

Table 4-1
Summary of Human Health Cleanup Levels and Hot Spot Levels^a
Nu-Way Oil Company Site

Scenario and Medium	Chemical	Specific Receptor	Cleanup Level	Hot Spot Level
Human Health – On-site Industrial				
Surface Soil (mg/kg)	Arsenic	Onsite worker	7 ^c	170
	Lead	Onsite worker	800	8,000
	PCB	Onsite worker	1.4	140
	TPH	Construction worker	16,000	160,000
Subsurface Soil (mg/kg)	Lead	Onsite worker	800	8,000
	PCB	Onsite worker	1.4	140
	TCE	Onsite worker	0.08	8
	TPH ^b	Construction worker	33,000	330,000
Groundwater (µg/L)	Vinyl chloride	Onsite worker	270	NA ^d
Human Health – Off-site Industrial				
Surface Soil (mg/kg)	Lead	Offsite worker	800	8,000
	PCB	Offsite worker	1.4	140
	TPH	Construction worker	16,000	160,000
Human Health – Residential				
Surface Soil (mg/kg)	Lead	Resident	400	4,000
Subsurface Soil (mg/kg)	TPH ^b	Construction worker	7,600	76,000
Groundwater (µg/L)	TCE	Resident	11	NA
	TCE	Excavation worker	130	NA
Human Health – Recreational Fishing				
Sediment (mg/kg)	PCB	Angler	0.024 ^e	0.14
	Lead	Angler	90 ^e	90
Bank Soils and Drainage Ditch Sediment (mg/kg)	PCB	Angler	0.024 ^e	0.14
	Lead	Angler	17 ^e	20

Notes:

- a) Source: Table 20 in DEQ memorandum, *Summary of the Risk Assessment and Derivation of Cleanup Levels*, 7 September 2005.
- b) Contact with separate phase petroleum hydrocarbons (e.g., in the residual LNAPL zone) is also considered unacceptable.
- c) The risk-based concentration is below the regional background value, so the background concentration is used as the cleanup level. Hot-spot level is 100 times the risk-based value.
- d) NA = not applicable because there are no identified human health beneficial uses of groundwater. Hot spots for water are based on significant adverse effects on beneficial uses.
- e) Baseline concentrations are presented because they are higher than toxicity-based or bioaccumulation-based values. Source: DEQ, *Columbia Slough – Baseline Concentrations, Documentation of Methodology*, 21 November 2002; and DEQ, *Columbia Slough Sediment Record of Decision*, 2005.

**Table 4-2
Summary of Ecological Cleanup Levels and Hot Spot Levels
Nu-Way Oil Company Site**

Chemical	Cleanup Level^a	Hot Spot Level^b	Basis
Terrestrial Soil (mg/kg)			
Cadmium	20	200	Plants
Chromium	42	42	Background ^{c,d}
Lead	80	800	Birds
Mercury	0.5	5	Invertebrates
DDD/DDE/DDT	0.05	0.5	Birds
PCBs	20	200	Mammals
Groundwater (mg/L)			
Lead	0.0025	0.0025 ^e	Ambient Water Quality Criterion ^f
TPH	Sheen in surface water ^g	NA ^h	Unacceptable physical contact ^g
Bank Soil (mg/kg)			
Chromium	30	300	
Lead	90	90	The risk-based and hot spot levels were below the Columbia Slough baseline level ^d , so both were set at the baseline level.
DDE	0.007	0.02	Columbia Slough baseline ^d
DDT	0.004	0.04	
Dieldrin	0.003	0.03	
Heptachlor	0.002	0.02	
PAHs	Baseline ^{d,i}	Baseline ^{d,i}	Columbia Slough baseline ^d
PCBs	0.024	0.34	The risk-based level was below the Columbia Slough baseline level ^d , so the target cleanup level was set at the baseline level. Hot spot level is based on 10 times the risk-based level.
TPH	Sheen ^g	NA ^h	Unacceptable physical contact ^g
Sediment (mg/kg)			
Lead	90	90 ⁱ	The risk-based and hot spot levels were below the Columbia Slough baseline level ^d , so both were set at the baseline level.
PAHs	Baseline ^{d,i}	Baseline ^{d,i}	Columbia Slough baseline ^d
PCBs	0.024	0.34	The risk-based level was below the Columbia Slough baseline level ^d , so the target cleanup level was set at the baseline level. Hot spot level is based on 10 times the risk-based level.
TPH	Sheen ^g	NA ^h	Unacceptable physical contact ^g

Table 4-2
Summary of Ecological Cleanup Levels and Hot Spot Levels
Nu-Way Oil Company Site

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Notes:

- a) Source: Tables 22 and 23 in DEQ memorandum, *Summary of the Risk Assessment and Derivation of Cleanup Levels*, 7 September 2005.
- b) Hot spot level set at 10 times cleanup level.
- c) Background soil concentration is greater than cleanup level and hot spot level.
- d) Source: DEQ, *Columbia Slough – Baseline Concentrations, Documentation of Methodology*, 21 November 2002; and DEQ, *Columbia Slough Sediment Record of Decision*, 2005. Baseline concentrations are higher than toxicity-based or bioaccumulation-based values.
- e) Hot spots for water occur when there are significant adverse effects on beneficial uses. Exceeding AWQC indicates a potential hot spot.
- f) From DEQ Water Quality Table 33C. Based on a default hardness of 100 mg/L, and converted from a total recoverable concentration of 0.0032 mg/L to a dissolved concentration.
- g) The risk of organisms contacting sheen was not quantified, but was considered an unacceptable risk.
- h) NA = not applicable. Without a quantified risk, a hot spot level could not be established.
- i) Baseline values can be obtained for individual PAHs.

