology is shown on Figure 10.

Capital Costs:	$ 323,000,000
O&M Costs:	$ 2,880,000
Net Present Value (0%):	**$ 326,000,000**
Net Present Value (7%):	$ 235,000,000
Construction Timeframe:	11 years

7.4.10 Alternative 3E (PCB RAL=7.5 mg/kg)

Alternative 3E(7.5) is the most removal-focused alternative, with removal in the open water and all of the Under-pier Areas. This alternative employs a combination of removal and capping in the open water areas; ENR and diver-assisted dredging (prior to in situ treatment) in all limited access areas, as shown on Figure 13. This alternative addresses 132 acres by dredging 1,080,000 cy of contaminated sediment and placing 270,000 cy of new clean material for capping and ENR, and placing an RMC. The total acres assigned each technology is summarized on Figure 10.

Capital Costs:	$ 408,000,000
O&M Costs:	$ 2,850,000
Net Present Value (0%):	**$ 411,000,000**
Net Present Value (7%):	$ 285,000,000
Construction Timeframe:	13 years

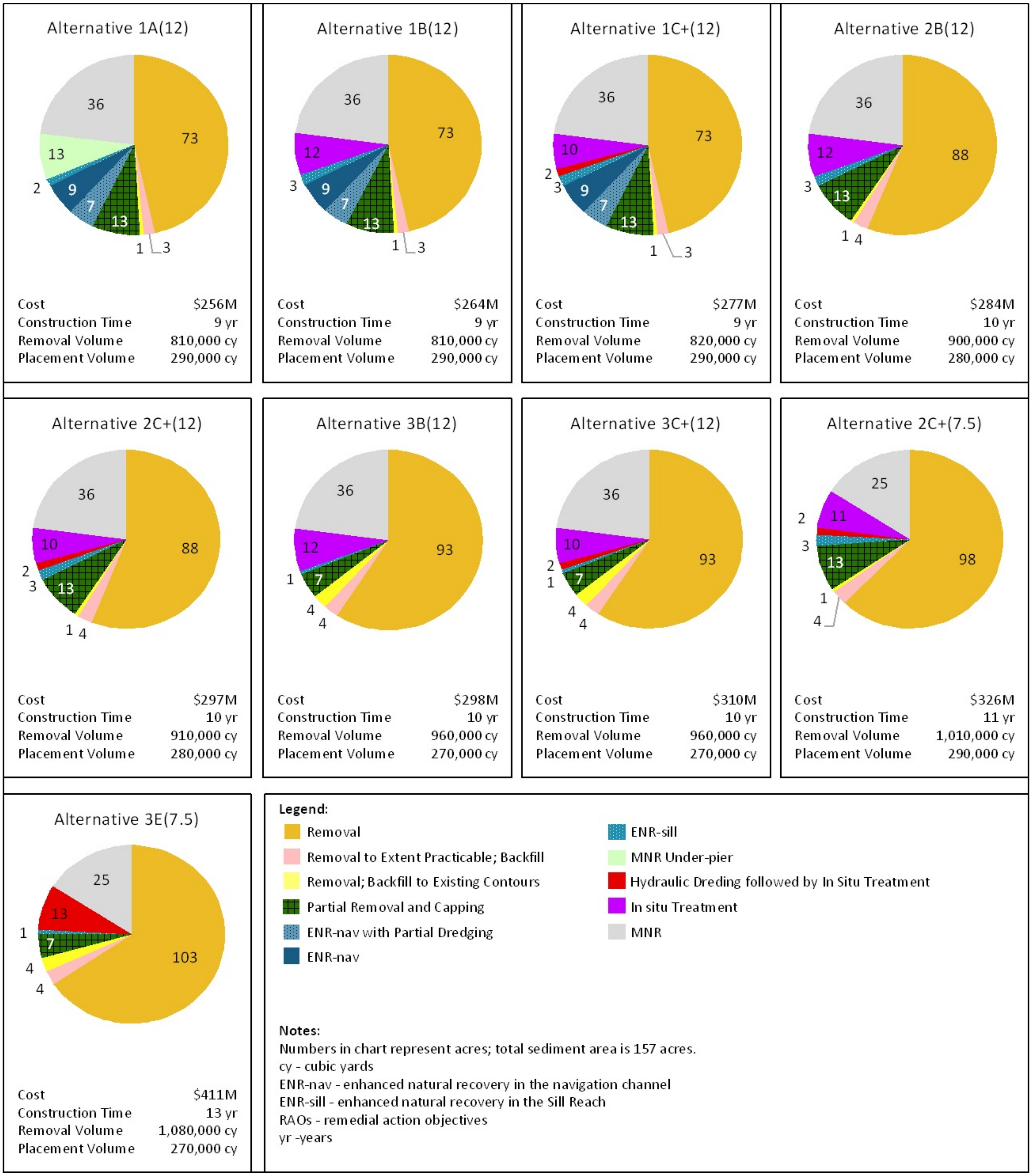

Figure 10. Areas, Volumes, and Costs for all Action Alternatives

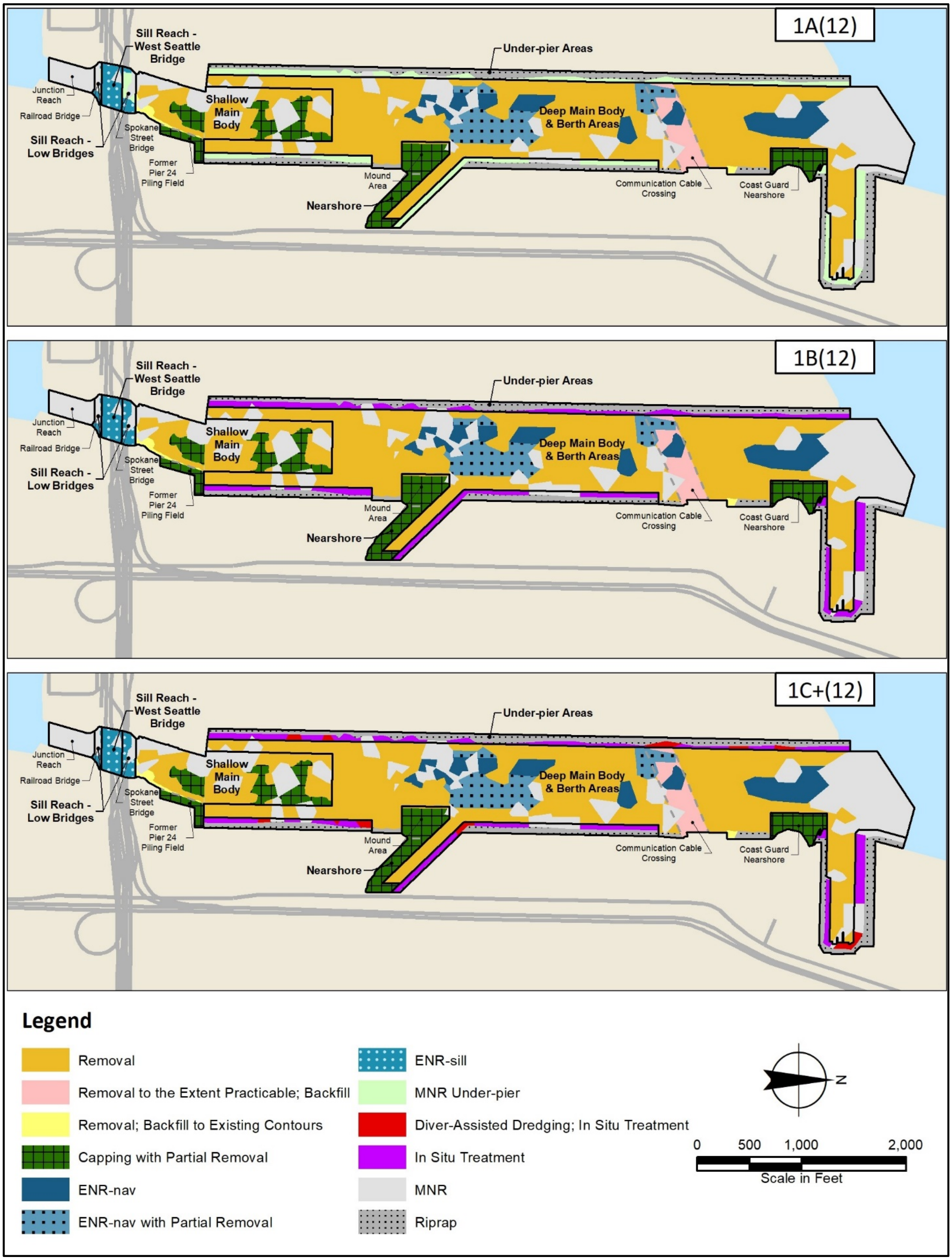

Figure 11. Map of Alternatives 1A(12), 1B(12), and 1C+(12)

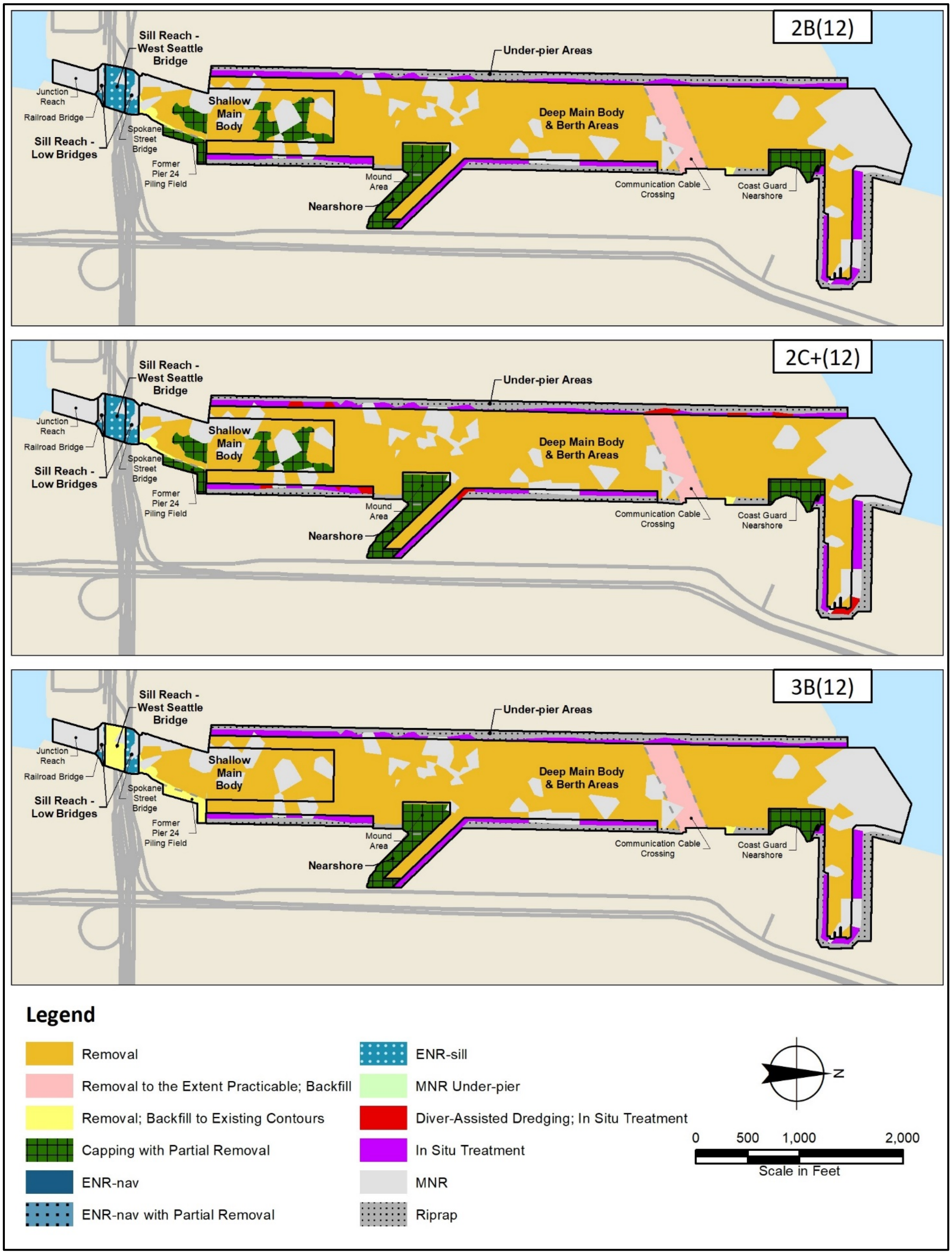

Figure 12. Map of Alternatives 2B(12), 2C+(12), and 3B(12)

