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DEPARTMENT OF ECOLOGY

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April 4, 2023

Allison Geiselbrecht, Ph.D.
Floyd|Snider
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Re: Ecology's proposed remedy for Western Port Angeles Harbor

- **Site Name:** Western Port Angeles Harbor
- **Site Address:** Western Port Angeles Harbor, Port Angeles, Clallam County, WA, 98363
- **Cleanup Site ID**: 11907
- **Facility/Site ID**: 18898

Dear Allison Geiselbrecht:

This letter provides clarification on the cleanup action selection process under the Model Toxics Control Act (MTCA), the Washington State Department of Ecology's (Ecology's) rationale and decision for the proposed cleanup action, and next steps for completion of work under Agreed Order No. DE 9781 (agreed order).

This letter also responds to a February 7, 2022, letter to the Washington State Attorney General's Office from legal counsel for the City of Port Angeles, Georgia-Pacific, LLC, Nippon Paper Industries, Merrill & Ring, and Owens-Corning.[1]

On November 18, 2020, Ecology approved the Western Port Angeles Harbor Sediment Cleanup Unit Remedial Investigation/Feasibility Study (RI/FS).[2] A November 30, 2020,

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[1] Barnett, Thiele, Mitchell, and Tohan. Letter to Fitz, Anderson, and Thompson at Washington State Attorney General's Office. Re: Western Port Angeles Harbor Site – Remedy for SMA 2. February 7, 2022.

[2] Western Port Angeles Harbor Group. Final Western Port Angeles Harbor Sediment Cleanup Unit Remedial Investigation/Feasibility Study. October 2020.

amendment to Agreed Order No. DE 9781 (Agreed Order) between Ecology and the Western Port Angeles Harbor Group (WPAHG) added the preparation of a preliminary draft cleanup action plan (DCAP). The WPAHG submitted a preliminary DCAP[3] for review on March 26, 2021.

The preliminary DCAP included WPAHG's recommended remedial alternatives for each of the three sediment management areas (SMAs):

- SMA 1, Inner Harbor: Partial intertidal excavation and capping, with subtidal capping (RI/FS Alternative 1-D)
- SMA 2, Lagoon: Intertidal capping with subtidal enhanced monitored natural recovery (EMNR) and partial excavation for habitat mitigation (RI/FS Alternative 2-E)
- SMA 3, Waterfront and Outer Harbor: EMNR and monitored natural recovery to an extent that cleanup standards will be achieved within 10 years after competition of construction (RI/FS Alternative 3-B)

Ecology selects Alternatives 1-D and Alternative 3-B as part of the proposed remedy, as recommended in the RI/FS for SMA 1 and 3, respectively. **After reviewing the preliminary DCAP, considering new information about SMA 2 (the lagoon), and completing additional evaluation of the SMA 2 disproportionate cost analysis (DCA), Ecology selects Alternative 2-D for SMA 2. This is a different alternative than the one recommended in the RI/FS**.

[3] Western Port Angeles Harbor Group. Draft Cleanup Action Plan Western Port Angeles Harbor, Port Angeles, WA, Preliminary Review Version. March 2021.

MTCA and Selection of Remedy

The MTCA rules prescribe how to evaluate and select cleanup actions.[4] The rules also set forth expectations for cleanup actions.[5] The selected cleanup action must meet the "threshold"[6] and "other"[7] requirements, including using permanent solutions to the maximum extent practicable.

We use the DCA to determine which alternative uses permanent solutions to the maximum extent practicable.[8] This involves comparing the alternatives against the evaluation criteria:[9]

- Protectiveness
- Permanence
- Effectiveness over the long term
- Management of short-term risks
- Technical and administrative implementability
- Consideration of public concerns
- Cost

The FS evaluated the alternatives presented against these criteria, calculated benefit-to-cost ratio, and recommended the alternative with the highest benefit-to-cost ratio as the recommended alternative for each SMA.

Under a DCA, Ecology's comparison of benefits and costs may be quantitative, but will often be qualitative and require the use of best professional judgement.[10] In particular, Ecology has the discretion to favor or disfavor qualitative benefits and use that information in selecting a cleanup action.[11] When determining which cleanup action

[4] WAC 173-340-360
[5] WAC 173-340-370
[6] WAC 173-340-360(2)(a)
[7] WAC 173-340-360(2)(b)
[8] WAC 173-340-360(3)(b), (e)
[9] WAC 173-340-360(3)(f)
[10] WAC 173-340-360(3)(e)(ii)(C)
[11] WAC 173-340-360(3)(e)(ii)(C)

alternative "uses permanent solutions to the maximum extent practicable,"[12] MTCA requires Ecology to select the most permanent alternative whose incremental cost is not disproportionate to the incremental benefit it would achieve compared to the lower cost alternative.[13] Thus, the alternative with the highest benefit-to-cost ratio is not necessarily the same as the alternative that is "permanent to the maximum extent practicable."

The agreed order required WPAHG to produce a remedial investigation and feasibility study. The feasibility study included an evaluation of alternative cleanup actions that protect human health and the environment in accordance with WAC 173-240 and WAC 173-340. In the November 18, 2020, RI/FS approval letter, Ecology stated "Ecology accepts this RI/FS as providing sufficient information for Ecology to select a remedial action alternative and approves it."[14] However, our approval of the RI/FS for that purpose did not constitute concurrence with the conclusions reached regarding the recommended preferred alternatives of the RI/FS.

SMA 2 Alternatives presented in the RI/FS

The RI/FS considered seven alternatives for SMA 2: Two alternatives (2-F and 2-G) failed to meet the preliminary sediment cleanup levels at the point of compliance within a reasonable timeframe and were eliminated from further consideration. The remaining five alternatives (2-A through 2-E) were retained for further evaluation, including:

Alternative 2-A: Maximum Dredging and Excavation – This alternative includes intertidal excavation and subtidal dredging of contaminated sediments to the maximum extent practicable (estimated to be approximately 4-feet deep) across the lagoon. Excavated and dredged areas would be filled to the current grade.

Alternative 2-B: Partial Dredging and Excavation with Capping – This alternative includes intertidal excavation and subtidal dredging of the top two feet of contaminated sediment across the lagoon. Excavated and dredged areas would be capped with an approximately 2-foot-thick engineered cap to return the areas to the current grade.

Alternative 2-C: Partial Intertidal Excavation and Capping with Subtidal EMNR – This alternative includes partial intertidal excavation and capping in contaminated intertidal

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[12] WAC 173-340-360(3)(b)
[13] WAC 173-340-360(3)(e)
[14] Washington State Department of Ecology. Letter to Allison Geiselbrecht, Ph.D. Floyd||Snider, Re: Approval of Western Port Angeles Harbor Sediment Cleanup Unit Remedial Investigation/Feasibility Study. November 18, 2020.

sediments, along with EMNR (average 6-inch-thick layer placed over 2 years with 3-inches placed each year) over subtidal sediments.

Alternative 2-D: Optimized intertidal capping, partial intertidal excavation and capping, partial intertidal excavation and EMNR, subtidal dredge with EMNR, and subtidal EMNR – This alternative is designed to maximize contaminated sediment removal, while minimizing the footprint of disturbance to ecologically sensitive areas. It includes a combination of intertidal capping, partial excavation with backfill or capping in contaminated intertidal sediments, partial excavation with backfill or EMNR in intertidal or subtidal contaminated sediment, and subtidal EMNR over two construction seasons. This alternative proposes excavation of a man-made causeway and other upland soils as mitigation since intertidal capping will result in loss of aquatic habitat. Specific mitigation requirements will be determined during remedial design.