Table 4-3
Volume Calculations
(Rounded to Closest 10 CY for Volumes Greater than 15 CY)

	Cubic Yards
Soil Volumes at Concentrations above RBCs	
Upland Surface Soils	2950
Upland Subsurface Soils	180
Bank Surface Soils	<u>840</u>
Total Volume of Contaminated Soils	3970
Soil Volumes at Concentrations above Hot Spots	
Upland Surface Soil	110
Upland Subsurface Soil	20
Bank Surface Soils	<u>640</u>
Total Hot Spot Soils	770
Off-Site Soils above RBCs	
Residential Soils	15
Off-site Industrial Soils	<u>4</u>
Total Off-Site	19 (20)
Bank Soils	
Contaminated Bank Soils	840
Additional Soils for Bank Stabilization	<u>1660</u>
Total Soils Removed for Bank Stabilization	2500
Sediments	
Contaminated Sediments Below On-Site Disposal	1610
Sediments at Concentrations Above On-Site Disposal Criteria	40
Drainage Ditch Sediments	<u>15</u>
Total Contaminated Sediments	1665
On-Site Disposal Volumes Soil Volumes	
Bank Soil	2500
Off-Site Soils	20
Whitaker Slough Sediments Below On-Site Disposal Criteria	1610
Drainage Ditch Sediments	<u>15</u>
Total Volume ON-Site Disposal	4145
Off-Site Disposal Soil Volumes	
Upland Hot Spots	110
Upland Subsurface Hot Spots	20
Sediments (SD-20)	<u>40</u>
Total Off-Site Disposal Volume	170
Volume of gravel in former sludge pond (150x200x5)(in feet)	5550
Volume of soil required for bank stabilization (Import Fill)	1600
Volume of soil for upland cap	8880

(Source: E&E 2005)

**Table 5-1
On-Site Disposal Criteria**

COC	Disposal Criteria (mg/kg)	Rationale
TPH	50,000	Mobility Limit in silt to fine sand
Lead	8,000	Upland direct contact hot spot concentration
PCBs	50	Toxic Substances Control Act action level
Arsenic	170	Upland direct contact hot spot concentration

Table 5-2
COST PROPOSAL
Reforestation/Restoration Services
For: DEQ Nu-Way Oil Company Site
By: BES Watershed Revegetation Program
November 6, 1998

Item	Sub-Item	Description	Quantity	Units	Cost/Unit	Factor	Total	
1		Planning and construction oversight	160	hours	\$50.00	1	\$8,000.00	
2		Excavation and reconstruction						
	2a	mobilization	1	job	\$1,200.00	1	\$1,200.00	
	2b	excavator - includes operator	160	hours	\$120.00	1	\$19,200.00	
	2c	dump trucks	160	hours	\$50.00	1	\$8,000.00	
	2d	drum roller	32	hours	\$100.00	1	\$3,200.00	
	2e	angle dozer	80	hours	\$60.00	1	\$4,800.00	
	2f	misc. equip. and supplies	1	job	\$1,000.00	1	\$1,000.00	
		Excavation and reconstruction (subtotal)						\$37,400.00
3		Rock	2,000	tons	\$12.00	1	\$24,000.00	
4		Geogrid (Mirafi 5X)	1,000	sq. yd.	\$5.00	1	\$5,000.00	
5		Coir (Bonterra cf7 or equiv)	2,600	sq. yd.	\$2.50	1	\$6,500.00	
6		Geotextile fabric (linq gtf 250ex)	1,500	sq. yd.	\$0.90	1	\$1,350.00	
7		Geogrid, geotextile install labor	72	hours	\$40.00	1	\$2,880.00	
8		Willow live stakes-installed	50,000	l.f.	\$0.40	1	\$20,000.00	
9		Import fill	1,200	cu. yd.	\$5.50	1	\$6,600.00	
10		Native plant seed-applied	40	lbs.	\$48.00	1	\$1,920.00	
11		Wheat straw-applied	2	tons	\$250.00	1	\$500.00	
12		Planting installation	0.6	acres	\$9,713.50	1	\$5,828.00	
Total							\$119,978.00	
Estimated Cost in 2004 Dollars (Note 1)							\$152,000.00	

Notes:

- 1 Original cost estimate prepared by BES in 1998. Estimated cost in 2004 dollars was determined by calculating the future value of the original estimate, based on a 4% interest rate (a conservative inflation rate) and a period of six years.
15% Contingency removed from total cost.

