

Appendix C

Detailed Alternative Assumptions and Cost Evaluations

C.1 Overview

This appendix presents the assumptions underlying the estimation of costs for the remedial alternatives discussed in Sections 4 and 5. Table C-1 summarizes the process options included in each alternative. From this description, specific costs associated with each process and alternative were developed. The applicable areas and equivalent volumes associated with these areas are presented in Tables C-2 and C-3. Detailed cost estimates were developed consistent with the EPA guidance document *Guide to Developing and Documenting Cost Estimates during the Feasibility Study, July 2000* (USEPA, 2000).

Costs for the various operational components of the remedial alternatives (e.g., dredging, capping, physical separation, and disposal) were obtained from the following sources:

- RS Means Heavy Construction Cost Data 2005
- Washington Department of Labor and Industries (Labor)
- Boskalis Dolman (soil washing and mechanical dewatering)
- American and General Construction (dredge production equipment rental)
- Material and equipment suppliers (e.g., sand and gravel, water treatment)
- Experience gained from other remediation projects with similar scope and in-house estimates developed for those projects.

Costs are provided in 2005 US dollars. Present values were calculated for long-term (multiyear) cost components assuming a 7 percent interest rate. The total estimated costs for remedial alternatives also assume a 30% contingency and 8.6% sales tax. In addition, 15% contractor overhead costs are applied to all contractor activities.

Table C-4 presents the individual assumptions and equipment costs that are used to develop all remedial alternative costs. These values are multiplied by the appropriate unit quantity (e.g., sediment surface area, sediment volume, days of operation) to obtain overall costs for each remedial alternative. A summary of unit costs applied to each alternative (B through G) can be found in Table C-5. A detailed breakdown of how each unit cost is derived is presented in Tables C-6 through C-15.

CERCLA guidance requires that cost estimates for each remedial alternative be accurate to within plus 50 and minus 30 percent at the conclusion of an FS. Because this is a preliminary document, the assumptions and estimated costs presented in the PSA may not be within these guidelines.

C.2 Cost Assumptions

As with all feasibility study cost estimates, numerous assumptions were made that ultimately need to be addressed in more detail during subsequent stages of cleanup planning. For example, the estimates assume that space is available onshore for temporary facilities, equipment, and material staging. The Port of Seattle's Terminal 25 has been used for handling dredged sediments intended for upland landfill disposal. Costs developed in the PSA assumed the continued availability of Terminal 25 for similar use during cleanup of the Lower Duwamish. While there is no certainty that the facility could be used for this purpose, the assumption of availability provided a real and suitable site for estimating material transport costs (e.g., barge and truck transport to sediment handling facility).

To establish a feasible unit cost to be applied for all alternative actions, a representative remedial quantity of 50,000 cubic yards was assumed. This equates to a project area over which to establish additional costs (e.g., capping, long-term capping monitoring, and construction QA/QC) of 5.17 acres. This is the area necessary to contain 50,000 cubic yards (assuming a dig depth of 6 feet). Unit costs are then applied to each alternative for each hypothetical remedial action level (multiple of the SQS).

C.2.1 Common Elements

Estimating costs in the PSA requires establishing a number of assumptions. These assumptions are made to apply generalizations across the entire LDW and reduce complexity at this stage of the FS process. These assumptions fall into two groups: (1) common elements with costs built into each alternative; and (2) elements not estimated as costs; and are discussed below.

Comment Elements Not Included as Costs in the PSA

For the PSA, differences in several costs were assumed not to vary appreciably among alternatives. These costs include long-term compliance monitoring costs as well as costs associated with project administration and institutional controls.

Long-term compliance monitoring is assumed to occur site-wide regardless of the alternative ultimately selected. Monitoring will likely occur at regular intervals after remedy completion until the RAOs (yet to be determined) have been met and/or discussed with EPA and Ecology. Because long-term monitoring is a common component among all alternatives presented in the PSA, and RAOs have not been developed for the project, long-term monitoring costs were not developed in this document. Site-specific details will vary somewhat by alternative and reach but are assumed to be similar. If monitored natural recovery is a component of the selected alternative, monitoring of natural recovery processes will also be incorporated into the long-term monitoring program.

Institutional controls and administrative costs are assumed to be an essential component of all remedial alternatives discussed in the PSA. Institutional controls include, but are not limited to, public outreach, fish consumption advisories, water use restrictions, and installation and maintenance of warning signs. Costs associated with the administration of remedial O&M are assumed to be a part of all alternatives. Those costs are not included in any of the alternatives.

Common Costs and Assumptions Applied to All Alternatives Included in the PSA

The costs developed within this document are estimates based on assumptions and conditions that can vary considerably with time and scale. These variances include, but are not limited to, mobilization costs, labor costs, cost of fuel and supplies, increase in taxes, contractor availability, and weather. In addition, unit quantities are likely to vary significantly depending on performance criteria developed during the design phase. As a result of the potential for such variances, a contingency factor has been built into each unit cost. The contingency factor used in the PSA is 30%. This factor has been applied to all unit costs.

Design and project management costs are applied throughout each unit cost. These costs are assumed to be a percentage of capital costs. For the purposes of the PSA, a factor of 12% has been applied to all capital costs used to derive each unit cost (e.g., dredging, capping, etc.).

Additional costs assumed to be common to all unit costs are sales tax and contractor profit/overhead. For the purposes of the PSA, sales tax is set at 8.6%. Contractor profit and overhead is assumed at 15% of capital costs.

Table C-1 Process Options for the Assembled Remedial Alternatives

REMEDIAL AREAS	Alternatives						
	A	B	C	D	E	F	G
	Complete Sponsored EAAs and PPAs.	Complete the Sponsored EAAs and PPAs. Dredge with upland disposal the AOIs for total PCBs > multiples of the SQS. MNR remaining areas.	Complete the Sponsored EAAs and PPAs. Dredge with upland disposal the AOIs for total PCBs > multiples of the SQS. ENR to next action level. MNR remaining areas.	Complete the Sponsored EAAs and PPAs. Dredge with on-site, in-water disposal of AOIs to multiples of the SQS. ENR to next action level. MNR remaining areas.	Complete the Sponsored EAAs and PPAs. Dredge with treatment, upland disposal and beneficially use the AOIs > multiples of the SQS. ENR to next action level. MNR remaining areas.	Complete the Sponsored EAAs and PPAs. Cap Deep Bench Areas of the AOIs that exceed multiples of the SQS. ENR to next action level. MNR remaining areas.	Downstream RM 2.0: dredge with upland disposal Navigation Channel and Deep Bench Areas above 65 mg/kg OC (extending dredge area to areas > 12 mg/kg OC) and ENR Shallow Bench Areas above 12 mg/kg OC. Upstream RM 2.0: Dredge with Upland Disposal Navigation Channel above 12 mg/kg. Dredge with upland disposal and cap Shallow Bench Areas above 24 mg/kg OC (extending dredge area to areas > 12 mg/kg OC). Dredge with upland disposal Deep Bench Areas above 24 mg/kg OC. MNR remaining areas.
Sponsored EAAs	Dredge / Cap	Dredge / Cap	Dredge / Cap	Dredge / Cap	Dredge / Cap	Dredge / Cap	Dredge / Cap
PPAs	Dredge / Cap	Dredge / Cap	Dredge / Cap	Dredge / Cap	Dredge / Cap	Dredge / Cap	Dredge / Cap
AOIs							
Navigation Channel Downstream RM 2.0	—	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose in CAD	Dredge 6 ft. and treat/reuse	Dredge 6 ft. and dispose	Dredge 6 ft. > 65 mg/kg OC and dispose
Navigation Channel RM 2.0 to 3.0	—	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose in CAD	Dredge 6 ft. and treat/reuse	Dredge 6 ft. and dispose	Dredge 6 ft. > 12 mg/kg OC and dispose
Navigation Channel Upstream RM 3.0	—	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose in CAD	Dredge 6 ft. and treat/reuse	Dredge 6 ft. and dispose	Dredge 6 ft. > 12 mg/kg OC and dispose
<i>Bench Areas Downstream RM 2.0</i>							
Shallow Bench Areas	—	Dredge 3 ft., cap 3 ft.	Dredge 3 ft., cap 3 ft.	Dredge 3 ft., dispose in CAD, cap 3 ft.	Dredge 3 ft., cap 3 ft.	Dredge 3 ft., cap 3 ft.	ENR > 12 mg/kg OC
Deep Bench Areas	—	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose in CAD	Dredge 6 ft. and treat/reuse	Cap 3 ft.	Dredge > 65 mg/kg OC
<i>Bench Areas RM 2.0 to 3.0</i>							
Shallow Bench Areas	—	Dredge 3 ft., cap 3 ft.	Dredge 3 ft., cap 3 ft.	Dredge 3 ft., dispose in CAD, cap 3 ft.	Dredge 3 ft., cap 3 ft.	Dredge 3 ft., cap 3 ft.	Dredge / Cap > 24 mg/kg OC
Deep Bench Areas	—	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose in CAD	Dredge 6 ft. and treat/reuse	cap 3 ft.	Dredge > 24 mg/kg OC
<i>Bench Areas Upstream RM 3.0</i>							
Shallow Bench Areas	—	Dredge 3 ft., cap 3 ft.	Dredge 3 ft., cap 3 ft.	Dredge 3 ft., dispose in CAD, cap 3 ft.	Dredge 3 ft., cap 3 ft.	Dredge 3 ft., cap 3 ft.	Dredge / Cap > 24 mg/kg OC
Deep Bench Areas	—	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose	Dredge 6 ft. and dispose in CAD	Dredge 3 ft., cap 3 ft.	cap 3 ft.	Dredge > 24 mg/kg OC
			ENR to selected levels of total PCBs	ENR to selected levels of total PCBs	ENR to selected levels of total PCBs	ENR to selected levels of total PCBs	
Navigation Channel	—	—	ENR	ENR	ENR	ENR	
Bench Areas			ENR	ENR	ENR	ENR	
		MNR Remaining Areas	MNR Remaining Areas	MNR Remaining Areas	MNR Remaining Areas	MNR Remaining Areas	MNR Remaining Areas
Navigation Channel	—	MNR	MNR	MNR	MNR	MNR	MNR
Bench Areas	—	MNR	MNR	MNR	MNR	MNR	MNR