Alternative 2-E: Intertidal Capping with Subtidal EMNR – This alternative includes capping intertidal sediments, along with subtidal EMNR. This alternative proposes excavation of a man-made causeway and other upland soils as mitigation since intertidal capping will result in loss of aquatic habitat. Specific mitigation requirements will be determined during remedial design.

Rationale for Ecology's SMA 2 alternative selection

As part of Ecology's review of the preliminary DCAP, Ecology reviewed the RI/FS and DCA, and applied both qualitative and quantitative methods and best professional judgement to determine which alternative is permanent to the maximum extent practicable. The DCA for SMA 2, included in the RI/FS as Table 14.2, includes both narrative and numerical evaluations of the various alternatives.

New information

Ecology's review of the DCA included new information, summarized below, learned since the approval of the RI/FS.

Recognizing Tribal sovereignty, Ecology has a duty to collaborate and share knowledge with Tribes on program implementation matters that directly affect Tribes.[15] Recent discussions and correspondence with the Lower Elwha Klallam (LEKT), Port Gamble S'Klallam and Jamestown S'Klallam Tribes increased our awareness and knowledge of the

[15] RCW 43.376.020(1).

cultural and historical significance of the lagoon to the Klallam Tribes. Ecology also recognizes the Tribes' expertise and knowledge of the local habitat.

The unique natural resources of the lagoon were important to the location of the aboriginal Tse-whit-zen village and cemetery site. Butler et al., 2019a, provides insight into the great significance of the village and cemetery site located east of the lagoon and includes a photograph ca. 1900 taken from the bluff west of Tse-whit-zen noting structures, likely LEKT residences, found on land around the lagoon and built on piers that extend into the lagoon.[16] Butler et al., 2019b, acknowledges the lagoon as an important source of resources, including fish, shellfish and waterfowl.[17] LEKT harvested these resources under its treaty rights until 2007, when it temporarily closed the Harbor to harvest activities pending remediation of toxic contamination.

The RI/FS justified capping and awarded greater benefit scores to alternatives that avoided disturbance of cultural resources. The Lower Elwha Klallam Tribe has indicated there are ways to monitor dredging or excavation to minimize or altogether prevent cultural resource disturbance, and that promoting and justifying capping to avoid disturbance of cultural resource is at cross-purposes with the Tribe's focus on environmental and cultural restoration of the lagoon.[18] Monitoring protocols have been used successfully in conjunction with the City of Port Angeles CSO project, and in other instances, to prevent or mitigate impacts to cultural resources.

Ecology gained an increased understanding of the lagoon as a regionally rare, tidally influenced, barrier beach system providing the only salt marsh habitat in Port Angeles Harbor.[19,20] The lagoon, along with all nearshore marine areas of the Strait of Juan de Fuca east of the western end of the Elwha River delta, from the line of extreme high tide out to a depth of 30 meters, is designated critical habitat for threatened Puget Sound

[16] Butler, Virginia L.; Bovy, Kristine M.; Campbell, Sarah K.; Etnier, Michael A.; and Sterling, Sarah L., (2019a) "The Čḯx̣wicən Project of Northwest Washington State, U.S.A.: Opportunity Lost, opportunity Found" 2019. *Anthropology Faculty and Staff Publications*. 25. https://cedar.wwu.edu/anthropology_facpubs/25.

[17] Butler, V., Campbell, S., Bovy, K., Etnier, M. (2019b). Exploring Ecodynamics of Coastal Foragers Using Integrated Faunal Records from Čḯx̣wicən Village (Strait of Juan de Fuca, Washington, U.S.A.). Journal of Archaeological Science: Reports, Volume 23, 2019, Pages 1143-1167.

[18] Lower Elwha Klallam Tribe. 2021. Summary of Concerns with SMA 2 Preferred Alternative (2E) and Recommended Actions, August 31.

[19] Port Angeles Harbor Natural Resource Trustees (PAHNRT). 2021. Damage Assessment and Restoration Plan: Western Port Angeles Harbor, Final. Developed May 2021 by NOAA Damage Assessment, Remediation and Restoration Program, Seattle, Washington. 47 pp.

[20] Shipman, H. 2008. A Geomorphic Classification of Puget Sound Nearshore Landforms. Puget Sound Nearshore Partnership Report No. 2008-01. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington

Chinook salmon. Puget Sound Chinook salmon are a critical food source for Southern Resident killer whales,[21] listed as endangered under the Endangered Species Act.[22] Chinook salmon are identified as an important prey item year-round for the Southern Resident killer whales, averaging 50% of their diet in the fall, increasing to 70-80% in the mid-winter/early spring, and increasing to nearly 100% in the spring.[16] The lagoon is also mapped in a 2020 National Oceanic and Atmospheric Administration (NOAA) Fisheries publication as a pocket estuary, a habitat type with high potential value for juvenile Puget Sound Chinook Salmon.[23]

The lagoon remains connected to the harbor along the inside of Ediz Hook. Nearshore vessel beach-seining conducted by NOAA in Port Angeles Harbor (2006-2022) recorded significant utilization of nearshore habitats by juvenile salmonids and other forage fish.[24] Forage fish species upon which ESA-listed salmon depend were found in great abundance at sample sites in the harbor. These studies provide evidence of the presence of juvenile salmon and forage fish in the nearshore near the lagoon, and the lagoon is located adjacent to and connected to migration routes. The protected lagoon contains a known eelgrass bed ecologically important as nurseries for a range of fish. The lagoon likely provides essential rearing habitat and prey protection for juvenile fish, shellfish, birds, and other wildlife. Although lagoon site access for a biological assessment has not been provided by the former or current owners, several significant factors – including but not limited to: the presence of juvenile salmon and forage fish in contiguous nearshore habitat, which is both connected to the lagoon and located along migration routes; the protection from predators afforded by the seclusion of the lagoon rearing habitat; and the known eelgrass beds, which are important as nurseries for many species - all support the designation of the lagoon as potential high value habitat.

The effects of capping up to 10-acres of intertidal sediment in this critical habitat, without any excavation, would be greater than just the loss of fringe aquatic lands around the

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[21] Hanson MB, Emmons CK, Ford MJ, Everett M, Parsons K, Park LK, et al. (2021) Endangered predators and endangered prey: Seasonal diet of Southern Resident killer whales. PLoS ONE 16(3): e0247031. https://doi.org/10.1371/journal.pone.0247031

[22] Protected Resources App (noaa.gov); 50 CFR Sec. 226.212(g)(16)

[23] Puget Sound Natal & Pocket Estuaries - Overview (arcgis.com); Puget Sound Natal & Pocket Estuaries (arcgis.com); Puget Sound Nearshore "Conservation Calculator" User Guide ("development of a pocket estuary will incur more debits due to the importance of these areas to juvenile Puget Sound Chinook salmon.").

[24] Frick, et al. 2022. Spatiotemporal variation in Distribution, Size, and Relative Abundance within a Salish Sea Nearshore Forage Fish Community. Marine and Coastal Fisheries. Dynamics, Management, and Ecosystem science 14: e10202.

lagoon, as was assumed by the mitigation calculations underlying alternative 2-E. The RI/FS did not include a discussion of temporal and permanent impacts of intertidal capping on habitat functions, such as loss of shallow habitat, altered inundation regime, net bathymetry changes or the potential for weak or delayed recruitment of biota due to the discontinuity and elevation difference between capped and surrounding uncapped areas. Capping materials, chosen for the purpose of contaminant containment and exposure elimination, rather than for the purposes of providing habitat, may impede recolonization of native vegetation. A biological review during pre-engineering design would bolster our understanding of impacts. Intertidal capping without excavation is also likely to affect the valuable, existing salt marsh habitat by reducing or interrupting tidal flow and inundation time to this area in the southwest portion of the lagoon.

