

APPENDIX K
COST ESTIMATE DETAILS

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List of Attachments

Engineer's Opinion of Probable Construction Cost Estimate

LIST OF ACRONYMS AND ABBREVIATIONS

BMP	best management practice
EDR	Engineering Design Report
EMNR	enhanced monitored natural recovery
MLLW	mean lower low water
RMC	residuals management cover
TIN	triangulated irregular networks

1 PURPOSE AND ORGANIZATION

This appendix has been prepared to support the Engineering Design Report (EDR) for the cleanup of Port Gamble Bay. Construction activities planned as part of the cleanup include structural demolition, creosote-treated pile removal, excavation, dredging, capping, and placement of enhanced monitored natural recovery (EMNR) material and residuals management cover (RMC). Demolished structures, creosote-treated piles, and debris will be transported and disposed of in an off-site disposal or recycling facility. Excavated and dredged sediment will be disposed of in an upland placement area constructed on a nearby property (referred to as the “upland placement area”).

This appendix summarizes the assumptions used to develop the Engineer’s Opinion of Probable Construction Cost Estimate presented in the EDR. This cost estimate was developed based on previous dredging experience at the site, experience at other contaminated sediment sites in the Puget Sound area, discussions with marine contractors and vendors, and best professional judgment. Costs are based on the design elements in the Draft Construction Drawings (Appendix J of the EDR) and Construction Specifications (Appendix I of the EDR). All costs are presented in present-day dollars (i.e., 2015).

The attached table presents the engineer’s opinion of probable construction cost. The remainder of this appendix discusses the methods for developing the costs for the construction elements.

2 UNIT COST DEVELOPMENT

This section presents the following:

- Construction tasks used as the basis for developing costs
- Methods used for developing quantities for the different construction tasks
- Cost approach used for each construction task

The costs include both direct (Section 2.1) and indirect (Section 2.2) construction tasks.

2.1 Direct Construction Tasks

The following direct construction tasks are presented in the attached table and summarized in the following bullets:

- **Mobilization/demobilization** includes the costs associated with mobilizing and demobilizing personnel and equipment, procedural costs, contractor work plan development, and contractor site office and administration costs. Special bonding and insurance are also included in the mobilization/demobilization costs.
- **Site preparation for offloading and on site processing** includes the costs associated with site preparation such as clearing and grubbing upland areas prior to excavation, preparation and maintenance of the upland staging area and site access, installation and maintenance of a temporary fencing and temporary erosion and sediment controls, and installation of offloading best management practices (BMPs) such as a spill apron.
- **Demolition, pile removal, and disposal** includes the costs for removal and disposal or recycling of upland debris, debris located on the shoreline, and creosote-treated pile removal.
- **Dredging and excavation** costs are described in Section 2.1.2, including each technology assumed for dredging.
- **Offload and debris separation** includes costs for offloading dredged material, and screening and disposing of debris as necessary.
- **On site beneficial use/disposal** includes the costs associated with placing excavated and dredged sediment in an upland placement area constructed near or on the Mill Site.

- **Purchase and place material** includes the costs for capping, EMNR, RMC, and armor materials of various thicknesses and gradations.
- **Environmental controls** includes costs for environmental protection during construction include furnishing and installing a partial length silt curtain and temporary erosion and sedimentation control during removal and material placement activities.
- **Survey** costs include contactor pre-construction, progress, acceptance, and as-built topographic and bathymetric surveys.

Sections 2.1.1 through 2.1.5 provide more detail on key direct construction tasks.

2.1.1 Demolition, Pile Removal, and Disposal

Direct construction costs for demolition and debris removal were developed using the following assumptions:

- Structures to be demolished will be removed prior to dredging.
- Equipment needs include a material barge and applicable vibratory pile extraction equipment, suitable clamshell or closed environmental bucket for debris removal, a push tug, and work boats.
- Structures for demolition and disposal are shown in the Construction Drawings (Appendix J of the EDR) and include the eastern wharf, piers, log transfer dock, conveyor/pier, alder mill loading facility, timber breakwater, and piles throughout the site.
- Demolished structures, decking, and piles will be processed (e.g., cut to size as necessary) and shipped to a permitted landfill or recycling facility for disposal.
- Broken or subsurface piles discovered and cut during dredging/excavation are included in this line item.

The total quantity of decking material was estimated based on aerial photographs. Unit costs were estimated based on contractor bids and experience at other projects.

The pile removal cost was calculated based on the pile removal approach detailed in the EDR. The total quantity of piles was calculated based on prior project experience at the site,

high definition bathymetric surveys, visual surveys, test pits, and aerial photographs. The underlying unit costs were estimated based on previous project experience, contractor bids and contractor discussions, and experience at other projects.