Key:

BES = City of Portland, Bureau of Environmental Services.
DEQ = Oregon Department of Environmental Quality.

**TABLE 5-3
ALTERNATIVE 2 COST SUMMARY
EXCAVATION OF SOILS ABOVE HOT SPOT LEVELS AND SEDIMENTS ABOVE BASELINE LEVELS, OFF-SITE DISPOSAL
INSTITUTIONAL/ENGINEERING CONTROLS (CAPPING)
NU-WAY OIL COMPANY
PORTLAND, OREGON**

Line Item	Reference	Item Description	Quantity	Unit	Cost/Unit	Factor	Cost
DIRECT CAPITAL COSTS:							
Mobilization/Demobilization:							
1	HCCD 02305-250-0020	Excavation	1	Job	Lump	1	\$1,280
2	MCDD	Dredging	1	Job	Lump	1	\$3,000
Lagoon Pit Excavation:							
3	HCCD 02315-400-0250	Excavation of Lagoon Pit Gravel ^a	2,000	cu. yd.	\$2.98	1	\$5,952
4	HCCD 02315-120-3300	Front-end loader to stockpile pit spoils ^a	2,000	cu. yd.	\$2.15	1	\$4,300
Contaminated Soil Excavation:							
5	HCCD 02315-400-0250	Soil Excavation (HS-5 to HS-8, and HS-1')	130	cu. yd.	\$2.98	1	\$387
6	HCCD 02315-400-0250	Offsite Soil Excavation (A8, A9, A14)	19	cu. yd.	\$2.98	1	\$57
7	HCCD 02315-400-0250	Drainage Ditch Excavation	15	cu. yd.	\$2.98	1	\$45
Contaminated Sediment Excavation:							
8	MCDD	Sediment Removal	1,650	cu. yd.	\$22.90	1	\$37,785
Offsite Disposal Subtitle D							
9	Landfill	Bank Soils and Drainage Ditch Soils	852	tons	\$54.80	1	\$46,690
10	Landfill	Sediment	2,090	tons	\$54.80		\$114,532
Water Treatment:							
11	ERCD 33 13 2006 / Vendor	25 GPM, Carbon Adsorption (or ion exchange) Treatment System	2	each	\$1,938.00	1	\$5,876
12	ERCD 33 29 0119	25 GPM, 1 HP, Transfer Pump w/Motor, Valves, Piping	2	each	\$2,362.00	1	\$4,724
13	Vendor, Past Experience	Baker Tank rental (2), De-watering containment unit	1	Job	\$7,000.00	1	\$7,000
Soil/Sediment Hot Spot Disposal:							
14	Vendor	PCB and Lead Hot Spots (HS-8) ^{a,b}	14	tons	\$174.00	1	\$2,488
15	Vendor	Lead only Hot Spots (HS-1', HS-5, -6, -7, and SD20) ^{a,c}	196	tons	\$165.00	1	\$32,340
Backfilling:							
16	HCCD 02315-120-3300	Front-end loader to place bank soil in pit	1,860	cu. yd.	\$2.15	1	\$3,999
17	HCCD 02315-300-5040	Compaction soil, vibratory roller, 6-in lift, 4 passes	1,860	cu. yd.	\$0.46	1	\$856
18	HCCD 02315-120-3300	Front-end loader to place gravel over contaminated soil in pit	140	cu. yd.	\$2.15	1	\$301
19	HCCD 02315-300-5040	Compaction gravel, vibratory roller, 6-in lift, 4 passes	140	cu. yd.	\$0.46	1	\$64
20	Vendor	Geotextile Demarcation (Supply and Install) ^d	6,589	sq. yd.	\$0.72	1	\$4,744
21	ERCD 17 03 0101	Grading with D6 Dozer ^e	6,500	sq. yd.	\$4.31	1	\$28,015
22	Vendor	Import gravel to backfill A8, A9, and A14 ^d	25	tons	\$9.25	1	\$228
23	Vendor	Import rock for drainage ditch ^h	20	tons	\$11.50	2	\$460
24	HCCD 02315-120-3300	Front-end loader to backfill off-site excavations and ditch	34	cu. yd.	\$2.15	1	\$73
25	HCCD 02315-300-5040	Compaction, vibratory roller, 6-in lift, 4 passes	19	cu. yd.	\$0.46	1	\$9
Drilling							
26		Monitoring well abandonment	200	ft	\$38.00	1	\$7,600
27		Well Modification (extension)	8	each	\$1,000.00	1	\$8,000
Analytical Costs							
28	Vendor, Past Experience	PCB Confirmation Sampling EPA Method 8082 (24-hr TAT) ^f	39	samples	\$160.00	1	\$6,240
29	Vendor, Past Experience	Lead Confirmation Sampling EPA Method 6000 (24-hr TAT) ^f	39	samples	\$34.00	1	\$1,326
30	Vendor, Past Experience	PAH Confirmation Sampling EPA Method 8270 SIM (24-hr TAT) ^f	25	samples	\$350.00	1	\$8,750
31	Vendor, Past Experience	PCB Composite Samples ^g	21	samples	\$80.00	1	\$1,680
32	Vendor, Past Experience	Lead TCLP Composite Samples ^g	42	samples	\$55.00	1	\$2,310
33	BES	Bank Stabilization and Revegetation ^h	1	Job	Lump ⁱ	1	\$152,000
34		Cap	1	Job	Lump	1	\$285,023
35		Groundwater Monitoring/Air Evaluation	1	Job	Lump	1	\$30,000
36		Building Demolition	1	Job	Lump	1	\$29,300
Subtotal New Capital Costs							\$837,433
Overhead and Profit (25%)							\$209,358
Total New Direct Capital Costs							\$1,047,000
INDIRECT CAPITAL COSTS:							
Engineering and Design (5%)							\$52,350
Construction Oversight (5%)							\$52,350
Legal Fees and License/Permit Costs (2%)							\$20,940
Total New Indirect Capital Costs							\$125,640
Subtotal Capital Costs (Direct + Indirect)							\$1,172,640
Contingency Allowance (15%)							\$175,896
TOTAL CAPITAL COSTS (DIRECT + INDIRECT)							\$1,348,536
TOTAL ALTERNATIVE COST							\$1,349,000