In recent cases, the National Marine Fisheries Service has determined that shoreline development actions which result in adverse impact to Chinook salmon critical habitats are likely to jeopardize the species and is pressing “reasonable and prudent alternatives” to avoid, minimize or mitigate for any loss of habitat function.[25]

The Port Angeles NRDA Trustees consider the uncommon barrier beach lagoon, once part of an extensive barrier embayment, one of the greatest opportunities to restore ecosystem services in the harbor and maximize public benefit.[26] The Trustees continue to express concerns that large scale capping without first excavating or dredging will limit future restoration options.

We continue to hear public concerns on Port Angeles-related cleanups supporting selecting remedies that include removal of contamination rather than just capping or containing it.[27,28]

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[25] U.S. DEP’T OF COM., NAT’L MARINE FISHERIES SERV., NMFS No. WRCO-2020-01361, Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Issuance of 39 Permits under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act for New, Replacement, or Repaired Structures in the Nearshore Environment of Puget Sound 169 (Nov. 9, 2020).

[26] Port Angeles Harbor Natural Resource Trustees, Damage Assessment and Restoration Plan: Western Port Angeles Harbor, May 2021.

[27] Washington State Department of Ecology. Western Port Angeles Harbor Sediment Cleanup Unit Remedial Investigation and Feasibility Study Responsiveness Summary. September 2020.

[28] Ecology, Port Angeles Rayonier Mill Site Interim Action Reports Volumes I, II, and III Responsiveness Summary. January 2021.

Updates to SMA 2 DCA

Based on this new information, we adjusted the SMA 2 DCA. Table 1 shows the revised SMA 2 DCA scores highlighted in yellow.

The criteria for protectiveness includes consideration of "improvement of the overall environmental quality."[29] Intertidal capping would reduce risks to human health and the environment by containing contamination; however, our understanding of the adverse effects of intertidal capping without excavation on the regionally rare barrier lagoon has increased. Capping with or without excavation will both have temporary adverse effects due to the destruction of existing habitat. As mentioned above, capping without excavation is expected to have permanent impacts on habitat functions due to loss of shallow water habitat, changes in inundation regime, net bathymetry changes, reduction in the volume of the lagoon, and the potential for weak or altered recruitment of biota following capping. These impacts are expected to be more pronounced for capping on grade for sediment at elevations lower in the intertidal range in that less area would remain fully inundated during typical tide cycles. NMFS has strongly recommended limits on conversion of shallow water habitat to "submersible lands" (areas that would not be constantly submerged).[30] We are reducing the DCA scores for alternatives that include intertidal capping without excavation due to decreased "improvement" in the overall environmental quality. We also recognize the historical and cultural significance of the lagoon for the Tribes and their desire to protect the environmental quality for future generations by minimizing impacts and changes to the configuration of the lagoon that move it further from its original configuration. Based on this information, we decreased the scores for protectiveness on Alternative 2-D from 2.5 to 2.0 and Alternative 2-E from 2.0 to 1.0.

We also decreased the permanence score for Alternative 2-E from 2.0 to 1.5 for two reasons. There is no permanent reduction in the volume of hazardous substances under this alternative and the previous score didn't adequately reflect this. Also, under Alternatives 2-C, 2-D and 2-E, the engineered cap will control the mobility of contaminants remaining in place under the cap, but there is less confidence that EMNR will mix with and dilute contaminants due to the limited data available to show this is an

[29] WAC 173-340-360(3)(f)(i)
[30] USEPA Region 10. Record of Decision, Portland Harbor Superfund Site, Portland, Oregon. January 2017.

appropriate remedy. The limited data may result in EMNR being applied incorrectly to areas with high levels of contamination or the potential for erosion.

We increased the long-term effectiveness score for Alternative 2-D from 2.5 to 3.0. Alternative 2-D has the potential to eliminate areas of higher contamination in both intertidal and subtidal sediment and reduce reliance on EMNR in the subtidal areas with higher contamination levels where EMNR would be less effective. This score better reflects the added long-term effectiveness of contaminated sediment removal as compared to no contaminated sediment removal in 2-E. The potential to remove areas of higher contamination in the subtidal areas also increases the long-term effectiveness score of 2-D.

We changed the technical and administrative implementability scores for Alternatives 2-C, 2-D, and 2-E from 3.0, 4.0 and 5.0, respectively, to 3.5, 3.5 and 4.0, respectively. Our review found that all these alternatives have moderate technical challenges with remediation on active industrial property and materials movement. All potentially have site access issues requiring access to all parts of the lagoon. Alternative 2-D potentially requires less dredged material dewatering and material removal when compared to 2-C but adds the challenge of mitigation requiring material removal and/or relocation; therefore, we changed the scores of these two alternatives to be the same at 3.5. The technical and administrative implementability of alternative 2-E also involves moderate technical challenges with capping on active industrial property, material delivery issues, site access issues, but higher mitigation requirements involving dredged material dewatering and removal or movement of material for mitigation; therefore, we scored 2-E slightly higher at 4.0.

We changed the score for public concern on Alternative 2.D from 4.5 to 5.0 and Alternative 2-E from 3.0 to 2.0. The previous scores did not adequately consider the public's desire for contaminant removal over containment and capping, the lagoon's historical or cultural significance to the Klallam Tribes, and the Tribes' concerns regarding Alternative 2-E.[18,31,32] In the absence of additional sampling prior to remedy selection, the Lower Elwha Klallam Tribe supports Alternative 2-D because it "provides the flexibility to

[31] Port Gamble S'Klallam Tribe Natural Resources Department. 2021. RE: Lower Elwha Klallam Tribe's "Summary of Concerns with SMA 2 Preferred Alternative (2E) and Recommended Actions. September 9.

[32] Jamestown S'Klallam Tribe. 2021. RE: Lower Elwha Klallam Tribe's "Summary of Concerns with SMA 2 Preferred Alternative (2E) and Recommended Actions. September 24.

apply various cleanup methods following further contaminant characterization, thereby minimizing negative ecological and social costs associated with a remedy."[18]

These changes result in a change in total weighted benefits for Alternatives 2-C, 2-D, and 2-E from 3.2, 3.0, and 2.7, respectively, to 3.3, 3.0, and 2.1, respectively. This changed the total benefit per $1 million cost for Alternative 2-E from 0.38 to 0.29.

Table 1: SMA 2 Revised DCA

Criteria	Weighting	2-A	2-B	2-C	2-D	2-E
Protectiveness	30%	5.0	4.5	3.0	2.0	1.0
Permanence	20%	5.0	4.0	3.0	2.5	1.5
Effectiveness Over the Long-Term	20%	5.0	4.0	3.0	3.0	2.0
Management of Short-Term Risk	10%	2.5	3.0	3.5	4.0	4.5
Technical and Administrative Implementability	10%	1.5	2.0	3.5	3.5	4.0
Consideration of Public Concerns	10%	2.5	4.0	4.5	5.0	2.0
Total Weighted Benefits		4.2	3.9	3.3	3.0	2.1
Estimated Cost ($M)		$59.0	$30.1	$13.9	$9.9	$7.0
Total Benefit per $M		0.07	0.13	0.23	0.30	0.29

A full, revised SMA 2 DCA table with qualitative descriptions and quantitative scores is included as Enclosure A to this letter.

Review of Total Benefit and Cost

Figure 1 shows the revised, total estimated cost with the total weighted benefits of each alternative in blue and green columns, respectively. Shown in order of permanence from most permanent on the left to least permanent on the right, the total cost decreases from an estimated $59 million for Alternative 2-A to an estimated $7 million for Alternative 2-E. Error bars for each cost show the generally accepted range of error for cost estimates of remedial alternatives in feasibility studies of -30% to +50%.[33] The overall benefits scores also decrease from 4.2 for Alternative 2-A to 2.1 for Alternative 2-E. We also considered a range of error for benefit scores of +/- 15%.

