APPENDIX D
QUANTITIES
PASCO LANDFILL NPL SITE

Prepared for

Industrial Waste Area Generator Group III

Prepared by

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August 2017

ZONE A

Table 1a
Zone A
Area/Volume Calculations

Parameter	Quantity	Unit	Source/Notes
Areas for Zone A			
Fence Area	133,327	ft^2	Areas calculated using GIS for current fence and geomembrane limits, as of January 2017.
	3.061	AC	
Geomembrane Area	87,289	ft^2	
	2.004	AC	
Average Area Between Fence and Geomembrane (calculated)	110,308	ft^2	-
	2.532	AC	
Soil Volumes for Zone A			
Average Volume from Ground Cover to Geomembrane	9,000	CY	Per Triad Associates' estimate. Depth of soil back-calculated to be 2.2 ft, using the average area between fence and geomembrane.
	13,500	TN	
Average Volume from Geomembrane to Top of Visqueen Layer	31,000	CY	Per Triad Associates' estimate. Depth of soil back-calculated to be 7.6 ft, using the average area between fence and geomembrane.
	46,500	TN	
Average Volume from Top of Visqueen Layer to Top of Touchet Beds (Between Fence and Geomembrane and including Drum Volumes)	69,000	CY	Per Triad Associates' estimate. Depth of soil back-calculated to be 17 ft, using the average area between fence and geomembrane.
	103,500	TN	
Average Volume from Top of Visqueen Layer to Top of Touchet Beds (Between Fence and Geomembrane and excluding Drum Volumes) (calculated)	62,200	CY	Includes volume of Historic Mixed Waste; see definition and detailed assumptions in Table 1b.
	93,300	TN	
Average Volume from Top of Touchet Beds to Top of Upper Pasco Gravels (Between Fence and Geomembrane)	61,000	CY	Per Triad Associates' estimate. Depth of soil back-calculated to be 15 ft, using the average area between fence and geomembrane.
	91,500	TN	
Drum Volumes for Zone A			
Volume of Stacked Drums with Casting Sands (8,900 drums)	2,421	CY	Number of stacked drums with casting sands (8,900) based on Table 3-7 (Waste Inventory) of Phase I Remedial Investigation Report (Burlington Environmental Inc., 1993). Assumed 0.272 CY per drum, per Envirocon's estimate.
	3,631	TN	
Volume of Stacked Drums with Hazardous Wastes (16,100 drums)	4,379	CY	Number of stacked drums with hazardous wastes (16,100) calculated as the difference between the total number of stacked drums (25,000, see Table 1b) and stacked drums with casting sands (8,900). Hazardous wastes include liquids and sludges. Assumed 0.272 CY per drum, per Envirocon's estimate.
	6,569	TN	
Soil Layback Area/Volume Between Visqueen Layer and Top of Touchet Beds			
Layback Volume (calculated)	30,200	CY	Per Envirocon's estimate. Assumed a 3:1 slope on 3 sides and 2:1 slope on the west side, sloping up 17 feet from the bottom area of excavation (110,300 ft^2, average area between fence and geomembrane).
	45,300	TN	
Average Layback Thickness	9	ft	Per EPI's estimate.
Layback Area (calculated)	90,600	ft^2	-
	2.08	AC	
Soil Layback Area/Volume Between Top of Touchet Beds and Top of Upper Pasco Gravels			
Layback Volume (calculated)	54,800	CY	Per Envirocon's estimate. Assumed a 3:1 slope on 3 sides and 2:1 slope on the west side, sloping up 32 feet from the bottom area of excavation (110,300 ft^2, average area between fence and geomembrane). The layback volume from Visqueen to Top of Touchet Beds is then subtracted, resulting in 79,500 CY.
	82,200	TN	
Average Layback Thickness	15	ft	Per EPI's estimate.
Layback Area (calculated)	62,400	ft^2	-
	1.43	AC	
Total Excavation Area/Volume for Alternatives A-5 and A-6			
Total Excavation Area (calculated)	200,908	ft^2	Calculated as the sum of the average area between fence and geomembrane and layback area (from top of Visqueen Layer to top of Touchet Beds).
	4.61	AC	
Total Excavation Volume, including Drum Volumes (calculated)	139,200	CY	Calculated as the sum of volumes between ground cover and to top of Touchet Beds (including drum volumes).
	208,800	TN	
Total Excavation Volume, excluding Drum Volumes (calculated)	132,400	CY	Calculated as the sum of volumes between ground cover and to top of Touchet Beds (excluding drum volumes).
	198,600	TN	
Total Excavation Area/Volume for Alternatives A-7, A-8, and A-9			
Total Excavation Area (calculated)	263,308	ft^2	Calculated as the sum of the average area between fence and geomembrane and layback area (from top of Touchet Beds to top of Upper Pasco Gravels).
	6.04	AC	
Total Excavation Volume, including Drum Volumes (calculated)	255,000	CY	Calculated as the sum of volumes between ground cover and to top of Upper Pasco Gravels (including drum volumes).
	382,500	TN	
Total Excavation Volume, excluding Drum Volumes (calculated)	248,200	CY	Calculated as the sum of volumes between ground cover and to top of Upper Pasco Gravels (excluding drum volumes).
	372,300	TN	

Notes:
Assumed conversion of 1.5 TN/CY.
- = not applicable
AC = acre
CY = cubic yard
ft = foot
ft^2 = square foot
TN = ton

Table 1b
Zone A
Drum Area/Volume Calculations

Parameter	Quantity	Unit	Source/Notes
Estimated Total Number of Drums (Stacked Drums and Historic Mixed Waste[1])	35,000	drums	Based on Section 3.6 and Table 3-7 (Waste Inventory) of Phase I Remedial Investigation Report (Burlington Environmental Inc., 1993).
Stacked Drum Volume for Zone A (containing both hazardous wastes and casting sands)			
Stack Height	4	stacks	Based on Section 3.6 (Waste Inventory) of Phase I Remedial Investigation Report (Burlington Environmental Inc., 1993).
Number of Drums per Stack (calculated)	5,210	drums	Assumed hexagonally-packed drums and 24 in-drum diameter. See Figure 1 of this Appendix for stacked drum footprint (based on Figure 2 of Geophysical Investigation and Interpretation Report [NGA 2009]).
Total Number of Stacked Drums (calculated)	25,000	drums	Total number of stacked drums includes a 20% increase to account for widening of the bottom stack. Includes stacked drums with casting sands (8,900 drums) and stacked drums with hazardous wastes (16,100 drums).
Volume of Stacked Drums (calculated)	6,800	CY	Assumed 0.272 CY per drum, per Envirocon's estimate.
Weight of Stacked Drums (calculated)	10,200	TN	Assumed conversion of 1.5 TN/CY.
Historic Mixed Waste [1] Area/Volume for Zone A			
Area of Historic Mixed Waste (calculated)	22,500	ft^2	Assumed area of 300-ft long by 75-ft wide, based on Phase I Remedial Investigation Report (Figures 3-64 and 3-65; Phillip Environmental Services Corp., 1998). It includes drummed waste (formerly known in the Phase I and I Remedial Investigation Reports as "Randomly-placed Drums", with approximately 10,000 drums, equivalent to 4,100 TN) that were placed randomly, crushed/compacted in place, and covered or interlayered with soil and debris (approximately 5,900 TN), in the western edge of Zone A.
Depth of Historic Mixed Waste	8	ft	Assumed depth between Visqueen and top of Touchet Beds.
Volume of Historic Mixed Waste (calculated)	180,000	ft^3	-
	6,667	CY	
Weight of Historic Mixed Waste (calculated)	10,000	TN	-

Notes:
Assumed conversion of 1.5 TN/CY.
See Figure 1 of this Appendix for stacked drum footprint, based on Figure 2 of Geophysical Investigation and Interpretation Report (Northwest Geophysical

1. Per the updated CSM described in Section 2.6 of the Draft Final FFS, the historic mixed waste is the area in the western edge of Zone A, where approximately 10,000 drums (as drummed waste and formerly known in the Phase I and I Remedial Investigation Reports as "Randomly-placed Drums") were placed randomly, crushed/compacted in place, and covered or interlayered with soil and debris. Per Phase I Remedial Investigation Report (Burlington Environmental Inc. 1993), random disposal of drummed waste in the western edge of Zone A occurred from April to October 1972 and crushed/compacted drums were mixed and covered with soil. Per Larry Dietrich (meeting notes 1993), the condition of the randomly-disposed drums was poor. For FFS costing purposes, the 10,000 TN within the Historic Mixed Waste area are assumed to be included in the volume of mixed soils/debris between the Visqueen to Top of Touchet Beds layer, in Alternatives A-5 through A-9 (see Sections 5.4.5 through 5.4.9).

CSM = conceptual site model
CY = cubic yard
FFS = Focused Feasibility Study
ft = foot
ft^2 = square foot
ft^3 = cubic foot
TN = ton

Table 1c
Zone A
AOC Drum Area/Volume Calculations

Parameter	Quantity	Unit	Source/Notes
AOC for Alternatives A-5 and A-6			
Total Waste Volume (calculated)	98,905	CY	Calculated as the sum of volumes of drums and soil between Geomembrane to Top of Touchet Beds (see Table 1a for assumptions). Assumed 75% of volume of stacked drums containing hazardous wastes, 100% of volume of stacked drums containing casting sands, and 100% of the historic mixed waste volume would go into the AOC.
	148,358	TN	
Waste Placement Thickness	10	ft	Assumed AOC thickness for constructability.
Average Waste Area (calculated)	267,044	ft^2	Calculated as Total AOC Waste Volume divided by the Waste Placement Thickness.
	6.13	AC	
Top Waste Area	302,500	ft^2	Assumed dimensions for the top waste area are 550 x 550 ft^2.
	6.9	AC	
Bottom Waste Area (at 10 ft depth)	240,100	ft^2	Assumed dimensions for the bottom waste area are 490 x 490 ft^2 with 3:1 side slopes.
	5.5	AC	
Compacted Soil Layer Area (at 12 ft depth)	228,484	ft^2	Assumed dimensions for compacted soil layer area are 478 x 478 ft^2 with 3:1 side slopes.
	5.2	AC	
Layback Side Slope Waste Area	65,775	ft^2	Surface area of layback side slopes (truncated square pyramid).
	1.5	AC	
Compacted Soil Liner Thickness	3	ft	Per Hazardous Waste Landfill MTRs (EPA 1989, 2005).
Compacted Soil Liner Volume	32,695	CY	Calculated as the sum of the compacted soil liner area and the layback side slope waste area, multiplied by the compacted soil liner thickness.
	49,043	TN	
LCRS and LDS Thickness	2	ft	Per Hazardous Waste Landfill MTRs (EPA 1989, 2005).
LCRS and LDS Volume	22,657	CY	Calculated as the sum of the bottom waste area and the layback side slope AOC area, multiplied by the LCRS thickness.
	33,986	TN	
RCRA Cap Area	336,400	ft^2	RCRA Cap extends 10 ft beyond the GCL, so assumed RCRA cap area of 580 x 580 ft^2.
	7.7	AC	
RCRA Cap Thickness	5	ft	Per Hazardous Waste Landfill MTRs (EPA 1989, 2005).
RCRA Cap Volume	62,296	CY	Calculated as the RCRA cap area multiplied by the RCRA cap thickness.
	93,444	TN	
Total Excavation Volume for AOC	154,258	CY	Calculated as the sum of the total waste volume, over-excavation volume for liner, and LCRS volume.
	231,387	TN	
AOC for Alternatives A-7 and A-8			
Total Waste Volume (calculated)	159,905	CY	Calculated as the sum of volumes of drums and soil between Geomembrane to Top of Upper Pasco Gravels (see Table 1a for assumptions). Assumed 75% of volume of stacked drums containing hazardous wastes, 100% of volume of stacked drums containing casting sands, and 100% of the historic mixed waste volume would go into the AOC.
	239,858	TN	
Waste Placement Thickness	10	ft	Assumed AOC thickness for constructability.
Average Waste Area (calculated)	431,744	ft^2	Calculated as Total AOC Waste Volume divided by the Waste Placement Thickness.
	9.91	AC	
Top Waste Area	469,225	ft^2	Assumed dimensions for the top waste area are 685 x 685 ft^2.
	10.8	AC	
Bottom Waste Area (at 10 ft depth)	390,625	ft^2	Assumed dimensions for the bottom waste area are 625 x 625 ft^2 with 3:1 side slopes.
	9.0	AC	
Compacted Soil Layer Area (at 12 ft depth)	375,769	ft^2	Assumed dimensions for compacted soil layer area are 613 x 613 ft^2 with 3:1 side slopes.
	8.6	AC	
Layback Side Slope Waste Area	82,852	ft^2	Surface area of layback side slopes (truncated square pyramid).
	1.9	AC	
Compacted Soil Liner Thickness	3	ft	Per Hazardous Waste Landfill MTRs (EPA 1989, 2005).
Compacted Soil Liner Volume	50,958	CY	Calculated as the sum of the compacted soil liner area and the layback side slope waste area, multiplied by the compacted soil liner thickness.
	76,437	TN	
LCRS and LDS Thickness	2	ft	Per Hazardous Waste Landfill MTRs (EPA 1989, 2005).
LCRS and LDS Volume	35,072	CY	Calculated as the sum of the bottom waste area and the layback side slope AOC area, multiplied by the LCRS thickness.
	52,609	TN	
RCRA Cap Area	511,225	ft^2	RCRA Cap extends 10 ft beyond the GCL, so assumed RCRA cap area of 715 x 715 ft^2.
	11.7	AC	
RCRA Cap Thickness	5	ft	Per Hazardous Waste Landfill MTRs (EPA 1989, 2005).
RCRA Cap Volume	94,671	CY	Calculated as the RCRA cap area multiplied by the RCRA cap thickness.
	142,007	TN	
Total Excavation Volume for AOC	245,935	CY	Calculated as the sum of the total waste volume, over-excavation volume for liner, and LCRS volume.
	368,903	TN	

Notes:
Assumed conversion of 1.5 TN/CY.
See Figure 2 of this Appendix for typical cross section of an AOC cell with details of the top RCRA cap and bottom liner layer.
AC = acre
AOC = area of contamination
EPA = U.S. Environmental Protection Agency
CY = cubic yard
ft = foot
ft^2 = square foot
GCL = geosynthetic clay layer
LCRS = leachate collection and removal system
LDS = leak detection system
MTR = minimum technology requirement
RCRA = Resource Conservation and Recovery Act
TN = ton

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SOIL VOLUME CALCULATIONS

TRIAD JOB NAME:	**PASCO LAND FILL**
TRIAD JOB NUMBER:	**10-051**

ASSUMPTIONS - Per phone call with Adam Morine January, 29 2014 and Monty Busbee January 31, 2014

VOLUME CALCULATION - Volumes were calculated using the "TIN SUBRACT" method using AutoCAD Civil 3D

SURFACE ELVATIONS - All surface elevations we determined from Zone "A" A-D cross section and plan view drawings provided to Triad by Monty Busbee per 1/23/2013 email. All elevation points were calculated to the nearest 0.5'. The TIN surfaces were constructed using a straight line interpolation between the points set on the cross section lines

FENCE SURFACE BOUNDARY - Based on the built surfaces of Visqueen, Top Touche and Top Pasco some portion of the surfaces lay outside the fence boundary. In addition there were surface voids inside the fence boundary. It was determined by Adam Morine that the portion of the surface outside the fence boundary was ± equal to the voids inside. Thus the entire surface will be used to calculate the "fence boundary" surface.

GEOMEMBRANE SURFACE BOUNDARY- Based on the built surfaces of Visqueen, Top Touche and Top Pasco there existed some minor surface voids inside the geomembrane surface boundary. It was determined by EPI that because they were trying to represent a "lower range value" for this surface no attempt would be made by Triad to fill these voids with additional data.

TOP OF VISQUEEN LAYER - There were areas where the direction of the visqueen top was unknown as shown in EPI cross sections A-D as a "?". It was agreed with Adam Morine that Triad would just extend the Visqueen linework along it last known direction. Triad would then use this extended linework to determine additional needed top of visqueen layer elevations.

COVER LAYER VOLUME - This volume will be computed by first taking the geomenbrane boundary area and then subtracting out the West and East basin areas. Then a cover of 3' feet will be assumed and will be multiplied by the above resulting area. This result will then be subtracted the ground to visqueen soil volume for the final cover layer soil volume. This will be a mixed boundary limit using the geomembrane for the 3 feet cover volume and the fence for the ground to visqueen volume.