^aAssumes 1.3 tons per cubic yard.

^bUnit cost includes transportation, treatment (if necessary), disposal, and applicable taxes. Assumes PCB will drive the disposal costs.

^cUnit cost includes transportation, disposal, and taxes. Assumes all samples will fail TCLP and require disposal in a Subtitle C facility (conservative approach).

^dDemarcation for top and bottom of pit.

^eGrade site in preparation for cap. Area shown is that area that will be impacted by this removal action only.

^fNumber of samples is based on 1 confirmation sample per 100 square yards (sediment and bank). PAH sampling is based on 1 sample per 200 square yards for sediment (1/100 for bank).

^gNumber of samples based on one composite sample per 100 tons (lead) approx. 200 tons (PCB)

^hAssumes HS-1, -2, -3, and -4 (Approx. 636 cu. yds.) will be excavated as part of bank stabilization.

ⁱRefer to Table 2A for detailed cost breakdown.

Key:

cu. yd. = Cubic yard.

ERCDC = R.S. Means, 2003, Environmental Remediation Cost Data, 9th Annual Edition (ERCDC).

HCCDC = 2002, R.S. Means Co., Heavy Construction Cost Data (HCCDC), 16th Annual Edition.

sq. ft. = Square foot.

sq. yd. = Square yard.

Line Item	Derivation
1	Lump sum.
2	Lump sum.
3	Volume removed to accommodate bank soils
4	Same as 4.
5	Sum of Upland Surface Soil Hot Spots
6	Sum of Offsite Soil Excavation
7	400 square feet x 1 foot depth=400 cubic feet or 15 cy
8	Total sediment removal volume
9	Hot spot contaminated bank soils (640 cy) and drainage ditch soils (15 cy) using 1.3 multiplier, Subtitle D disposal
10	Total volume for excavated sediments below the on-site disposal criteria
11	Assumes two systems will be required to treat the water. An additional \$2,000 is added to account for ion exchange resin if necessary. Resin is approximately \$1.00 more per pound than carbon.
12	Assumes two systems will be required to treat the water.
13	Assumes 2 baker tanks and temporary containment structure
14	Volume of PCB and Lead Hot Spot Soils: 10 cy
15	Volume of Lead Only Hot Spot Soils and Hot Spot Sediments: 160 cy
16	Volume of Bank Soils placed in pit: 1660 + 200 cy.
17	Same as 16
18	Difference between line 3 and line 16
19	Same as 18
20	Twice the area of the pit, converted to yards.
21	Area from Autocad. Approximate area of assumed stockpile on east side, lagoon pit on west side, and area in between.
22	Line item 6 converted to tons using 1.3 multiplier.
23	Line item 7 converted to tons using 1.3 multiplier.
24	Sum of line items 6 and 7.
25	Same as line item 6. Ditch won't need compaction.
26	Based on previous drilling quotes including mob (assumes 5 wells)
27	Based on previous estimates to extend wells as need for cap placement
28	See Footnote f. Assumes 4 wall samples and 1 floor sample for HS-8
29	See Footnote f. Assumes 4 wall samples and 1 floor sample from HS-1', HS-7, HS-8, and SD20. Assumes 6 wall samples and 2 floor samples from
30	See Footnote f. HS-5 and HS-6.
31	See Footnote g. Assumes one sample per 200 tons for off-site disposal plus some additional
32	See Footnote g. Assumes one sample per 100 tons for off-site disposal, plus some additional
33	See Table 5-2
34	See Table 5-4. Cap with 30 year operation and maintenance.
35	See E&E 2005
36	See E&E 2005