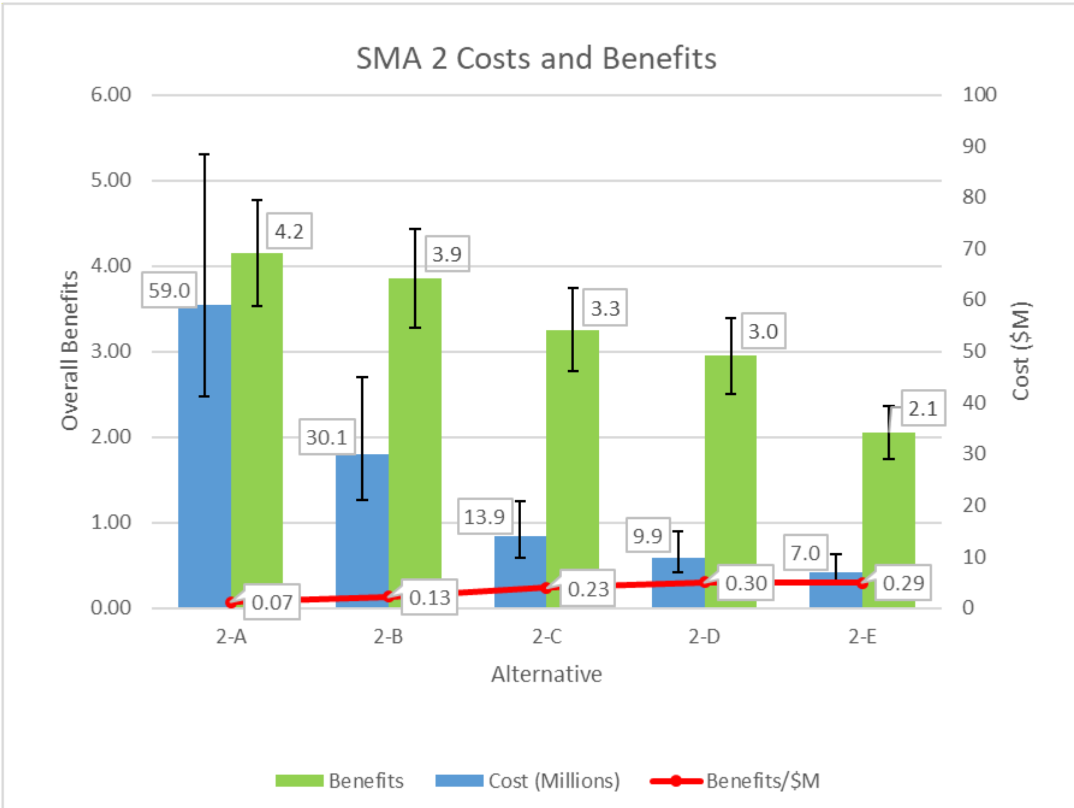

Figure 1: SMA 2 costs and benefits

Review Benefits per $Million Cost

Figure 1 presents the revised total weighted benefits per million dollars of cost in a similar fashion to the RI/FS using the red line; however, graphing these results on the same scale as the overall benefits makes it difficult to see the changes in this line.

Figure 2 shows this line at a better scale. Progressing from Alternative 2-A to Alternative 2-E shows an increasing ratio of benefits to costs, or cost effectiveness, with a slight decrease from Alternative 2-D to 2-E. Alternative 2-D provides the highest ratio of benefits per million dollars of 0.3. This result is different than the one presented in the

[33] USEPA. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. July 2000.

RI/FS. The DCA presented in the RI/FS identified Alternative 2-E as having the highest benefit to cost ratio.

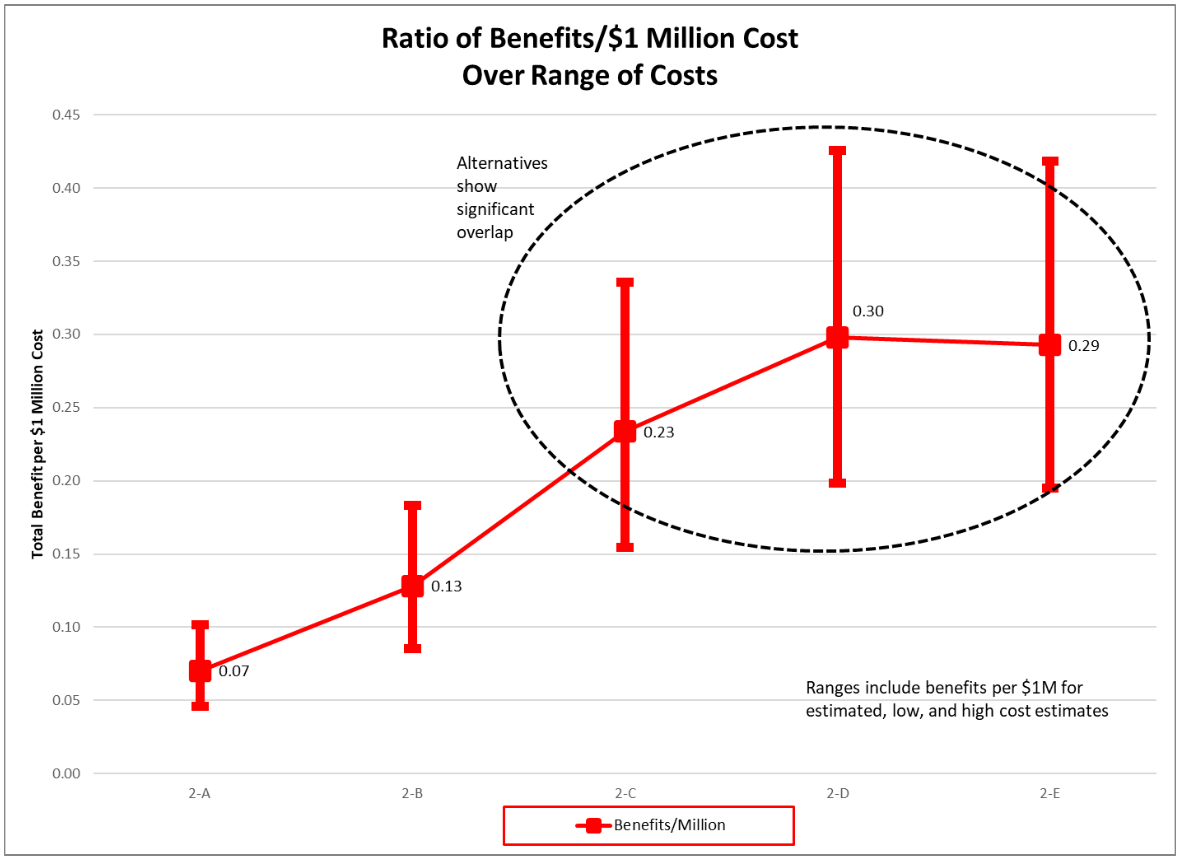

Figure 2: Ratio of benefits/$million over range of costs

Figure 2 includes error bars generated by considering low, estimated, and high-cost estimates showing the possible range of benefits to costs ratios. There is significant overlap in the potential ratios of benefits to costs for Alternatives 2-C, 2-D, and 2-E.

The alternative with the highest benefits to cost ratio is not necessarily the alternative that uses permanent solutions to the maximum extent practicable. MTCA's disproportionality test states costs are disproportionate to benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the lower cost alternative. Therefore, we continued our evaluation by reviewing incremental costs and incremental benefits.