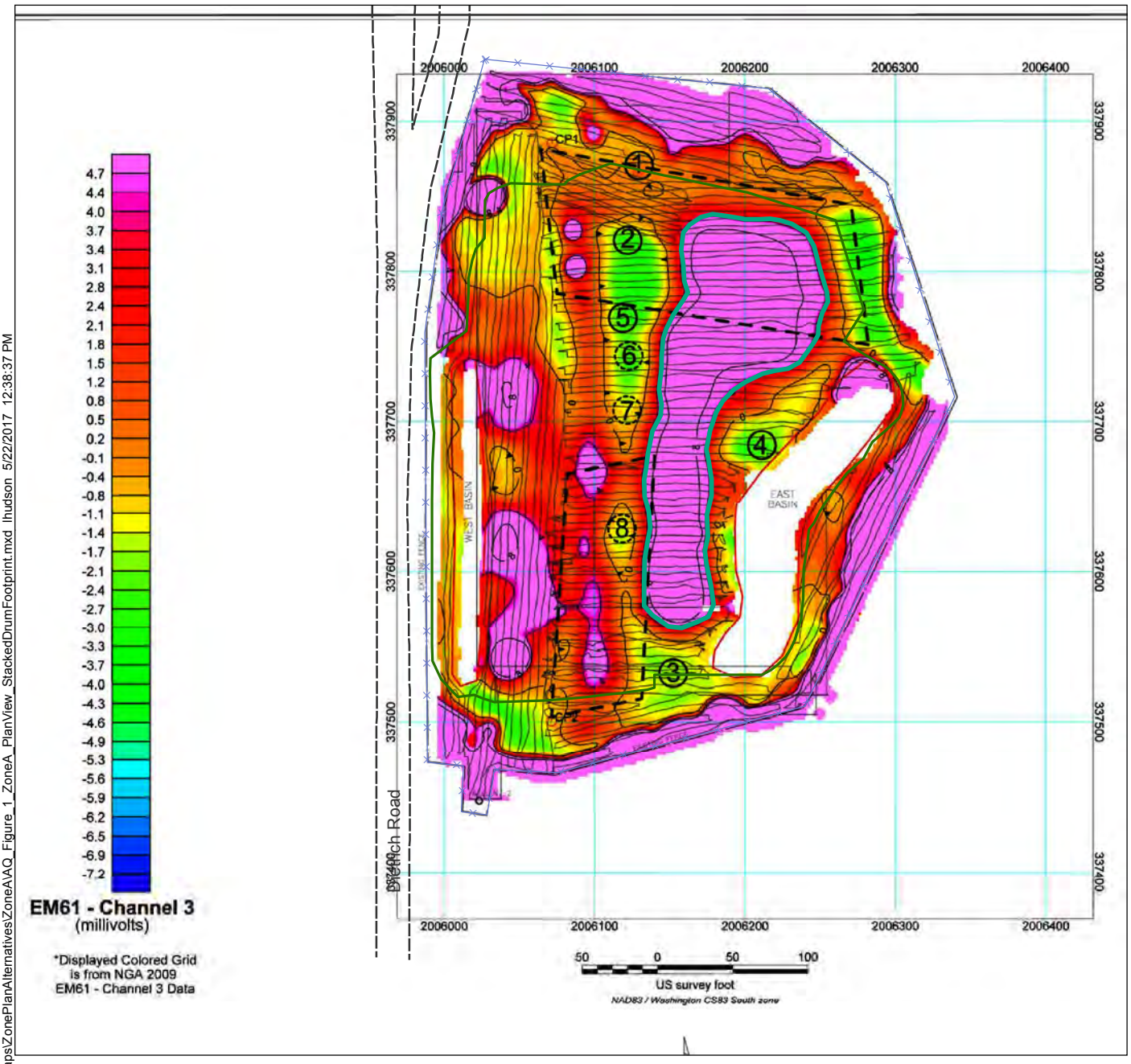
BOUNDARY LIMIT AREAS	
BOUNDARY	***AREA***
FENCE	**± 133,536 SQ. FT**
	± 3.06 ACRES
GEOMENBRANE	**± 95,462 SQ. FT**
	± 2.19 ACRES

SOIL VOLUME CALCULATIONS		
SOIL LAYERS MEASURED	***BOUNDARY LIMIT***	***SOIL VOLUME***
GROUND TO VISQUEEN	FENCE	**± 40,125 CU. YD.**
VISQUEEN TO TOP TOUCHET	GEOMEMBRANE	**± 59,308 CU. YD.**
VISQUEEN TO TOP TOUCHET	FENCE	**± 79,298 CU. YD.**
TOP TOUCHEE TO TOP PASCO	GEOMEMBRANE	**± 51,240 CU. YD.**
TOP TOUCHEE TO TOP PASCO	FENCE	**± 71,609 CU. YD.**
MEMBRANE PLUS 3' COVER	MEMBRANE	**± 9,124 CU. YD.**
COVER LAYER	FENCE = GROUND TO VISQUEEN	
(GROUND TO VISQUEEN) - (AREA OF MEMBRANE WITH 3 FEET OF COVER)	MEMBRANE = MEMBRANE WITH 3 FEET COVER	(± 40,125 CU. YD.) - (+/- 9,124) = **± 31, 001 CU YD.**

Pasco Landfill Soil & Drum Removal Estimate

Volume Summary

Item Number	Description	Quantity	Unit of Measure	Converted Quantity	Unit of Measure	Estimator
2	GROUND COVER TO GEOMEMBRANE	9,000	CY	13,500	TN	Triad Estimate
3	GEOMEMBRANE TO VISQUEEN	31,000	CY	46,500	TN	Triad Estimate
4	VISQUEEN TO TOP OF TOUCHET	69,000	CY	103,500	TN	Triad Estimate
5	LAYBACK - VISQUEEN TO TOP OF TOUCHET	25,000	CY	37,500	TN	Envirocon Estimate
6	TOP OF TOUCHET TO TOP OF PASCO GRAVELS	61,000	CY	91,500	TN	Triad Estimate
7	LAYBACK - TOP OF TOUCHET TO TOP OF PASCO GRAVELS	50,000	CY	75,000	TN	Envirocon Estimate
8	VOLUME OF STACKED DRUMS (25,000 DRUMS)	6,800	CY	10,200	TN	Envirocon Estimate



Fence

Dietrich Road

Geomembrane Cap

Stacked Drum Footprint

Notes:
1. Stacked drum footprint based on Figure 2 of Geophysical Investigation Report (Northwest Geophysical Associates, Inc. 2009).
2. Geomembrane from Operations and Maintenance Manual for Industrial Waste Area Caps, Figure 2 (EPI, 2013).

Feet
0 50 100

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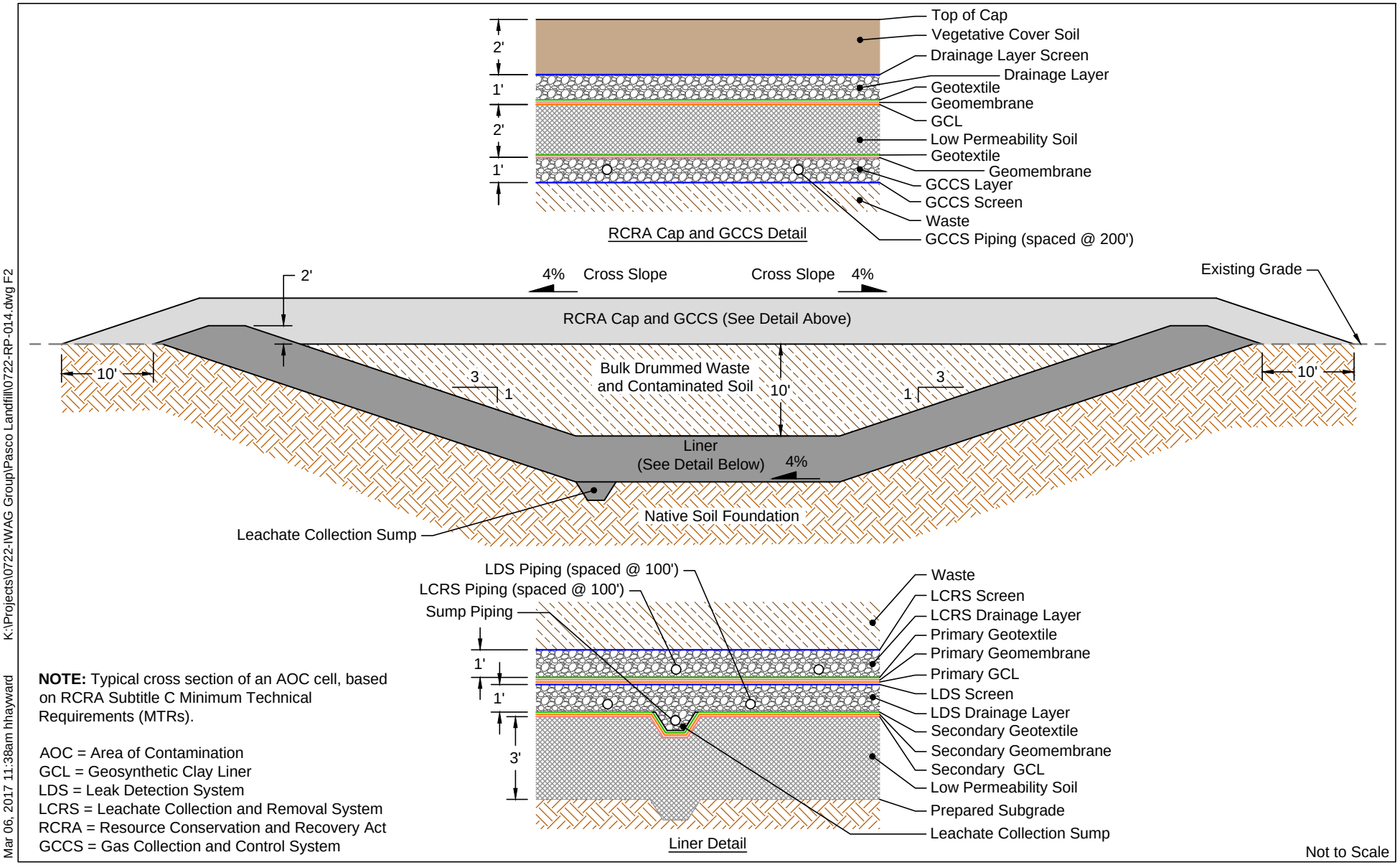
Figure 1
Zone A Plan View – Stacked Drum Footprint
Pasco, WA



NOTE: Typical cross section of an AOC cell, based on RCRA Subtitle C Minimum Technical Requirements (MTRs).

AOC = Area of Contamination
GCL = Geosynthetic Clay Liner
LDS = Leak Detection System
LCRS = Leachate Collection and Removal System
RCRA = Resource Conservation and Recovery Act
GCCS = Gas Collection and Control System

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Figure 2
Typical Cross Section of AOC Cell
Pasco, WA

ZONES C/D AND E

Table 2a
Zones C/D and E
General Dimensions – Existing Zones

Parameter	Unit	Quantity			Source/Notes
		Zone C	Zone D	Zone E	
Waste					
Average Waste Depth	ft	6	9	10	As reported in 1999 FS (Philip Environmental, April 1999) and 1973 RCC Letter (Resource Recovery Corporation Letter to Ecology, May 1973).
	ft	7.5		13	For Zone C/D, calculated as the average of Zone C (6-ft) and Zone D (9-ft) waste depths. For Zone E, calculated with a 5 degree slope, which results as the average of waste depth range from 10 to 16 ft.
Area within Waste Limit	ft^2	19,341		39,186	Approximate limit of waste delineated per Figures 3-35 (Zone E) and 3-40 (Zones C/D) of 1998 Phase II RI (Philip Environmental, March 1998). Area estimated in GIS.
	ac	0.44		0.90	
Waste Volume	ft^3	145,058		509,418	Approximate waste volumes and weights, based on assumptions on this table.
	CY	5,373		18,867	
	TON	8,059		28,301	
Geomembrane					
Area within Geomembrane Boundary	ft^2	30,490		56,622	Approximate geomembrane boundary delineated per O&M Manual for IWA Caps (EPI, November 2013). Area estimated in GIS. Applicable to Alternatives CD-1/CD-2 and E-1 only.
	ac	0.70		1.30	
Fence					
Length of Fence	ft	990		1,180	Approximate fence boundary delineated per O&M Manual for IWA Caps (EPI, November 2013). Length estimated in GIS. Applicable to Alternatives CD-1/CD-2/CD-3 and E-1 only.
Area within Fence Boundary	ft^2	67,408		94,808	Approximate fence boundary delineated per O&M Manual for IWA Caps (EPI November 2013). Area estimated in GIS. Applicable to Alternatives CD-1/CD-2/CD-3 and E-1 only.
	ac	1.55		2.18	
RCRA Cap System					
Cap Depth	ft	3		3	Per O&M Manual for IWA Caps (EPI, November 2013), cap system is 3 ft deep, with a 2-ft vegetative layer and a 1-ft drainage layer.

Table 2a
Zones C/D and E
General Dimensions – Existing Zones

Parameter	Unit	Quantity			Source/Notes
		Zone C	Zone D	Zone E	
Engineering Fill					
Engineering Fill Depth	ft	2		2	Per O&M Manual for IWA Caps (EPI, November 2013), engineering fill is 2 ft deep (minimum), in order to obtain 4% minimum slope.
Drain System					
Length of Perforated Collector Drain, 6"	ft	530		740	Approximate collector drain location delineated per O&M Manual for IWA Caps (EPI, November 2013). Length estimated in GIS.

Notes:

Zones C/D combined include the individual cells plus the soils between them.

Assumed conversion of 1.5 TON/CY.

ac = acre

CY = cubic yard

ft = feet

ft^2 = square foot

ft^3 = cubic foot

RCRA = Resource Conservation and Recovery Act

Table 2b
Zone C/D
Treatment Areas/Volumes – Alternative CD-2

Parameter	Unit	Quantity		Source/Notes
		Zone C	Zone D	
Treatment				
Treatment Area (within Geomembrane Boundary)	ft^2	30,490		Approximate geomembrane boundary delineated per O&M Manual for IWA Caps (EPI, November 2013). Area estimated in GIS.
	ac	0.70		
Average Treatment Depth	ft	10		Approximate depth based on a targeted vadose zone for amendment.
Treatment Soil Volume	ft^3	304,900		Approximate treatment volume based on assumptions on this table.
	CY	11,293		

Notes:
Appendix F describes in detail the screening of treatment technologies, rationale for amendment selection, and methodology to obtain reagent dose and frequency of application.
Treatment volumes do not account for porosity in this table. Additional porosity adjustments are detailed in Appendix F.
ac = acre
CY = cubic yard
ft = foot
ft^2 = square foot
ft^3 = cubic foot

Table 2c
Zones C/D and E
Excavation Areas/Volumes – Alternatives CD-3 and E-3

Parameter	Unit	Quantity			Source/Notes
		Zone C	Zone D	Zone E	
Excavation of RCRA Cap System					
Area within Waste Limit (+ additional 10% assumed)	ft^2	21,275		43,105	Based on cross sections, vegetative and drainage layers extend laterally, beyond the waste limit, by approximately 10%.
Cap Volume	ft^3	63,825		129,314	Approximate cap volume, based on a 3-ft RCRA cap depth (Table 2a).
	CY	2,364		4,789	
Excavation of Engineering Fill					
Area within Waste Limit (+ additional 20% assumed)	ft^2	23,209		47,023	Based on cross sections, the engineering fill extends laterally, beyond the waste limit, by approximately 20%.
Engineering Fill Volume	ft^3	46,418		94,046	Approximate fill volume, based on a 2-ft fill depth (Table 2a).
	CY	1,719		3,483	
Excavation of Waste					
Waste Volume	ft^3	145,058		509,418	Approximate waste volumes and weights (Table 2a).
	CY	5,373		18,867	
	TON	8,059		28,301	
Over-Excavation Below Waste					
Average Over-Excavation Depth (Below Waste)	ft	3.5		2	Average depth of over-excavation for Zones C/D (3.5 ft) is calculated as the average of over-excavation depths in Zone C (5-ft) and Zone D (2-ft). Over-excavation depth of 2 ft is assumed for Zone E.
Over-Excavation Volume (Below Waste)	ft^3	67,694		78,372	Approximate over-excavation volumes, based on area within waste limit (Table 2a).
	CY	2,507		2,903	
Over-Excavation of Side-Slopes					
Area within Over-Excavation Boundary (including Side-Slopes Area)	ft^2	27,484		57,596	Area of over-excavation is determined based on sloping out beyond the waste limit (3H:1V slope for ramp access on one end and 1H:1V slope on other ends). Ramp access assumed to be on east end (for Zones C/D) and north end (for Zone E). Area estimated in GIS.
Annular Area of Over-Excavation (for Side-Slopes)	ft^2	8,143		18,410	Calculated as the area within over-excavation boundary minus the area within waste limit.