Table C-2 Number of Acres in AOIs Above Total PCB Values Expressed as Multiples of the SQS and the CSL

Total PCBs (mg/kg OC)	# of Acres in AOIs	Total # of Acres in AOI											
		Downstream RM 2.0				RM 2.0 to 3.0				Upstream RM 3.0			
		In Navigation Channel	In Bench Areas			In Navigation Channel	In Bench Areas			In Navigation Channel	In Bench Areas		
			< -4 MLLW	-4 to -9 MLLW	≥ -9 MLLW		< -4 MLLW	-4 to -9 MLLW	≥ -9 MLLW		< -4 MLLW	-4 to -9 MLLW	≥ -9 MLLW
> 6 mg/kg OC	149.7	21.1	24.2	3.6	43.1	7.4	11.0	3.1	16.0	5.4	10.0	1.7	3.1
> 12 mg/kg OC	46.6	9.6	10.6	1.3	11.6	1.3	4.3	0.8	2.4	0.5	3.3	0.5	0.4
> 24 mg/kg OC	14.3	4.0	2.5	0.5	3.6	0.3	1.5	0.3	0.4	0.0	1.0	0.2	0.0
> 36 mg/kg OC	5.5	1.9	1.0	0.2	1.3	0.1	0.4	0.2	0.1	0.0	0.3	0.0	0.0
> 65 mg/kg OC	2.1	0.9	0.0	0.0	0.6	0.1	0.1	0.1	0.1	0.0	0.2	0.0	0.0

Table C-3 Potential Dredge/Excavation Volumes in AOIs Above Total PCB Values Expressed as Multiples of the SQS and the CSL 1,2

Total PCBs (mg/kg OC)	Total Volume in AOIs (CYS)	Total Dredge/Excavation Volumes in AOI (CYS)											
		Downstream RM 2.0				RM 2.0 to 3.0				Upstream RM 3.0			
		In Navigation Channel	In Bench Areas			In Navigation Channel	In Bench Areas			In Navigation Channel	In Bench Areas		
			< -4 MLLW	-4 to -9 MLLW	≥ -9 MLLW		< -4 MLLW	-4 to -9 MLLW	≥ -9 MLLW		< -4 MLLW	-4 to -9 MLLW	≥ -9 MLLW
> 6 mg/kg OC	1,189,429	204,248	117,273	17,424	417,014	71,632	53,192	14,907	154,590	52,659	48,545	8,228	29,718
> 12 mg/kg OC	350,464	92,928	51,110	6,292	112,288	12,584	20,715	4,066	23,522	4,453	15,924	2,420	4,162
> 24 mg/kg OC	109,287	38,720	12,003	2,420	34,751	2,904	7,163	1,452	3,969	0	4,937	968	0
> 36 mg/kg OC	43,220	18,392	4,646	968	12,390	968	2,130	968	1,258	0	1,500	0	0
> 65 mg/kg OC	18,005	8,712	0	0	5,518	968	678	484	678	0	968	0	0

1. Volumes in Navigation Channel and Deep Bench Areas ≥ -9 ft MLLW assume 6-ft excavation.
2. Volumes in Shallow Bench Areas < -9 ft MLLW assume 3-ft excavation.

Table C-4 Basis for Preliminary Cost Estimates¹

UNIT COST INFORMATION
LOWER DUWAMISH WATERWAY

Cost Estimating Parameters & Methodology:		Notes	
Interest Rate	7.0%		
Engineering, Procurement and Construction Mgmt	12.0%		
Contractor Overhead and Profit - Dredging Only	15.0%		
Sales Tax	8.6%		
Contingency	30.0%		
Treatment by Soil Washing, Mechanical Dewatering & Water Trmt			
Mob/Demob and Site Layout	\$2,000,000 LS	2	Boskalis Dolman Bean Environmental
Soil Washing, Mech Dewatering & Water Trmt	\$30 per cy	2,9	
Sediment with organic content will need to be pre-treated to assist in de-watering before separating silt/sand.			
Dredging - 12 cy bucket			
Debris Sweep	\$40,000 per acre	4	RS Means American & General Construction
Mobilization - Equipment/temp facilities	\$200,000 LS	4	
Shift Rate (10 hours)	\$6,000 per shift	3,4,5	
Dredge Rate	1200 cy <i>in situ</i> per 10 hour shift	2	
Assist Tug	2,500 per day	3	
Sediment Handling and Disposal Costs			
Off-Site Disposal			2
Railcar transport to and tipping at Roosevelt, WA	\$45 per ton		
Transportation cost by tug/barge to transloading facility	\$7,000 per day	3,7	
Rabanco: Cost includes Barge unloading, sediment dewatering, supernatant handling/treatment, railcar loading and transportation to disposal facility.			
Transport sediment to offload facility. Cost includes daily rate for two 2,500 cy capacity disposal barges and 1,000 hp tug.			
Capping			
Debris Sweep (Approx 50% of cap area to be swept for debris)	\$40,000 per acre	4	American & General Construction American & General Construction Glacier Northwest American & General Construction
Additional Mobilization/Demobilization Costs	\$50,000 LS	4	
Cap Placement Rate	75.0 cy per hour	2	
Cap Material Placement	\$6.50 per cy	2	
Cap material procurement and delivery	\$15 per cy	2	
Deck Barge for Cap Material	2,000 per day	2	
Assist Tug	2,500 per day	3	
Construction office	\$76,717 per month	3,6	
Confined Aquatic Disposal			
Dredge, Transport and Dispose Clean Sediments	\$7.50 per cy	2	American & General Construction
Dredge and place clean sediment in turning basin for reuse	\$3.00 per cy	2	American & General Construction
Rehandle material for Sand Cap	\$3.00 per cy	4	
WDNR Lease Fee	\$20,000 per acre per year	8	
Long Term CAD Monitoring	\$130,000 per acre	4	Based on Long Term Cap Monitoring Costs
CAD Construction QA & QC	\$122,000 per acre	4	
Transport sediment to CAD site	\$10,000 per day	3	Cost includes daily rate for four 2,500 cy capacity disposal barges and 1 000 hp tug. 2 barges on standby to allow for settling of material within
Construction QA/QC			
Suspended Solids Testing	\$2,000 per day	4	(total PCBs twice daily by subcontractor)
Turbidity Sampling	\$1,000 per day	4	(twice daily by subcontractor)
Daily Bathymetric Check Survey	\$2,500 per day	4	QC dredging/cap placement process)
End of Project Compliance Testing	\$10,000 per acre	4	(surface samples from cap/dredge areas, bathymetric surveys)
Project Completion Report (incl. As-built drawings)	\$15,000 LS	4	
Long-term Cap Monitoring			
Bathymetric Surveys	\$25,000 per year	4	1 per year + report submittal
Surface Water Sampling	\$5,000 per acre	4	2 per year per acre; includes equip., personnel, samples/testing, report submittal
Sediment Sampling	\$15,000 per acre	4	4 per year per acre surface grab sample 2 per year per acre sediment cores through cap includes equip., personnel, samples/testing, report submittal

Notes

- 2005 dollars
- Supplier quote (Boskalis Dolman / Bean , May 7, 2006)
- RSMeans *Heavy Construction Cost Data 2005* with cost index of 110% for Seattle.
- Professional judgment based on previous projects.
- 12 cy mechanical dredge with 0.85 Fill Factor, 4.5 min cycle time, and 0.85 TE.
Compares with quoted price, including mob/demob, of \$30/cy for environmental dredging (Bean Environmental)
- Construction office includes rental (\$2350/month), utilities and equipment (\$630/month), 1-superintendent (\$944/12-hr shift x 24 days/month = \$24,656/month), 2-foremen (\$618/ea/12-hr shift x 24 day/month x 2 ea = \$29,664/month), 2-clerks (\$154/ea/12-hr shift x 24 day/month x 2 ea = \$7,008), 1-timekeeper (\$489/ea/12-hr shift x 24 days/month = \$11544/month) for a total of \$76,716/month.
- Assume two 2,500cy barges available to transport contaminated sediment to offload facility, one tug to alternate to rotate barges between loading at waterway and unloading. Rental (2 ea x \$2000/ea/day barges + 1 ea x \$600/day tug) at \$4,800/day plus operations (1 ea x \$200/hr x 12 hr tug) at \$2,400/day for a total of \$7,000/day. Labor included in operations costs. Assume dredging on day 1, dewatering and offloading on day 2
- DNR Lease costs \$20,000 / acre. Use 30 yr PVN value
- Soil washing costs assume porosity of .40. 30% is reusable as capping material with remaina 70% processed as filter cake and disposed at off-site upland disposal facility.