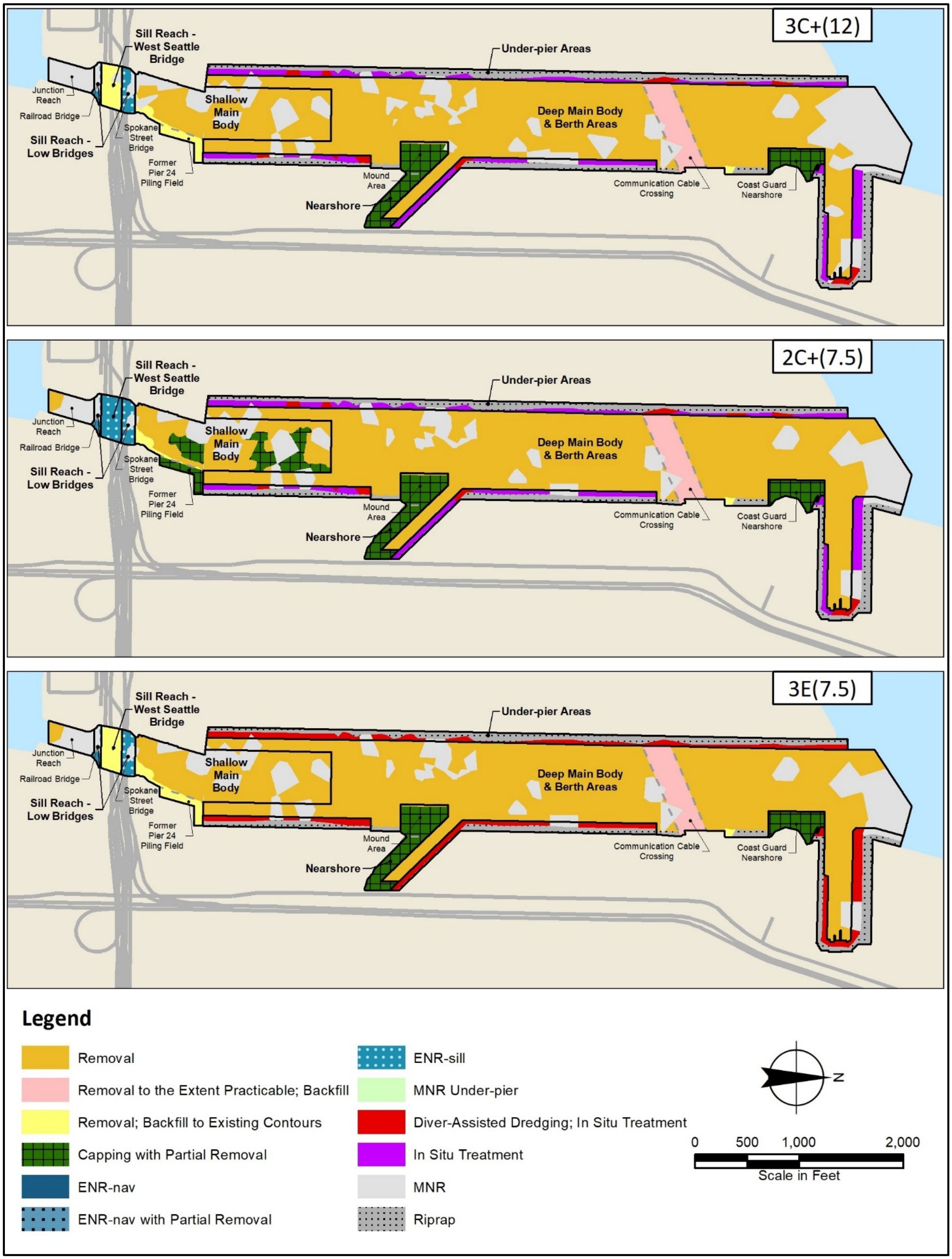

Figure 13. Map of Alternatives 3C+(12), 2C+(7.5), and 3E(7.5)

THE NINE SUPERFUND EVALUATION CRITERIA (40 C.F.R. § 300.430(e)(9)(iii))

The first two criteria are ***threshold criteria*** that must be met by each alternative.

1. **Overall Protection of Human Health and the Environment** evaluates whether an alternative adequately protects human health and the environment by eliminating, reducing, or controlling unacceptable risks posed by exposures to hazardous substances, pollutants, or contaminants.
2. **Compliance with ARARs** evaluates whether the alternative meets Federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver of any such requirements is justified.

The next five criteria are the ***balancing criteria*** upon which the analysis in this Proposed Plan is based.

3. **Long-Term Effectiveness and Permanence** considers the ability of an alternative to maintain protection of human health and the environment over time.
4. **Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment** evaluates an alternative's use of treatment or recycling to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
5. **Short-Term Effectiveness** considers the length of time needed to achieve protection and the risks or impacts the alternative poses to workers, the community, and the environment during implementation of the remedial action.
6. **Implementability** considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
7. **Cost** includes estimated capital and annual operations and maintenance costs, as well as net present value of these costs. Net present value cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

The final two criteria are referred to as ***modifying criteria***, which will be evaluated following comments received during the public comment period and addressed in making the final remedy decision in the ROD.

8. **State/Tribal Acceptance** considers state and affected Tribes' concerns related to the Preferred Alternative, other alternatives, and ARARs.
9. **Community Acceptance** considers whether the local community agrees with EPA's analyses and Preferred Alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

8 Evaluation of Alternatives

Superfund regulations require that alternatives be evaluated using nine criteria (described in the inset above). Using these criteria, the alternatives are evaluated independently, then compared to identify the relative advantages and disadvantages of each.

Threshold criteria must be achieved for an alternative to be considered under CERCLA. The Preferred Alternative is then selected based on the weight of evidence of the five balancing criteria. Two "modifying" criteria (state and Tribal acceptance, and community acceptance) will be evaluated based on comments received on the Proposed Plan during the public comment period.

The FS considered both the threshold criteria and balancing criteria in evaluating each of the alternatives. The following section summarizes the results of the alternatives evaluation. Additional details can be found in the FS, Section 10.

8.1 Overall Protection of Human Health and the Environment

A requirement of CERCLA is that the final selected remedial action be protective of human health and the environment. An alternative is protective if it reduces current and potential future risks associated with each exposure pathway at a site to acceptable levels (see Table 6).

The No Action Alternative would not be protective of human health and the environment. Contaminants in the EW OU surface sediments, surface water, and biota would continue to pose unacceptable risks to human health and the environment for the foreseeable future. Natural recovery alone is unlikely to achieve all cleanup levels and meet the RAOs in a reasonable timeframe.

The remaining alternatives are expected to result in declining contaminant concentrations in sediment following construction through natural recovery that will achieve the sediment remedial goals.

Each of the action alternatives achieve a similar level of overall protection of human health and the environment by relying primarily on removing contaminated sediment from the EW OU. Remaining risks are addressed through a combination of capping, ENR, MNR, and institutional controls. Differences between action alternatives are the potential application of ENR or capping in open water areas, and the use of in situ treatment or diver-assisted hydraulic dredging in the limited access areas. The remedial footprint is similar for seven of the nine action alternatives. Two of the remedial alternatives apply a lower RAL for PCBs (7.5 mg/kg OC), resulting in a slightly larger remedial footprint.

8.2 Compliance with ARARs

ARARs are presented in Sections 6.21 and 7.3 of the FS.

The No Action Alternative is not expected to comply with ARARs, and therefore the No Action Alternative does not meet either threshold criteria and is not discussed further.