Table 2c
Zones C/D and E
Excavation Areas/Volumes – Alternatives CD-3 and E-3

Parameter	Unit	Quantity			Source/Notes
		Zone C	Zone D	Zone E	
Depth of Over-Excavation in Annular Area (for Side-Slopes)	ft	11		15	Calculated as the average waste depth plus the average over-excavation depth.
Over-Excavation Annular Volume (including Side-Slopes Prism)	ft^3	89,571		276,144	Approximate over-excavation annular volume, including side-slope prism volume, based on assumptions on this table.
Over-Excavation Side-Slope Prism Volume	ft^3	44,709		139,328	Approximate over-excavation side-slope volumes, based on assumptions on this table.
	CY	1,656		5,160	
Total Excavation, Disposal, and Backfill					
Total Excavation Area	ft^2	27,484		57,596	Calculated as the sum of waste area and over-excavation areas of access ramp and side-slopes.
	ac	0.63		1.32	
Total Excavation Volume	CY	13,619		35,203	Calculated as the sum of cap volume, engineering fill volume, waste volume, and over-excavation volumes below waste and side-slopes.
	TON	20,428		52,804	
Total Disposal Volume	CY	11,255		30,413	Calculated as the sum of engineering fill volume, waste volume, and over-excavation volumes below waste and side-slopes. Material in the RCRA cap assumed to be clean.
	TON	16,882		45,620	
Available Backfill Volume (On-Site Material)	CY	2,364		4,789	Excavated RCRA cap system material assumed to be stored on site and reused for backfill.
	TON	3,546		7,184	
Additional Backfill Volume (Common Borrow)	CY	8,891		25,624	Additional backfill material assumed to be brought from off site.
	TON	13,336		38,436	

Notes:

Volume, materials, and installation of new RCRA cap system are excluded from backfill volumes specified in this table.

Assumed conversion of 1.5 TON/CY.

ac = acre
CY = cubic yard
ft = foot
ft^2 = square foot
ft^3 = cubic foot
RCRA = Resource Conservation and Recovery Act

Table 2d
Zones C/D and E
General New Dimensions – Alternatives CD-3 and E-3

Parameter	Unit	Quantity			Source/Notes
		Zone C	Zone D	Zone E	
New Geomembrane					
Area within Geomembrane Boundary	ft^2	38,618		76,432	Approximate geomembrane boundary delineated beyond the over-excavation boundary. Area estimated in GIS.
	ac	0.89		1.75	
New Fence					
Length of Fence	ft	990		1,200	Fence boundary is similar for all Zone C/D alternatives. Approximate Zone E fence boundary delineated based on over-excavation boundary. Length estimated in GIS.
Area within Fence	ft^2	67,408		101,195	Fence area is similar for all Zone C/D alternatives. Approximate Zone E area within fence boundary delineated based on over-excavation boundary. Area estimated in GIS.
	ac	1.55		2.32	
New Drain System					
Length of Perforated Collector Drain, 6"	ft	605		890	Approximate collector drain location delineated between the over-excavation and geomembrane boundaries. Length estimated in GIS.

Notes:
ac = acre
ft = foot
ft^2 = square foot

APPENDIX E
DETAILED COST ESTIMATES AND BACKUP FOR ZONES A, C/D, AND E PASCO LANDFILL NPL SITE

Prepared for

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Zone A

Zones C/D and E

Attachment G – Zone A Contingency and Sensitivity Analyses

Attachment H – Natural Gas Pipeline Backup

Table 1a
Alternative A-1 (On-going SVE Treatment)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$65,068	% construction costs
Bonds and Insurance	-	-	3%	$24,401	% construction costs
Site Preparation	-	-	5%	$40,668	% construction costs
Ground Water Well Decommissioning	LS	1	$23,521	$23,521	
Cap Replacements (Years 1 and 15)	LS	1	$782,933	$782,933	
Institutional Controls (EC)	LS	1	$6,900	$6,900	
Subtotal - Construction Costs	-	-	-	***$943,491***	
Sales Tax	-	-	8.6%	$81,140	
Total - Construction Costs	-	-	-	***$1,025,000***	
Non-Construction Costs					
Design, Project Management, and Permitting	-	-	17%	$174,250	
Construction Management and Inspection	-	-	8%	$82,000	
Ground Water Monitoring and Reporting	LS	1	$1,232,272	$1,232,272	
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,377,378	$2,377,378	
SVE System Operation, Maintenance, and Repairs	LS	1	$7,862,938	$7,862,938	
Institutional Controls Operation and Maintenance	LS	1	$621,334	$621,334	
Total - Non-Construction Costs	-	-	-	***$12,350,000***	
Total Project Costs					
Contingency (+20%)	-	-	20%	$2,675,000	
Total Project Cost (Excluding Contingency)				**$13,375,000**	
Total Project Costs (Including Contingency)				**$16,050,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

2. Rationale for specific contingencies applied to the Zone A alternatives is described in Appendix E, Attachment G.

EC = environmental covenant

LS = lump sum

SVE = soil vapor extraction

Table 1b
Alternative A-2 (Enhanced SVE Treatment + Air Sparging/Ozone Treatment)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$120,131	% construction costs
Bonds and Insurance	-	-	3%	$45,049	% construction costs
Site Preparation	-	-	5%	$75,082	% construction costs
Air Sparging and Ozone Treatment					
Sparge Well Installation	LS	1	$109,435	$109,435	
SVE Well Installation	LS	1	$38,802	$38,802	
IDW Profiling and Disposal	LS	1	$61,814	$61,814	
Borelogs	LS	1	$4,322	$4,322	
SVE/Sparge Piping	LS	1	$60,603	$60,603	
Compound Expansion	LS	1	$42,913	$42,913	
Additional Sparge and SVE Equipment Upgrades	LS	1	$92,737	$92,737	
As-Built and O&M Plan Updates	LS	1	$16,070	$16,070	
Decommission Sparge Wells	LS	1	$7,980	$7,980	
System Decommission	LS	1	$8,952	$8,952	
Ground Water Well Decommissioning	LS	1	$23,521	$23,521	
Additional SVE Well Installation (for Enhanced SVE)	LS	1	$244,651	$244,651	
Cap Replacements (Years 1 and 15)	LS	1	$782,933	$782,933	
Institutional Controls (EC)	LS	1	$6,900	$6,900	
Subtotal - Construction Costs	-	-	-	***$1,741,893***	
Sales Tax	-	-	8.6%	$149,803	
Total - Construction Costs	-	-	-	***$1,892,000***	
Non-Construction Costs					
Design, Project Management, and Permitting	-	-	17%	$321,640	
Construction Management and Inspection	-	-	8%	$151,360	
Ground Water Monitoring and Reporting	LS	1	$1,232,272	$1,232,272	
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,377,378	$2,377,378	
SVE System Operation, Maintenance, and Repairs	LS	1	$7,862,938	$7,862,938	
Air Sparging and Ozone Operation/Maintenance					
Additional Operational Labor	LS	1	$494,925	$494,925	
Power Consumption	LS	1	$257,695	$257,695	
Institutional Controls Operation and Maintenance	LS	1	$621,334	$621,334	
Total - Non-Construction Costs	-	-	-	***$13,320,000***	
Total Project Costs					
Contingency (+20%)	-	-	20%	$3,042,400	
Total Project Cost (Excluding Contingency)				**$15,212,000**	
Total Project Costs (Including Contingency)				**$18,254,000**	

Table 1b
Alternative A-2 (Enhanced SVE Treatment + Air Sparging/Ozone Treatment)
Detailed Cost Estimate

Notes:
1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Rationale for specific contingencies applied to the Zone A alternatives is described in Appendix E, Attachment G.

EC = environmental covenant
IDW = investigation-derived waste
LS = lump sum
O&M = operations and maintenance
SVE = soil vapor extraction

Table 1c
Alternative A-3 (Enhanced SVE Treatment + Contingency for Ground Water)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$117,443	% construction costs
Bonds and Insurance	-	-	3%	$44,041	% construction costs
Site Preparation	-	-	5%	$73,402	% construction costs
In-Situ Amendments					
Well Installation and Data Collection	LS	1	$105,249	$105,249	
Boring Logs	LS	1	$6,259	$6,259	
IDW Profiling and Disposal	LS	1	$52,537	$52,537	
ISCO Treatment Events	LS	1	$226,662	$226,662	
Decommission Injection Wells	LS	1	$19,330	$19,330	
Ground Water Well Decommissioning	LS	1	$23,521	$23,521	
Additional SVE Well Installation (for Enhanced SVE)	LS	1	$244,651	$244,651	
Cap Replacements (Years 1 and 15)	LS	1	$782,933	$782,933	
Institutional Controls (EC)	LS	1	$6,900	$6,900	
Subtotal - Construction Costs	-	-	-	***$1,702,928***	
Sales Tax	-	-	8.6%	$146,452	
Total - Construction Costs	-	-	-	***$1,849,000***	
Non-Construction Costs					
Design, Project Management, and Permitting	-	-	17%	$314,330	
Construction Management and Inspection	-	-	8%	$147,920	
Ground Water Monitoring and Reporting	LS	1	$1,232,272	$1,232,272	
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,377,378	$2,377,378	
SVE System Operation, Maintenance, and Repairs	LS	1	$7,862,938	$7,862,938	
Institutional Controls Operation and Maintenance	LS	1	$621,334	$621,334	
Total - Non-Construction Costs	-	-	-	***$12,556,000***	
Total Project Costs					
Contingency (+20%)	-	-	20%	$2,881,000	
Total Project Cost (Excluding Contingency)				**$14,405,000**	
Total Project Costs (Including Contingency)				**$17,286,000**	

Note:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Rationale for specific contingencies applied to the Zone A alternatives is described in Appendix E, Attachment G.

EC = environmental covenant

IDW = investigation derived waste

ISCO = in situ chemical oxidation

LS = lump sum

SVE = soil vapor extraction

Table 1d
Alternative A-4 (Enhanced SVE Treatment + Contingency for Soil)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$1,651,333	% construction costs
Bonds and Insurance	-	-	3%	$619,250	% construction costs
Site Preparation	-	-	5%	$1,032,083	% construction costs
In-Situ Amendments					
Well Installation and Data Collection	LS	1	$464,257	$464,257	
Boring Logs	LS	1	$5,538	$5,538	
IDW Profiling and Disposal	LS	1	$55,723	$55,723	
ISCO Treatment Events	LS	1	$19,069,297	$19,069,297	
Ground Water Well Decommissioning	LS	1	$12,360	$12,360	
Additional SVE Well Installation (for Enhanced SVE)	LS	1	$244,651	$244,651	
Cap Replacements (Years 1 and 15)	LS	1	$782,933	$782,933	
Institutional Controls (EC)	LS	1	$6,900	$6,900	
Subtotal - Construction Costs	-	-	-	***$23,944,323***	
Sales Tax	-	-	8.6%	$2,059,212	
Total - Construction Costs	-	-	-	***$26,004,000***	
Non-Construction Costs					
Design, Project Management, and Permitting	-	-	17%	$4,420,680	
Construction Management and Inspection	-	-	8%	$2,080,320	
Ground Water Monitoring and Reporting	LS	1	$1,232,272	$1,232,272	
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,377,378	$2,377,378	
SVE System Operation, Maintenance, and Repairs	LS	1	$7,862,938	$7,862,938	
Institutional Controls Operation and Maintenance	LS	1	$621,334	$621,334	
Total - Non-Construction Costs	-	-	-	***$18,595,000***	
Total Project Costs					
Contingency (+40%)	-	-	40%	$17,839,600	
Total Project Cost (Excluding Contingency)				**$44,599,000**	
Total Project Costs (Including Contingency)				**$62,439,000**	

Note:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

2. Rationale for specific contingencies applied to the Zone A alternatives is described in Appendix E, Attachment G.

EC = environmental covenant

IDW = investigation derived waste

ISCO = in situ chemical oxidation

LS = lump sum

SVE = soil vapor extraction

Table 1e
Alternative A-5 (On-site AOC and SVE Treatment in Touchet Beds)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Construction Costs						
Mobilization and Support						
Work Plan Technical Assistance and Report	LS	1	$50,000.00	100%	$50,000	
Preconstruction Planning, Permitting, and Design	LS	1	$93,500.00	100%	$93,500	
Mobilization and Site Preparation						
Mobilization	LS	1	$150,000.00	100%	$150,000	
Surveying	LS	1	$85,000.00	100%	$85,000	
Bonds and Insurance	LS	1	$18,644,111	1%	$186,441	
Temporary Facilities	MO	12	$15,000.00	100%	$180,000	
Well Abandonment	EA	15	$1,500.00	100%	$22,500	
Drum Staging and Handling Area Construction	LS	1	$340,000.00	100%	$340,000	
Sediment and Erosion Controls	LS	1	$26,500.00	100%	$26,500	
Demobilization/Project Closeout						
Drum Staging and Handling Area Decommissioning	LS	1	$210,500.00	100%	$210,500	
Demobilization	LS	1	$100,000.00	100%	$100,000	
Support of Report Preparation	LS	1	$50,000.00	100%	$50,000	
Support Costs						
Operations Supervisory & Support Costs - w/ per diem, lodging, and other items	MO	12	$310,000.00	100%	$3,720,000	
Health & Safety Supervisory Support Costs	MO	12	$17,000.00	100%	$204,000	
Personnel/Perimeter Air Monitoring	MO	12	$6,500.00	100%	$78,000	
Training, Medical & Incentives	MO	12	$4,200.00	100%	$50,400	
Health & Safety and PPE	MO	12	$21,000.00	100%	$252,000	
Contractor Planning, Mobilization, and Project Support - Subtotal	**LS**	**1**	**$5,798,841**	**100%**	**$5,798,841**	
Ground to Geomembrane - Clean Excavation						
Clean Soil Removal and Stockpile (Ground to Geomembrane)	TN	13,500	$3.20	100%	$43,200	
Geomembrane to Top of Visqueen - Excavation and Disposal						
Soil Excavation - Geomembrane to Top of Visqueen	TN	46,500	$3.45	100%	$160,425	
Visqueen to Top of Touchet - Excavation and Disposal						
Soil Excavation - Visqueen to Top of Touchet Beds	TN	93,300	$4.70	100%	$438,510	
Visqueen to Top of Touchet Beds - Layback						
Layback Excavation - Visqueen to Top of Touchet Beds	TN	45,300	$4.10	100%	$185,730	
Site Restoration						
Backfill - Visqueen to Top of Touchet Beds	TN	93,300	$10.25	100%	$956,325	
Backfill of Layback - Visqueen to Top of Touchet Beds	TN	45,300	$5.30	100%	$240,090	
RCRA Cap Installation	AC	2	$285,569.91	100%	$571,140	

Table 1e
Alternative A-5 (On-site AOC and SVE Treatment in Touchet Beds)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Stacked Drums - Handling and Disposal (Hazardous Wastes: Liquids and Sludges)						
Drum Extraction	EA	16,100	$50.16	100%	$807,576	
Lab Analysis for Hazardous Waste Drums - Offsite Lab (5%)	EA	16,100	$650.00	5%	$523,250	
Drum Handling w/ Overpacks	EA	16,100	$76.05	25%	$306,101	
Overpack T&D - Subtitle C Landfill: Direct Disposal	EA	16,100	$124.40	20%	$400,568	
Overpack T&D - Incineration (liquids)	EA	16,100	$376.70	5%	$303,244	
Stacked Drums - Handling and Disposal (Casting Sands)						
Drum Extraction - Casting Sands	EA	8,900	$50.16	100%	$446,424	
Lab Analysis for Casting Sands Drums - Offsite Lab (5%)	EA	8,900	$650.00	5%	$289,250	
Casting Sands T&D - Subtitle D Landfill: Direct Disposal	TN	3,630	$32.23	0%	$0	
Casting Sands T&D - Subtitle C Landfill: Direct Disposal	TN	3,630	$124.40	0%	$0	
Bulk Liquids						
Liquids Recovery - Labor & Equip	LS	1	$75,000.00	100%	$75,000	
Solvents Liquids - T&D	TN	1,000	$717.10	50%	$358,550	
Aqueous Liquids - T&D	TN	1,000	$923.59	50%	$461,795	
Excavation and Disposal - Subtotal	**LS**	**1**	**$6,567,178**	**100%**	**$6,567,178**	
Additional Activities Associated with Excavation						
Natural Gas Pipeline Relocation	LS	1	$281,045		$281,045	
BDI Building Demolition and Reconstruction	LS	1	$135,072		$135,072	
Dietrich Road Realignment	LS	1	$40,481		$40,481	
Additional Activities Associated with Excavation - Subtotal	**LS**	**1**	**$456,598**	**100%**	**$456,598**	
Construction and Placement in On-Site AOC						
Construction of On-site AOC Cell	LS	1	$2,956,690	100%	$2,956,690	
Handling/Placement of Drummed Waste in AOC	TN	148,358	$7.00	100%	$1,038,505	
RCRA Cap Construction on AOC Cell	LS	1	$1,101,121	100%	$1,101,121	
Construction and Placement in On-site AOC - Subtotal	**LS**	**1**	**$5,096,316**	**100%**	**$5,096,316**	
SVE Well Drilling	LS	1	$620,486		$620,486	
Ground Water Well Installation and Decommissioning	LS	1	$48,521		$48,521	
Institutional Controls (Fencing, Signage, EC)	LS	1	$56,172		$56,172	
Subtotal - Construction Costs	-	-	-		***$18,644,111***	
Sales Tax	-	-	8.6%		$1,603,394	
Total - Construction Costs	-	-	-		***$20,248,000***	

Table 1e
Alternative A-5 (On-site AOC and SVE Treatment in Touchet Beds)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Non-Construction Costs						
Design, Project Management, and Permitting	-	-	17%		$3,442,160	% total construction costs
Construction Management and Inspection	-	-	8%		$1,619,840	% total construction costs
Ground Water Monitoring and Reporting	LS	1	$1,232,272		$1,232,272	
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,059,129		$2,059,129	
AOC RCRA Cap Monitoring and Maintenance	LS	1	$2,890,057		$2,890,057	
SVE System Operation, Maintenance, and Repairs	LS	1	$7,862,938		$7,862,938	
Institutional Controls Operation and Maintenance	LS	1	$621,334		$621,334	
Total - Non-Construction Costs	-	-	-		***$19,728,000***	
Total Project Costs						
Contingency (+40%)	-	-	40%		$15,990,400	
Total Project Cost (Excluding Contingency)					**$39,976,000**	
Total Project Costs (Including Contingency)					**$55,966,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Cost template and unit costs provided by Envirocon (March 2014).
3. Rationale for specific contingencies applied to the Zone A alternatives is described in Appendix E, Attachment G.