Table C-5 Summary of Unit Cost Assumptions

Action	Unit	Unit Cost
Dredging	CYS	\$30
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level		
Pre-removal of debris, logs etc. before dredging		
Disposal	CYS	\$91
Disposal of impacted sediment at off-site subtitle D landfill.		
Cost includes transportation of sediment by barge/truck to transloading facility.		
Cost includes dewatering of supernatant		
Soil Washing, Handling, and Disposal	CYS	\$138 - \$329
Mobilization/Demobilization, siting costs, treatment, and disposal of impacted sediment to total PCB remediation level. Beneficial reuse of clean sediment with 30% or greater coarse fraction content. Upland off-site disposal at Subtitle D landfill remaining sediment. Assume a credit applied for beneficial reuse of clean sand.		
Confined Aquatic Disposal	CYS	\$63
Construction of Confined Aquatic Disposal Site, disposal of sediments within CAD, and associated long-term monitoring costs		
Containment Capping	Acres	\$388,582
Mobilization/Demobilization Costs and Placement of 3-feet of capping material to contain impacted sediment in-place		
Provides habitat enhancement		
Residual Capping	Acres	\$84,858
Placement of thin layer of capping material to address dredge residuals		
Habitat Restoration Capping	Acres	\$270,604
Placement of 3-feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.		
Armoring included as needed for erosion control		
Enhanced Natural Recovery (ENR)	Acres	\$75,549
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery		
Construction QA/QC	Acres	\$121,397
Monitoring active remediation processes - dredging, excavation, cap placement		
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)		
Long-Term Cap O&M Monitoring	Acres	\$128,099
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).		
Cost is present worth of annual cost assuming 7% interest rate.		
Monitored Natural Recovery		<i>Monitored Natural Recovery, compliance monitoring, and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.</i>
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.		
Compliance Monitoring		
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.		
Administrative Costs and Institutional Controls		
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.		

Table C-6 Dredging Unit Cost

Dredge Footprint (acres)	5.17
Dredge Footprint (sq. ft.)	225000
Dredge Depth (ft.)	6
Dredge Volume (cy)	50000
Production Rate (cy/day)	1200

Cost Estimating Parameters & Methodology:	
Engineering, Procurement and Construction Mgmt	12.0%
Contractor Overhead and Profit	15.0%
Sales Tax	8.6%
Contingency	30.0%
Dredging	
Debris Sweep	\$40,000 per acre
Mechanical - 12 cy bucket	
Mobilization - Equipment/temp facilities	\$200,000 LS
Shift Rate (10 hours)	\$6,000 per shift
Dredge Rate	1200 cy in situ per 10 hour shift
Assist Tug (daily rate)	2,500 per day
Construction office	\$76,717 per month

Capital Items	Quantity	Units	Cost
Mobilization - Equipment and Temporary Facilities	1	LS	\$200,000
Debris Sweep	5	acre	\$206,612
Dredging - 10 hour shifts	42	Day	\$252,000
Assist Tug	42	Day	\$105,000
Construction Office	2	Month	\$134,255
	Direct Capital:		\$897,866
	Engineering, Procurement & Construction Management:		107,744
	Sales Tax		77,217
	Contingency		269,360
	Contractor Overhead/Profit:		134,680
	Total Capital:		\$1,500,000
	TOTAL COST		\$1,500,000
	UNIT COST		\$30.00 per CY

Table C-7 Disposal Unit Cost

Cost Estimating Parameters & Methodology:	
Engineering, Procurement and Construction Mgmt	12.0%
Contingency	30.0%
Transport sediment to offload facility	\$7,000 per day
Cost includes daily rate for two 2,500 cy capacity disposal barges and 1 000 hp tug.	

Disposal			
Off-Site Disposal			
Railcar transport to and tipping at Roosevelt, WA		\$45 per ton	
Cost includes: Barge unloading, sediment dewatering, supernatant handling/treatment, railcar loading and transportation to disposal facility.			
Capital Items	Quantity	Units	Cost
Transport sediment to offload facility by barge	42	DAY	\$294,000
Railcar transport to and tipping at Roosevelt, WA	65,000	ton	\$2,925,000
Direct Capital:			\$3,219,000
Engineering, Procurement & Construction Management:			386,280
Contingency			965,700
Total Capital:			\$4,570,980
TOTAL COST			\$4,570,980
UNIT COST			\$91 per CY

Last updated by RETEC on 05-4-06

Table C-8a Soil Washing, Handling, and Disposal Unit Cost for Alternative E1

Note:
This spreadsheet draws input parameters from Mech Dredging worksheet.

Basis		Reference
Mechanical Dredging	20 Days	
Total Acreage of Option	2.1 Acres	
Percent Total Acres Assumed for Treatment	60%	
Percentage of Sand (weight basis)	30%	1
Percentage of Fines (weight basis)	70%	1
Bulk Density of Dredged Sediment	1.546 tons/cy	3
Bulk Density of Wet Filter Cake	1.3 tons/cy	3
Bulk Density of Wet Sand	1.6 tons/cy	4
Average Total Solids in Dredged Volume	57%	2
Percent Water in Filter Cake	50%	3
Percent Water in Sand	20%	4

Mass Balance and Volume Calculations

Notes (not for printed table)

Total Volume Dredged	23,407 CYS		
Dredge Volume Sent to Treatment	14,044 CYS		
Dredge Mass Sent to Treatment	21,712 TON		
Mass of Solids to Trmt	12,376 TON		
Mass of Fines in Filter Cake	8,663 TON		
Mass of Wet Filter Cake for Disposal	17,326 TON		
Volume of Dredge Filter Cake for Disposal	13,328 CYS		
Mass of Sand Resulting from Treatment	3,713 TON		
Mass of Wet Sand Resulting from Treatment	4,641 TON		
Volume of Clean Sand Resulting from Treatment	2,901 CYS		

From Mechanical Dredging Spreadsheet E-1.
 V x % of acres
 Vt x bulk density
 wet
 dry weight basis
 dry weight basis
 dry weight basis
 dry weight basis
 dry weight basis

Cost Estimating Parameters & Methodology:		
Engineering, Procurement and Construction Mgmt	12.0%	
Contractor Overhead and Profit	15.0%	
Contingency	30.0%	
Soil Washing, Mechanical Dewatering & Water Trmt		
Mobilization and Setup	\$2,000,000 LS	3
Soil Washing, Mech Dewatering & Water Trmt	\$30 per cy	
Offload Sediments to Stockpile at Treatment Facility		
Offload Sediments to Stockpile at Treatment Facility	\$3 per cy	
Transport filter cake to transload facility (truck)	\$4,000 per day	
Disposal		
Off-Site Disposal		
Railcar transport to and tipping at Roosevelt, WA	\$45 per ton	
Filter Cake	17,326 ton	
Coarse Sand from Soil Washing (assume clean)	2,901 cy	

Capital Items	Quantity	Units	Cost
Mobilization and Setup	1	LS	\$2,000,000
Offload Sediments to Stockpile for Treatment	14,044	CY	\$42,132
Soil Washing, Mech Dewatering & Water Trmt	14,044	CY	\$421,322
Transport Filter Cake to Rail Facility	10.0	DAY	\$40,000
Railcar transport to and tipping at Roosevelt, WA	17,326	ton	\$779,682
Direct Capital:			\$3,283,136
Engineering, Procurement & Construction Management:			393,976
Contingency			984,941
Total Capital:			\$4,662,053
Assume credit applied for beneficial reuse of clean sand @ \$15/CY			\$43,509
TOTAL COST			\$4,618,544
UNIT COST		\$/CY	\$329

Notes

- 1 Soil washing costs assume porosity of .40. 30% is reusable as capping material with remain 70% processed as filter cake and disposed at off-site upland disposal facility.
- 2 LDW Site Data and professional judgment based on previous projects.
- 3 Supplier quote (Boskalis Dolman / Bean , May 7, 2006).
- 4 The Excavation Handbook, Horace Church, McGraw-Hill, 1981. Table A-5.