**TABLE 5-4
CAPPING COST SUMMARY
INSTITUTIONAL/ENGINEERING CONTROLS
CAP WITH OPERATION AND MAINTENANCE
NU-WAY OIL COMPANY
PORTLAND, OREGON**

Reference	Item Description	Quantity	Unit	Cost/Unit	Factor	Cost
DIRECT CAPITAL COSTS:						
Institutional/Engineering Controls:						
ERCD 17 03 0101	Grading with D6 Dozer	23,156	sq. yd.	\$4.31	1	\$99,802
HCCD 02315-300-5040	Compaction, vibratory roller, 6-in lift, 4 passes ^a	8,876	cu. yd.	\$0.46	1	\$4,083
Vendor - Morse Bros.	Imported Gravel ^{a,b}	11,538	tons	\$9.75	1	\$112,496
Vendor - NW Linings	Geotextile Demarcation (Supply and Install) ^f	3,267	sq. yd.	\$0.72	1	\$2,352
Total New Direct Capital Costs						\$218,733
O & M YEARLY COSTS:						
E & E	Cap Patching and Adding Gravel ^d	1	Lump Sum	\$5,000	1	\$5,000
Total O & M Yearly Costs						\$5,000
30-Year Cost Projection (8% PW interest rate):						
O & M Present Worth						\$56,290.00
TOTAL CAP COST						\$285,023

^aQuantity calculated by taking area from Figure 2, multiplying by 2-foot thickness of cap, and adding 15% to account for shrinkage during compaction.

^bAssumes 1.3 tons per cubic yard.

^cAreas exceeding cleanup goals will require demarcation.

^dAssumes approximately 377 tons at \$9.75/ton. Plus, equipment and labor will be required on an annual basis to fill in areas where the cap is compromised.

Key:

cu. yd. = Cubic yard.

E & E = Ecology and Environment, Inc.

ERCD = R.S. Means, 2003, Environmental Remediation Cost Data, 9th Annual Edition (ERCD).

HCCD = 2002, R.S. Means Co., Heavy Construction Cost Data (HCCD), 16th Annual Edition.

l.f. = Linear foot.

O & M = Operation and maintenance.

PW = Present worth.

sq. yd. = Square yard.

Table 5-5
ALTERNATIVE 3 REMEDIAL ACTION COST SUMMARY
EXCAVATION, OFF SITE DISPOSAL OF SOILS AND SEDIMENTS ABOVE THE ON-SITE DISPOSAL CRITERIA
EXCAVATION OF SOILS AND SEDIMENT BELOW THE ON-SITE DISPOSAL CRITERIA, AND
INSTITUTIONAL/ENGINEERING CONTROLS (CAPPING)
NU-WAY OIL COMPANY
PORTLAND, OREGON