Review of incremental changes in cost and benefits

To look at the incremental change in cost versus the incremental change in benefit, Ecology plotted the estimated costs versus the benefits in Figure 3 Beginning with the most permanent alternative, 2-A, we compared it to the next most permanent alternative, 2-B. The incremental change in cost from Alternative 2-B to 2-A is approximately $29 million and the incremental change in benefit is 0.3. The slope of the line between these two alternatives is steep showing the incremental change in cost between Alternatives 2-B and 2-A is much greater than the incremental change in benefit. This change in cost appears disproportionate to the change in benefit. Based on this, we eliminated Alternative 2-A as too costly for the additional benefits gained.

Comparing Alternatives 2-C with 2-B, we reach a similar conclusion. The incremental change in cost between Alternatives 2-C and 2-B is approximately $16 million and the incremental change in benefit is 0.6. The slope of the line between these two alternatives is approaching a 1 to 1 slope but is still steep. Based on this, we eliminated Alternative 2-B as too costly for the additional benefits gained.

Next, we compared Alternatives 2-D and 2-C. The incremental change in cost between Alternatives 2-D and 2-C is approximately $4 million and the incremental change in benefits is 0.3. Figure 3 shows an inflection point in the curve at Alternative 2-C as indicated by the red circle. This inflection point is where the incremental change in cost no longer appears be greater than the incremental change in benefits and the slope of the line between these two alternatives is shallower.

The incremental change in costs between Alternatives 2-E and 2-D is less than $3 million with an incremental change in benefit of 0.9. The shallow slope of the line between Alternatives 2-D and 2-E in Figure 3 shows the incremental change in benefit between the two alternatives is greater than the incremental change in cost. This indicates Alternative 2-D is not disproportionately costly for the added benefits over Alternative 2-E.

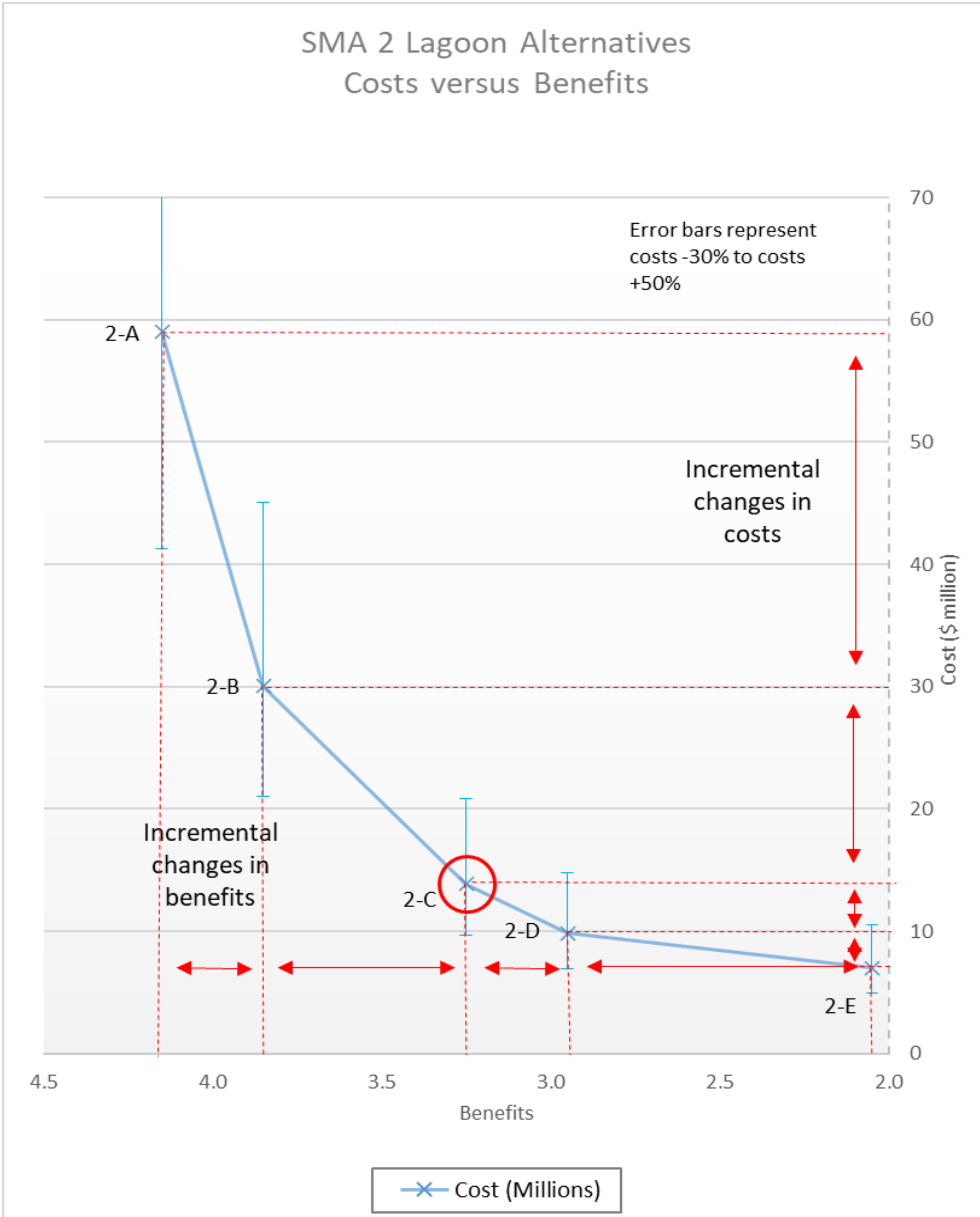

Figure 3: SMA 2 lagoon alternatives - costs versus benefits

Though 2-C appears to be the alternative that is permanent to the maximum extent practicable through comparison of the incremental change in costs to the incremental change in benefits of Figure 3, it is difficult to compare incremental cost and benefits because they are on different scales. We continued our evaluation by reviewing the proportional changes in incremental benefits and costs.

Review of proportional change in incremental benefits and costs

Considering the changes in cost and benefit as percentages is another way to compare the incremental changes. This converts the different scales of costs and benefits to a similar scale. Table 2 shows the incremental change in costs and benefits as percentages.

The equation for the ratio of incremental costs to incremental benefits is:

$$\frac{Incremental\ Costs_{x,y}(\%)}{Incremental\ Benefits_{x,y}(\%)} = \frac{(Cost\ X - Cost\ Y)}{Cost\ Y} * 100)/(\frac{Benefit\ X - Benefit\ Y}{Benefit\ Y}) * 100)$$

Table 2: Comparison of Incremental changes in cost and benefits (%)

Alternative	2-A	2-B	2-C	2-D	2-E
Benefit	4.2	3.9	3.3	3.0	2.1
Cost ($Million)	59.0	30.1	13.9	9.9	7.0
Alternatives compared	2-B to 2-A	2-C to 2-B	2-D to 2-C	2-E to 2-D	
Incremental benefit (%)	8%	18%	10%	44%	
Incremental cost (%)	96%	117%	40%	41%	
Ratio of IC (%) / IB (%)	12.3	6.3	4.0	0.9	

The most permanent alternative, 2-A, is identified as the initial baseline. This is compared to the next most permanent alternative, 2-B. If the incremental costs between the two alternatives are disproportionate to the incremental benefits, the baseline is eliminated, and the next alternative becomes the baseline. This process continues until the incremental costs are not disproportionate to the incremental benefits. When comparing Alternatives 2-D and 2-E, the incremental cost is 41% and the incremental benefit is 44% (highlighted in yellow), showing 2-D is not disproportionate and uses permanent solutions to the maximum extent practicable.