Table C-8b Soil Washing, Handling, and Disposal Unit Cost for Alternative E2

Note:
This spreadsheet draws input parameters from Mech Dredging worksheet.

Basis		Reference
Mechanical Dredging	47 Days	
Total Acreage of Option	2.1 Acres	
Percent Total Acres Assumed for Treatment	60%	
Percentage of Sand (weight basis)	30%	1
Percentage of Fines (weight basis)	70%	1
Bulk Density of Dredged Sediment	1.546 tons/cy	3
Bulk Density of Wet Filter Cake	1.3 tons/cy	3
Bulk Density of Wet Sand	1.6 tons/cy	4
Average Total Solids in Dredged Volume	57%	2
Percent Water in Filter Cake	50%	3
Percent Water in Sand	20%	4

Mass Balance and Volume Calculations

Notes (not for printed table)

Total Volume Dredged	56,187 CYS		From Mechanical Dredging Spreadsheet E-1.
Dredge Volume Sent to Treatment	33,712 CYS		V x % of acres
Dredge Mass Sent to Treatment	52,119 TON		Vt x bulk density
Mass of Solids to Trmt	29,708 TON		dry weight basis Wet mass x % solids
Mass of Fines in Filter Cake	20,795 TON		dry weight basis Dry mass x % fines
Mass of Wet Filter Cake for Disposal	41,591 TON		Dry mass / % solids
Volume of Dredge Filter Cake for Disposal	31,993 CYS		Wet mass / bulk density
Mass of Sand Resulting from Treatment	8,912 TON		dry weight basis Dry mass x % sand
Mass of Wet Sand Resulting from Treatment	11,140 TON		Dry mass / % solids
Volume of Clean Sand Resulting from Treatment	6,963 CYS		Wet mass / bulk density

Cost Estimating Parameters & Methodology:		
Engineering, Procurement and Construction Mgmt	12.0%	
Contractor Overhead and Profit	15.0%	
Contingency	30.0%	
Soil Washing, Mechanical Dewatering & Water Trmt		
Mobilization and Setup	\$2,000,000 LS	3
Soil Washing, Mech Dewatering & Water Trmt	\$30 per cy	
<hr/>		
Offload Sediments to Stockpile at Treatment Facility	\$3 per cy	
Transport filter cake to transload facility (truck)	\$4,000 per day	
<hr/>		
Disposal		
Off-Site Disposal		
Railcar transport to and tipping at Roosevelt, WA	\$45 per ton	
Filter Cake	41,591 ton	
Coarse Sand from Soil Washing (assume clean)	6,963 cy	

Capital Items	Quantity	Units	Cost
Mobilization and Setup	1	LS	\$2,000,000
Offload Sediments to Stockpile for Treatment	33,712	CY	\$101,136
Soil Washing, Mech Dewatering & Water Trmt	33,712	CY	\$1,011,357
Transport Filter Cake to Rail Facility	22.0	DAY	\$88,000
Railcar transport to and tipping at Roosevelt, WA	41,591	ton	\$1,871,579
Direct Capital:			\$5,072,073
Engineering, Procurement & Construction Management:			608,649
Contingency			1,521,622
Total Capital:			\$7,202,343
Assume credit applied for beneficial reuse of clean sand @ \$15/CY			\$104,441
TOTAL COST			\$7,097,902
UNIT COST			\$211

Notes

- 1 Soil washing costs assume porosity of .40. 30% is reusable as capping material with remain 70% processed as filter cake and disposed at off-site upland disposal facility.
- 2 LDW Site Data and professional judgment based on previous projects.
- 3 Supplier quote (Boskalis Dolman / Bean , May 7, 2006).
- 4 The Excavation Handbook, Horace Church, McGraw-Hill, 1981. Table A-5.

Table C-8c Soil Washing, Handling, and Disposal Unit Cost for Alternative E3

Note:
This spreadsheet draws input parameters from Mech Dredging worksheet.

Basis		Reference
Mechanical Dredging	100	Days
Total Acreage of Option	2.1	Acres
Percent Total Acres Assumed for Treatment	60%	
Percentage of Sand (weight basis)	30%	1
Percentage of Fines (weight basis)	70%	1
Bulk Density of Dredged Sediment	1.546	tons/cy 3
Bulk Density of Wet Filter Cake	1.3	tons/cy 3
Bulk Density of Wet Sand	1.6	tons/cy 4
Average Total Solids in Dredged Volume	57%	2
Percent Water in Filter Cake	50%	3
Percent Water in Sand	20%	4

Mass Balance and Volume Calculations

Notes (not for printed table)

Total Volume Dredged	120,215 CYS		From Mechanical Dredging Spreadsheet E-1.
Dredge Volume Sent to Treatment	72,129 CYS		V x % of acres
Dredge Mass Sent to Treatment	111,512 TON		Vt x bulk density
Mass of Solids to Trmt	63,562 TON		wet
Mass of Fines in Filter Cake	44,493 TON		dry weight basis
Mass of Wet Filter Cake for Disposal	88,986 TON		dry weight basis
Volume of Dredge Filter Cake for Disposal	68,451 CYS		Wet mass x % solids
			Dry mass x % fines
			Dry mass / % solids
			Wet mass / bulk density
Mass of Sand Resulting from Treatment	19,069 TON		dry weight basis
Mass of Wet Sand Resulting from Treatment	23,836 TON		Dry mass x % sand
Volume of Clean Sand Resulting from Treatment	14,897 CYS		Dry mass / % solids
			Wet mass / bulk density

Cost Estimating Parameters & Methodology:		
Engineering, Procurement and Construction Mgmt	12.0%	
Contractor Overhead and Profit	15.0%	
Contingency	30.0%	
Soil Washing, Mechanical Dewatering & Water Trmt		
Mobilization and Setup	\$2,000,000 LS	3
Soil Washing, Mech Dewatering & Water Trmt	\$30 per cy	
Offload Sediments to Stockpile at Treatment Facility		
Offload Sediments to Stockpile at Treatment Facility	\$3 per cy	
Transport filter cake to transload facility (truck)	\$4,000 per day	
Disposal		
Off-Site Disposal		
Railcar transport to and tipping at Roosevelt, WA	\$45 per ton	
Filter Cake	88,986 ton	
Coarse Sand from Soil Washing (assume clean)	14,897 cy	

Capital Items	Quantity	Units	Cost
Mobilization and Setup	1	LS	\$2,000,000
Offload Sediments to Stockpile for Treatment	72,129	CY	\$216,388
Soil Washing, Mech Dewatering & Water Trmt	72,129	CY	\$2,163,879
Transport Filter Cake to Rail Facility	45.0	DAY	\$180,000
Railcar transport to and tipping at Roosevelt, WA	88,986	ton	\$4,004,392
Direct Capital:			\$8,564,658
Engineering, Procurement & Construction Management:			1,027,759
Contingency			2,569,397
Total Capital:			\$12,161,814
Assume credit applied for beneficial reuse of clean sand @ \$15/CY			\$223,459
TOTAL COST			\$11,938,355
UNIT COST		\$/CY	\$166

Notes

1. Soil washing costs assume porosity of .40. 30% is reusable as capping material with remaining 70% processed as filter cake and disposed at off-site upland disposal facility.
2. LDW Site Data and professional judgment based on previous projects.
3. Supplier quote (Boskalis Dolman / Bean, May 7, 2006).
4. The Excavation Handbook, Horace Church, McGraw-Hill, 1981. Table A-5.

Table C-8d Soil Washing, Handling, and Disposal Unit Cost for Alternative E4

Note:
This spreadsheet draws input parameters from Mech Dredging worksheet.