AC = acre
AOC = area of contamination
EA = each
EC = environmental covenant
LS = lump sum
MO = month
PPE = personal protective equipment
RCRA = Resource Conservation and Recovery Act
SVE = soil vapor extraction
T&D = transportation and disposal

Table 1f
Alternative A-6 (On-site AOC and Thermal Treatment in Touchet Beds)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Construction Costs						
Mobilization and Support						
Work Plan Technical Assistance and Report	LS	1	$50,000.00	100%	$50,000	
Preconstruction Planning, Permitting, and Design	LS	1	$93,500.00	100%	$93,500	
Mobilization and Site Preparation						
Mobilization	LS	1	$150,000.00	100%	$150,000	
Surveying	LS	1	$85,000.00	100%	$85,000	
Bonds and Insurance	LS	1	$24,933,798	1%	$249,338	
Temporary Facilities	MO	12	$15,000.00	100%	$180,000	
Well Abandonment	EA	15	$1,500.00	100%	$22,500	
Drum Staging and Handling Area Construction	LS	1	$340,000.00	100%	$340,000	
Sediment and Erosion Controls	LS	1	$26,500.00	100%	$26,500	
Demobilization/Project Closeout						
Drum Staging and Handling Area Decommissioning	LS	1	$210,500.00	100%	$210,500	
Demobilization	LS	1	$100,000.00	100%	$100,000	
Support of Report Preparation	LS	1	$50,000.00	100%	$50,000	
Support Costs						
Operations Supervisory & Support Costs - w/ per diem, lodging, and other items	MO	12	$310,000.00	100%	$3,720,000	
Health & Safety Supervisory Support Costs	MO	12	$17,000.00	100%	$204,000	
Personnel/Perimeter Air Monitoring	MO	12	$6,500.00	100%	$78,000	
Training, Medical & Incentives	MO	12	$4,200.00	100%	$50,400	
Health & Safety and PPE	MO	12	$21,000.00	100%	$252,000	
Contractor Planning, Mobilization, and Project Support - Subtotal	**LS**	**1**	**$5,861,738**	**100%**	**$5,861,738**	
Ground to Geomembrane - Clean Excavation						
Clean Soil Removal and Stockpile (Ground to Geomembrane)	TN	13,500	$3.20	100%	$43,200	
Geomembrane to Top of Visqueen - Excavation and Disposal						
Soil Excavation - Geomembrane to Top of Visqueen	TN	46,500	$3.45	100%	$160,425	
Visqueen to Top of Touchet Beds - Excavation and Disposal						
Soil Excavation - Visqueen to Top of Touchet Beds	TN	93,300	$4.70	100%	$438,510	
Visqueen to Top of Touchet Beds- Layback						
Layback Excavation - Visqueen to Top of Touchet Beds	TN	45,300	$4.10	100%	$185,730	
Site Restoration						
Backfill - Visqueen to Top of Touchet	TN	93,300	$10.25	100%	$956,325	
Backfill of Layback - Visqueen to Top of Touchet Beds	TN	45,300	$5.30	100%	$240,090	
RCRA Cap Installation	AC	2	$285,570	100%	$571,140	

Table 1f
Alternative A-6 (On-site AOC and Thermal Treatment in Touchet Beds)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Stacked Drums - Handling and Disposal (Hazardous Wastes: Liquids and Sludges)						
Drum Extraction	EA	16,100	$50.16	100%	$807,576	
Lab Analysis for Hazardous Waste Drums - Offsite Lab (5%)	EA	16,100	$650.00	5%	$523,250	
Drum Handling w/ Overpacks	EA	16,100	$76.05	25%	$306,101	
Overpack T&D - Subtitle C Landfill: Direct Disposal	EA	16,100	$124.40	20%	$400,568	
Overpack T&D - Incineration (liquids)	EA	16,100	$376.70	5%	$303,244	
Stacked Drums - Handling and Disposal (Casting Sands)						
Drum Extraction - Casting Sands	EA	8,900	$50.16	100%	$446,424	
Lab Analysis for Casting Sands Drums - Offsite Lab (5%)	EA	8,900	$650.00	5%	$289,250	
Bulk Liquids						
Liquids Recovery - Labor & Equip	LS	1	$75,000.00	100%	$75,000	
Solvents Liquids - T&D	TN	1,000	$717.10	50%	$358,550	
Aqueous Liquids - T&D	TN	1,000	$923.59	50%	$461,795	
Excavation and Disposal - Subtotal	**LS**	**1**	**$6,567,178**	**100%**	**$6,567,178**	
Additional Activities Associated with Excavation						
Natural Gas Pipeline Relocation	LS	1	$281,045		$281,045	
BDI Building Demolition and Reconstruction	LS	1	$135,072		$135,072	
Dietrich Road Realignment	LS	1	$40,481		$40,481	
Additional Activities Associated with Excavation - Subtotal	**LS**	**1**	**$456,598**	**100%**	**$456,598**	
Construction & Placement in On-Site AOC						
Construction of On-site AOC Cell	LS	1	$2,956,690	100%	$2,956,690	
Handling/Placement of Drummed Waste in AOC	TN	148,358	$7.00	100%	$1,038,505	
RCRA Cap Construction on AOC Cell	LS	1	$1,101,121	100%	$1,101,121	
Construction and Placement in On-site AOC - Subtotal	**LS**	**1**	**$5,096,316**	**100%**	**$5,096,316**	
SVE Well Drilling	LS	1	$453,544		$453,544	
Thermal Treatment						
Treatment of the Touchet Beds	EA	1	$6,384,000		$6,384,000	TRS Group's estimate (vapor treatment excluded)
Ground Water Well Installation and Decommissioning	LS	1	$58,253		$58,253	
Institutional Controls (Fencing, Signage, EC)	LS	1	$56,172		$56,172	
Subtotal - Construction Costs	-	-	-		***$24,933,798***	
Sales Tax	-	-	8.6%		$2,144,307	
Total - Construction Costs	-	-	-		***$27,078,000***	

Table 1f
Alternative A-6 (On-site AOC and Thermal Treatment in Touchet Beds)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Non-Construction Costs						
Design, Project Management, and Permitting	-	-	17%		$4,603,260	% total construction costs
Construction Management and Inspection	-	-	8%		$2,166,240	% total construction costs
Ground Water Monitoring and Reporting	LS	1	$1,247,794		$1,247,794	
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,059,129		$2,059,129	
AOC RCRA Cap Monitoring and Maintenance	LS	1	$2,890,057		$2,890,057	
SVE System Operation, Maintenance, and Repairs	LS	1	$3,724,189		$3,724,189	
Institutional Controls Operation and Maintenance	LS	1	$621,334		$621,334	
Total - Non-Construction Costs	-	-	-		***$17,312,000***	
Total Project Costs						
Contingency (+40%)	-	-	40%		$17,756,000	
Total Project Cost (Excluding Contingency)					**$44,390,000**	
Total Project Costs (Including Contingency)					**$62,146,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Cost template and unit costs provided by Envirocon (March 2014).
3. Rationale for specific contingencies applied to the Zone A alternatives is described in Appendix E, Attachment G.

AC = acre
AOC = area of contamination
EA = each
EC = environmental covenant
LS = lump sum
MO = month
PPE = personal protective equipment
RCRA = Resource Conservation and Recovery Act
SVE = soil vapor extraction
T&D = transportation and disposal
TN = ton

Table 1g
Alternative A-7 (On-site AOC to Top of Upper Pasco Gravels)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Construction Costs						
Mobilization and Support						
Work Plan Technical Assistance and Report	LS	1	$50,000.00	100%	$ 50,000	
Preconstruction Planning, Permitting, and Design	LS	1	$93,500.00	100%	$ 93,500	
Mobilization and Site Preparation						
Mobilization	LS	1	$150,000.00	100%	$ 150,000	
Surveying	LS	1	$85,000.00	100%	$ 85,000	
Bonds and Insurance	LS	1	$23,495,291	1%	$ 234,953	
Temporary Facilities	MO	12	$15,000.00	100%	$ 180,000	
Well Abandonment	EA	15	$1,500.00	100%	$ 22,500	
Drum Staging and Handling Area Construction	LS	1	$340,000.00	100%	$ 340,000	
Sediment and Erosion Controls	LS	1	$26,500.00	100%	$ 26,500	
Demobilization/Project Closeout						
Drum Staging and Handling Area Decommissioning	LS	1	$210,500.00	100%	$ 210,500	
Demobilization	LS	1	$100,000.00	100%	$ 100,000	
Support of Report Preparation	LS	1	$50,000.00	100%	$ 50,000	
Support Costs						
Operations Supervisory & Support Costs - w/ per diem, lodging, and other items	MO	12	$310,000.00	100%	$ 3,720,000	
Health & Safety Supervisory Support Costs	MO	12	$17,000.00	100%	$ 204,000	
Personnel/Perimeter Air Monitoring	MO	12	$6,500.00	100%	$ 78,000	
Training, Medical & Incentives	MO	12	$4,200.00	100%	$ 50,400	
Health & Safety and PPE	MO	12	$21,000.00	100%	$ 252,000	
Contractor Planning, Mobilization, and Project Support - Subtotal	**LS**	**1**	**$5,847,353**	**100%**	**$5,847,353**	
Ground to Geomembrane - Clean Excavation						
Clean Soil Removal and Stockpile (Ground to Geomembrane)	TN	13,500	$3.20	100%	$43,200	
Geomembrane to Top of Visqueen - Excavation and Disposal						
Soil Excavation - Geomembrane to Top of Visqueen	TN	46,500	$3.45	100%	$160,425	
Visqueen to Top of Touchet Beds - Excavation and Disposal						
Soil Excavation - Visqueen to Top of Touchet Beds	TN	93,300	$4.70	100%	$438,510	
Visqueen to Top of Top of Touchet Beds - Layback						
Layback Excavation - Visqueen to Top of Touchet Beds	TN	45,300	$4.10	100%	$185,730	
Top of Touchet Beds to Top of Upper Pasco Gravels - Excavation and Disposal						
Soil Excavation - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	91,500	$5.86	100%	$536,190	
Top of Touchet Beds to Top of Upper Pasco Gravels - Layback						
Layback - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	82,200	$4.50	100%	$369,900	

Table 1g
Alternative A-7 (On-site AOC to Top of Upper Pasco Gravels)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Site Restoration						
Backfill - Visqueen to Top of Touchet	TN	93,300	$10.25	100%	$956,325	
Backfill of Layback - Visqueen to Top of Touchet Beds	TN	45,300	$5.30	100%	$240,090	
Backfill - Top of Touchet to Top of Pasco Gravels	TN	91,500	$10.25	100%	$937,875	
Backfill of Layback - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	82,200	$5.30	100%	$435,660	
RCRA Cap Installation	AC	2	$285,570	100%	$571,140	
Stacked Drums - Handling and Disposal (Hazardous Wastes: Liquids and Sludges)						
Drum Extraction	EA	16,100	$50.16	100%	$807,576	
Lab Analysis for Hazardous Waste Drums - Offsite Lab (5%)	EA	16,100	$650.00	5%	$523,250	
Drum Handling w/ Overpacks	EA	16,100	$76.05	25%	$306,101	
Overpack T&D - Subtitle C Landfill: Direct Disposal	EA	16,100	$124.40	20%	$400,568	
Overpack T&D - Incineration (liquids)	EA	16,100	$376.70	5%	$303,244	
Stacked Drums - Handling and Disposal (Casting Sands)						
Drum Extraction - Casting Sands	EA	8,900	$50.16	100%	$446,424	
Lab Analysis for Casting Sands Drums - Offsite Lab (5%)	EA	8,900	$650.00	5%	$289,250	
Bulk Liquids						
Liquids Recovery - Labor & Equip	LS	1	$75,000.00	100%	$75,000	
Solvents Liquids - T&D	TN	1,000	$717.10	50%	$358,550	
Aqueous Liquids - T&D	TN	1,000	$923.59	50%	$461,795	
Excavation and Disposal - Subtotal	**LS**	**1**	**$8,846,803**	**100%**	**$8,846,803**	
Additional Activities Associated with Excavation						
Natural Gas Pipeline Relocation	LS	1	$281,045		$281,045	
BDI Building Demolition and Reconstruction	LS	1	$135,072		$135,072	
Dietrich Road Realignment	LS	1	$40,481		$40,481	
Additional Activities Associated with Excavation - Subtotal	**LS**	**1**	**$456,598**	**100%**	**$456,598**	
Construction and Placement in On-Site AOC						
Construction of On-site AOC Cell	LS	1	$4,478,727	100%	$4,478,727	
Handling/Placement of Drummed Waste in AOC	TN	239,858	$7.00	100%	$1,679,005	
RCRA Cap Construction on AOC Cell	LS	1	$1,618,838	100%	$1,618,838	
Construction and Placement in On-site AOC - Subtotal	**LS**	**1**	**$7,776,569**	**100%**	**$7,776,569**	
Well Drilling	LS	1	$453,544		$453,544	
Ground Water Well Installation and Decommissioning	LS	1	$58,253		$58,253	
Institutional Controls (Fencing, Signage, EC)	LS	1	$56,172		$56,172	
Subtotal - Construction Costs	-	-	-		***$23,495,291***	
Sales Tax	-	-	8.6%		$2,020,595	
Total - Construction Costs	-	-	-		***$25,516,000***	

Table 1g
Alternative A-7 (On-site AOC to Top of Upper Pasco Gravels)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Non-Construction Costs						
Design, Project Management, and Permitting	-	-	17%		$4,337,720	% total construction costs
Construction Management and Inspection	-	-	8%		$2,041,280	% total construction costs
Ground Water Monitoring and Reporting	LS	1	$1,247,794		$1,247,794	
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,059,129		$2,059,129	
AOC RCRA Cap Monitoring and Maintenance	LS	1	$3,501,914		$3,501,914	
SVE System Operation, Maintenance, and Repairs	LS	1	$3,724,189		$3,724,189	
Institutional Controls Operation and Maintenance	LS	1	$621,334		$621,334	
Total - Non-Construction Costs	-	-	-		***$17,533,000***	
Total Project Costs						
Contingency (+40%)	-	-	40%		$17,219,600	
Total Project Cost (Excluding Contingency)					**$43,049,000**	
Total Project Costs (Including Contingency)					**$60,269,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Cost template and unit costs provided by Envirocon (March 2014).
3. Rationale for specific contingencies applied to the Zone A alternatives is described in Appendix E, Attachment G.