Figure 4 also shows the ratio of incremental change in costs as a percentage to the incremental change in benefits as a percentage. We considered multiple cost and benefits scenarios since estimated costs and benefits at this stage of planning could vary. Due to the high-level of estimation at this stage in the planning, we used an error range of +50% to -30% to calculate incremental changes in costs. We compared the difference in high to high, estimated to estimate, low to low, high to estimated, estimated to high, low to estimated and estimated to low-cost scenarios. Recognizing the inherent limitations in quantifying benefits over a small numerical scale, we considered a range of incremental changes in benefits using the estimated and potential high to low changes in benefits by applying an error range of plus or minus 15%. The resulting ratios are shown in Figure 4 with error bars above and below the estimated result.

Beginning with the most permanent alternative, 2-A, we compared this with the next most permanent alternative, 2-B. To compare Alternative 2-A and 2-B, we compared the proportional change in incremental cost of approximately 96% to the proportional change in incremental benefit of approximately 8%. This results in a ratio of 12.3. Though the costs and benefits are estimates, this appears to show the costs of Alternative 2-A are disproportionate to the benefits gained over Alternative 2-B.

Next, comparing Alternative 2-B to 2-C, the results also appear disproportionate with a 117% proportional change in incremental cost for an 18% proportional change in incremental benefit resulting in a ratio of 6.3. This appears to show the costs of Alternative 2-B are disproportionate to the benefits gained over Alternative 2-C.

The proportional changes in incremental costs and benefits from Alternative 2-D to 2-C are 40% and 10%, respectively, resulting in a ratio of 4.0. Although the estimated percentage change in cost is four times the estimated percentage change in benefit, it is less clear that this is disproportionate, given the wide range of error in remedial costs at the feasibility study stage. The low end of the error bar on Figure 4 shows a potential for the percent incremental change in costs between Alternative 2-C and 2-D to be less than the percent incremental change in benefits. A decision to support 2-C as the remedy for SMA 2 was considered based on this evaluation; however, the confidence in that decision would be low based on only the low end of the range appearing below 1 where the incremental costs and benefits are equal.

The proportional change in incremental costs and benefits between Alternatives 2-D and 2-E, are 41% and 44%, respectively. As illustrated in Figure 4, the ratio of these proportional changes in incremental costs and benefits is 0.9. This supports the selection of 2-D over 2-E since 2-D is more permanent and provides increase benefit that is not disproportionately costly.

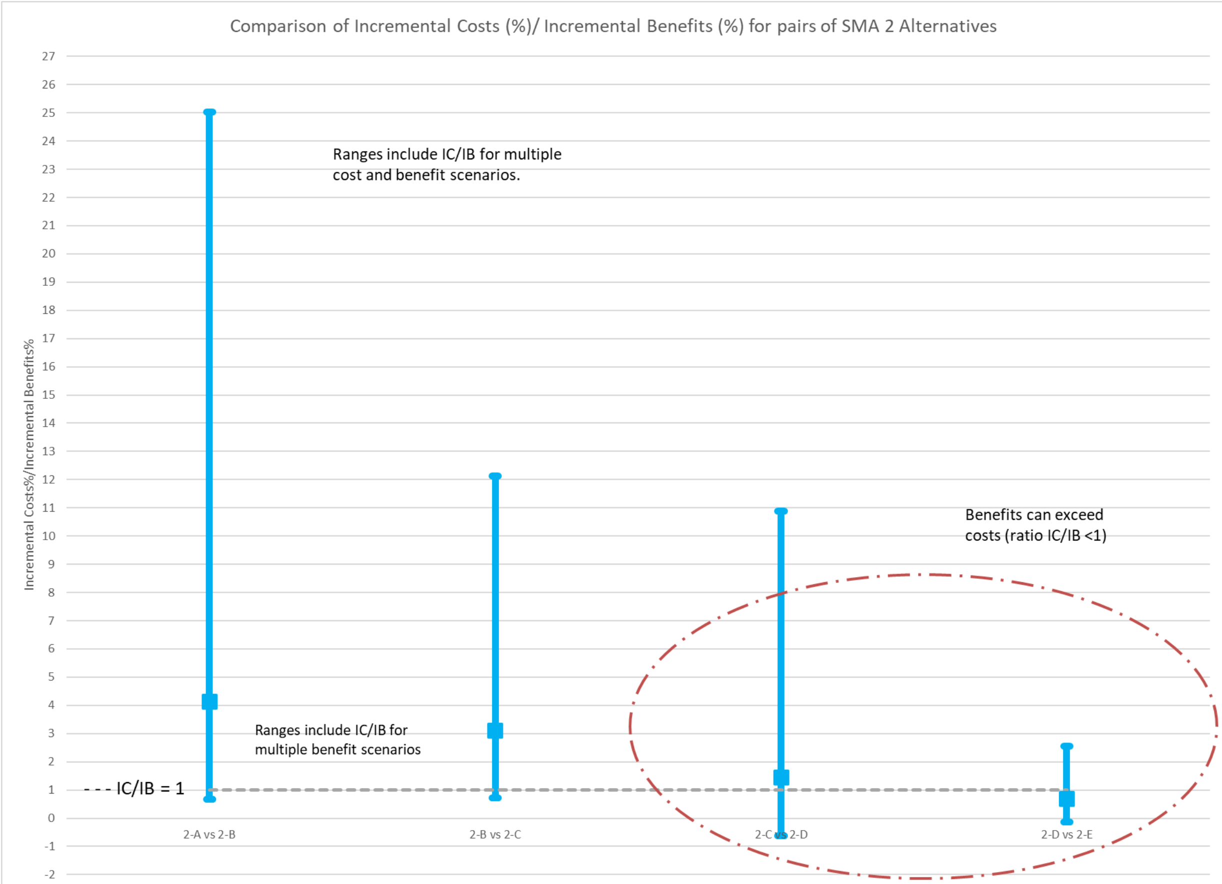

Figure 4: Incremental costs (%)/Incremental benefits (%) with variable costs and benefits

After carefully evaluating these results, Ecology selects Alternative 2-D for SMA 2 as part of the proposed remedy. **Alternative 2-D is permanent to the maximum extent practicable** and includes a combination of partial excavation with backfill or capping in contaminated intertidal sediments, partial excavation with backfill or EMNR in intertidal or subtidal contaminated sediment, intertidal capping, subtidal EMNR, and habitat mitigation over two construction seasons.

SMA 2 Design Sampling Expectations

Additional characterization of the sediments in the lagoon is necessary to finalize the remedy design. Ecology expects pre-engineering design sampling and evaluations, consistent with, but not limited to, the data collection and engineering evaluations described in the RI/FS (WPAHG 2020),[34] to will provide the additional information needed to refine the conceptual plan provided in the RI/FS. The final engineering design will refine the remedial footprints and determine where each of the remedial techniques will be applied with the goals of maximizing contaminant removal and minimizing the footprint of disturbance to ecologically sensitive areas.

Next Steps

Ecology plans to accept the preliminary DCAP submitted March 26, 2021, by the WPAHG as satisfactory to meet the submittal requirement under the agreed order. Ecology will modify the preliminary DCAP to include Ecology's proposed remedy and prepare the DCAP for your review. We propose the following cleanup actions for the DCAP:

- SMA 1, Inner Harbor: Partial intertidal excavation and capping, with subtidal capping (RI/FS Alternative 1-D)

- SMA 2, Lagoon: Optimized intertidal capping, partial intertidal excavation and capping, partial intertidal excavation and EMNR, subtidal dredge with EMNR, subtidal EMNR, and habitat mitigation (RI/FS Alternative 2-D)

- SMA 3, Waterfront and Outer Harbor: EMNR and monitored natural recovery to an extent that cleanup standards will be achieved within 10 years after competition of construction (RI/FS Alternative 3-B)

Ecology will provide the DCAP for your review as part of our final negotiations on the consent decree. The consent decree and DCAP will go out for public comment after we complete negotiations.