Basis			Reference
Mechanical Dredging	321	Days	
Total Acreage of Option	2.1	Acres	
Percent Total Acres Assumed for Treatment	60%		
Percentage of Sand (weight basis)	30%		1
Percentage of Fines (weight basis)	70%		1
Bulk Density of Dredged Sediment	1.546	tons/cy	3
Bulk Density of Wet Filter Cake	1.3	tons/cy	3
Bulk Density of Wet Sand	1.6	tons/cy	4
Average Total Solids in Dredged Volume	57%		2
Percent Water in Filter Cake	50%		3
Percent Water in Sand	20%		4

Mass Balance and Volume Calculations

Notes (not for printed table)

Total Volume Dredged	385,510 CYS		From Mechanical Dredging Spreadsheet E-1.
Dredge Volume Sent to Treatment	231,306 CYS		V x % of acres
Dredge Mass Sent to Treatment	357,599 TON		Vt x bulk density
Mass of Solids to Trmt	203,832 TON		dry weight basis
Mass of Fines in Filter Cake	142,682 TON		dry weight basis
Mass of Wet Filter Cake for Disposal	285,364 TON		Wet mass x % solids
Volume of Dredge Filter Cake for Disposal	219,511 CYS		Dry mass / % solids
			Wet mass / bulk density
Mass of Sand Resulting from Treatment	61,150 TON		dry weight basis
Mass of Wet Sand Resulting from Treatment	76,437 TON		Dry mass x % sand
Volume of Clean Sand Resulting from Treatment	47,773 CYS		Dry mass / % solids
			Wet mass / bulk density

Cost Estimating Parameters & Methodology:		
Engineering, Procurement and Construction Mgmt	12.0%	
Contractor Overhead and Profit	15.0%	
Contingency	30.0%	
Soil Washing, Mechanical Dewatering & Water Trmt		
Mobilization and Setup	\$2,000,000 LS	3
Soil Washing, Mech Dewatering & Water Trmt	\$30 per cy	
Offload Sediments to Stockpile at Treatment Facility		
Offload Sediments to Stockpile at Treatment Facility	\$3 per cy	
Transport filter cake to transload facility (truck)	\$4,000 per day	
Disposal		
Off-Site Disposal		
Railcar transport to and tipping at Roosevelt, WA	\$45 per ton	
Filter Cake	285,364 ton	
Coarse Sand from Soil Washing (assume clean)	47,773 cy	

Capital Items	Quantity	Units	Cost
Mobilization and Setup	1	LS	\$2,000,000
Offload Sediments to Stockpile for Treatment	231,306	CY	\$693,919
Soil Washing, Mech Dewatering & Water Trmt	231,306	CY	\$6,939,187
Transport Filter Cake to Rail Facility	144.0	DAY	\$576,000
Railcar transport to and tipping at Roosevelt, WA	285,364	ton	\$12,841,396
Direct Capital:			\$23,050,502
Engineering, Procurement & Construction Management:			2,766,060
Contingency			6,915,151
Total Capital:			\$32,731,713
Assume credit applied for beneficial reuse of clean sand @ \$15/CY			\$716,596
TOTAL COST			\$32,015,117
UNIT COST		\$/CY	\$138

Notes

- 1 Soil washing costs assume porosity of .40. 30% is reusable as capping material with remain 70% processed as filter cake and disposed at off-site upland disposal facility.
- 2 LDW Site Data and professional judgment based on previous projects.
- 3 Supplier quote (Boskalis Dolman / Bean , May 7, 2006). Mobilization/Demobilization and Site Layout Costs will not vary with quantity of material processed.
- 4 The Excavation Handbook, Horace Church, McGraw-Hill, 1981. Table A-5.

Table C-9 CAD Construction Unit Cost

Confined Aquatic Disposal Facility Requirements	
Dredge QTY for placement in CAD	50,000 cy
Dredge QTY to construct CAD	80,000 cy
Sand Cap Volume	14,870 cy
Area of Excavation	2.5 acres

Cost Estimating Parameters & Methodology:	
Engineering, Procurement and Construction Mgmt	12.0%
Contractor Overhead and Profit - Dredging Only	15.0%
Sales Tax	8.6%
Contingency	30.0%
Dredging	
Debris Sweep	\$40,000 per acre
Includes check survey, removal and disposal of debris	
Transport sediment to CAD site	\$10,000 per day
—— Cost includes daily rate for four 2,500 cy capacity disposal barges and 1,000 hp tug. Two barges on standby to allow for settling of material within barge	
Construction office	\$76,717 per month
Confined Aquatic Disposal	
Dredge, Transport and Dispose Clean Sediments	\$9.00 per cy
Dredge and place clean sediment in turning basin for reuse	\$4.00 per cy
Rehandle material for Sand Cap	\$4.00 per cy
WDNR Lease Fee	\$20,000 per acre per year
Long Term CAD Monitoring (Based on Long Term Cap Monitoring Costs)	\$130,000 per acre
CAD Construction QA & QC	\$122,000 per acre

CONFINED AQUATIC DISPOSAL

Capital Items	Quantity	Units	Cost
Debris Sweep	2.5	acres	\$101,010
Transport Dredge Material (duration of dredge project)	42	days	\$420,000
Dredge, Transport and Dispose Clean Sediments in PSDDA	65,130	CY	\$586,171
Dredge and stockpile clean sediment in turning basin for reuse	14,870	CY	\$59,480
Place Impacted Sediment in CAD	50,000	CY	\$200,000
Rehandle material and placement for Sand Cap	14,870	CY	\$59,480
WDNR Lease Fee (Present Worth)	30	YR	\$864,602
Long-Term CAD Monitoring (Present Worth)	2.5	acres	\$325,000
CAD Construction QA/QC (Based on Construction QA & QC Costs)	2.5	acres	\$308,081
Construction Office	1.8	Month	\$134,255
Direct Capital (excluding Long-Term Monitoring and WDNR Lease Fees)			\$1,868,476
Sales Tax			\$160,689
Contingency			\$560,543
Overhead and Profit on Dredging			\$96,848
Engineering, Procurement & Construction Management:			\$224,217
WDNR Lease Fee			\$864,602
Long-Term CAD Monitoring			\$325,000
Total Capital:			\$4,100,374
Assume credit applied for beneficial reuse of clean sand (65,000 CYS @ \$15/CY)			\$975,000
TOTAL COST			\$3,125,374
Unit Cost			\$63 per CY

(1) costs incurred at years 1,5,10,15,20, 25 and 30 (Bathy Survey annually)

Table C-10 Containment Capping Unit Cost

Cap Area (acres)	5.17
Cap Area (sq. ft.)	225,000
Cap Depth (ft.)	4
Cap Volume (cy)	33,333

Cost Estimating Parameters & Methodology:	
Engineering, Procurement and Construction Mgmt	12.0%
Contractor Overhead and Profit	15.0%
Sales Tax	8.6%
Contingency	30.0%
Capping	
Mobilization and temporary facilities (in addition to dredge equip.)	\$50,000 lump sum
Debris Sweep (Approx 50% of cap area to be swept for debris)	\$40,000 per acre
Cap Placement Rate	75.0 cy per hour
Cap Material Placement	\$6.50 per cy
Cap material procurement and delivery	\$15 per cy
Deck Barge for Cap Material	2,000 per day
Assist Tug	2,500 per day
Construction office	\$76,717 per month

Capital Items	Quantity	Units	Cost
Mobilization and temporary facilities	1	LS	\$50,000
Debris Sweep	2.6	acres	\$103,306
Deck Barge for Cap Material	44	days	\$88,889
Assist Tug	44	days	\$111,111
Cap Material Procurement and Delivery	33,333	cy	\$500,000
Cap Material Placement	33,333	cy	\$216,667
Construction Office	1.9	Month	\$142,069
Direct Capital:			\$1,212,041
Sales Tax			\$104,236
Contingency			\$363,612
Contractor Overhead and Profit			\$181,806
Engineering, Procurement & Construction Management:			145,445
Total Capital:			\$2,007,140
Unit Cost			\$388,582 per Acre

Table C-11 Residual Capping Unit Cost

Cap Area (acres)	5.17
Cap Area (sq. ft.)	225000
Cap Depth (ft.)	1
Cap Volume (cy)	8333

Cost Estimating Parameters & Methodology:	
Engineering, Procurement and Construction Mgmt	12.0%
Contractor Overhead and Profit	15.0%
Sales Tax	8.6%
Contingency	30.0%
Capping	
Cap Placement Rate	75.0 cy per hour
Cap Material Placement	\$6.50 per cy
Cap material procurement and delivery	\$15 per cy
Deck Barge for Cap Material	2,000 per day
Assist Tug	2,500 per day
Construction office	\$76,717 per month

Capital Items	Quantity	Units	Cost
Deck Barge for Cap Material	11	days	\$22,222
Assist Tug	11	days	\$27,778
Cap Material Procurement and Delivery	8,333	cy	\$125,000
Cap Material Placement	8,333	cy	\$54,167
Construction Office	0.5	Month	\$35,517
Direct Capital:			\$264,684
Sales Tax			\$22,763
Contingency			\$79,405
Contractor Overhead and Profit			\$39,703
Engineering, Procurement & Construction Management:			31,762
Total Capital:			\$438,316
Unit Cost			\$84,858 per Acre

Table C-12 Habitat Restoration Capping Unit Cost

Cap Area (acres)	5.17
Cap Area (sq. ft.)	225000
Cap Depth (ft.)	3
Cap Volume (cy)	25000

Cost Estimating Parameters & Methodology:	
Engineering, Procurement and Construction Mgmt	12.0%
Contractor Overhead and Profit	15.0%
Sales Tax	8.6%
Contingency	30.0%
Capping	
Mobilization and temporary facilities (in addition to dredge equip.)	\$50,000 lump sum
Cap Placement Rate	75.0 cy per hour
Cap Material Placement	\$6.50 per cy
Cap material procurement and delivery	\$15 per cy
Deck Barge for Cap Material	2,000 per day
Assist Tug	2,500 per day
Construction office	\$76,717 per month