2.1.2 Dredging/Excavation

Direct construction costs for excavation and dredging were developed using the following assumptions:

- Piles and in-water debris within the dredge area will be removed prior to dredging.
- Dredging and excavation will be performed consistent with BMPs identified in the EDR. For example, excavation of intertidal sediments will be performed during low tide to reduce resuspension.
- Upland excavator equipment will be used to excavate the shoreline bank down to an assumed elevation of 0 foot mean lower low water (MLLW). Shoreline materials will be stockpiled on the former Mill Site for ex situ characterization prior to beneficial reuse or disposal.
- In-water equipment needs are assumed to consist of a dredge plant barge and excavator with hydraulically closing environmental bucket, material scows, push tug, work boat, survey boat, and front-end loader.
- Crew needs are assumed to consist of a superintendent, foreman, two excavator operators, loader operator, ground spotter, dredge operator, and three deck hands.
- Water will be collected on dredged material barges and gravity filtered prior to discharge.

Dredging and excavation volumes were calculated using AutoDesk Civil3D software. Three-dimensional terrain models consisting of triangulated irregular networks (TINs) were created of the existing bathymetry based on multibeam survey data and the proposed dredge plan. An average overdredging depth of 0.5 foot was added to all subtidal dredging areas to estimate removal pay volumes.

The dredging and excavation unit costs were estimated based on experience at other cleanup sites in Puget Sound, and previous dredging performed at the site.

2.1.3 Offload and Debris Separation

The offload and off-site disposal costs were based on the following assumptions:

- Debris encountered during dredging will require barge loading, sorting in the temporary stockpile area, offsite transportation, and disposal in a permitted landfill.
- The sediment on the haul barge will be offloaded mechanically from barges and put into stockpiles on the Mill Site for subsequent ex situ characterization.
- No additives or reagents (e.g., diatomaceous earth or cement) to absorb excess water were assumed for the disposal estimates.
- Approximately 60% of shoreline riprap can be stockpiled and replaced following remediation.

The offload and debris disposal unit costs were estimated based on contractor bids and experience at other cleanup sites in Puget Sound. The majority of dredged/excavated sediment was assumed to go to on site beneficial reuse for purposes of developing the EDR cost estimate; the ultimate placement of sediment would be determined during construction using ex situ characterization of stockpiles.

2.1.4 Material Placement (Capping, EMNR, RMC, and Armor)

Direct construction costs for material placement activities were developed using the following assumptions:

- Operational BMPs are included in the production rates. Placement in areas shallower than 0 foot MLLW will be performed during low tide. No physical water quality control measures are assumed to be needed during material placement.
- All material will be mechanically placed.
- Equipment needs are assumed to be the same as required for dredging/excavation.

Material placement volumes were calculated by multiplying the area by the average thickness for each material layer. Average thickness includes overplacement. Material thicknesses and specifications are listed in the main text of the EDR.

The unit costs for purchase and delivery of specified material gradations are based on vendor estimates. The unit costs for placement are based on experience at projects in the Puget Sound area.

2.2 Indirect Construction Tasks

Indirect construction tasks include a number of activities that are necessary to the project but are not performed by the contractor. These indirect construction tasks include: project management, pre-design sampling, engineering and design, permitting, construction management, cultural resources, environmental monitoring during construction, verification sampling, long term monitoring, post-construction reporting, and Washington State Department of Ecology oversight. Costs for these indirect construction activities were estimated based on project experience at similar remediation sites in the Puget Sound region.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST ESTIMATE

Engineer's Opinion of Probable Construction Cost Estimate - Port Gamble Bay Cleanup Project