AC = acre
AOC = area of contamination
EA = each
EC = environmental covenant
LS = lump sum
MO = month
PPE = personal protective equipment
RCRA = Resource Conservation and Recovery Act
SVE = soil vapor extraction
T&D = transportation and disposal
TN = ton

Table 1h
Alternative A-8 (Implementation of A-2 for Years 1 through 10 and A-7 for Years 11 through 30)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Notes
Implementation of A-2 (Years 1 through 10)					
A-2 Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$96,049	% construction costs
Bonds and Insurance	-	-	3%	$36,019	% construction costs
Site Preparation	-	-	5%	$60,031	% construction costs
Air Sparging and Ozone Treatment					
Sparge Well Installation	LS	1	$109,435	$109,435	
SVE Well Installation	LS	1	$38,802	$38,802	
IDW Profiling and Disposal	LS	1	$61,814	$61,814	
Borelogs	LS	1	$4,322	$4,322	
SVE/Sparge Piping	LS	1	$60,603	$60,603	
Compound Expansion	LS	1	$42,913	$42,913	
Additional Sparge and SVE Equipment Upgrades	LS	1	$92,737	$92,737	
As-Built and O&M Plan Updates	LS	1	$16,070	$16,070	
Decommission Sparge Wells	LS	1	$14,412	$14,412	
System Decommission	LS	1	$16,168	$16,168	
Ground Water Well Decommissioning	LS	1	$20,463	$20,463	
Additional SVE Well Installation (for Enhanced SVE)	LS	1	$244,651	$244,651	
Cap Replacement (Year 1)	LS	1	$471,329	$471,329	
Institutional Controls (EC)	LS	1	$6,900	$6,900	
Subtotal - Construction Costs	LS	-	-	***$1,392,717***	
Sales Tax	LS	-	8.6%	$119,774	
Total - Construction Costs	LS	-	-	***$1,512,000***	
A-2 Non-Construction Costs					
Design, Project Management, and Permitting	-	-	17%	$257,040	
Construction Management and Inspection	-	-	8%	$120,960	
Ground Water Monitoring and Reporting	LS	1	$839,703	$839,703	
Cap Monitoring, Maintenance, and Inspection	LS	1	$1,215,127	$1,215,127	
SVE System Operation, Maintenance, and Repairs	LS	1	$4,375,116	$4,375,116	
Air Sparging and Ozone Operation/Maintenance					
Additional Operational Labor	LS	1	$149,976	$149,976	
Power Consumption	LS	1	$78,089	$78,089	
Institutional Controls Operation and Maintenance	LS	1	$270,407	$270,407	
Total - Non-Construction Costs	-	-	-	***$7,306,000***	
Total A-2 Costs					
A-2 Contingency (+20%)	-	-	20%	$1,763,600	
Total A-2 Cost (Excluding Contingency)				**$8,818,000**	
Total A-2 Costs (Including Contingency)				**$10,582,000**	

Table 1h
Alternative A-8 (Implementation of A-2 for Years 1 through 10 and A-7 for Years 11 through 30)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost		Total	Notes
Implementation of A-7 (Years 11 through 30)						
A-7 Construction Costs						
Mobilization and Support						
Work Plan Technical Assistance and Report	LS	1	$36,121	100%	$ 36,121	
Preconstruction Planning, Permitting, and Design	LS	1	$67,546	100%	$ 67,546	
Mobilization and Site Preparation						
Mobilization	LS	1	$108,363	100%	$ 108,363	
Surveying	LS	1	$61,406	100%	$ 61,406	
Bonds and Insurance	LS	1	$16,951,481	1%	$ 169,515	
Temporary Facilities	MO	12	$10,836	100%	$ 130,036	
Well Abandonment	EA	15	$1,084	100%	$ 16,254	
Drum Staging and Handling Area Construction	LS	1	$245,623	100%	$ 245,623	
Sediment and Erosion Controls	LS	1	$19,144	100%	$ 19,144	
Demobilization/Project Closeout						
Drum Staging and Handling Area Decommissioning	LS	1	$152,070	100%	$ 152,070	
Demobilization	LS	1	$72,242	100%	$ 72,242	
Support of Report Preparation	LS	1	$36,121	100%	$ 36,121	
Support Costs						
Operations Supervisory & Support Costs - w/ per diem, lodging, and other items	MO	12	$223,951	100%	$ 2,687,407	
Health & Safety Supervisory Support Costs	MO	12	$12,281	100%	$ 147,374	
Personnel/Perimeter Air Monitoring	MO	12	$4,696	100%	$ 56,349	
Training, Medical & Incentives	MO	12	$3,034	100%	$ 36,410	
Health & Safety and PPE	MO	12	$15,171	100%	$ 182,050	
Contractor Planning, Mobilization, and Project Support - Subtotal	**LS**	**1**	**$4,224,032**	**100%**	**$4,224,032**	
Ground to Geomembrane - Clean Excavation						
Clean Soil Removal and Stockpile (Ground to Geomembrane)	TN	13,500	$2.31	100%	$31,209	
Geomembrane to Top of Visqueen - Excavation and Disposal						
Soil Excavation - Geomembrane to Top of Visqueen	TN	46,500	$2.49	100%	$115,894	
Visqueen to Top of Touchet Beds - Excavation and Disposal						
Soil Excavation - Visqueen to Top of Touchet Beds	TN	93,300	$3.40	100%	$316,789	
Visqueen to Top of Top of Touchet Beds - Layback						
Layback Excavation - Visqueen to Top of Touchet Beds	TN	45,300	$2.96	100%	$134,175	
Top of Touchet Beds to Top of Upper Pasco Gravels - Excavation and Disposal						
Soil Excavation - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	91,500	$4.23	100%	$387,355	
Top of Touchet Beds to Top of Upper Pasco Gravels - Layback						
Layback - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	82,200	$3.25	100%	$267,224	

Table 1h
Alternative A-8 (Implementation of A-2 for Years 1 through 10 and A-7 for Years 11 through 30)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost		Total	Notes
Site Restoration						
Backfill - Visqueen to Top of Touchet	TN	93,300	$7.40	100%	$690,870	
Backfill of Layback - Visqueen to Top of Touchet Beds	TN	45,300	$3.83	100%	$173,446	
Backfill - Top of Touchet to Top of Pasco Gravels	TN	91,500	$7.40	100%	$677,541	
Backfill of Layback - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	82,200	$3.83	100%	$314,730	
RCRA Cap Installation	AC	2	$206,302	100%	$412,604	
Stacked Drums - Handling and Disposal (Hazardous Wastes: Liquids and Sludges)						
Drum Extraction	EA	16,100	$36.24	100%	$583,410	
Lab Analysis for Hazardous Waste Drums - Off-site Lab (5%)	EA	16,100	$469.57	5%	$378,007	
Drum Handling w/ Overpacks	EA	16,100	$54.94	25%	$221,134	
Overpack T&D - Subtitle C Landfill: Direct Disposal	EA	16,100	$89.87	20%	$289,379	
Overpack T&D - Incineration (liquids)	EA	16,100	$272.14	5%	$219,070	
Stacked Drums - Handling and Disposal (Casting Sands)						
Drum Extraction - Casting Sands	EA	8,900	$36.24	100%	$322,506	
Lab Analysis for Casting Sands Drums - Off-site Lab (5%)	EA	8,900	$469.57	5%	$208,960	
Bulk Liquids						
Liquids Recovery - Labor & Equip	LS	1	$54,181.60	100%	$54,182	
Solvents Liquids - T&D	TN	1,000	$518.05	50%	$259,024	
Aqueous Liquids - T&D	TN	1,000	$667.22	50%	$333,611	
Excavation and Disposal - Subtotal	**LS**	**1**	**$6,391,118**	**100%**	**$6,391,118**	
Additional Activities Associated with Excavation						
Natural Gas Pipeline Relocation	LS	1	$203,033		$203,033	
BDI Building Demolition and Reconstruction	LS	1	$97,579		$97,579	
Dietrich Road Realignment	LS	1	$29,244		$29,244	
Additional Activities Associated with Excavation - Subtotal	**LS**	**1**	**$329,856**	**100%**	**$329,856**	
Construction and Placement in On-Site AOC						
Construction of On-site AOC Cell	LS	1	$3,235,528	100%	$3,235,528	
Handling/Placement of Drummed Waste in AOC	TN	239,858	$5.06	100%	$1,212,949	
RCRA Cap Construction on AOC Cell	LS	1	$1,169,483	100%	$1,169,483	
Construction and Placement in On-site AOC - Subtotal	**LS**	**1**	**$5,617,959**	**100%**	**$5,617,959**	
Well Drilling (Year 11)	LS	1	$327,650		$327,650	
Ground Water Well Installation (Year 11) and Decommissioning (Year 30)	LS	1	$25,270		$25,270	
Institutional Controls (Fencing, Signage, EC)	LS	1	$35,595		$35,595	
Subtotal - Construction Costs	-	-	-		***$16,951,481***	
Sales Tax	-	-	8.6%		$1,457,827	
Total - Construction Costs	-	-	-		***$18,409,000***	

Table 1h
Alternative A-8 (Implementation of A-2 for Years 1 through 10 and A-7 for Years 11 through 30)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost		Total	Notes
A-7 Non-Construction Costs						
Design, Project Management, and Permitting	-	-	17%		$3,129,530	% total construction costs
Construction Management and Inspection	-	-	8%		$1,472,720	% total construction costs
Ground Water Monitoring and Reporting	LS	1	$371,660		$371,660	
Cap Monitoring, Maintenance, and Inspection	LS	1	$1,054,698		$1,054,698	
AOC RCRA Cap Monitoring and Maintenance	LS	1	$1,678,409		$1,678,409	
SVE System Operation, Maintenance, and Repairs (Years 11 through 20)	LS	1	$1,627,010		$1,627,010	
Institutional Controls Operation and Maintenance	LS	1	$350,927		$350,927	
Total - Non-Construction Costs	-	-	-		***$9,685,000***	
Total A-7 Costs						
A-7 Contingency (+40%)	-	-	40%		$11,237,600	
Total A-7 Cost (Excluding Contingency)					**$28,094,000**	
Total A-7 Costs (Including Contingency)					**$39,332,000**	
Total Project Cost (Excluding Contingency)					**$36,912,000**	
Total Project Costs (Including Contingency)					**$49,914,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Cost template and unit costs provided by Envirocon (March 2014).
3. Rationale for specific contingencies applied to the Zone A alternatives is described in Appendix E, Attachment G.

AC = acre
AOC = area of contamination
BDI = Basin Disposal, Inc.
EA = each
EC = environmental covenant
IDW = investigation-derived waste
LS = lump sum
MO = month
O&M = operations and maintenance
PPE = personal protective equipment
RCRA = Resource Conservation and Recovery Act
SVE = soil vapor extraction
T&D = transportation and disposal
TN = ton

Table 1i
Alternative A-9 (Excavation to Top of Upper Pasco Gravels + Off-site Disposal)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Construction Costs						
Mobilization and Support						
Work Plan Technical Assistance and Report	LS	1	$50,000.00	100%	$50,000	
Preconstruction Planning, Permitting, and Design	LS	1	$93,500.00	100%	$93,500	
Mobilization and Site Preparation						
Mobilization	LS	1	$150,000.00	100%	$150,000	
Surveying	LS	1	$85,000.00	100%	$85,000	
Bonds and Insurance	LS	1	$55,255,728	1%	$552,557	
Temporary Facilities	MO	12	$15,000.00	100%	$180,000	
Well Abandonment	EA	15	$1,500.00	100%	$22,500	
Drum Staging and Handling Area Construction	LS	1	$340,000.00	100%	$340,000	
Sediment and Erosion Controls	LS	1	$26,500.00	100%	$26,500	
Demobilization/Project Closeout						
Drum Staging and Handling Area Decommissioning	LS	1	$210,500.00	100%	$210,500	
Demobilization	LS	1	$100,000.00	100%	$100,000	
Support of Report Preparation	LS	1	$50,000.00	100%	$50,000	
Support Costs						
Operations Supervisory & Support Costs - w/ per diem, lodging, and other items	MO	12	$310,000.00	100%	$3,720,000	
Health & Safety Supervisory Support Costs	MO	12	$17,000.00	100%	$204,000	
Personnel/Perimeter Air Monitoring	MO	12	$6,500.00	100%	$78,000	
Training, Medical & Incentives	MO	12	$4,200.00	100%	$50,400	
Health & Safety and PPE	MO	12	$21,000.00	100%	$252,000	
Contractor Planning, Mobilization, and Project Support - Subtotal	**LS**	**1**	**$6,164,957**	**100%**	**$6,164,957**	
Ground to Geomembrane - Clean Excavation						
Clean Soil Removal and Stockpile (Ground to Geomembrane)	TN	13,500	$3.20	100%	$43,200	
Geomembrane to Top of Visqueen - Excavation and Disposal						
Soil Excavation - Geomembrane to Top of Visqueen	TN	46,500	$3.45	100%	$160,425	
Soil T&D - Subtitle D Landfill	TN	46,500	$32.23	100%	$1,498,695	
Visqueen to Top of Touchet Beds - Excavation and Disposal						
Soil Excavation - Visqueen to Top of Touchet Beds	TN	93,300	$4.70	100%	$438,510	
Soil T&D - Subtitle C Landfill: Direct Disposal	TN	93,300	$123.83	50%	$5,776,670	
Soil T&D - Subtitle C Landfill: With RCRA Stabilization	TN	93,300	$223.53	50%	$10,427,675	
Visqueen to Top of Touchet Beds - Layback						
Layback Excavation - Visqueen to Top of Touchet Beds	TN	45,300	$4.10	100%	$185,730	
Layback Soil T&D - Subtitle D Landfill	TN	45,300	$32.23	25%	$365,005	
Top of Top of Touchet Beds to Top of Upper Pasco Gravels - Excavation and Disposal						
Soil Excavation - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	91,500	$5.86	100%	$536,190	

Table 1i
Alternative A-9 (Excavation to Top of Upper Pasco Gravels + Off-site Disposal)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Soil T&D - Subtitle C Landfill: Direct Disposal	TN	91,500	$123.83	50%	$5,665,223	
Soil T&D - Subtitle C Landfill: With RCRA Stabilization	TN	91,500	$223.53	40%	$8,181,198	
Soil T&D - Incineration (Clean Harbors)	TN	91,500	$609.00	10%	$5,572,350	
Top of Touchet Beds to Top of Upper Pasco Gravels - Layback						
Layback - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	82,200	$4.50	100%	$369,900	
Layback Soil T&D - Subtitle D Landfill	TN	20,000	$32.23	100%	$644,600	
Site Restoration						
Backfill - Visqueen to Top of Touchet Beds	TN	93,300	$10.25	100%	$956,325	
Backfill of Layback - Visqueen to Top of Touchet Beds	TN	45,300	$6.20	100%	$280,860	
Backfill - Top of Top of Touchet Beds to Top of Upper Pasco Gravels	TN	91,500	$10.25	100%	$937,875	
Backfill of Layback - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	82,200	$6.20	100%	$509,640	
RCRA Cap Installation	AC	2	$285,570	100%	$571,140	
Stacked Drums - Handling and Disposal (Hazardous Wastes: Liquids and Sludges)						
Removal of Drums	EA	16,100	$50.16	100%	$807,576	
Lab Analysis for Hazardous Waste Drums - Offsite Lab (5%)	EA	16,100	$650.00	5%	$523,250	
Drum Handling w/ Overpacks	EA	16,100	$76.05	25%	$306,101	
Overpack T&D - Subtitle C Landfill: Direct Disposal	EA	16,100	$124.40	20%	$400,568	
Overpack T&D - Incineration (liquids)	EA	16,100	$376.70	5%	$303,244	
Bulked Drum Waste T&D Subtitle C Landfill: Direct Disposal	TN	4,930	$123.83	50%	$305,241	
Bulked Drum Waste T&D Subtitle C Landfill: With RCRA Stabilization	TN	4,930	$223.53	50%	$551,001	
Stacked Drums - Handling and Disposal (Casting Sands)						
Removal of Drums	EA	8,900	$50.16	100%	$446,424	
Lab Analysis for Casting Sands Drums - Offsite Lab (5%)	EA	8,900	$650.00	5%	$289,250	
Casting Sands T&D - Subtitle D Landfill: Direct Disposal	TN	3,630	$32.23	100%	$116,995	
Bulk Liquids						
Liquids Recovery - Labor & Equip	LS	1	$75,000.00	100%	$75,000	
Solvents Liquids - T&D	TN	1,000	$717.10	50%	$358,550	
Aqueous Liquids - T&D	TN	1,000	$923.59	50%	$461,795	
Excavation and Disposal - Subtotal	**LS**	**1**	**$48,066,204**	**100%**	**$48,066,204**	
Additional Activities Associated with Excavation						
Natural Gas Pipeline Relocation	LS	1	$281,045		$281,045	
BDI Building Demolition and Reconstruction	LS	1	$135,072		$135,072	
Dietrich Road Realignment	LS	1	$40,481		$40,481	
Additional Activities Associated with Excavation - Subtotal	**LS**	**1**	**$456,598**		**$456,598**	
SVE Well Drilling	LS	1	$453,544		$453,544	
Ground Water Well Installation and Decommissioning	LS	1	$58,253		$58,253	
Institutional Controls (Fencing, Signage, EC)	LS	1	$56,172		$56,172	

Table 1i
Alternative A-9 (Excavation to Top of Upper Pasco Gravels + Off-site Disposal)
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	% of Units	Total	Notes
Subtotal - Construction Costs	-	-	-		***$55,255,728***	
Sales Tax	-	-	8.6%		$4,751,993	
Total - Construction Costs	-	-	-		***$60,008,000***	
Non-Construction Costs						
Design, Project Management, and Permitting	-	-	17%		$10,201,360	% total construction costs
Construction Management and Inspection	-	-	8%		$4,800,640	% total construction costs
Ground Water Monitoring and Reporting	LS	1	$1,247,794		$1,247,794	
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,059,129		$2,059,129	
SVE System Operation, Maintenance, and Repairs	LS	1	$3,724,189		$3,724,189	
Institutional Controls Operation and Maintenance	LS	1	$621,334		$621,334	
Total - Non-Construction Costs	-	-	-		***$22,654,000***	
Total Project Costs						
Contingency (+55%)	-	-	55%		$45,464,100	
Total Project Cost (Excluding Contingency)					**$82,662,000**	
Total Project Costs (Including Contingency)					**$128,126,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Cost template and unit costs provided by Envirocon (March 2014).
3. Rationale for specific contingencies applied to the Zone A alternatives is described in Appendix E, Attachment G.