Line Item	Reference	Item Description	Quantity	Unit	Cost/Unit	Factor	Cost
DIRECT CAPITAL COSTS:							
Mobilization/Demobilization:							
1	HCCD 02305-250-0020	Excavation	1	Job	Lump	1	\$1,280
2	MCDD	Dredging	1	Job	Lump	1	\$3,000
Lagoon Pit Excavation:							
3	HCCD 02315-400-0250	Excavation of Lagoon Pit Gravel ^a	5,491	cu. yd.	\$2.98	1	\$16,341
4	HCCD 02315-120-3300	Front-end loader to stockpile pit spoils ^a	5,491	cu. yd.	\$2.15	1	\$11,806
Contaminated Soil Excavation:							
5	HCCD 02315-400-0250	Soil Excavation (HS-5 to HS-8, and HS-1)	130	cu. yd.	\$2.98	1	\$387
6	HCCD 02315-400-0250	Offsite Soil Excavation (A8, A9, A14)	19	cu. yd.	\$2.98	1	\$57
7	HCCD 02315-400-0250	Drainage Ditch Excavation	15	cu. yd.	\$2.98	1	\$45
Contaminated Sediment Excavation:							
8	MCDD	Sediment Removal	1,650	cu. yd.	\$22.90	1	\$37,785
Water Treatment:							
9	ERCD 33 13 2006 / Vendor	25 GPM, Carbon Adsorption (or ion exchange) Treatment System	2	each	\$1,938.00	1	\$5,876
10	ERCD 33 29 0119	25 GPM, 1 HP, Transfer Pump w/Motor, Valves, Piping	2	each	\$2,362.00	1	\$4,724
11	Vendor, Past Experience	Baker Tank rental (2), De-watering containment unit	1	Job	\$7,000.00	1	\$7,000
Contaminated Soil Off-Site Disposal:							
12	Vendor	PCB and Lead Hot Spots (HS-8) ^b	14	tons	\$174.00	1	\$2,488
13	Vendor	Lead only Hot Spots (HS-1', HS-5, -6, -7, and SD20) ^{b,c}	196	tons	\$165.00	1	\$32,340
Backfilling:							
14	HCCD 02315-120-3300	Front-end loader to place contaminated soil in pit	4,142	cu. yd.	\$2.15	1	\$8,905
15	HCCD 02315-300-5040	Compaction soil, vibratory roller, 6-in lift, 4 passes	4,142	cu. yd.	\$0.46	1	\$1,905
16	HCCD 02315-120-3300	Front-end loader to place gravel over contaminated soil in pit	1,349	cu. yd.	\$2.15	1	\$2,900
17	HCCD 02315-300-5040	Compaction gravel, vibratory roller, 6-in lift, 4 passes	1,349	cu. yd.	\$0.46	1	\$621
18	Vendor	Geotextile Demarcation (Supply and Install) ^d	6,589	sq. yd.	\$0.72	1	\$4,744
19	ERCD 17 03 0101	Grading with D6 Dozer ^e	6,500	sq. yd.	\$4.31	1	\$28,015
20	Vendor	Import gravel to backfill A8, A9, and A14 ^d	25	tons	\$9.25	1	\$228
21	Vendor	Import rock for drainage ditch ^d	20	tons	\$11.50	2	\$460
22	HCCD 02315-120-3300	Front-end loader to backfill off-site excavations and ditch	34	cu. yd.	\$2.15	1	\$73
23	HCCD 02315-300-5040	Compaction, vibratory roller, 6-in lift, 4 passes	19	cu. yd.	\$0.46	1	\$9
Drilling							
24		Monitoring well abandonment	200	ft	\$38.00	1	\$7,600
25		Well Modification (extention)	8	each	\$1,000.00	1	\$8,000
Analytical Costs							
26	Vendor, Past Experience	PCB Confirmation Sampling EPA Method 8082 (24-hr TAT) ^f	39	samples	\$160.00	1	\$6,240
27	Vendor, Past Experience	Lead Confirmation Sampling EPA Method 6000 (24-hr TAT) ^f	39	samples	\$34.00	1	\$1,326
28	Vendor, Past Experience	PAH Confirmation Sampling EPA Method 8270 SIM (24-hr TAT) ^f	25	samples	\$350.00	1	\$8,750
29	Vendor, Past Experience	PCB Composite Samples ^g	10	samples	\$80.00	1	\$800
30	Vendor, Past Experience	Lead TCLP Composite Samples ^g	15	samples	\$55.00	1	\$825
31	BES	Bank Stabilization and Revegetation ^h	1	Job	Lump ^j	1	\$152,000
32		Cap	1	Job	Lump	1	\$285,023
33		Groundwater Monitoring/Air Evaluation	1	Job	Lump	1	\$30,000
34		Building Demolition	1	Job	Lump	1	\$29,300
		Subtotal New Capital Costs					\$700,853
		Overhead and Profit (25%)					\$175,213
		Total New Direct Capital Costs					\$876,000
INDIRECT CAPITAL COSTS:							
		Engineering and Design (5%)					\$43,800
		Construction Oversight (5%)					\$43,800
		Legal Fees and License/Permit Costs (2%)					\$17,520
		Total New Indirect Capital Costs					\$105,120
		Subtotal Capital Costs (Direct + Indirect)					\$981,120
		Contingency Allowance (15%)					\$147,168
		TOTAL CAPITAL COSTS (DIRECT + INDIRECT)					\$1,128,288
		TOTAL ALTERNATIVE COST					\$1,128,000

^aAssumes 1.3 tons per cubic yard.

^bUnit cost includes transportation, treatment (if necessary), disposal, and applicable taxes. Assumes PCB will drive the disposal costs.

^cUnit cost includes transportation, disposal, and taxes. Assumes all samples will fail TCLP and require disposal in a Subtitle C facility (conservative approach).

^dDemarcation for top and bottom of pit.

^eGrade site in preparation for cap. Area shown is that area that will be impacted by this removal action only.

^fNumber of samples is based on 1 confirmation sample per 100 square yards (sediment and bank). PAH sampling is based on 1 sample per 200 square yards for sediment (1/100 for bank).

^gNumber of samples based on one composite sample per 100 tons (lead) approx. 200 tons (PCB)

^hAssumes HS-1, -2, -3, and -4 (Approx. 636 cu. yds.) will be excavated as part of bank stabilization.

ⁱRefer to Table 5-2 for detailed cost breakdown.

Key:

cu. yd. = Cubic yard.

ERCD = R.S. Means, 2003, Environmental Remediation Cost Data, 9th Annual Edition (ERCD).

HCCD = 2002, R.S. Means Co., Heavy Construction Cost Data (HCCD), 16th Annual Edition.

sq. ft. = Square foot.

sq. yd. = Square yard.