The NCP requires that as part of the selected final remedial action, cleanup remediation goals be established based on acceptable exposure levels that are protective of human health and the environment [40 C.F.R. § 300.430(e)(2)(i)]. These may be based on ARARs or other factors and are considered essential in that they provide a measure by which the remedial action may be deemed adequately protective of human health and the environment.

Consistent with those portions of SMS considered to be ARARs, each of the action alternatives are designed to achieve concentrations that are protective of benthic organisms (RAO 3) and fish and shellfish (RAO 4).

As discussed in Section 7.3, to protect threatened species under the Endangered Species Act, including Puget Sound Chinook salmon, construction windows (also known as fish windows) will be adhered to in order to minimize the effects of in-water construction on migration of endangered salmon.

8.3 Long-Term Effectiveness and Permanence

Long-term protectiveness and permanence refer to the ability for each alternative to remain protective of human health and the environment over time once the cleanup goals are achieved. Key considerations for evaluating these criteria are long-term risks and magnitude of the residual risk, and the adequacy and reliability of controls for containing untreated waste left in place at depth or treatment residuals.

8.3.1 Magnitude of Residual Risk

Residual risk is the same for all the alternatives as each would achieve the cleanup goals and remedial action objectives.

8.3.2 Adequacy and Reliability of Controls

The adequacy and reliability of controls is a measure of the effectiveness of the controls needed to manage residual risks from remaining contaminated sediment following remediation. The magnitude and importance of those controls is driven primarily by the potential for exposure to contaminants left in place

The alternatives differ in the long-term reliability of the methods used to contain contamination left in place. Alternative 1A(12) relies on MNR, particularly under docks and piers. Surface sediment contamination would remain in place untreated, resulting in ongoing exposures and risk for an extended period of time. Exposure to contamination is predicted to be lower for all other alternatives, primarily due to the contaminated sediment removal and the application of the RMC layer in open water areas and treatment or removal in the limited access areas.

The amount of subsurface contamination that is removed also provides an indication of the long-term permanence of the alternatives. Bottom disturbance, such as propwash from vessel traffic, can expose and redistribute contaminated subsurface sediments. The potential for exposing contaminated subsurface sediments is lowest for alternatives that include complete removal and capping.

In the Under-pier Areas, in situ treatment would be less protective than dredging or capping because it leaves contaminants in place and would not entirely reduce contaminant risks. Effective in situ treatment would be expected to reduce bioavailability by 70 to 90 percent. ENR reduces risk from contaminated sediments by placing a 9- to 18-inch layer of sand/gravel over the sediment surface, lowering surface sediment concentrations. This cleaner material provides a protective layer that is mixed into the underlying sediment over time, but subsurface contaminants can be exposed through disturbance and mixing of the ENR layer. MNR represents the highest potential for exposure to residual subsurface contamination because it consists of a non-engineered cover.

Based on the amount of subsurface contamination left in place and the potential for that contamination to be exposed or redistributed, it is anticipated that those alternatives with the most extensive removal of contaminated sediments would provide the best long-term effectiveness. While the application of in situ treatment/ENR/MNR are important considerations, the Under-pier Areas proposed for these treatments are relatively small compared to the areas proposed for dredging and capping.

An RMC layer for dredge residuals, institutional controls, monitoring, and maintenance is included in the various alternatives. The application of an RMC layer is included in each alternative as a means of controlling dredged residuals and is similar for each alternative. The potential sources to the EW OU are regulated under State and Federal programs and would be addressed regardless of the selected alternative. Further discussion of residuals management and source control are presented in Section 10 of the FS and Sections 3 and 6 of this Proposed Plan.

The extent of monitoring and maintenance is directly related to the areal extent where contamination is left in place. Alternatives that remove more of the contaminated sediments require less long-term monitoring. Alternatives with more capping would require more monitoring than those that rely on a greater amount of dredging. Alternatives that rely more on MNR, ENR, and in situ treatment would require the collection of more monitoring data to ensure adequate progress toward achieving the RAOs. These alternatives also have a greater potential that additional actions may be needed if monitoring data indicate that the RAOs may not be achieved in a reasonable timeframe.

Additional actions may be required if monitoring indicates that the remedy is not performing as designed. Alternatives with more sediment removal are more permanent and would require less maintenance compared to alternatives that rely on capping, ENR, and MNR.

Institutional controls will be required for all alternatives to protect human health until RAO 1 is achieved, and to maintain the integrity of all capped areas.

8.3.3 Summary

Long-term effectiveness and permanence were evaluated for each alternative based on long-term risk reduction and magnitude of the risk remaining and the adequacy and reliability of controls. This evaluation considers areas where contamination is permanently removed as well as areas that will require technology-specific monitoring and maintenance.

Alternative 3E(7.5) removes the greatest amount of contaminated sediment and would require the fewest long-term controls. Alternatives 2B(12), 2C+(12), 3B(12), 3C+(12), 2C+(7.5) each rely on either extensive contaminated sediment removal or other permanent actions that would require minimal maintenance and monitoring. Alternatives 1B(12) and 1C+(12) leave more contaminated sediment in place and would require more maintenance and monitoring to maintain long-term protectiveness. Alternative 1A(12) would leave the greatest amount of contaminated sediment in place, resulting in greater reliance on MNR and less reliance on engineered controls.

8.4 Reduction in Toxicity, Mobility, or Volume through Treatment

Alternative 1A(12) does not include any treatment. All other action alternatives include in situ treatment using activated carbon or other sequestering agents as a remedial technology in the Under-pier Areas of the EW OU.

8.5 Short-Term Effectiveness

Short-term effectiveness evaluates the impacts of each alternative on human health and the environment during the construction phase of the remedial action and until RAOs are achieved. This criterion includes the following metrics:

- Community and worker protection during construction.
- Environmental impacts from construction, including those associated with dredge releases, transportation, air emissions, and carbon footprint during implementation.
- The time to construct the remedy.
- The time to achieve RAOs (as a measure of the risk that is present on site until the RAOs are met).

8.5.1 Community and Worker Protection

Risks to workers from activities at the construction site as well as exposure to EW-related contaminants are generally low and are managed through established health and safety requirements for work at hazardous waste sites and best management practices. Nevertheless, the potential for worker injuries increases with a longer construction period. Consumption of shellfish and resident fish during and following construction represents a short-term risk to the community. Concentrations of COCs in resident fish are expected to remain constant or may increase during construction due to contaminated sediment resuspension but are expected to decline once construction activities cease.

Disruptions and inconveniences to the public and commercial community, such as increased traffic and temporary waterway restrictions, can be expected during construction. These include the impacts of trucks, trains, and barges needed to transport materials to and from the EW OU.

Short-term risks to workers and the community are generally proportional to the duration of construction activities, volume of material handled, and transportation requirements.