Capital Items	Quantity	Units	Cost
Mobilization and temporary facilities	1	LS	\$50,000
Deck Barge for Cap Material	33	days	\$66,667
Assist Tug	33	days	\$83,333
Cap Material Procurement and Delivery	25,000	cy	\$375,000
Cap Material Placement	25,000	cy	\$162,500
Construction Office	1.4	Month	\$106,551
Direct Capital:			\$844,051
Sales Tax			\$72,588
Contingency			\$253,215
Contractor Overhead and Profit			\$126,608
Engineering, Procurement & Construction Management:			101,286
Total Capital:			\$1,397,749
Unit Cost			\$270,604 per Acre

Table C-13 ENR Unit Cost

Cap Area (acres)	5.17
Cap Area (sq. ft.)	225000
Cap Depth (ft.)	0.5
Cap Volume (cy)	4167

Cost Estimating Parameters & Methodology:	
Engineering, Procurement and Construction Mgmt	12.0%
Contractor Overhead and Profit	15.0%
Sales Tax	8.6%
Contingency	30.0%

Capping	
Debris Sweep (Approx 50% of cap area to be swept for debris)	\$40,000 per acre
Material Placement Rate	75.0 cy per hour
Material Placement Cost	\$6.50 per cy
Material Procurement and Delivery	\$15 per cy
Deck Barge for ENR Material	2,000 per day
Assist Tug	2,500 per day
Construction Office	\$76,717 per month

Capital Items	Quantity	Units	Cost
Debris Sweep	2.6	acres	\$103,306
Deck Barge for ENR Material	6	days	\$11,111
Assist Tug	6	days	\$13,889
Material Procurement and Delivery	4,167	cy	\$62,500
Material Placement	4,167	cy	\$27,083
Construction Office	0.2	Month	\$17,759
Direct Capital:			\$235,648
Sales Tax			\$20,266
Contingency			\$70,694
Contractor Overhead and Profit			\$35,347
Engineering, Procurement & Construction Management:			28,278
Total Capital:			\$390,233
Unit Cost			\$75,549 per Acre

Table C-14 Construction QA & QC Unit Cost

Operating Area (acres)	5.17
Assume: 48 days of dredging	
18 days of capping	

Cost Estimating Parameters & Methodology:	
Engineering, Procurement and Construction Mgmt	12.0%
Contractor Overhead and Profit	15.0%
Sales Tax	8.6%
Contingency	30.0%
Suspended Solids Testing (total PCBs twice daily by subcontractor)	\$2,000 per day
Turbidity Sampling (twice daily by subcontractor)	\$1,000 per day
Daily Bathymetric Check Survey (QC dredging/cap placement process)	\$2,500 per day
End of Project Compliance Testing (surface samples from cap/dredge areas, bathymetric surveys)	\$10,000 per acre
Project Completion Report (incl. as-built drawings)	\$15,000 LS

Items	Quantity	Units	Cost
Suspended Solids Testing (Dredging Only)	48	days	\$96,000
Turbidity Sampling (Dredging and Capping)	66	days	\$66,000
Daily Bathy Survey (Dredging and Capping)	66	days	\$165,000
EoP Compliance Testing	5.17	acres	\$51,653
Project Completion Report ¹	1	LS	\$15,000
Direct Capital:			\$378,653
Sales Tax			\$32,564
Contingency			\$113,596
Contractor Overhead and Profit			\$56,798
Engineering, Procurement & Construction Management:			45,438
Total Cost:			\$627,049
Unit Cost:			\$121,397 per acre

Note:

¹ Project completion report lump sum is included in 12% Engineering, Procurement and Construction Management, and is thus not included in Direct Capital sum.

Table C-15 Long Term Cap Monitoring Unit Cost

Cap Area (acres)	5.17
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Cost Estimating Parameters & Methodology:	
Interest Rate	7.0%
Contingency	30.0%
Bathymetric Surveys	\$25,000 per year
1 per year + report submittal	
Surface Water Sampling	\$5,000 per acre
2 per year per acre	
includes equip., personnel, samples/testing, report submittal	
Sediment Sampling	\$15,000 per acre
4 per year per acre surface grab sample	
2 per year per acre sediment cores through cap	
includes equip., personnel, samples/testing, report submittal	

Present Worth of Annual Operating Costs	Years	Annual Cost	
Bathymetric Survey	(1)	\$25,000	\$99,173
Surface Water Sampling	(1)	\$25,826	\$102,451
Sediment Sampling	(1)	\$77,479	\$307,353
Present Worth - Long Term Cap Monitoring (Based on 7% interest rate)			\$508,976
Contingency			\$152,693
Total Present Worth - Long Term Cap Monitoring			\$661,669
Unit Cost			\$128,099 per acre

(1) costs incurred at years 1,5,10,15,20, 25 and 30

Preliminary Screening of Alternatives
PPAs: Summary of Alternative Costs and Assumptions
Dredge with upland disposal at PPAs

PPAs	Quantity	Unit	Unit Cost	Cost
Dredging	186,000	CYS	\$30	\$5,580,000
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal	186,000	CYS	\$91	\$17,004,046
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	0.00	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	10.30	Acres	\$84,858	\$874,038
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	9.00	Acres	\$270,604	\$2,435,438
Placement of 3-feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	0.00	Acres	\$75,549	\$0
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	19.30	Acres	\$121,397	\$2,342,957
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	0	Acres	\$128,099	\$0
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$28,236,478

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Preliminary Screening of Alternatives

Alternative B1: Summary of Alternative Costs and Assumptions

Dredge with upland disposal at Sponsored EAAs, PPAs and AOIs for total PCBs > 65 mg/kg OC.

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres)¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	23,407	CYS	\$30	\$702,203
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	23,407	CYS	\$91	\$2,139,837
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	0.00	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	2.40	Acres	\$84,858	\$203,659
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	0.40	Acres	\$270,604	\$108,242
Placement of 3-feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	0.00	Acres	\$75,549	\$0
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	2.80	Acres	\$121,397	\$339,911
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	0	Acres	\$128,099	\$0
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$76,193,851

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated with engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost.

Preliminary Screening of Alternatives
Alternative B2: Summary of Alternative Costs and Assumptions
Dredge with upland disposal at Sponsored EAAs, PPAs and AOI for total PCBs > 36 mg/kg OC.

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	56,187	CYS	\$30	\$1,685,596
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	56,187	CYS	\$91	\$5,136,549
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	0.00	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2 feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	5.00	Acres	\$84,858	\$424,290
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	2.10	Acres	\$270,604	\$568,269
Placement of 3-feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	0.00	Acres	\$75,549	\$0
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	7.10	Acres	\$121,397	\$861,917
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	0	Acres	\$128,099	\$0
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$81,376,621

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated with engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost.

Preliminary Screening of Alternatives
Alternative B3: Summary of Alternative Costs and Assumptions
Dredge with upland disposal at Sponsored EAAs, PPAs, and AOIs for total PCBs > 24 mg/kg OC.

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	120,215	CYS	\$30	\$3,606,464
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	120,215	CYS	\$91	\$10,990,051
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	0.00	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2 feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	6.50	Acres	\$84,858	\$551,577
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	6.00	Acres	\$270,604	\$1,623,625
Placement of 3-feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	0.00	Acres	\$75,549	\$0
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	12.50	Acres	\$121,397	\$1,517,459
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	0	Acres	\$128,099	\$0
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10				
and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$90,989,177

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated with engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost.

Preliminary Screening of Alternatives
Alternative B4: Summary of Alternative Costs and Assumptions
Dredge with upland disposal at Sponsored EAAs, PPAs and AOI for total PCBs > 12 mg/kg OC.

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	385,510	CYS	\$30	\$11,565,312
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	385,510	CYS	\$91	\$35,243,207
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	0	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	26.60	Acres	\$84,858	\$2,257,224
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	20.80	Acres	\$270,604	\$5,628,568
Placement of 3-feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	0	Acres	\$75,549	\$0
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	47.40	Acres	\$121,397	\$5,754,205
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	0	Acres	\$128,099	\$0
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$133,148,515

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated with engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost.

Preliminary Screening of Alternatives
Alternative B5: Summary of Alternative Costs and Assumptions
Dredge with upland disposal at Sponsored EAAs, PPAs and AOI for total PCBs > 6 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	1,189,429	CYS	\$30	\$35,682,876
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	1,189,429	CYS	\$91	\$108,737,142
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	0	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	96.1	Acres	\$84,858	\$8,154,858
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	53.6	Acres	\$270,604	\$14,504,387
Placement of 3-feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	0	Acres	\$75,549	\$0
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	149.7	Acres	\$121,397	\$18,173,089
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	0	Acres	\$128,099	\$0
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$257,952,352

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated with engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost.