Line Item	Derivation
1	Lump sum.
2	Lump sum.
3	Volume of gravel to accommodate on-site soil disposal.
4	Same as 4.
5	Sum of upland soil hot spots volume
6	Sum of off-site soil excavation volume
7	400 square feet x 1 foot depth=400 cubic feet or 15 cy
8	Total sediment removal volume
9	Assumes two systems will be required to treat the water. An additional \$2,000 is added to account for ion exchange resin if necessary. Resin is approximately \$1.00 more per pound than carbon.
10	Assumes two systems will be required to treat the water.
11	Assumes 2 baker tanks and temporary containment structure
12	Volume of PCB/Lead contaminated soils: 10 cy converted to tons assuming 1.3 multiplier.
13	Sum of volume of lead only hot spot soils and hot spot sediment: 160 cy converted to tons using 1.3 multiplier.
14	Sum of bank stabilization volume, all sediments (excluding SD20), A8, A9, A14, ditch.
15	Same as 14.
16	Difference between line 3 and line 13.
17	Same as 14.
18	Twice the area of the pit, converted to yards.
19	Area from Autocad. Approximate area of assumed stockpile on east side, lagoon pit on west side, and area in between.
20	Line item 6 converted to tons using 1.3 multiplier.
21	Line item 7 converted to tons using 1.3 multiplier.
22	Sum of line items 6 and 7.
23	Same as line item 6. Ditch won't need compaction.
24	Based on previous drilling quotes including mob (assumes 5 wells)
25	Based on previous estimates to extend wells as need for cap placement
26	See Footnote f. Assumes 4 wall samples and 1 floor sample for HS-8
27	See Footnote f. Assumes 4 wall samples and 1 floor sample from HS-1', HS-7, HS-8, and SD20. Assumes 6 wall samples and 2 floor samples from
28	See Footnote f. HS-5 and HS-6.
29	See Footnote g. Assumes one sample per 200 tons for off-site disposal plus some additional
30	See Footnote g. Assumes one sample per 100 tons for off-site disposal, plus some additional
31	See Table 5-2
32	See Table 5-4. Cap with 30 year operation and maintenance.
33	See E&E 2005
34	See E&E 2005

**Table 5-6
ALTERNATIVE 4 COST SUMMARY
CLEANUP LEVEL EXCAVATION, OFF-SITE DISPOSAL, NO CAPPING
NU-WAY OIL COMPANY
PORTLAND, OREGON**

Line Item	Reference	Item Description	Quantity	Unit	Cost/Unit	Factor	Cost
DIRECT CAPITAL COSTS:							
Mobilization/Demobilization:							
1	HCCD 02305-250-0020	Excavation	1	Job	Lump	1	\$1,280
2	MCDD	Dredging	1	Job	Lump	1	\$3,000
Contaminated Soil Excavation:							
3	HCCD 02315-400-0250	Uplands Surface Soil	2,950	cu. yd.	\$2.98	1	\$8,779
4	HCCD 02315-400-0250	Uplands Subsurface Soil	180	cu. yd.	\$2.98	1	\$536
5	HCCD 02315-400-0250	Off-site soils	20	cu. yd.	\$2.98	1	\$60
6	HCCD 02315-400-0250	Drainage Ditch Excavation	15	cu. yd.	\$2.98	1	\$45
Contaminated Sediment Excavation:							
7	MCDD	Sediment Removal	1,650	cu. yd.	\$22.90	1	\$37,785
Water Treatment:							
9	ERCDC 33 13 2006 / Vendor	25 GPM, Carbon Adsorption (or ion exchange) Treatment System	2	each	\$1,938.00	1	\$5,876
9	ERCDC 33 29 0119	25 GPM, 1 HP, Transfer Pump w/Motor, Valves, Piping	2	each	\$2,362.00	1	\$4,724
10	Vendor, Past Experience	Baker Tank rental (2), De-watering containment unit	1	Job	\$7,000.00	1	\$7,000
Contaminated Soil Off-Site Subtitle C Disposal							
11	Vendor	PCB and Lead Hot Spots (HS-8) ^{ab}	14	tons	\$174.00	1	\$2,488
12	Vendor	Lead only Hot Spots (HS-1 ^a , HS-5, -6, -7, and SD20) ^{abc}	196	tons	\$165.00	1	\$32,390
Contaminated Soil Off-site Subtitle D Disposal:							
13	Vendor	All Remaining soils	9,300	tons	\$54.80	1	\$509,640
Backfilling:							
14	HCCD 02315-120-3300	Front-end loader to backfill on-site	3,130	cu. yd.	\$2.15	1	\$6,730
15	HCCD 02315-300-5040	Grading with D6 Dozere	11,578	sq. ft.	\$4.31	1	\$49,901
16	HCCD 02315-300-5040	Compaction gravel, vibratory roller, 6-in lift, 4 passes	3,130	cu. yd.	\$0.46	1	\$1,440
17	Vendor	Import Gravel	4,152	tons	\$9.75	1	\$40,482
18	Vendor	Import rock for drainage ditch ^a	20	tons	\$11.50	2	\$460
19	HCCD 02315-120-3300	Front-end loader to backfill off-site excavations and ditch	34	cu. yd.	\$2.15	1	\$73
20	HCCD 02315-300-5040	Compaction, vibratory roller, 6-in lift, 4 passes	19	cu. yd.	\$0.46	1	\$9
Drilling							
21		Monitoring well abandonment	200	ft	\$38.00	1	\$7,600
Analytical Costs							
22	Vendor, Past Experience	PCB Confirmation Sampling EPA Method 8082 (24-hr TAT) ^f	130	samples	\$160.00	1	\$20,800
23	Vendor, Past Experience	Lead Confirmation Sampling EPA Method 6000 (24-hr TAT) ^f	130	samples	\$34.00	1	\$4,420
24	Vendor, Past Experience	PAH Confirmation Sampling EPA Method 8270 SIM (24-hr TAT) ^f	65	samples	\$350.00	1	\$22,750
25	Vendor, Past Experience	PCB Composite Samples ^g	95	samples	\$80.00	1	\$7,600
26	Vendor, Past Experience	Lead TCLP Composite Samples ^g	95	samples	\$55.00	1	\$5,225
Additional Actions:							
27	BES	Bank Stabilization and Revegetation ^h	1	Job	Lump ⁱ	1	\$152,000
28	E&E 2005	Groundwater Monitoring/Air Evaluation	1	job	Lump	1	\$30,000
29	E&E 2005	Building Demolition	1	Job	Lump	1	\$29,300
Subtotal New Capital Costs							\$992,391
Overhead and Profit (25%)							\$248,098
Total New Direct Capital Costs							\$1,240,000
INDIRECT CAPITAL COSTS:							
Engineering and Design (5%)							\$62,000
Construction Oversight (5%)							\$62,000
Legal Fees and License/Permit Costs (2%)							\$24,800
Total New Indirect Capital Costs							\$148,800
Subtotal Capital Costs (Direct + Indirect)							\$1,388,800
Contingency Allowance (15%)							\$208,320
TOTAL CAPITAL COSTS (DIRECT + INDIRECT)							\$1,597,120
TOTAL ALTERNATIVE COST							\$1,597,000