Diver-assisted hydraulic dredging is a specialized worker category included in Alternatives 1C+(12), 2C+(12), 3C+(12), 2C+(7.5), and 3E(7.5). This activity has more risk for workers than any of the other construction activities, with risks increasing with greater duration and amount of this activity. Alternative 3E(7.5) poses the highest risk to worker safety because of the amount of hazardous diver-assisted hydraulic dredging included (13 acres).

The relative impacts of trucks, trains, and barges needed to transport sediment were based on the total hauled miles, which included transporting sediment to off-site disposal facilities as well as transporting construction materials (sand, gravel, armor stone, and activated carbon) to the EW OU. Transportation impacts will be managed with traffic control plans developed during remedial design. Based on the volume of material removed and imported for caps and cover, duration of construction and transportation miles, Alternatives 1A(12), 1B(12), and 1C+(12) are predicted to have the lowest short-term community impacts. Alternatives 2B(12), 2C+(12), 3B(12), and 3C+(12) would have greater impacts, and Alternatives 2C+(7.5) and 3E(7.5) would have the greatest impacts.

8.5.2 Environmental Impacts

Environmental impacts considered in evaluating the alternatives included noise, air emissions, landfill capacity utilization, depletion of natural resources, ecological impacts, and energy consumption. As with impacts to the community, alternatives with longer durations and higher volumes of sediment to transport have greater environmental impacts. Remedial design will evaluate ways to lower environmental impacts when alternatives exist, following regional and national green remediation guidance (EPA 2009).

8.5.3 Time to Achieve RAOs

The time to achieve RAOs is an evaluation of the time required from the start of construction until cleanup levels are met. Impacts to human health and the environment will occur during construction and, in some cases, following construction. Relative short-term risks are considered to be less as the timeframe required to achieve RAOs decreases.

RAO 1: Reduce to protective levels risks associated with the consumption of contaminated resident EW fish and shellfish by adults and children with the highest potential exposure. All action alternatives are predicted to achieve the same order of magnitude in reduction of cancer risk and non-cancer hazard. Based on the estimated site-wide concentrations immediately following the completion of construction, Alternative 2C+(7.5) is expected to achieve RAO in the shortest timeframe, followed in order by Alternatives 1B(12) and 1C+(12), then 3E(7.5), then 2B(12) and 2C+(12), then 3B(12) and 3C+(12), with Alternative 1A(12) predicted to take the longest period of time to achieve this RAO.

RAO 2: Reduce to protective levels risks from direct contact (skin contact and incidental ingestion) by adults and children to contaminated sediments during net fishing and clamming. All alternatives are predicted to achieve this objective at the end of construction. The construction periods for the different alternatives range from 9 to 13 years.

RAO 3: Reduce to protective levels risks to benthic invertebrates from exposure to contaminated sediments. Alternative 1A(12) has the longest timeframe to achieve this RAO, while the other alternatives are predicted to achieve this objective immediately after construction completion (9 to 13 years, depending on the alternative).

RAO 4: Reduce to protective levels risks to crabs and fish from exposure to contaminated sediment, surface water, and prey. All alternatives are predicted to achieve this objective. The time required to achieve sediment concentrations protective of crabs and fish is directly correlated to the length of construction. Alternatives with shorter periods of construction will achieve this RAO in a shorter timeframe.

8.5.4 Summary

Relative rankings for short-term effectiveness were based on community/worker protection and environmental impacts, as indicated by construction duration, volume removed, and time to achieve RAOs.

Alternatives 1B(12), 1C+(12), 2B(12), and 3B(12) have the fewest impacts to workers, the community, and the environment, with construction durations of 9 to 10 years, no diver-assisted hydraulic dredging, and low to moderate volumes of sediment removal. These alternatives achieve the RAOs either at the end of construction or within a reasonable timeframe.

Alternatives 2C+(12) and 3C+(12) are expected to have greater short-term risks to workers, the community, and the environment than Alternatives 1B(12), 1C+(12), 2B(12), and 3B(12), with construction durations of 10 years and removal of 910,000 to 960,000 cy of sediment, and 2 years of diver-assisted hydraulic dredging.

Alternative 1A(12) is considered to have greater short-term risks to workers, the community, and the environment than Alternatives 2C+(12) and 3C+(12) because the time to achieve RAOs is longer due to greater reliance on MNR. Alternative 2C+(7.5) also has greater construction impacts compared to the other action alternatives (11 years of construction; 2 years of diver-assisted dredging).

Alternative 3E(7.5) has the greatest short-term risks to workers, the community, and the environment. This alternative includes extensive diver-assisted dredging, the largest volume of dredged sediment, and the longest construction timeframe (13 years).

8.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Technical feasibility encompasses the complexity and uncertainties associated with implementation of the alternative; the reliability of the technologies; the availability of materials, services, and equipment necessary for construction; and monitoring requirements. Administrative feasibility includes the activities required for coordination with other parties and agencies (such as obtaining permits for any off-site activities, access, or rights-of-way for construction).

All alternatives employ similar technologies in open water areas, including dredging, capping, and ENR. The construction activities required for the implementation of all open water technologies would be technically feasible and have been implemented at many Superfund sites around the country. Materials, services, and equipment necessary for construction are readily available. Disposal facilities are also readily available and have adequate capacity for the volumes of material being removed.

The degree of technical challenges associated with the limited access areas vary more widely. MNR, as part of Alternative 1A(12), poses few technical challenges, with the lowest potential for difficulties, delays, and impacts to EW tenants and users. In situ treatment and diver-assisted hydraulic dredging in Under-Pier areas pose greater technical challenges than MNR. In situ treatment, included in all alternatives except 1A(12), requires the selection of effective treatment material that depends on site-specific chemical and physical factors. Placement of in situ treatment material would be performed by conveyors, which is more complex than placement in open water areas.

Diver-assisted hydraulic dredging, included in all C+ and E alternatives, is a more difficult remedial technology to implement. Divers will be operating the dredge on steep slopes composed of large riprap. There are a number of factors that make the work more hazardous from a worker health and safety perspective, including divers working below overwater structures while anchoring sediment is removed, working in low visibility as a result of shade from the pier, working in deeper water, and working in sediments suspended due to dredging activities. Debris such as cables, large wood, and broken pilings will also make dredging more difficult and potentially physically more dangerous for workers implementing the remedy. Finally, hydraulic dredging generates large quantities of slurry (sediment/water) that must be treated prior to discharge back to the waterway, requiring large upland areas for storage, dewatering, and treatment.

Administrative feasibility factors for the EW include in-water construction windows, coordination with the maintenance and deepening of navigational depths, and coordination with ongoing vessel activities. As described in Section 7.3, in-water construction is not anticipated to occur year-round in order to protect juvenile salmonids migrating through the EW. This affects all the alternatives requiring in-water work proportional to the estimated length of the construction timeframe for each alternative. Coordination with DNR will be needed for all alternatives that include capping on State-owned aquatic land.