[34] Western Port Angeles Harbor Group, Final Western Port Angeles Harbor Sediment Cleanup Unit Remedial Investigation/Feasibility Study. October 2020, Section 15.7.

If you have any questions, you can reach me at connie.groven@ecy.wa.gov or by phone at 360-584-7037. Let us know if you would like to meet to discuss Ecology's proposed remedy or these next steps.

Sincerely,

Connie Groven

Connie G. Groven, P.E.
Cleanup Project Manager
Toxics Cleanup Program
Southwest Region Office

By certified mail: 9489 0090 0027 6382 0424 50

Enclosures (1): Revised SMA 2 DCA

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Ecology Site file

Enclosure 1

Revised SMA 2 DCA

Criterion	Weighting	WAC Language	Considerations for Site-Specific Evaluation	2-A Maximum Dredging and Excavation	2-B Partial Dredging and Excavation with Capping	2-C Partial Intertidal Excavation and Capping with Subtidal EMNR	2-D Excavation and Capping with Subtidal EMNR	2-E Intertidal Capping with Subtidal EMNR
Protectiveness	30%	*Overall protectiveness of human health and the environment, including the degree to which existing risks are reduced, time required to reduce risk at the facility and attain cleanup standards, on-site and off-site risks resulting from implementing the alternative, and improvement of the overall environmental quality.*	**Degree to Which Existing Risks Are Reduced**	Largest volume of contaminated sediment removed	Large volume of contaminated sediment removed; exposure to sediment remaining controlled by durable engineered cap	Medium volume of contaminated sediment removed; exposure to sediment remaining controlled by durable engineered cap and EMNR	Medium volume of contaminated sediment removed; exposure to sediment remaining controlled by durable engineered cap and EMNR	No sediment removed, but exposure to sediment remaining controlled by durable engineered cap and EMNR
			Time Required to Reduce Risks and Achieve Cleanup Standards (years)[1]	Cleanup levels are achieved (througout the SMA) immediately following construction (5 years)	Cleanup levels are achieved (throughout the SMA) at the point of compliance immediately following construction (3 years)	Cleanup levels are achieved (throughout the SMA) at the point of compliance immediately following construction (2 years)	Cleanup levels are achieved (throughout the SMA) at the point of compliance immediately following construction (2 years)	Cleanup levels are achieved (throughout the SMA) at the point of compliance immediately following construction (2 years)
			On-Site Risks Resulting from Implementation	All contaminated sediment removed from Site with no potential for future exposure	Contaminated sediment remain on- site beneath caps; potential exposure risks controlled by durable cap designs; protectiveness would be confirmed during post- construction monitoring and contingency measures implemented as necessary	Contaminated sediment remain on- site beneath caps and EMNR layers; potential exposure risks controlled by durable cap designs; protectiveness would be confirmed during post-construction monitoring and contingency measures implemented as necessary	Contaminated sediment remain on- site beneath caps and EMNR layers; potential exposure risks controlled by durable cap designs; protectiveness would be confirmed during post-construction monitoring and contingency measures implemented as necessary	Contaminated sediment remain on- site beneath caps and EMNR layers; potential exposure risks controlled by durable cap designs; protectiveness would be confirmed during post-construction monitoring and contingency measures implemented as necessary
			Off-Site Risks Resulting from Implementation	No known off-site risks resulting from remedy implementation				
			Improvement of the Overall Environmental Quality	High degree of improvement in overall environmental quality through removal and off-site disposal of contaminated sediment	High degree of improvement in overall environmental quality through limited contaminated sediment mass removal, and containment of contaminated sediment remaining on-site beneath engineered caps	Moderate to high degree of improvement in overall environmental quality through limited intertidal contaminated sediment mass removal, containment of contaminated intertidal sediment remaining on-site beneath durable engineered caps and applying EMNR layers to subtidal sediment.Lessor potential for temporary or permanent impacts due to areas of intertidal capping with excavation on habitat function.No impacts to existing salt marsh from capping since existing elevations maintained.	Moderate to high degree of improvement in overall environmental quality through limited intertidal and subtidal contaminated sediment mass removal, containment of contaminated intertidal sediment remaining on-site beneath durable engineered caps and applying EMNR layers to intertidal and subtidal sediment. Moderate potential for temporary or permanent impacts due to areas of intertidal and subtidal capping on habitat function.Lower impacts to existing salt marsh from capping, without excavation or dredging, reducing or interrupting tidal flow to existing salt marsh.	Moderate to high degree of improvement in overall environmental quality through containment of contaminated intertidal sediment beneath durable engineered caps and applying EMNR layers to subtidal sediment. High potential for temporary or permanent impacts due to large scale intertidal capping on habitat function.High potential for impacts to existing salt marsh from intertidal capping, without excavation or dredging, reducing or interrupting tidal flow to existing salt marsh.
			Total Score	5.0	4.5	3.0	2.0	1.0
Permanence	20%	*The degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances, including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and quantity of treatment residuals generated.*	**Permanent Reduction of Toxicity, Mobility, or Volume of Hazardous Substances**	Dredging and excavation remove sediment exceeding cleanup levels from SMA 2; subtidal dredging residuals would be addressed by post-dredge EMNR	Dredging and excavation remove some contaminants from SMA 2, reducing the on-site contaminant volume; engineered capping controls the mobility of contaminants remaining in place	Excavation removes some of the contaminants from intertidal SMA 2, reducing the on-site contaminant volume; engineered capping ~~and EMNR~~ controls the mobility of intertidal contaminants remaining in place; EMNR accelerates recovery of subtidal contaminants remaining in place	Excavation removes some of the contaminants from intertidal and subtidal SMA 2, reducing the on-site contaminant volume; engineered capping ~~and EMNR~~ control the mobility of some intertidal contaminants remaining in place; EMNR accelerates recovery of some intertidal and all subtidal contaminants remaining in place	No contaminants are removed from the Site; ~~however,~~ engineered capping ~~and EMNR~~ control the mobility of intertidal contaminants remaining in place; EMNR accelerates recovery of subtidal contaminants remaining in place.
			Adequacy of Alternative in Destroying the Hazardous Substance, and Degree of Irreversibility of Waste Treatment Processes	Dredging, excavation, capping, and EMNR are not treatment technologies that result in destruction of hazardous substances but rather remove contaminants from the Site, or contain them on-site: therefore, consideration of the adequacy of alternatives to destroy hazardous substances and the irreversibility of treatment processes do not affect the alternative scoring for permanence				
			Reduction or Elimination of Hazardous Substance Releases and Source of Releases	Site releases resulting in contamination are from historical sources and no longer processing/ongoing; ongoing sources of hazardous substances such a cPAHs are outside the scope of this RI/FS and are being managed under separate source control authorities; this site-specific evaluation consideration does not affect alternative scoring for permanence				
			Characteristics and Quantity of Treatment Residuals Generated	All removed sediments and dewatering fluids will contain COCs that must be handled, disposed of, and controlled; significant treatment residuals are associated with this alternative	A smaller volume of removed sediments and dewatering fluids will contain COCs that must be handled, disposed of, and controlled; no treatment residuals are associated with capping or EMNR except pre-placement debris removal	A smaller volume of removed sediments and dewatering fluids will contain COCs that must be handled, disposed of, and controlled; no treatment residuals are associated with capping or EMNR except pre-placement debris removal	A smaller volume of removed sediments and dewatering fluids will contain COCs that must be handled, disposed of, and controlled; no treatment residuals are associated with capping or EMNR except pre-placement debris removal and upland soil excavated from the causeway	No treatment residuals are associated with capping or EMNR except pre-placement debris removal and upland soil excavated from the causeway
			Total Score	5.0	4.0	3.0	2.5	1.5
Effectiveness Over the Long-Term	20%	*The degree of certainty that the alternative will be successful, the reliability of the alternative during the period of time hazardous substances are expected to remain on-site at concentrations that exceed cleanup levels, the magnitude of residual risk with the alternative in place, and the effectiveness of controls required to manage treatment residues or remaining wastes.*	**SMS Technology**	Acres by technology				
			Removal	23.6	0	0	0	0
			Partial Removal and Capping	0	23.6	10.1	2.0	0.6
			Partial Removal and EMNR	0	0	0	4.3	0
			Capping	0	0	0	6.4	10.1
			EMNR	0	0	13.5	11.4	13.5
			MNR	0	0	0	0	0
			Total Score	5.0	4.0	3.0	3.0	2.0