Preliminary Screening of Alternatives
Alternative C1: Summary of Alternative Costs and Assumptions

Dredge with upland disposal at Sponsored EAAs, PPAs and AOIs for total PCBs > 65 mg/kg OC, ENR to 36 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	23,407	CYS	\$30	\$702,203
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	23,407	CYS	\$91	2,139,837
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	0	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	1.70	Acres	\$84,858	\$144,259
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	0.40	Acres	\$270,604	\$108,242
Placement of 3-feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	3.40	Acres	\$75,549	\$256,867
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	5.50	Acres	\$121,397	\$667,682
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	3.40	Acres	\$128,099	\$435,537
Costs associated with long-term monitoring of containment, habitat restoration, and ENR caps.				
Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$77,154,626

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated with engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives
Alternative C2: Summary of Alternative Costs and Assumptions
Dredge with upland disposal at Sponsored EAAs, PPAs and AOIs for total PCBs > 36 mg/kg OC, ENR to 24 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	56,187	CYS	\$30	\$1,685,596
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	56,187	CYS	\$91	5,136,549
Disposal of impacted sediment at off-site subtitle D landfill				
Cost includes transportation of sediment by barge/truck to transloading facility				
Cost includes dewatering of supernatant				
Containment Capping	0	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	3.60	Acres	\$84,858	\$305,489
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	2.10	Acres	\$270,604	\$568,269
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	8.60	Acres	\$75,549	\$649,722
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	14.30	Acres	\$121,397	\$1,735,973
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	8.60	Acres	\$128,099	\$1,101,653
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$83,883,250

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives

Alternative C3: Summary of Alternative Costs and Assumptions

Dredge with upland disposal at Sponsored EAAs, PPAs, and AOIs for total PCBs > 24 mg/kg OC, ENR to 12 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	120,215	CYS	\$30	\$3,606,464
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	120,215	CYS	\$91	10,990,051
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	0.00	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	9.80	Acres	\$84,858	\$831,609
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	6.00	Acres	\$270,604	\$1,623,625
Placement of 3-feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	30.80	Acres	\$75,549	\$2,326,910
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	46.60	Acres	\$121,397	\$5,657,087
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	30.80	Acres	\$128,099	\$3,945,453
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$101,681,200

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives
Alternative C4: Summary of Alternative Costs and Assumptions

Dredge with upland disposal at Sponsored EAAs, PPAs and AOI for total PCBs > 12 mg/kg OC, ENR to 6 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	385,510	CYS	\$30	\$11,565,312
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	385,510	CYS	\$91	\$35,243,207
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	0.00	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	36.80	Acres	\$84,858	\$3,122,776
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	20.80	Acres	\$270,604	\$5,628,568
Placement of 3-feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	92.10	Acres	\$75,549	\$6,958,065
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	149.70	Acres	\$121,397	\$18,173,089
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	92.10	Acres	\$128,099	\$11,797,930
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$165,188,948

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives

Alternative D1: Summary of Alternative Costs and Assumptions

Complete the Sponsored EAAs, Dredge with upland disposal the PPAs. On-site, in-water disposal of AOI for total PCBs > 65 mg/kg OC. ENR to 36 mg/kg OC.

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	23,407	CYS	\$30	\$702,203
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	0	CYS	\$91	00,000
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility				
Cost includes dewatering of supernatant				
Confined Aquatic Disposal	23,407	CYS	\$63	\$1,463,098
Construction of Confined Aquatic Disposal Site, disposal of sediments within CAD, and associated long-term monitoring costs				
Containment Capping	0	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	1.70	Acres	\$84,858	\$144,259
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	0.40	Acres	\$270,604	\$108,242
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	3.40	Acres	\$75,549	\$256,867
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	5.50	Acres	\$121,397	\$667,682
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	3.40	Acres	\$128,099	\$435,537
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$76,477,886

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives

Alternative D2: Summary of Alternative Costs and Assumptions

Complete the Sponsored EAAs, Dredge with upland disposal the PPAs. On-site, in-water disposal of AOIs for total PCBs > 36 mg/kg OC. ENR to 24 mg/kg OC.

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	56,187	CYS	\$30	\$1,685,596
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	0	CYS	\$91	00,000
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Confined Aquatic Disposal	56,187	CYS	\$63	\$3,512,078
Construction of Confined Aquatic Disposal Site, disposal of sediments within CAD, and associated long-term monitoring costs				
Containment Capping	0	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	3.60	Acres	\$84,858	\$305,489
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	2.10	Acres	\$270,604	\$568,269
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	8.60	Acres	\$75,549	\$649,722
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	14.30	Acres	\$121,397	\$1,735,973
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	8.60	Acres	\$128,099	\$1,101,653
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$82,258,779

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives
Alternative D3: Summary of Alternative Costs and Assumptions

Complete the Sponsored EAAs, Dredge with upland disposal the PPAs. On-site, in-water disposal of AOI for total PCBs > 24 mg/kg OC. ENR to 12 mg/kg OC.

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	120,215	CYS	\$30	\$3,606,464
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	0	CYS	\$91	\$0
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Confined Aquatic Disposal	120,215	CYS	\$63	\$7,514,367
Construction of Confined Aquatic Disposal Site, disposal of sediments within CAD, and associated long-term monitoring costs				
Containment Capping	0.00	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	9.80	Acres	\$84,858	\$831,609
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	6.00	Acres	\$270,604	\$1,623,625
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	30.80	Acres	\$75,549	\$2,326,910
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	46.60	Acres	\$121,397	\$5,657,087
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	30.80	Acres	\$128,099	\$3,945,453
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$98,205,516

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives

Alternative D4: Summary of Alternative Costs and Assumptions

Complete the Sponsored EAAs, Dredge with upland disposal the PPAs. On-site, in-water disposal of AOlS for total PCBs > 12 mg/kg OC. ENR to 6 mg/kg OC.

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	385,510	CYS	\$30	\$11,565,312
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	101,510	CYS	\$91	9,280,040
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Confined Aquatic Disposal	284,000	CYS	\$63	\$17,752,124
Construction of Confined Aquatic Disposal Site, disposal of sediments within CAD, and associated long-term monitoring costs				
Containment Capping	0.00	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	36.80	Acres	\$84,858	\$3,122,776
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	20.80	Acres	\$270,604	\$5,628,568
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	92.10	Acres	\$75,549	\$6,958,065
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	149.70	Acres	\$121,397	\$18,173,089
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	92.10	Acres	\$128,099	\$11,797,930
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$156,977,905

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives

Alternative E1: Summary of Alternative Costs and Assumptions

Complete the Sponsored EAAs and PPAs, Dredge with Treatment, Upland Disposal and Beneficially Use the AOs that exceed total PCBs > 65 mg/kg OC and contain <= 70% fines, ENR to 36 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	23,407	CYS	\$30	\$702,203
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	9,363	CYS	\$91	\$855,935
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Soil Washing, Handling, and Disposal of Filter Cake	14,044	CYS	\$329	\$4,618,544
Mobilization/Demobilization, siting costs, treatment, and disposal of impacted sediment to total PCB remediation level. Beneficial reuse of clean sediment with 30% or greater coarse fraction content.				
Upland off-site disposal at Subtitle D landfill for remaining material				
Containment Capping	0	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	1.70	Acres	\$84,858	\$144,259
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	0.40	Acres	\$270,604	\$108,242
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	3.40	Acres	\$75,549	\$256,867
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	5.50	Acres	\$121,397	\$667,682
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	3.40	Acres	\$128,099	\$435,537
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$80,489,267

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives

Alternative E2: Summary of Alternative Costs and Assumptions

Complete the Sponsored EAAs and PPAs, Dredge with Treatment, Upland Disposal and Beneficially Use the AOI that exceed 36 mg/kg OC and contain <= 70% fines, ENR to 24 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	56,187	CYS	\$30	\$1,685,596
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	22,475	CYS	\$91	\$2,054,620
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Soil Washing, Handling, and Disposal of Filter Cake	33,712	CYS	\$211	\$7,097,902
Mobilization/Demobilization, siting costs, treatment, and disposal of impacted sediment to total PCB remediation level. Beneficial reuse of clean sediment with 30% or greater coarse fraction content.				
Upland off-site disposal at Subtitle D landfill for remaining material				
Containment Capping	0	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2 feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	3.60	Acres	\$84,858	\$305,489
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	2.10	Acres	\$270,604	\$568,269
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	8.60	Acres	\$75,549	\$649,722
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	14.30	Acres	\$121,397	\$1,735,973
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	8.60	Acres	\$128,099	\$1,101,653
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$87,899,223