Construction activities associated with each alternative vary with respect to the compatibility with potential future dredging to maintain navigation depths in the waterway. Alternatives 1A(12), 1B(12), 1C+(12), 2B(12), 2C+(12), and 2C+(7.5) include capping in the southern Shallow Main Body Reach area, where the cap would be placed at elevations shallower than the current authorized elevation. Such cap placements may interfere with future efforts to increase navigation depths in the Shallow Main Body Reach.

The compatibility with future channel deepening from the Seattle Harbor Navigation Improvement Project (SHNIP) and amount of coordination required vary among the alternatives. Alternatives 1A(12), 1B(12), and 1C+(12) include areas of ENR and partial removal with ENR. ENR is assumed to require placement of a sand layer with a thickness of 18 inches. Given the currently authorized depth of -51 MLLW for the EW, it is likely that the future SHNIP will result in interference with ENR for these alternatives. The remaining Alternatives 2B(12), 2C+(12), 3B(12), 3C+(12), 2C+(7.5), and 3E(7.5) include full removal of contaminated sediment within the navigation channel boundaries. Therefore, these alternatives are unlikely to conflict with future SHNIP construction activities.

Alternatives 1A(12), 1B(12), 2B(12), and 3B(12) are considered to be the most implementable, balancing both technical and administrative implementability. Alternatives 1C+(12), 2C+(12), 3C+(12), 2C+(7.5), and 3E(7.5) were considered to be less implementable.

8.7 Cost

The estimated costs for the alternatives are based on the best available information related to volumes, concentrations and current market unit costs. Using a 7 percent discount rate Alternative 1A(12) is the least expensive at $256 million, followed by alternatives 1B(12) 1C+(12), 2B(12), 2C+(12), and 3B(12), 3 C+(12), 2C+(7.5) in increasing order, with alternative 3E(7.5) being the most costly at $411 million.

8.8 State and Tribal Acceptance

EPA will evaluate State and Tribal acceptance of the Preferred Alternative based on the comments received from the public comment period of this Proposed Plan.

8.9 Community Acceptance

EPA will evaluate community acceptance of the Preferred Alternative based on the comments received during the public comment period on this Proposed Plan and will respond to community comments in the responsiveness summary of the ROD.

9 Preferred Alternative

After consideration of the comparative analysis of remedial alternatives presented in the FS, EPA is proposing a modified version of Alternative 3B(12) as the Preferred Alternative. It follows the technology assignments of this alternative, except the open water area under the West Seattle Bridge. In this area, EPA is proposing ENR rather than contaminated sediment dredging and backfill due to the technical limitations of mechanical dredging near the low clearance bridges. The options are defined in Section 7.4. The locations for each remedial technology for the Preferred Alternative are shown on Figure 14, and total acreage of each technology is summarized on Figure 15.

The key elements of the Preferred Alternative are:

- Open water: Option 3 Modified
  - Deep Main Body and Berth Areas: sediment removal.
  - Shallow Main Body Reach: sediment removal, or sediment removal and backfill.
  - Nearshore: Capping.
  - Sill Reach – West Seattle Bridge: ENR.
- Limited Access: Option B
  - Under-pier Areas: In situ treatment.
  - Sill Reach – Low Bridges: ENR.
- PCB RAL: 12 mg/kg OC.

A list of RALs for the other COCs for the Preferred Alternative is shown in Table 8.

The Preferred Alternative actively remediates 121 acres of the EW and includes the following:

- Dredging 99 acres of contaminated sediment in the open water portions of the EW. This includes 93 acres of dredging without backfill, 2 acres of dredging with backfill to existing contours, and up to 4 acres of dredging and backfilling in the Communication Cable Crossing.
- Capping 7 acres in the Nearshore Areas, which may require some dredging to accommodate navigation and habitat elevation requirements.
- Placement of approximately 3 acres of a 9-inch ENR layer in the Sill Reach under the Spokane Street, West Seattle, and Railroad Bridges. Access in this area is limited by low-clearance bridges that restrict access by mounted dredges.
- Placement of in situ treatment for contaminated sediments on over 12 acres of limited access Under-pier Areas.
- Monitored natural recovery in 36 acres of the waterway, where contaminant concentrations are below the RALs.
- The estimated time for construction is 10 years, assuming a 4.5-month construction window each year (see Section 7.3).

Sediment Disposal: An estimated 940,000 cy of contaminated sediment will be removed from the waterway. This material will be transported, likely via barge and rail, to a permitted upland off-site disposal facility that accepts non-hazardous waste. Any hazardous waste encountered during dredging would be sent to a facility that is permitted to accept hazardous waste.

Residuals Management Cover: An RMC will be placed as soon as possible following completion of dredging activities for each dredging season and in areas adjacent to dredged areas where residuals may have settled. The RMC will consist of clean sand and is expected to be between 4 to 12 inches thick, with the final thickness to be determined based on post-remediation sediment bed elevation and sampling.

Institutional Controls: These controls include fish advisories specific to the EW and educational outreach, waterway use restrictions, and land use restrictions to protect caps and areas where in situ treatment is applied, as described in Section 7.2.3. Institutional controls for Tribal fisheries will be limited to educational outreach and coordination with the Suquamish Tribe and Muckleshoot Indian Tribe.

Monitoring: Monitoring during construction will be conducted to ensure that the remedial components are built according to specifications, such as determining that materials are dredged to the specified depth, verifying that sediments where contaminant concentrations exceeding the RAL are removed, and ensuring the RMC is placed to the specified thickness and elevation. During construction activities, COC concentrations will be monitored in the water column to ensure that best management practices for controlling resuspension of contaminated sediment during dredging are effective. Post-construction short-term monitoring will track natural recovery processes in achieving the cleanup levels in affected media (sediments, water, and biota) within the estimated/planned time frame. Long-term monitoring will be conducted to ensure that the remedy remains protective over time once cleanup levels are met.

Cost: The total estimated capital cost to construct the Preferred Alternative is $290 million ($214 million in net present value at the start of construction). This estimate is based on Alternative 3B(12), with some cost reduction associated with the change in technology in the Sill Reach – West Seattle Bridge.

9.1 Rationale for the Preferred Alternative

The Preferred Alternative provides the best balance of tradeoffs among the balancing criteria. It will reduce sediment contaminant concentrations contributing to human health and ecological risks to acceptable levels within a reasonable timeframe, it will provide for long-term reliability, and it is implementable, cost-effective, and consistent with future uses of the EW OU.