Item	Total Quantity	Unit	Unit Cost	Estimated Cost
Mobilization and Site Preparation				
Mobilization & Demobilization	10	%	\$ 13,346,555	\$ 1,334,655
Site Preparation for Offloading and On Site Processing	1	LS	\$ 200,000	\$ 200,000
Demolition, Pile Removal, Disposal				
Deck Demolition (not including piles)	58,000	SF	\$ 5	\$ 290,000
Miscellaneous Structure Demolition	1	LS	\$ 200,000	\$ 200,000
Pile Removal - Standard DNR Protocols	3,250	EA	\$ 286	\$ 929,500
Pile Removal - Difficult Piles (15/day; 2,175 piles)	145	DAY	\$ 6,100	\$ 884,500
Additional Sediment Excavation During Pile Removal	2,200	CY	\$ 15	\$ 33,000
Offload Sediment at Mill Site	2,200	CY	\$ 5	\$ 11,000
Ship Sediment from Pile Removal Disposal	2,200	CY	\$ 8	\$ 17,160
Purchase and Place Post Pile Removal Sand Cover	4,375	TN	\$ 15	\$ 65,625
Purchase and Place Post Pile Removal Habitat Mix	6,296	TN	\$ 24	\$ 151,111
Purchase and Place Sand/Organoclay Mix for Cut Piles	500	EA	\$ 300	\$ 150,000
Dredging and Excavation				
Excavation	21,900	CY	\$ 15	\$ 328,500
Dredging	46,800	CY	\$ 20	\$ 936,000
Offload and Debris Separation				
Offload Dredged Material at Mill Site	46,800	CY	\$ 5	\$ 234,000
Screen and Separate Debris; Initial Stockpile	68,700	CY	\$ 8	\$ 549,600
Stockpile Rip Rap for Reuse	600	CY	\$ 5	\$ 3,000
On Site Beneficial Use/Disposal				
Creosote Debris Disposal	4,649	TN	\$ 93	\$ 432,334
Miscellaneous Debris Disposal (5% of material)	5,153	TN	\$ 65	\$ 334,913
Rehandle and Place Sediment On Site	61,830	CY	\$ 8	\$ 482,274
Load, Transport and Dispose Landfill	8,931	TN	\$ 70	\$ 625,170
Cap Material Purchase and Transport				
Procure/Transport Sand Local Sand Pit	-	TON	\$ 5.00	\$ -
Purchase/Transport Sand - Commercial Quarry/Truck	90,300	TON	\$ 8.00	\$ 722,400
Purchase/Transport Sand - Commercial Quarry/Barge	99,000	TON	\$ 9.00	\$ 891,000
Purchase/Transport Filter	10,100	TON	\$ 20.00	\$ 202,000
Purchase/Transport Type 1 Armor	4,082	TON	\$ 20.00	\$ 81,635
Purchase/Transport Type 2 Armor	11,977	TON	\$ 38.00	\$ 455,143
Purchase/Transport Type 3 Armor	6,266	TON	\$ 20.00	\$ 125,318
Purchase/Transport Fish Mix	6,540	TON	\$ 14.00	\$ 91,560
Cap Material Load and Placement				
Load and Place Sand - SMA-1 and SMA-2	60,200	CY	\$ 25	\$ 1,505,000
Load and Place Sand - SMA-3	66,000	CY	\$ 20	\$ 1,320,000
Place Filter	10,100	TON	\$ 10	\$ 101,000
Place Type 1 Armor	4,082	TON	\$ 10.00	\$ 40,817
Place Type 2 Armor	12,997	TON	\$ 25.00	\$ 324,936
Place Type 3 Armor	6,266	TON	\$ 10.00	\$ 62,659
Place Fish Mix	6,540	TON	\$ 10	\$ 65,400
Eelgrass Mitigation Construction	1	LS	\$ 200,000	\$ 200,000
Environmental Controls	1	LS	\$ 100,000	\$ 100,000
Contractor Surveys	1	LS	\$ 200,000	\$ 200,000
Subtotal Construction Costs				
				\$ 14,680,000
Tax	8.7	%		\$ 1,277,160
Total Remedial Construction Cost				\$ 15,960,000
Construction Contingency	15	%		\$ 2,202,000
Non-Construction Remedial Costs				
Project Management	1.5	%		\$ 239,400
On Site Construction Management	1	LS	\$ 675,000	\$ 675,000
Office and On Site Engineering during Construction	1	LS	\$ 745,000	\$ 745,000
Water Quality Monitoring	1	LS	\$ 450,000	\$ 450,000
Archaeological Monitoring	1	LS	\$ 110,000	\$ 110,000
Shellfish Monitoring	1	LS	\$ 340,000	\$ 340,000
Post-Dredge Confirmation Sampling	1	LS	\$ 220,000	\$ 220,000
Ex Situ Characterize Stockpiles (1,500 cy ea)	46	EA	\$ 2,000	\$ 92,000
Construction Outreach	1	LS	\$ 40,000	\$ 40,000
Eelgrass Transplant and Monitoring	1	LS	\$ 155,000	\$ 155,000
Long Term Monitoring	1	LS	\$ 627,200	\$ 627,200
Post Construction Completion Report	1	LS	\$ 75,000	\$ 75,000
Ecology Oversight Costs	1	LS	\$ 650,000	\$ 650,000
Total Non-Construction Remedial Cost				\$ 4,420,000
Total Remedial Cost				\$ 20,400,000
Total Remedial Cost + Contingency				\$ 22,600,000

In providing opinions of probable construction cost, the Client understands that the Consultant (Anchor QEA, LLC) has no control over the cost or availability of labor, equipment, or materials, or over market condition or the Contractor's method of pricing, and the Consultant's opinions of probable construction costs are made on the basis of the Consultant's professional judgment and experience. The Consultant makes no warranty, express or implied, that the bids or the negotiated cost of the work will not vary from the Consultant's opinion of probable construction cost.