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives

Alternative E3: Summary of Alternative Costs and Assumptions

Complete the Sponsored EAAs and PPAs, Dredge with Treatment, Upland Disposal and Beneficially Use the AOI that exceed 24 mg/kg OC and contain <= 70% fines, ENR to 12 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	120,215	CYS	\$30	\$3,606,464
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	48,086	CYS	\$91	\$4,396,020
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Soil Washing, Handling, and Disposal of Filter Cake	72,129	CYS	\$166	\$11,938,355
Mobilization/Demobilization, siting costs, treatment, and disposal of impacted sediment to total PCB remediation level. Beneficial reuse of clean sediment with 30% or greater coarse fraction content.				
Upland off-site disposal at Subtitle D landfill for remaining material				
Containment Capping	0.00	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2 feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	9.80	Acres	\$84,858	\$831,609
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	6.00	Acres	\$270,604	\$1,623,625
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	30.80	Acres	\$75,549	\$2,326,910
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	46.60	Acres	\$121,397	\$5,657,087
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	30.80	Acres	\$128,099	\$3,945,453
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$107,025,525

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives

Alternative E4: Summary of Alternative Costs and Assumptions

Complete the Sponsored EAAs and PPAs, Dredge with Treatment, Upland Disposal and Beneficially Use the AOI that exceed 12 mg/kg OC and contain <= 70% fines, ENR to 6 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	385,510	CYS	\$30	\$11,565,312
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	154,204	CYS	\$91	\$14,097,283
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Soil Washing, Handling, and Disposal of Filter Cake	231,306	CYS	\$138	\$32,015,117
Mobilization/Demobilization, siting costs, treatment, and disposal of impacted sediment to total PCB remediation level. Beneficial reuse of clean sediment with 30% or greater coarse fraction content.				
Upland off-site disposal at Subtitle D landfill for remaining material				
Containment Capping	0.00	Acres	\$388,582	\$0
Mobilization/Demobilization Costs and Placement of 2 feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	36.80	Acres	\$84,858	\$3,122,776
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	20.80	Acres	\$270,604	\$5,628,568
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	92.10	Acres	\$75,549	\$6,958,065
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	149.70	Acres	\$121,397	\$18,173,089
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	92.10	Acres	\$128,099	\$11,797,930
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30 year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$176,058,141

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives
Alternative F1: Summary of Alternative Costs and Assumptions

Complete the Sponsored EAAs, Dredge the PPAs, and Cap the AOI bench areas that exceed 65 mg/kg OC, ENR to 36 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	10,823	CYS	\$30	\$324,683
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	10,823	CYS	\$91	989,412
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	0.70	Acres	\$388,582	\$272,008
Mobilization/Demobilization Costs and Placement of 2 feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	1.00	Acres	\$84,858	\$84,858
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	0.40	Acres	\$270,604	\$108,242
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	3.40	Acres	\$75,549	\$256,867
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	5.50	Acres	\$121,397	\$667,682
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	4.10	Acres	\$128,099	\$525,206
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$75,928,958

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives
Alternative F2: Summary of Alternative Costs and Assumptions
Complete the Sponsored EAAs, Dredge the PPAs, and Cap the AOI bench areas that exceed 36 mg/kg OC, ENR to 24 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	31,019	CYS	\$30	\$930,556
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	31,019	CYS	\$91	2,835,701
Disposal of impacted sediment at off-site subtitle D landfill. Cost includes transportation of sediment by barge/truck to transloading facility. Cost includes dewatering of supernatant				
Containment Capping	1.40	Acres	\$388,582	\$544,015
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place Provides habitat enhancement				
Residual Capping	2.20	Acres	\$84,858	\$186,688
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	2.10	Acres	\$270,604	\$568,269
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment. Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	8.60	Acres	\$75,549	\$649,722
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	14.30	Acres	\$121,397	\$1,735,973
Monitoring active remediation processes - dredging, excavation, cap placement Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	10.00	Acres	\$128,099	\$1,280,991
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry). Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$81,431,914

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives
Alternative F3: Summary of Alternative Costs and Assumptions

Complete the Sponsored EAAs, Dredge the PPAs, and Cap the AOI deep bench areas that exceed 24 mg/kg OC, ENR to 12 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	74,429	CYS	\$30	\$2,232,872
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	74,429	CYS	\$91	6,804,277
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	4.00	Acres	\$388,582	\$1,554,329
Mobilization/Demobilization Costs and Placement of 2-feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	5.80	Acres	\$84,858	\$492,177
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	6.00	Acres	\$270,604	\$1,623,625
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	30.80	Acres	\$75,549	\$2,326,910
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	46.60	Acres	\$121,397	\$5,657,087
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	34.80	Acres	\$128,099	\$4,457,850
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$97,849,127

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives
Alternative F4: Summary of Alternative Costs and Assumptions

Complete the Sponsored EAAs, Dredge the PPAs, and Cap the AOI bench areas that exceed 12 mg/kg OC, ENR to 6 mg/kg OC

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	264,549	CYS	\$30	\$7,936,474
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	264,549	CYS	\$91	\$24,184,975
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	14.40	Acres	\$388,582	\$5,595,585
Mobilization/Demobilization Costs and Placement of 2 feet of capping material to contain impacted sediment in-place				
Provides habitat enhancement				
Residual Capping	22.40	Acres	\$84,858	\$1,900,820
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	20.80	Acres	\$270,604	\$5,628,568
Placement of 3 feet of capping material for enhancement of nearshore habitat				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	92.10	Acres	\$75,549	\$6,958,065
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	149.70	Acres	\$121,397	\$18,173,089
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	106.50	Acres	\$128,099	\$13,642,558
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$156,720,134

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.

Note: Costs associated engineering, procurement, management, overhead, contingency, and sales tax are calculated within each unit cost

Preliminary Screening of Alternatives
Alternative G: Summary of Alternative Costs and Assumptions

Downstream RM 2.0: dredge with upland disposal Navigation Channel and Deep Bench Areas to 65 mg/kg OC (extending dredge area to areas > 12 mg/kg OC) and ENR Shallow Bench to 12 mg/kg OC.

Upstream RM 2.0: Dredge with Upland Disposal Navigation Channel to 12 mg/kg, Dredge with upland disposal and Cap Shallow Bench Areas to 24 mg/kg OC (extending dredge area to areas > 12 mg/kg OC). Dredge with upland disposal Deep Bench Areas to 24 mg/kg OC. MNR remaining areas.

Sponsored EAAs and PPAs	Quantity	Units	Cost
Sponsored Early Action Areas ¹	31.2	Acres	\$44,500,000
Potential Priority Areas (acres) ¹	19.3	Acres	\$28,200,000

1. Assumes 6 ft removal of Navigation Channel and Deep Bench Areas and 3 ft removal and 3 ft capping of Shallow Bench Areas

Areas of Interest	Quantity	Unit	Unit Cost	Cost
Dredging	41,344	CYS	\$30	\$1,240,320
Mobilization/Demobilization and Removal of impacted sediment to total PCB active remediation level				
Pre-removal of debris, logs etc. before dredging				
Disposal of Dredge Material	41,344	CYS	\$91	\$3,779,652
Disposal of impacted sediment at off-site subtitle D landfill.				
Cost includes transportation of sediment by barge/truck to transloading facility.				
Cost includes dewatering of supernatant				
Containment Capping	3.00	Acres	\$388,582	\$1,165,747
Mobilization/Demobilization Costs and Placement of 2 feet of capping material to contain impacted sediment in-place				
Residual Capping	14.70	Acres	\$84,858	\$1,247,413
Placement of thin layer of capping material to address dredge residuals				
Habitat Restoration Capping	0.00	Acres	\$270,604	\$0
Placement of 3 feet of capping material for enhancement of nearshore habitat after removal of impacted sediment.				
Armoring included as needed for erosion control				
Enhanced Natural Recovery (ENR)	11.90	Acres	\$75,549	\$899,033
Placement of thin 6-inch thick layer of material for Enhanced Natural Recovery				
Construction QA/QC	29.60	Acres	\$121,397	\$3,593,343
Monitoring active remediation processes - dredging, excavation, cap placement				
Post-verification surface sediment monitoring to verify remedy (may include water/sediment quality - chemical analysis, bathymetry, turbidity)				
Long-Term Cap O&M Monitoring	14.90	Acres	\$128,099	\$1,908,677
Costs associated with long-term monitoring of containment caps and ENR. Performed at years 1, 2, 5, 10 and every 5 years until year 30 (may include sediment coring, chemical analysis, bathymetry).				
Cost is present worth of annual cost assuming 7% interest rate.				
Monitored Natural Recovery				
Costs associated with monitoring natural recovery. Cost is present worth of annual cost assuming 30-year duration and 7% interest rate.				
Compliance Monitoring				
Costs associated with long-term monitoring of project site to ensure project site remains protective of human/environmental health.				
Administrative Costs and Institutional Controls				
Costs associated with establishment and public education of site-specific restrictions including periodic reviews, and long-term administration of established restrictions.				
TOTAL ESTIMATED COST				\$13,834,186

Monitored Natural Recovery, compliance monitoring, administrative and institutional controls costs are assumed to be independent of active remedial action levels and therefore not included for analysis under the PSA.