AOC = area of contamination
EA = each
EC = environmental covenant
LS = lump sum
MO = month
PPE = personal protective equipment
RCRA = Resource Conservation and Recovery Act
SVE = soil vapor extraction
T&D = transportation and disposal
TN = ton

Table 1j
No Action Alternative for Zone A
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$2,679	% construction costs
Bonds and Insurance	-	-	3%	$1,005	% construction costs
Site Preparation	-	-	5%	$1,674	% construction costs
Ground Water Well Decommissioning	LS	1	$33,484	$33,484	
Subtotal - Construction Costs	-	-	-	***$38,842***	
Sales Tax	-	-	8.6%	$3,340	
Total - Construction Costs	-	-	-	***$42,000***	
Non-Construction Costs					
Project Management	-	-	10%	$4,200	
Ground Water Monitoring and Reporting	LS	1	$839,703	$839,703	
Cap Monitoring	LS	1	$1,002,896	$1,002,896	
Total - Non-Construction Costs	-	-	-	***$1,847,000***	
Total Project Costs					
Contingency (+20%)	-	-	20%	$377,800	
Total Project Cost (Excluding Contingency)				**$1,889,000**	
Total Project Costs (Including Contingency)				**$2,267,000**	

Note:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Rationale for specific contingencies applied to the Zone A alternatives is described in Appendix E, Attachment G.

LS = lump sum

Table 2a
Zones C/D – Alternative CD-1
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$11,263	% construction costs
Bonds and Insurance	-	-	3%	$4,224	% construction costs
Site Preparation	-	-	5%	$7,040	% construction costs
Ground Water Well Decommissioning	LS	1	$6,419	$6,419	"GW Monitor Backup"
Cap Replacement (Year 15)	LS	1	$128,372	$128,372	"Cap O&M Backup"
Institutional Controls (Environmental Covenant)	LS	1	$6,000	$6,000	"IC Backup"
Subtotal - Construction Costs	-	-	-	***$163,318***	
Sales Tax	-	-	8.6%	$14,045	Current sales tax is 8.6%
Total - Construction Costs	-	-	-	***$177,363***	
Non-construction Costs					
Design, Project Management, and Permitting	-	-	17%	$30,152	% total construction costs
Construction Management and Inspection	-	-	8%	$14,189	% total construction costs
Ground Water Monitoring and Reporting					"GW Monitor Backup"
Quarterly Ground Water Monitoring (Years 1-5)	LS	1	$141,213	$141,213	
Semi-annual Ground Water Monitoring (Years 6-9)	LS	1	$62,099	$62,099	
Annual Ground Water Monitoring (Years 10-15)	LS	1	$55,483	$55,483	
Cap Monitoring, Maintenance, and Inspection	LS	1	$80,390	$80,390	"Cap O&M Backup"
Institutional Controls Operation and Maintenance					"IC Backup"
Fencing Operation and Maintenance	LS	1	$14,922	$14,920	
Environmental Covenant Operation and Maintenance	LS	1	$5,969	$5,970	
Beneficial Use Survey and Reporting	LS	1	$11,938	$11,940	
Total - Non-construction Costs	-	-		***$416,356***	
Total Project Costs					
Contingency (+20%)	-	-	20%	$118,744	% total construction and non-construction costs
Total Project Cost (Excluding Contingency)	-	-	-	**$593,718**	
Total Project Cost (Including Contingency)	-	-	-	**$712,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

2. Rationale for specific contingencies applied to the Zones C/D alternatives is described in Section 5.1.5.

GW = ground water

IC = institutional controls

LS = lump sum

O&M = operations and maintenance

SVE = soil vapor extraction

Table 2b
Zones C/D – Alternative CD-2
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$38,017	% construction costs
Bonds and Insurance	-	-	3%	$14,256	% construction costs
Site Preparation	-	-	5%	$23,761	% construction costs
Contingent In situ Amendments					"ISCO Backup"
Horizontal Drilling and Data Collection	LS	1	$188,135	$188,135	
Boring Logs	LS	1	$4,440	$4,440	
IDW Profiling & Disposal	LS	1	$36,445	$36,445	
ISCO Treatment	LS	1	$105,405	$105,405	
Ground Water Well Decommissioning	LS	1	$6,419	$6,419	"GW Monitor Backup"
Cap Replacement (Year 15)	LS	1	$128,372	$128,372	"Cap O&M Backup"
Institutional Controls (Environmental Covenant)	LS	1	$6,000	$6,000	"IC Backup"
Subtotal - Construction Costs	-	-	-	***$551,251***	
Sales Tax	-	-	8.6%	$47,408	Current sales tax is 8.6%
Total - Construction Costs	-	-	-	***$598,659***	
Non-construction Costs					
Design, Project Management, and Permitting	-	-	17%	$101,772	% total construction costs
Construction Management and Inspection	-	-	8%	$47,893	% total construction costs
Ground Water Monitoring and Reporting					"GW Monitor Backup"
Quarterly Ground Water Monitoring (Years 1-5)	LS	1	$141,213	$141,213	
Semi-annual Ground Water Monitoring (Years 6-9)	LS	1	$62,099	$62,099	
Annual Ground Water Monitoring (Years 10-15)	LS	1	$55,483	$55,483	
Cap Monitoring, Maintenance, and Inspection	LS	1	$80,390	$80,390	"Cap O&M Backup"
Institutional Controls Operation and Maintenance					"IC Backup"
Fencing Operation and Maintenance	LS	1	$14,922	$14,922	
Environmental Covenant Operation and Maintenance	LS	1	$5,969	$5,969	
Beneficial Use Survey and Reporting	LS	1	$11,938	$11,938	
Total - Non-construction Costs	-	-	-	***$521,679***	
Total Project Costs					
Contingency (+40%)	-	-	40%	$448,135	% total construction and non-construction costs
Total Project Cost (Excluding Contingency)	-	-	-	**$1,120,338**	
Total Project Cost (Including Contingency)	-	-	-	**$1,568,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate.

2. Rationale for specific contingencies applied to the Zones C/D alternatives is described in Section 5.1.5.

GW = ground water

IDW = investigation-derived waste

ISCO = in situ chemical oxidation

LS = lump sum

O&M = operations and maintenance

Table 2c
Zones C/D – Alternative CD-3
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$246,106	% construction costs
Bonds and Insurance	-	-	3%	$92,290	% construction costs
Site Preparation	-	-	5%	$153,816	% construction costs
Surveying	LS	1	$1,200	$1,200	
Ground to Geomembrane - Clean Excavation					"Earthwork Backup"
Clean Soil Removal and Stockpile	CY	2,364	$3.20	$7,564	
Remove Geotextile	SF	21,275	$0.10	$2,128	
Geomembrane to Bottom of Over-excavation - Excavation					"Earthwork Backup"
Remove Geomembrane	SF	30,490	$0.10	$3,049	
Excavation - Engineering Fill	CY	1,719	$4.70	$8,080	
Excavation - Waste Material	CY	5,373	$4.70	$25,251	
Excavation - Sideslopes, Access Ramp, and Over-excavation (3.5-ft)	CY	4,163	$4.70	$19,566	
Waste Characterization - Lab Testing					"Lab Testing Backup"
Lab Testing - Waste (1 Composite Sample per Roll-off Bin)	Sample	269	$853.00	$229,137	
Lab Testing - Exposed Soils (1 Composite Sample per Roll-off Bin)	Sample	208	$853.00	$177,554	
Confirmational Sampling - Underlying Soils	Sample	5	$168.00	$840	ISM until clean layer
Transportation and Disposal of Waste/Soils - Subtitle C Landfill (100%)					"Disposal Backup"
Bulk Loads - Disposal	TON	16,882	$80.00	$1,350,570	
Fuel, Environmental, and Administrative Fee	TON	16,882	$14.00	$236,350	17.5% of disposal unit cost
ODEQ Haz Fee	TON	16,882	$2.50	$42,205	
Transport to Arlington	TON	16,882	$25.00	$422,053	Assumed 30 ton/load
Truck Liner (by WMX)	TON	16,882	$2.33	$39,392	
Backfill and Capping					"Earthwork Backup"
Backfill - Common Borrow	TON	13,336	$14.25	$190,042	
RCRA Cap Installation	ac	0.89	$285,570	$253,171	
Hydroseeding	SF	38,618	$0.13	$5,020	
Ground Water Well Installation and Decommissioning	LS	1	$27,441	$27,441	"GW Monitor Backup"
Institutional Controls (Fencing, Signage, Environmental Covenant)	LS	1	$35,710	$35,710	"IC Backup"
Subtotal - Construction Costs	-	-	-	***$3,568,536***	
Sales Tax	-	-	8.6%	$306,894	Current sales tax is 8.6%
Total - Construction Costs	-	-	-	***$3,875,430***	

Table 2c
Zones C/D – Alternative CD-3
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Non-construction Costs					
Design, Project Management, and Permitting	-	-	17%	$658,823	% total construction costs
Construction Management and Inspection	-	-	8%	$310,034	% total construction costs
Groundwater Monitoring and Reporting					"GW Monitor Backup"
Quarterly Groundwater Monitoring (Years 1-5)	LS	1	$141,213	$141,212.52	
Semi-annual Groundwater Monitoring (Years 6-8)	LS	1	$47,256	$47,256	
Annual Groundwater Monitoring (Years 9-10)	LS	1	$20,186	$20,186	
Cap Monitoring, Maintenance, and Inspection	LS	1	$80,390	$80,390	"Cap O&M Backup"
Institutional Controls Operation and Maintenance					"IC Backup"
Fencing Operation and Maintenance	LS	1	$14,922	$14,922	
Environmental Covenant Operation and Maintenance	LS	1	$5,969	$5,969	
Beneficial Use Survey and Reporting	LS	1	$11,938	$11,938	
Total - Non-construction Costs	-	-	-	***$1,290,731***	
Total Project Costs					
Contingency (+40%)	-	-	40%	$2,066,464	% total construction and non-construction costs
Total Project Cost (Excluding Contingency)	-	-	-	**$5,166,161**	
Total Project Cost (Including Contingency)	-	-	-	**$7,233,000**	

Notes:
1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Rationale for specific contingencies applied to the Zones C/D alternatives is described in Section 5.1.5.

ac = acre
CY = cubic yard
ft = foot
GW = ground water
IC = institutional controls
ISM = Incremental Sampling Methodology
LS = lump sum
ODEQ Haz = Oregon Department of Environmental Quality Hazardous Waste
O&M = operations and maintenance
SF = square foot
RCRA = Resource Conservation and Recovery Act
WMX = WMX, Inc.

Table 2d
Zones C/D – No Action Alternative
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$690	% construction costs
Bonds and Insurance	-	-	3%	$259	% construction costs
Site Preparation	-	-	5%	$431	% construction costs
Ground Water Well Decommissioning	LS	1	$8,626	$8,626	"GW Monitor Backup"
Subtotal - Construction Costs	-	-	-	***$10,006***	
Sales Tax	-	-	8.6%	$861	Current sales tax is 8.6%
Total - Construction Costs	-	-	-	***$10,867***	
Non-construction Costs					
Project Management	-	-	10%	$1,090	% total construction costs
Ground Water Monitoring and Reporting					"GW Monitor Backup"
Quarterly Ground Water Monitoring (Years 1-5)	LS	1	$141,213	$141,213	
Cap Monitoring	LS	1	$41,329	$41,329	"Cap O&M Backup"
Total - Non-construction Costs	-	-		***$183,631***	
Total Project Costs					
Contingency (+20%)	-	-	20%	$38,900	% total construction and non-construction costs
Total Project Cost (Excluding Contingency)	-	-	-	**$194,498**	
Total Project Cost (Including Contingency)	-	-	-	**$233,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

2. Rationale for specific contingencies applied to the Zones C/D alternatives is described in Section 5.1.5.

GW = ground water

LS = lump sum

O&M = operations and maintenance

Table 3a
Zone E – Alternative E-1
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$19,787	% construction costs
Bonds and Insurance	-	-	3%	$7,420	% construction costs
Site Preparation	-	-	5%	$12,367	% construction costs
Ground Water Well Decommissioning	LS	1	$3,209	$3,209	"GW Monitor Backup"
Cap Replacement (Year 15)	LS	1	$238,131	$238,131	"Cap O&M Backup"
Institutional Controls (Environmental Covenant)	LS	1	$6,000	$6,000	"IC Backup"
Subtotal - Construction Costs	-	-	-	***$286,915***	
Sales Tax	-	-	8.6%	$24,675	Current sales tax is 8.6%
Total - Construction Costs	-	-	-	***$311,589***	
Non-construction Costs					
Design, Project Management, and Permitting	-	-	17%	$52,970	% total construction costs
Construction Management and Inspection	-	-	8%	$24,927	% total construction costs
Ground Water Monitoring and Reporting					"GW Monitor Backup"
Quarterly Ground Water Monitoring (Years 1-5)	LS	1	$114,727	$114,727	
Semi-annual Ground Water Monitoring (Years 6-9)	LS	1	$47,511	$47,511	
Annual Ground Water Monitoring (Years 10-15)	LS	1	$38,399	$38,399	
Cap Monitoring, Maintenance, and Inspection	LS	1	$80,390	$80,390	"Cap O&M Backup"
Institutional Controls Operation and Maintenance					"IC Backup"
Fencing Operation and Maintenance	LS	1	$14,922	$14,922	
Environmental Covenant Operation and Maintenance	LS	1	$5,969	$5,969	
Beneficial Use Survey and Reporting	LS	1	$11,938	$11,938	
Total - Non-construction Costs	-	-	-	***$391,754***	
Total Project Costs					
Contingency (+20%)	-	-	20%	$140,669	% total construction and non-construction costs
Total Project Cost (Excluding Contingency)	-	-	-	**$703,343**	
Total Project Cost (Including Contingency)	-	-	-	**$844,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

2. Rationale for specific contingencies applied to the Zone E alternatives is described in Section 5.1.5.

GW = ground water

IC = institutional controls

LS = lump sum

O&M = operations and maintenance

SVE = soil vapor extraction

Table 3b
Zone E – Alternative E-2
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Construction Costs					
Ex situ Stabilization	LS	1	$938,963	$938,963	See Appendix H
Ground Water Well Decommissioning	LS	1	$3,209	$3,209	"GW Monitor Backup"
Institutional Controls (Environmental Covenant)	LS	1	$6,000	$6,000	"IC Backup"
Subtotal - Construction Costs	-	-	-	***$948,172***	
Sales Tax	-	-	8.6%	$81,543	Current sales tax is 8.6%
Total - Construction Costs	-	-	-	***$1,029,715***	
Non-construction Costs					
Design, Project Management, and Permitting	-	-	17%	$175,052	% total construction costs
Construction Management and Inspection	-	-	8%	$82,377	% total construction costs
Ground Water Monitoring and Reporting					"GW Monitor Backup"
Quarterly Ground Water Monitoring (Years 1-5)	LS	1	$114,727	$114,727	
Semi-annual Ground Water Monitoring (Years 6-9)	LS	1	$47,511	$47,511	
Annual Ground Water Monitoring (Years 10-15)	LS	1	$38,399	$38,399	
Cap Monitoring, Maintenance, and Inspection	LS	1	$80,390	$80,390	"Cap O&M Backup"
Institutional Controls Operation and Maintenance					"IC Backup"
Fencing Operation and Maintenance	LS	1	$14,922	$14,922	
Environmental Covenant Operation and Maintenance	LS	1	$5,969	$5,969	
Beneficial Use Survey and Reporting	LS	1	$11,938	$11,938	
Total - Non-construction Costs	-	-	-	***$571,286***	
Total Project Costs					
Contingency (+40%)	-	-	40%	$640,400	% total construction and non-construction costs
Total Project Cost (Excluding Contingency)	-	-	-	**$1,601,001**	
Total Project Cost (Including Contingency)	-	-	-	**$2,241,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