The Preferred Alternative will achieve substantial risk reduction primarily through dredging and capping the most contaminated sediments. Remaining risks are addressed through in situ treatment, ENR, MNR, and ICs. Based on the information currently available and discussed above, the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. EPA expects the Preferred Alternative to satisfy the following statutory requirements of CERCLA Section 121(b): (1) be protective of human health and the environment: (2) comply with ARARs (or justify waiver); (3) be cost effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element, or explain why the preference for treatment will not be met.

After receiving and reviewing comments during the public comment period, EPA will develop a Responsiveness Summary and finalize the remedy in the ROD. EPA's Administrator will approve and sign the ROD.

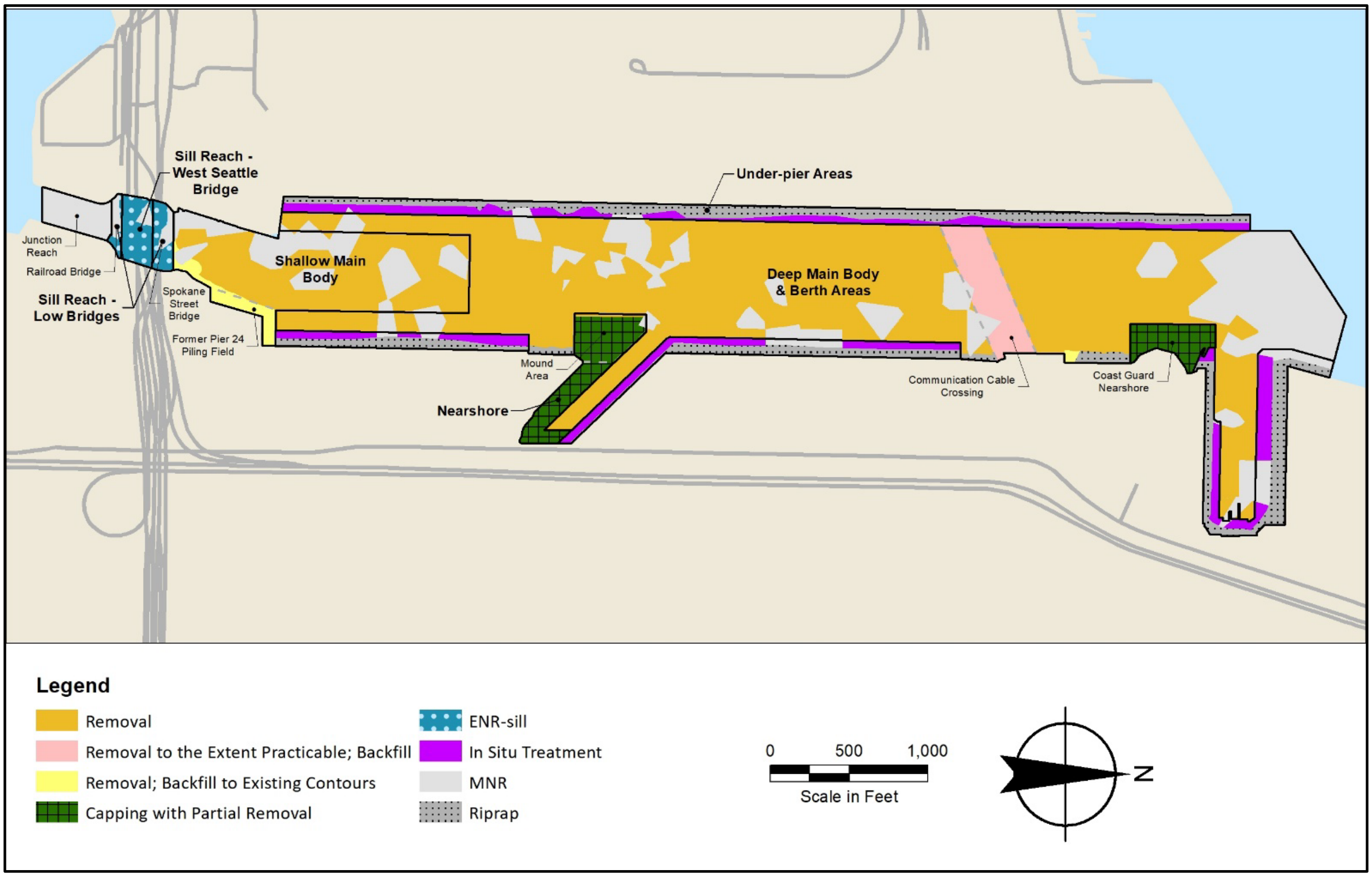

Figure 14. Preferred Alternative

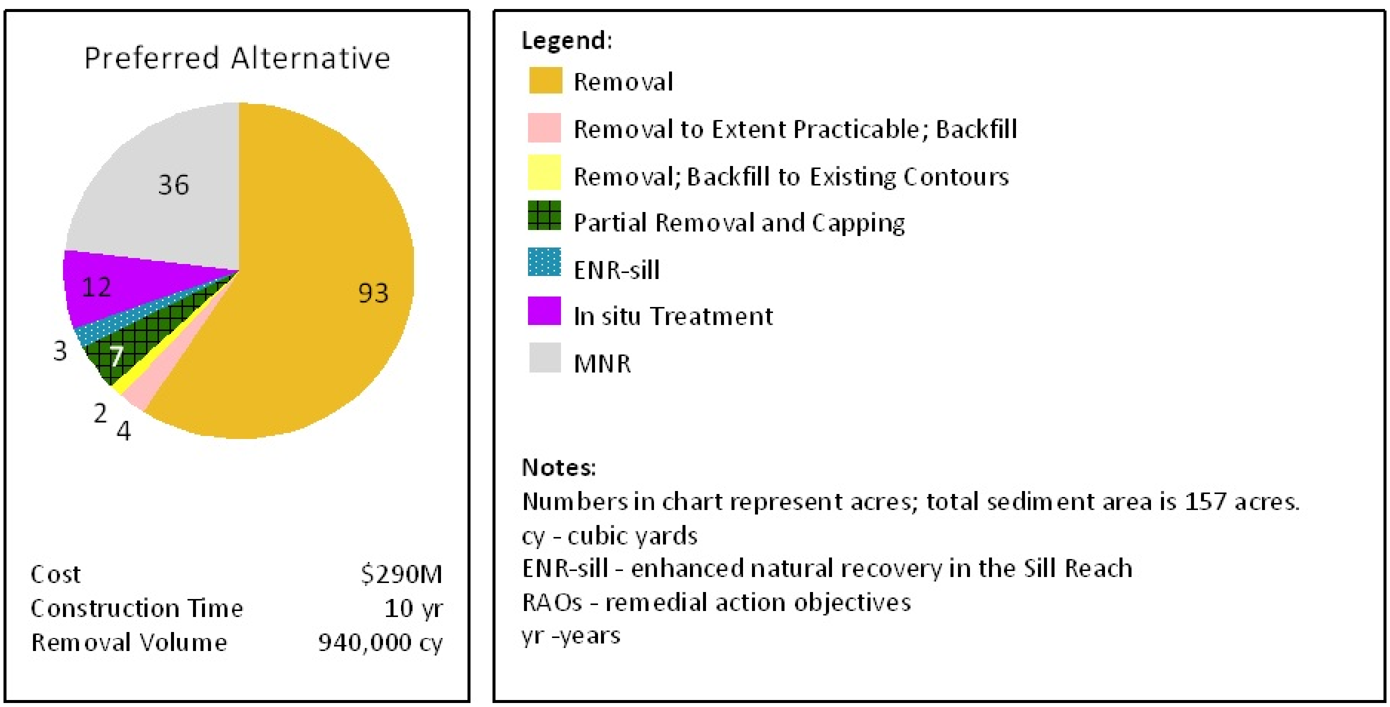

Figure 15. Area, Volume, and Cost Summary for the Preferred Alternative

10 References

Anchor QEA and Windward (Anchor QEA, LLC and Windward Environmental LLC). 2019. *Final Feasibility Study.* East Waterway Operable Unit Supplemental Remedial investigation/Feasibility Study. 11 June 2019.

King County. 1999. *King County Combined Sewer Overflow Water Quality Assessment for the Duwamish River and Elliott Bay*. Volume 1, Appendix B2, B3, & B4: Human Health, Wildlife, and Aquatic Life Risk Assessments. King County Department of Natural Resources, Seattle, Washington. 26 February 1999.

OMB (Office of Management and Budget). 2018. *Circular A-94 Appendix C: Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses, Revised November 2017.* Available from: https://www.federalregister.gov/documents/2018/02/08/2018-02520/discount-rates-for-cost-effectiveness-analysis-of-federal-programs. Accessed 31 Oct 2018.

The Suquamish Tribe. 2000. Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation; Puget Sound Region. August 2000.

Toy, Kelley A., Nayak L. Polissar, Shiquan Liao, Gillian D. Mittelstaedt. 1997. *A Fish Consumption Survey of The Tulalip and Squaxin Island Tribes of the Puget Sound Region*. October 1996.

USACE (U.S. Army Corps of Engineers). 2017a. Approved Work Windows for Fish Protection for All Marine/Estuarine Areas Excluding the Mouth of the Columbia River (Baker Bay), by tidal Reference Area. 21 August 2017. Accessed on 21 July 2020. Available from: <https://www.nws.usace.army.mil/Missions/Civil-Works/Regulatory/Permit-Guidebook/> at "Chapter X. Work Windows."

USACE. 2017b. *Final Integrated Feasibility Report and Environmental Assessment*, Seattle Harbor Navigation Improvement Project, Seattle, WA. November 2017.

U.S. Environmental Protection Agency (EPA). 1996. Soil Screening Guidance: User's Guide. Office of Emergency and Remedial Response, Washington, DC. EPA 540-R-96/018, OSWER 9355.4-23.

EPA. 1997. Rules of Thumb for Superfund Remedy Selection. Office of Emergency and Remedial Response, Washington, DC. EPA 540-R-97-013, OSWER 9355.0-69.

EPA. 1999. *Asian and Pacific Islander Seafood Consumption Study in King County, Washington.* EPA 910/R-99-003. Office of Environmental Assessment, Risk Evaluation Unit, U.S. Environmental Protection Agency, Region 10, Seattle, WA. 27 May 2009.