Criterion	Weighting	WAC Language	Considerations for Site-Specific Evaluation	2-A	2-B	2-C	2-D	2-E
				Maximum Dredging and Excavation	**Partial Dredging and Excavation with Capping**	**Partial Intertidal Excavation and Capping with Subtidal EMNR**	**Excavation and Capping with Subtidal EMNR**	**Intertidal Capping with Subtidal EMNR**
Management of Short-Term Risk	**10%**	***The risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks.***	**Risk to Human Health and the Environment Associated with Alternative during Construction and Implementation**	Dredging poses the greatest risk to human health and the environment due to: (1) uncontrollable releases during subtidal work; and (2) heavy truck traffic and travel on public roads associated with off-site disposal of removed material	Dredging poses the greatest risk to human health and the environment due to: (1) uncontrollable releases during subtidal work; and (2) heavy truck traffic and travel on public roads associated with off-site disposal of removed material	Excavation poses lower risks to human health and the environment due to: (1) effective control of releases during in-the-dry intertidal and shallow subtidal excavation work; and (2) less truck traffic and travel on public roads associated with off-site disposal of removed material	Excavation and limited subtidal dredging poses lower risks to human health and the environment due to: (1) effective control of releases during in-the-dry intertidal and shallow subtidal excavation work; and (2) less truck traffic and travel on public roads associated with off-site disposal of removed material	Less truck traffic and travel on public roads associated with off-site disposal of removed material
			Effectiveness of Measures That Will Be Taken to Manage Risk	Large amounts of debris (e.g., logs) limit the effectiveness of BMPs during subtidal dredging; flaggers and a traffic management plan can reduce risks to the public associated with truck traffic on public roads	Large amounts of debris (e.g., logs) limit the effectiveness of BMPs during subtidal dredging; flaggers and a traffic management plan can reduce risks to the public associated with truck traffic on public roads	BMPs during intertidal excavation are effective at managing risks of contaminant release; flaggers and a traffic management plan can reduce risks to the public associated with truck traffic on public roads	BMPs during intertidal excavation are effective at managing risks of contaminant release; flaggers and a traffic management plan can reduce risks to the public associated with truck traffic on public roads	Flaggers and a traffic management plan can reduce risks to the public associated with truck traffic on public roads
			Total Score	2.5	3.0	3.5	4.0	4.5
Technical and Administrative Implementability	**10%**	***Ability to be implemented including consideration of whether the alternative is technically possible, availability of necessary offsite facilities, services and materials, administrative and regulatory requirements, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with existing facility operations and other current or potential remedial actions.***	**Technical Feasibility**	Implementation has major technical challenges, including large volumes of sediment for off-site disposal, difficult access for dredging equipment, excavation on private property, and removal in sensitive cultural areas	Implementation has major technical challenges, including large volumes of sediment for off-site disposal, difficult access for dredging equipment, excavation on private property, and removal in sensitive cultural areas	Moderate technical challenges with excavation on private property, material removal/delivery and site access challenges and intertidal removal in culturally sensitive areas	Moderate technical challenges with excavation on private property, material removal/delivery and site access challenges; intertidal removal in culturally sensitive areas; alternative provides on-site, in-kind habitat mitigation also requiing material removal and/or relocation.	Moderate technical challenges with capping on private property, material delivery and site access challenges; alternative provides on-site, in-kind habitat mitigation also requiring material removal and/or relocation..
			Administrative Feasibility	Large disruption to McKinley start- up and/or operations due to traffic and safety concerns	Large disruption to McKinley start- up and/or operations due to traffic and safety concerns	Moderate disruption to McKinley start-up and/or operations due to traffic and safety concerns	Moderate disruption to McKinley start-up and/or operations due to traffic and safety concerns	Moderate disruption to McKinley start-up and/or operations due to traffic and safety concerns
			Total Score	1.5	2.0	3.5	3.5	4.0
Consideration of Public Concerns	**10%**	***Whether the community has concerns regarding the alternative and, if so, the extent to which the alternative addresses those concerns. This process includes concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the site.***	**Balance the Public Desire for Environmental Cleanup and Sustainable Local Economic Conditions**	May satisfy public desire for removal, but very high costs and disruption of McKinley operations likely to be a concern for the public	May satisfy public desire for some removal, but relatively high costs and likely disruption of McKinley operations likely to be a concern for the public	May satisfy public desire for some removal and does not require mitigation; prior input from the public indicate this alternative is preferred, but higher costs and potential disruption of McKinley operations likely to be a concern for the public	May satisfy public desire for some removal and reduced costs and disruption to the community likely to be preferred by the public. Requires mitigation, increasing potential for disruption of McKinley operations. The Klallam Tribes support this alternative. Port Angeles Natural Resource Damage Trustees expressed concerns that areas of intertidal capping without excavation will permanently impact habitat and limit future restoration opportunities.	Does not satisfy public desire for some ~~provide~~ removal~~, but reduces risk, and is less disruptive to the community~~. Lack of removal likely to be a concern for the public. Reduced costs and disruption to the community may be preferred by the public, but requires more mitigation, increasing potential for disruption of McKinley operations. Port Angeles Natural Resource Damage Trustees expressed concerns that large scale intertidal capping without excavation will permanently impact habitat and limit future restoration opportunities.
			Total Score	2.5	4.0	4.5	5.0	2.0
			Total Weighted Benefits	**4.2**	**3.9**	**3.3**	**3.0**	**2.1**
			Total Weighted Benefits High +15%	**4.8**	**4.4**	**3.7**	**3.4**	**2.4**
			Total Weighted Benefits Low -15%	**3.5**	**3.3**	**2.8**	**2.5**	**1.7**
			Cost	$59,000,000	$30,000,000	$13,900,000	$9,900,000	$7,000,000
			Total Benefit per $1 Million Cost	**0.07**	**0.13**	**0.23**	**0.30**	**0.29**
			Contingency % (low)	**-30%**	**-30%**	**-30%**	**-30%**	**-30%**
			Cost (low)	$41,300,000	$21,000,000	$9,730,000	$6,930,000	$4,900,000
			Total Benefit per $1 Million Cost (low)	**0.10**	**0.18**	**0.33**	**0.43**	**0.42**
			Contingency % (high)	**50%**	**50%**	**50%**	**50%**	**50%**
			Cost (high)	$88,500,000	$45,000,000	$20,850,000	$14,850,000	$10,500,000
			Total Benefit per $1 Million Cost (high)	**0.05**	**0.09**	**0.16**	**0.20**	**0.20**

Notes:

1 Construction years rounded up to nearest whole number.

Abbreviations:

BMP Best management practice COC Chemical of concern

cPAH Carcinogenic polycyclic aromatic hydrocarbon EMNR Enhanced monitored natural recover

MNR Monitored natural recovery

RI/FS Remedial Investigation/Feasibility Study SMA Sediment Management Area

SMS Sediment Management Standards WAC Washington Administrative Code