2. Rationale for specific contingencies applied to the Zone E alternatives is described in Section 5.1.5.

GW = ground water

IC = institutional controls

IDW = investigation-derived waste

O&M = operations and maintenance

S/S = solidification/stabilization

Table 3c
Zone E – Alternative E-3
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$719,050	% construction costs
Bonds and Insurance	-	-	3%	$269,644	% construction costs
Site Preparation	-	-	5%	$449,406	% construction costs
Surveying	LS	1	$1,200	$1,200	
Ground to Geomembrane - Clean Excavation					"Earthwork Backup"
Clean Soil Removal and Stockpile	CY	4,789	$3.20	$15,326	
Remove Geotextile	SF	43,105	$0.10	$4,310	
Geomembrane to Bottom of Over-excavation - Excavation					"Earthwork Backup"
Remove Geomembrane	SF	56,622	$0.10	$5,662	
Excavation - Engineering Fill	CY	3,483	$4.70	$16,371	
Excavation - Waste Material	CY	18,867	$4.70	$88,676	
Excavation - Sideslopes, Access Ramp, and Over-excavation (2-ft)	CY	8,063	$4.70	$37,896	
Remove Synthetic Liner at Bottom of Waste and Prepare Subbase	SF	43,105	$0.12	$5,173	
Waste Characterization - Lab Testing					"Lab Testing Backup"
Lab Testing - Waste (1 Composite Sample per Roll-off Bin)	Sample	943	$853.00	$804,692	
Lab Testing - Exposed Soils (1 Composite Sample per Roll-off Bin)	Sample	403	$853.00	$343,885	
Confirmational Sampling - Underlying Soils	Sample	5	$168.00	$840	
Transportation and Disposal of Waste/Soils - Subtitle C Landfill (80%)					"Disposal Backup"
Bulk Loads - Disposal	TON	36,496	$80.00	$2,919,695	
Fuel, Environmental, and Administrative Fee	TON	36,496	$14.00	$510,947	
ODEQ Haz Fee	TON	36,496	$2.50	$91,240	
Transport to Arlington	TON	36,496	$25.00	$912,405	
Truck Liner (by WMX)	TON	36,496	$2.33	$85,158	
Transportation and Disposal of Waste/Soils - Subtitle C Landfill with RCRA Stabilization (20%)					"Disposal Backup"
Bulk Loads - Disposal	TON	9,124	$164.00	$1,496,344	
Fuel, Environmental, and Administrative Fee	TON	9,124	$28.70	$261,860	17.5% of Disposal Costs
ODEQ Haz Fee	TON	9,124	$2.50	$22,810	
Transport to Arlington	TON	9,124	$25.00	$228,101	Assumed 30 ton/load
Truck Liner (by WMX)	TON	9,124	$2.33	$21,289	
Backfill and Capping					"Earthwork Backup"
Backfill - Common Borrow	TON	38,436	$14.25	$547,715	
RCRA Cap Installation	ac	1.75	$285,570	$501,072	
Hydroseed	SF	76,432	$0.13	$9,936	

Table 3c
Zone E – Alternative E-3
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Ground Water Well Installation and Decommissioning	LS	1	$13,720	$13,720	"GW Monitor Backup"
Institutional Controls (Fencing, Signage, Environmental Covenant)	LS	1	$41,800	$41,800	"IC Backup"
Subtotal - Construction Costs	-	-	-	***$10,426,224***	
Sales Tax	-	-	8.6%	$896,655	Current sales tax is 8.6%
Total - Construction Costs	-	-	-	***$11,322,879***	
Non-construction Costs					
Design, Project Management, and Permitting	-	-	17%	$1,924,889	% total construction costs
Construction Management and Inspection	-	-	8%	$905,830	% total construction costs
Ground Water Monitoring and Reporting					"GW Monitor Backup"
Quarterly Ground Water Monitoring (Years 1-5)	LS	1	$114,727	$114,727	
Semi-annual Ground Water Monitoring (Years 6-8)	LS	1	$36,155	$36,155	
Annual Ground Water Monitoring (Years 9-10)	LS	1	$13,970	$13,970	
Cap Monitoring, Maintenance, and Inspection	LS	1	$0	$0	"Cap O&M Backup"
Institutional Controls Operation and Maintenance					"IC Backup"
Fencing Operation and Maintenance	LS	1	$14,922	$14,922	
Environmental Covenant Operation and Maintenance	LS	1	$5,969	$5,969	
Beneficial Use Survey and Reporting	LS	1	$11,938	$11,938	
Total - Non-construction Costs	-	-	-	***$3,028,401***	
Total Project Costs					
Contingency (+40%)	-	-	40%	$5,740,512	% total construction and non-construction costs
Total Project Cost (Excluding Contingency)	-	-	-	**$14,351,281**	
Total Project Cost (Including Contingency)	-	-	-	**$20,092,000**	

Note:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

2. Rationale for specific contingencies applied to the Zone E alternatives is described in Section 5.1.5.

ac = acre

CY = cubic yard

ft = foot

GW = ground water

IC = institutional controls

LS = lump sum

O&M = operations and maintenance

ODEQ Haz = Oregon Department of Environmental Quality Hazardous Waste

RCRA = Resource Conservation and Recovery Act

SF = square foot

WMX = WMX, Inc.

Table 3d
Zone E – No Action Alternative
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization and Demobilization	-	-	8%	$345	% construction costs
Bonds and Insurance	-	-	3%	$129	% construction costs
Site Preparation	-	-	5%	$216	% construction costs
Ground Water Well Decommissioning	LS	1	$4,313	$4,313	"GW Monitor Backup"
Subtotal - Construction Costs	-	-	-	***$5,003***	
Sales Tax	-	-	8.6%	$430	Current sales tax is 8.6%
Total - Construction Costs	-	-	-	***$5,433***	
Non-construction Costs					
Project Management	-	-	10%	$540	% total construction costs
Ground Water Monitoring and Reporting					"GW Monitor Backup"
Quarterly Ground Water Monitoring (Years 1-5)	LS	1	$114,727	$114,727	
Cap Monitoring	LS	1	$41,329	$41,329	"Cap O&M Backup"
Total - Non-construction Costs	-	-	.	***$156,596***	
Total Project Costs					
Contingency (+20%)	-	-	20%	$32,406	% total construction and non-construction costs
Total Project Cost (Excluding Contingency)	-	-	-	**$162,029**	
Total Project Cost (Including Contingency)	-	-	-	**$194,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

2. Rationale for specific contingencies applied to the Zone E alternatives is described in Section 5.1.5.

GW = ground water

LS = lump sum

Table 4a
On-property Ground Water (Central Area) – Alternative ONP-1
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization & Demobilization	-	-	8%	$48,729	% construction costs
Bonds & Insurance	-	-	3%	$18,273	% construction costs
Site Preparation	-	-	5%	$30,456	% construction costs
Contingent SVE Treatment					"SVE Backup"
SVE Well Installation	LS	1	$32,594	$32,594	
IDW Profiling & Disposal	LS	1	$15,718	$15,718	
Boring Logs	LS	1	$1,682	$1,682	
SVE Piping & Equipment	LS	1	$78,577	$78,577	
As-built and O&M Plan Updates	LS	1	$16,070	$16,070	
Additional Operational Labor	LS	1	$115,038	$115,038	
Power Consumption	LS	1	$37,094	$37,094	
System Decommission	LS	1	$5,919	$5,919	
Post-remedy Source Evaluation	LS	1	$300,000	$300,000	
Ground Water Well Decommissioning	LS	1	$6,419	$6,419	"GW Monitor Backup"
Subtotal - Construction Costs	-	-	-	***$706,568***	
Sales Tax	-	-	8.6%	$60,765	
Total - Construction Costs	-	-	-	***$767,300***	
Non-construction Costs					
Design, Project Management, and Permitting	-	-	17%	$130,441	% total construction costs
Construction Management and Inspection	-	-	8%	$61,384	% total construction costs
Ground Water Monitoring and Reporting					"GW Monitor Backup"
Quarterly Ground Water Monitoring (Years 1-5)	LS	1	$143,704	$143,704	
Semi-annual Ground Water Monitoring (Years 6-9)	LS	1	$78,659	$78,659	
Annual Ground Water Monitoring (Years 10-15)	LS	1	$46,466	$46,466	
Subtotal - Non-construction Costs	-	-	-	***$460,700***	
Total Project Costs					
Contingency (+20%)	-	-	20%	$245,600	% total construction and non-construction costs
Total Project Cost (Excluding Contingency)	-	-	-	**$1,228,000**	
Total Project Cost (Including Contingency)	-	-	-	**$1,473,600**	

Note:

1. Total costs are presented as net present value (assuming a 3% discount rate).

2. Rationale for contingencies applied to the Central Area alternatives is described in Section 5.1.5.

IDW = investigation-derived waste

LS = lump sum

SVE = soil vapor extraction

Table 4b
On-property Ground Water (Central Area) – No Action Alternative
Detailed Cost Estimate

Task	Unit	Quantity	Unit Cost	Total	Source/Notes
Construction Costs					
Mobilization/Demobilization/Site Preparation					
Mobilization & Demobilization	-	-	8%	$690	% construction costs
Bonds & Insurance	-	-	3%	$259	% construction costs
Site Preparation	-	-	5%	$431	% construction costs
Ground Water Well Decommissioning	LS	1	$8,626	$8,626	"GW Monitor Backup"
Subtotal - Construction Costs	-	-	-	***$10,006***	
Sales Tax	-	-	8.6%	$861	
Total - Construction Costs	-	-	-	***$10,900***	
Non-construction Costs					
Project Management	-	-	10%	$1,090	% total construction costs
Ground Water Monitoring and Reporting					"GW Monitor Backup"
Quarterly Ground Water Monitoring (Years 1-5)	LS	1	$143,704	$143,704	
Subtotal - Non-construction Costs	-	-	-	***$144,800***	
Total Project Costs					
Contingency (+20%)	-	-	20%	$31,140	% total construction and non-construction costs
Total Project Cost (Excluding Contingency)	-	-	-	**$155,700**	
Total Project Cost (Including Contingency)	-	-	-	**$186,840**	

Note:

1. Total costs are presented as net present value (assuming a 3% discount rate).
2. Rationale for contingencies applied to the Central Area alternatives is described in Section 5.1.5.

LS = lump sum

APPENDIX E, ATTACHMENT A
GENERAL BACKUP FOR DETAILED COST ESTIMATES

ZONE A

Tables A
Zone A
Ground Water Monitoring and Reporting Cost Summaries

Table A-1
Zone A – Ground Water Monitoring and Reporting Cost Summary

Task	Unit	Unit Assumption	Quantities/Costs							Reference/Comments
							Alt. A-8			
			Alt. A-1 to A-4	Alt. A-5	Alt. A-6	Alt. A-7 and A-9	Alt. A-2 (Years 1-10)	Alt. A-7 (Years 11-30)	No Action Alternative	
Assumed Number of Monitoring Wells	-	Years 1-10	18	18	21	21	18	-	18	A site-wide ground water compliance monitoring program will be developed after the CAP is finalized. Ground water protection, performance, and confirmational monitoring activities are anticipated for cost purposes in this FFS.
		Years 11-30	12	12	7	7	-	7	0	
Construction Costs										
Assumed Number of Wells Replaced	well	-	-	5	5	5	-	5	-	Well replacement assumed adjacent to Zone A immediately after drum removal.
Well Installation Cost	$/well	$5,000	-	$25,000	$25,000	$25,000	-	$18,061	-	
Well Decommissioning	$/well	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	Well decommissioning assumed to occur at years 10 and 30.
Year 10	NPV $	-	$11,161	$11,161	$26,043	$26,043	$20,463	-	$33,484	
Year 30	NPV $	-	$12,360	$12,360	$7,210	$7,210	-	$7,210	-	
Subtotal Construction Costs	**NPV $**	**-**	**$23,521**	**$48,521**	**$58,253**	**$58,253**	**$20,463**	**$25,270**	**$33,484**	-
Sales Tax	%	8.6%	$2,023	$4,173	$5,010	$5,010	$1,760	$2,173	$2,880	-
Total Construction Costs	**$**	-	**$25,544**	**$52,694**	**$63,263**	**$63,263**	**$22,222**	**$27,444**	**$36,364**	-
Non-Construction Costs (Labor, Analytical & Data Validation)										
Quarterly Monitoring (Years 1 to 10)	$/year	-	$66,204	$66,204	$70,475	$70,475	$66,204	-	$66,204	Current quarterly and semiannual monitoring assumed to remain during years 1 to 10, based on Draft 2016 GW Annual Report (EPI, March 2017) and based on 2016 GW Monitoring Program (Ecology, December, 2016).
Semiannual Monitoring (Years 1 to 10)	$/year	-	$32,235	$32,235	$32,235	$32,235	$32,235	-	$32,235	
Quarterly and Semiannual Monitoring (Years 1 to 10)	$/year	-	$98,439	$98,439	$102,710	$102,710	$98,439	-	$98,439	
Year 1	NPV $	-	$95,572	$95,572	$99,718	$99,718	$95,572	-	$95,572	
Year 2	NPV $	-	$92,788	$92,788	$96,814	$96,814	$92,788	-	$92,788	
Year 3	NPV $	-	$90,085	$90,085	$93,994	$93,994	$90,085	-	$90,085	
Year 4	NPV $	-	$87,462	$87,462	$91,256	$91,256	$87,462	-	$87,462	
Year 5	NPV $	-	$84,914	$84,914	$88,598	$88,598	$84,914	-	$84,914	
Year 6	NPV $	-	$82,441	$82,441	$86,018	$86,018	$82,441	-	$82,441	
Year 7	NPV $	-	$80,040	$80,040	$83,512	$83,512	$80,040	-	$80,040	
Year 8	NPV $	-	$77,709	$77,709	$81,080	$81,080	$77,709	-	$77,709	
Year 9	NPV $	-	$75,445	$75,445	$78,718	$78,718	$75,445	-	$75,445	
Year 10	NPV $	-	$73,248	$73,248	$76,426	$76,426	$73,248	-	$73,248	
Total Net Present Value (Years 1 to 10)	**NPV $**	**-**	**$839,703**	**$839,703**	**$876,134**	**$876,134**	**$839,703**	**-**	**$839,703**	

Tables A
Zone A
Ground Water Monitoring and Reporting Cost Summaries

Task	Unit	Unit Assumption	Quantities/Costs							Reference/Comments
							Alt. A-8			
			Alt. A-1 to A-4	Alt. A-5	Alt. A-6	Alt. A-7 and A-9	Alt. A-2 (Years 1-10)	Alt. A-7 (Years 11-30)	No Action Alternative	
Semiannual Monitoring (Years 11 to 20)	$/year	-	$41,558	$41,558	$37,999	$37,999	-	$37,999	-	Semiannual monitoring assumed to occur during years 11 to 20.
Year 11	NPV $	-	$30,022	$30,022	$27,451	$27,451	-	$27,451	-	
Year 12	NPV $	-	$29,148	$29,148	$26,652	$26,652	-	$26,652	-	
Year 13	NPV $	-	$28,299	$28,299	$25,875	$25,875	-	$25,875	-	
Year 14	NPV $	-	$27,475	$27,475	$25,122	$25,122	-	$25,122	-	
Year 15	NPV $	-	$26,675	$26,675	$24,390	$24,390	-	$24,390	-	
Year 16	NPV $	-	$25,898	$25,898	$23,680	$23,680	-	$23,680	-	
Year 17	NPV $	-	$25,143	$25,143	$22,990	$22,990	-	$22,990	-	
Year 18	NPV $	-	$24,411	$24,411	$22,320	$22,320	-	$22,320	-	
Year 19	NPV $	-	$23,700	$23,700	$21,670	$21,670	-	$21,670	-	
Year 20	NPV $	-	$23,010	$23,010	$21,039	$21,039	-	$21,039	-	
Total Net Present Value (Years 11 to 20)	**NPV $**	**-**	**$263,780**	**$263,780**	**$241,190**	**$241,190**	-	**$241,190**	-	
Annual Monitoring (Years 21 to 30)	$/year	-	$27,269	$27,269	$27,625	$27,625	-	$27,625	-	Annual monitoring assumed to occur during years 21 to 30.
Year 21	NPV $	-	$14,658	$14,658	$14,850	$14,850	-	$14,850	-	
Year 22	NPV $	-	$14,231	$14,231	$14,417	$14,417	-	$14,417	-	
Year 23	NPV $	-	$13,817	$13,817	$13,997	$13,997	-	$13,997	-	
Year 24	NPV $	-	$13,414	$13,414	$13,589	$13,589	-	$13,589	-	
Year 25	NPV $	-	$13,024	$13,024	$13,194	$13,194	-	$13,194	-	
Year 26	NPV $	-	$12,644	$12,644	$12,809	$12,809	-	$12,809	-	
Year 27	NPV $	-	$12,276	$12,276	$12,436	$12,436	-	$12,436	-	
Year 28	NPV $	-	$11,918	$11,918	$12,074	$12,074	-	$12,074	-	
Year 29	NPV $	-	$11,571	$11,571	$11,722	$11,722	-	$11,722	-	
Year 30	NPV $	-	$11,234	$11,234	$11,381	$11,381	-	$11,381	-	
Total Net Present Value (Years 21 to 30)	**NPV $**	**-**	**$128,789**	**$128,789**	**$130,470**	**$130,470**	-	**$130,470**	-	
Total Non-Construction Costs	**$**	-	**$1,232,272**	**$1,232,272**	**$1,247,794**	**$1,247,794**	**$839,703**	**$371,660**	**-**	-
Total Ground Water Monitoring Costs (NPV $)			**$1,257,816**	**$1,284,966**	**$1,311,056**	**$1,311,056**	**$861,925**	**$399,103**	**$876,067**	**Total ground water monitoring costs for years 1 to 30.**

Note:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

NPV = net present value

Tables A
Zone A
Ground Water Monitoring and Reporting Cost Summaries

Table A-2
Zone A – Ground Water Monitoring and Reporting Costs Per Year (for quarterly, semiannual, and annual monitoring events)