^aAssumes 1.3 tons per cubic yard.

^bUnit cost includes transportation, treatment (if necessary), disposal, and applicable taxes. Assumes PCB will drive the disposal costs.

^cUnit cost includes transportation, disposal, and taxes. Assumes all samples will fail TCLP and require disposal in a Subtitle C facility (conservative approach).

^dDemarcation for top and bottom of pit.

^eGrade site in preparation for cap. Area shown is that area that will be impacted by this removal action only.

^fNumber of samples is based on 1 confirmation sample per 100 square yards for Lead and PCB. PAH sampling is based on 1 sample per 200 square yards. Lagoon area assumes 1 samples per 200 square yards for all analysis as this area is fill material (calculated square yard areas as follows: sediment: 2,891, bank: 1,111, upland: 7,657, and lagoon 29,650). Paved area not included equals 2,500 square yards

⁶Number of samples based on one composite sample per 100 tons (assuming off-site disposal of 9,510 tons.

^hAssumes HS-1, -2, -3, and -4 (Approx. 640 cu. yds.) will be excavated as part of bank stabilization.

ⁱRefer to Table 5-2 for detailed cost breakdown.

Key:

cu. yd. = Cubic yard.

ERCD = R.S. Means, 2003, Environmental Remediation Cost Data, 9th Annual Edition (ERCD).

HCCD = 2002, R.S. Means Co., Heavy Construction Cost Data (HCCD), 16th Annual Edition.

sq. ft. = Square foot.

sq. yd. = Square yard.

Line Item	Derivation
1	Lump sum.
2	Lump sum.
3	Total volume of upland surface soil above target cleanup level.
4	Total volume of upland subsurface soil above target cleanup level.
5	Total volume of upland off-site soil above target cleanup level.
6	Total volume of drainage ditch sediment to be excavated.
7	Total volume of sediment that will be excavated.
8	Assumes two systems will be required to treat the water. An additional \$2,000 is added to account for ion exchange resin if necessary. Resin is approximately \$1.00 more per pound than carbon.
9	Assumes two systems will be required to treat the water.
10	Assumes 2 baker tanks and temporary containment structure
11	Total volume of soils impacted with lead and PCBs above the upland hot spot cleanup level.
12	Total volume of upland soils impacted with lead and contaminated sediment above the upland hot spot cleanup level
13	Total volume of soil minus lines 11 and 12.
14	Volume to backfill after excavation. Sum of lines 3 and 4.
15	Area on site that must be graded following excavation
16	Same as 14
17	Gravel for site grading
18	Total volume of backfill for drainage ditch.
19	Management of off-site excavation areas.
20	Soil compaction in off-site excavation areas.
21	Based on previous drilling quotes including mob (assumes 5 wells)
22	See footnote f
23	See footnote f
24	See footnote f
25	See footnote g
26	See footnote g
27	See footnotes h and i
28	Estimated cost for annual gw monitoring (lump)
29	Cost for demolition and disposal of both site buildings. Refer to Tech Memo (E & E, 2005)