EPA. 2000. *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study.* EPA 540-R-00-0002. Office of Emergency and Remedial Response. Prepared by U.S. Army Corps of Engineers, Hazardous, Toxic, and Radioactive Waste Center of Expertise. July 2000.

EPA. 2002a. *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites.* EPA 540-R-01-003. Office of Emergency and Remedial Response. September 2002.

EPA. 2002b. *Role of Background in the CERCLA Cleanup Program*, OSWER 9285.6-07P Appendix B. Office of Solid Waste and Emergency Response.

EPA. 2009. US Environmental Protection Agency Region 10 Superfund, RCRA, LUST, and Brownfields Clean and Green Policy. Office of Environmental Cleanup, U.S. Environmental Protection Agency, Region 10, Seattle, Washington. August 2009.

West, James E., Sandra O'Neill, Greg Lippert, Stephen Quinnell. 2001. *Toxic contaminants in Marine and Anadromous Fishes from Puget Sound, Washington.* Results of the Puget Sound ambient monitoring program fish component 1989-1999. Washington Department of Fish and Wildlife, Olympia, WA. August 2001.

Windward (Windward Environmental LLC). 2007. *Baseline Human Health Risk Assessment, Lower Duwamish Waterway.* Final. 12 November 2007.

Windward. 2012a. *Baseline Ecological Risk Assessment (BERA)*. Appendix A, East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study. Final. August 2012.

Windward. 2012b. *Baseline Human Health Risk Assessment (BHHRA)*. Appendix B, East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study. Final. September 2012.

Windward and Anchor QEA. 2014. *Final Supplemental Remedial Investigation.* East Waterway Operable Unit Supplemental Remedial investigation/Feasibility Study. January 2014.

Windward. 2019. Baseline Human Health Risk Assessment Addendum: cPAH TEQ Updates. East Waterway Operable Unit Feasibility Study. April 2019.

11 Acronyms and Abbreviations

ARAR	applicable or relevant and appropriate requirements
AWQC	Ambient Water Quality Criteria, from the Clean Water Act Section 304(a)
BERA	baseline ecological risk assessment
BHHRA	baseline human health risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
cy	cubic yard
DNR	Washington State Department of Natural Resources
dw	dry weight
Ecology	Washington State Department of Ecology
ENR	enhanced natural recovery
EPA	U.S. Environmental Protection Agency
EW	East Waterway
EWG	East Waterway Group
FS	Feasibility Study
HI	hazard index
HQ	hazard quotient
kg	kilogram
LDW	Lower Duwamish Waterway
mg	milligram
MLLW	mean lower low water
MNR	monitored natural recovery
MTCA	Washington State Model Toxics Control Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
OC	organic carbon
O&M	operations & maintenance
OU	operable unit
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
RAL	remedial action level
RAO	remedial action objective
RBTC	risk-based threshold concentration
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RMC	residuals management cover
RME	reasonable maximum exposure
ROD	Record of Decision
SCO	Sediment Cleanup Objective
SHNIP	Seattle Harbor Navigation Improvement Project
SMS	Washington State Sediment Management Standards
SRI	Supplemental Remedial Investigation
TBT	tributyltin
TTC	target tissue concentration
TEQ	toxic equivalencies
µg	microgram
U and A	usual and accustomed
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
WQS	Washington water quality standards
ww	wet weight