Task	Unit	Unit Assumption	Quantities/Costs								Reference/Comments
			Alternatives A-1 to A-5, A-8 (Years 1-10), and No Action Alternative				Alternatives A-6, A-7, A-8 (Years 11-30) and A-9				
			Years 1 to 10		Years 11 to 20	Years 21 to 30	Years 1 to 10		Years 11 to 20	Years 21 to 30	
			Quarterly Monitoring	Semiannual Monitoring	Semiannual Monitoring	Annual Monitoring	Quarterly Monitoring	Semiannual Monitoring	Semiannual Monitoring	Annual Monitoring	
Assumed Number of Monitoring Wells	-	-	9	9	12	6	12	9	7	7	All applicable wells are nearby or downgradient of Zone A, excluding off-property wells. Current number of wells and sampling frequency (quarterly and semiannual) based on 2016 GW Monitoring Program (Ecology, December, 2016).
Sampling Frequency	events/year	-	4	2	2	1	4	2	2	1	
Annual Labor Costs											
Preparation Time	hour/event	7	28	14	14	7	28	14	14	7	Based on current labor for Pasco ground water monitoring. Preparation time includes field notebook, labels, reservations, bottle order, etc. Assumed 2.5 persons needed per event (i.e. two people for two quarterly events and three people for two quarterly/semiannual events).
Sample Collection Time	hour/well	0.75	27	13.5	18	4.5	36	13.5	10.5	5.25	
Equipment Load/Unload and Calibration Time	hour/event	5	20	10	10	5	20	10	10	5	
Drive to/from Pasco Landfill Site (Roundtrip)	hour/event	8	32	16	16	8	32	16	16	8	
Truck Rental/Return	hour/event	2.5	10	5	5	2.5	10	5	5	2.5	
Total Labor Time	**hours**	**-**	**117.0**	**58.5**	**63.0**	**27.0**	**126.0**	**58.5**	**55.5**	**27.8**	
Field Staff Billing Rate	$/hour	$100	$11,700	$5,850	$6,300	$2,700	$12,600	$5,850	$5,550	$2,775	
Number of Field Staff	person	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
Total Field Work Costs	**$**	**-**	**$29,250**	**$14,625**	**$15,750**	**$6,750**	**$31,500**	**$14,625**	**$13,875**	**$6,938**	
Data Management, Reporting, and Production	$/hour	$115	$30,188	$10,063	$17,250	$17,250	$30,188	$10,063	$17,250	$17,250	Assumed a total of 350 hours (years 1 to 10) and 150 hours (years 11 to 30).
Total Labor Costs (Field Work, Data Management and Reporting)	**$**	**-**	**$59,438**	**$24,688**	**$33,000**	**$24,000**	**$61,688**	**$24,688**	**$31,125**	**$24,188**	-
Annual Analytical Costs											
VOCs (Method EPA-8260 and 8260-SIM)	$/sample	$168	$6,062	$3,031	$4,042	$1,010	$8,083	$3,031	$2,358	$1,179	Analytical costs based on agreed rates with ALS, valid through 2017.
Total Cr (Method EPA-200.8)	$/sample	$30	$0	$120	$120	$60	$0	$120	$120	$60	
SVOCs (Method EPA 8270 and 8270-SIM)	$/sample	$288	$0	$2,304	$2,304	$1,152	$0	$2,304	$2,304	$1,152	
Herbicides (Method EPA 8151)	$/sample	$361	$0	$1,443	$1,443	$721	$0	$1,443	$1,443	$721	
Total Analytical Costs	**$**	**-**	**$6,062**	**$6,898**	**$7,908**	**$2,944**	**$8,083**	**$6,898**	**$6,224**	**$3,112**	
Annual Data Validation Costs											
Third Party Validation (Quarterly)	$/event	$176	$704	-	-	-	$703.80	-	-	-	Includes validation data costs for the specified analytes only.
Third Party Validation (Semiannual and Annual)	$/event	$325	-	$650	$650	$325	-	$650	$650	$325	
Total Data Validation Costs	**$**	**-**	**$704**	**$650**	**$650**	**$325**	**$704**	**$650**	**$650**	**$325**	
Ground Water Monitoring Costs per Year ($)			**$66,204**	**$32,235**	**$41,558**	**$27,269**	**$70,475**	**$32,235**	**$37,999**	**$27,625**	-

Note:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

Tables B
Zone A
Cost Summaries

Table B-1
Zone A – Cap Monitoring, Maintenance, and Replacement Cost Summary

Year	Yearly Routine Settlement Monitoring			Cap Evaluation and Performance Reporting	Cap Maintenance	Cap Inspection	Cap Replacement
	Year 1 to 10	Year 11 to 20	Year 21 to 30	Years 1 to 30	Years 1 to 30	Years 1 to 30	Years 1 and 15
	$61,750	$30,875	$15,438	$46,640	$24,880	$9,180	$485,469
	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	(lump sum)
1	$59,951			$45,282	$24,155	$8,913	$471,329
2	$58,205			$43,963	$23,452	$8,653	
3	$56,510			$42,682	$22,769	$8,401	
4	$54,864			$41,439	$22,106	$8,156	
5	$53,266			$40,232	$21,462	$7,919	
6	$51,715			$39,060	$20,837	$7,688	
7	$50,208			$37,923	$20,230	$7,464	
8	$48,746			$36,818	$19,641	$7,247	
9	$47,326			$35,746	$19,068	$7,036	
10	$45,948			$34,705	$18,513	$6,831	
11		$22,305		$33,694	$17,974	$6,632	
12		$21,655		$32,712	$17,450	$6,439	
13		$21,024		$31,760	$16,942	$6,251	
14		$20,412		$30,835	$16,449	$6,069	
15		$19,817		$29,936	$15,970	$5,892	$311,604
16		$19,240		$29,065	$15,504	$5,721	
17		$18,680		$28,218	$15,053	$5,554	
18		$18,136		$27,396	$14,614	$5,392	
19		$17,608		$26,598	$14,189	$5,235	
20		$17,095		$25,823	$13,775	$5,083	
21			$8,298	$25,071	$13,374	$4,935	
22			$8,057	$24,341	$12,985	$4,791	
23			$7,822	$23,632	$12,606	$4,651	
24			$7,594	$22,944	$12,239	$4,516	
25			$7,373	$22,276	$11,883	$4,384	
26			$7,158	$21,627	$11,537	$4,257	
27			$6,950	$20,997	$11,201	$4,133	
28			$6,747	$20,385	$10,874	$4,012	
29			$6,551	$19,792	$10,558	$3,895	
30			$6,360	$19,215	$10,250	$3,782	
Subtotals (Years 1-30)	**$526,740**	**$195,972**	**$72,911**	**$914,165**	**$487,659**	**$179,932**	**$782,933**
Total Cap Monitoring, Maintenance, and Inspection Costs (NPV $)			**Alts. A-1 to A-4 (Years 1 - 30)**		**$2,377,378**		**-**
			Alts. A-5, A-6, A-7, and A-9 (Years 1 - 30)		**$2,059,129**		**-**
			Alt. A-8	**Alt. A-2 (Years 1-10)**	**$1,215,127**		**-**
				Alt. A-7 (Years 11-30)	**$1,054,698**		**-**
Cap Replacement (NPV $)			**Alts. A-1 to A-4 (Years 1 and 15)**		**-**		**$782,933**
			Alt. A-8 (Year 1)		**-**		**$471,329**
Subtotals (Years 1-10)	**$526,740**	**-**	**-**	**$397,849**	**-**	**$78,307**	**-**
Total Cap Monitoring and Inspection Costs (NPV $)				**No Action Alternative**	**$1,002,896**		**-**

Notes:

1. Cap replacement is assumed to occur at years 1 and 15 for Alternatives A-1 to A-4. A new RCRA cap is assumed to be installed after drum removal for Alternatives A-5 to A-9 (costs for new RCRA cap included under site restoration). Cap replacement is assumed to occur at year 1 for Alternative A-8.

2. Alternatives A-5 to A-9 assume 60% of routine settlement monitoring effort compared to Alternatives A-1 to A-4, due to the reduced likeliness of settlement for backfill material.

3. Total costs are presented on a net present value basis (assuming a 3% discount rate).

NPV = net present value

Tables B
Zone A
Cost Summaries

Table B-2
Zone A – Routine Settlement Monitoring Costs Per Year

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Years 1 to 10					**$61,750**
Labor					
Principal	52	$/hour	$180	$9,360	
Senior Engineer	52	$/hour	$135	$7,020	
Project Environmental Scientist	26	$/hour	$105	$2,730	
Eric Jensen	48	$/hour	$105	$5,040	
Consultant					
Years 11 to 20					**$30,875**
Labor					
Principal	26	$/hour	$180	$4,680	
Senior Engineer	26	$/hour	$135	$3,510	
Project Environmental Scientist	13	$/hour	$105	$1,365	
Eric Jensen	24	$/hour	$105	$2,520	
Consultant					
Years 21 to 30					**$15,438**
Labor					
Principal	13	$/hour	$180	$2,340	
Senior Engineer	13	$/hour	$135	$1,755	
Project Environmental Scientist	7	$/hour	$105	$683	
Eric Jensen	12	$/hour	$105	$1,260	
Consultant					

Table B-3
Zone A – Cap Evaluation and Performance Reporting Costs Per Year

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Years 1 to 30					**$46,640**
Labor					
Principal	16	$/hour	$180	$2,880	
Senior Engineer	16	$/hour	$135	$2,160	
Consultant					

Tables B
Zone A
Cost Summaries

Table B-4
Zone A – Cap Maintenance Costs Per Year

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Years 1 to 30					**$24,880**
Labor					
Principal	8	$/hour	$180	$1,440	
Senior Engineer	24	$/hour	$135	$3,240	
Eric Jensen	40	$/hour	$105	$4,200	
Consultant					

Table B-5
Zone A – Cap Inspection Costs Per Year

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Years 1 to 30					**$9,180**
Labor					
Senior Engineer	12	$/hour	$135	$1,620	
Project Environmental Scientist	12	$/hour	$105	1,260	

Table B-6
Zone A – Cap Replacement Costs

Item	Unit	Quantity	Unit Cost	Subtotal
Bonding and Insurance	LS	1	$9,070.00	$ 9,070
General Contractor Mob/Demob	LS	1	$22,680.00	$ 22,680
Health and Safety Program	LS	1	$10,000.00	$ 10,000
Construction Surveying	LS	1	$5,000.00	$ 5,000
Cut Grading	CY	260	$4.25	$ 1,105
Fill Grading and Compaction	CY	450	$2.88	$ 1,296
Liner Crew Mob/Demob	LS	2	$1,400.00	$ 2,800
GCL (Needle Punched)	FT^2	135,510	$0.48	$ 65,045
60-Mil HDPE Textured Membrane	FT^2	135,510	$0.62	$ 84,016
Cover Penetration Seals (8"Ø Average Well Casing)	EA	20	$175.00	$ 3,500
16-ounce Non-Woven Geotextile (Fusion Seamed)	FT^2	124,140	$0.40	$ 49,656
Drainage Layer (12" Thick Sand)	CY	4,060	$27.12	$ 110,107
8-ounce Non-Woven Geotextile	FT^2	109,620	$0.18	$ 19,732
Cover Soil (24" Thick)	CY	9,200	$8.87	$ 81,604
Drainage Layer/Pond Edge Interface (2 layers)	LF	1,000	$11.71	$ 11,710
Hydroseed	1,000 FT^2	124	$65.71	$ 8,148
Cap Replacement Costs Subtotal				***$ 485,469***

Notes:
1. Cap replacement costs provided by SCS Engineers (October 2016).
CY = cubic yard
EA = each
FT^2 = feet squared
LF = linear foot
LS = lump sum

Tables C
Zone A
Cost Summaries

Table C-1
Zone A – SVE System Operation, Maintenance, and Repair Cost Summary

	Yearly SVE Operational Costs (Excludes Electrical and RTO Costs)			SVE Condensate Disposal			SVE System Electrical Costs	Vapor Sampling and Parameter Data Collection Labor Costs			Major SVE Equipment Upgrades	Additional Well Installation and Startup (Alts. A-2 through A-4 only)	Laboratory Analytical Fees and Data Validation	RTO Utility Consumption, Service, Compliance Sampling			Major RTO Part Upgrades	Contingent Technical Responses to Site Operations
	Year 1 - 5	Year 6 - 10	Year 11 - 30	Year 1 - 5	Year 6 - 10	Year 11 - 30	Years 1 - 30	Years 1 - 10	Years 11 - 20	Years 20 - 30	Years 5 - 20	Year 2	Years 1 - 30	Years 1 - 2	Years 3 - 5	Years 6 - 30	Years 10 - 20	Years 1 - 30
	$176,133	$150,000	$90,000	$50,800	$30,480	$15,240	$15,000	$116,747	$40,000	$35,000	$400,000	$259,550	$25,000	$40,900	$25,700	$36,200	$15,000	$75,000
Year	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	(lump sum)	(lump sum)	($/year)	($/year)	($/year)	($/year)	($/10 years)	($/year)
1	$171,003			$49,320			$14,563	$113,346					$24,272	$39,709				$72,816
2	$166,023			$47,884			$14,139	$110,045				$244,651	$23,565	$38,552				$70,695
3	$161,187			$46,489			$13,727	$106,840					$22,879		$23,519			$68,636
4	$156,492			$45,135			$13,327	$103,728					$22,212		$22,834			$66,637
5	$151,934			$43,821			$12,939	$100,707			$345,044		$21,565		$22,169			$64,696
6		$125,623			$25,527		$12,562	$97,773					$20,937			$30,317		$62,811
7		$121,964			$24,783		$12,196	$94,926					$20,327			$29,434		$60,982
8		$118,411			$24,061		$11,841	$92,161					$19,735			$28,577		$59,206
9		$114,963			$23,360		$11,496	$89,477					$19,160			$27,744		$57,481
10		$111,614			$22,680		$11,161	$86,870					$18,602			$26,936	$11,161	$55,807
11			$65,018			$11,010	$10,836		$28,897				$18,061			$26,152		$54,182
12			$63,124			$10,689	$10,521		$28,055				$17,534			$25,390		$52,603
13			$61,286			$10,378	$10,214		$27,238				$17,024			$24,650		$51,071
14			$59,501			$10,075	$9,917		$26,445				$16,528			$23,932		$49,584
15			$57,768			$9,782	$9,628		$25,674				$16,047			$23,235		$48,140
16			$56,085			$9,497	$9,348		$24,927				$15,579			$22,559		$46,738
17			$54,451			$9,220	$9,075		$24,201				$15,125			$21,902		$45,376
18			$52,866			$8,952	$8,811		$23,496				$14,685			$21,264		$44,055
19			$51,326			$8,691	$8,554		$22,811				$14,257			$20,644		$42,771
20			$49,831			$8,438	$8,305		$22,147		$221,470		$13,842			$20,043	$8,305	$41,526
21			$48,379			$8,192	$8,063			$18,814			$13,439			$19,459		$40,316
22			$46,970			$7,954	$7,828			$18,266			$13,047			$18,893		$39,142
23			$45,602			$7,722	$7,600			$17,734			$12,667			$18,342		$38,002
24			$44,274			$7,497	$7,379			$17,218			$12,298			$17,808		$36,895
25			$42,985			$7,279	$7,164			$16,716			$11,940			$17,289		$35,820
26			$41,733			$7,067	$6,955			$16,229			$11,592			$16,786		$34,777
27			$40,517			$6,861	$6,753			$15,757			$11,255			$16,297		$33,764
28			$39,337			$6,661	$6,556			$15,298			$10,927			$15,822		$32,781
29			$38,191			$6,467	$6,365			$14,852			$10,609			$15,361		$31,826
30			$37,079			$6,279	$6,180			$14,420			$10,300			$14,914		$30,899
Subtotals (Years 1 - 10)	**$1,399,213**			**$353,060**			**$127,953**	**$995,873**			**$345,044**	**-**	**$213,255**	**$289,791**			**$11,161**	**$639,765**
Subtotals (Years 1 - 30)	**$2,395,535**			**$521,771**			**$294,007**	**$1,415,067**			**$566,514**	**$244,651**	**$490,011**	**$690,534**			**$19,467**	**$1,470,033**

Total SVE System Operation, Maintenance, and Repair Costs (NPV $)		**Alts. A-1 through A-5 (Years 1 - 30)**	**$7,862,938**
		Alts. A-6, A-7, and A-9 (Years 1 - 10)	**$3,724,189**
	Alt. A-8	**Alt. A-2 (Years 1 - 10)**	**$4,375,116**
		Alt. A-7 (Years 11 - 20)	**$1,627,010**
Total Additional SVE Well Installation Costs (NPV $)		**Alts. A-2, A-3, A-4, and A-8 (Year 2)**	**$244,651**

Note: 1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

NPV = net present value

Tables C
Zone A
Cost Summaries

Table C-2
Zone A – Yearly SVE Operational Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$79,133**
Principal	40	$/hour	180	7,200	
Senior Engineer	260	$/hour	135	35,100	
Project Environmental Scientist	60	$/hour	105	6,300	
Technical Editor	13	$/hour	110	1,467	
Draftsperson	40	$/hour	85	3,400	
Eric Jensen	0.33	$/year	77,000	25,667	
Consultant					**$85,000**
HiLine Engineering & Fabrication, Inc.	1	$/year	42,000	42,000	
Glacier Engineering Services, Inc.	1	$/year	35,000	35,000	
Freestone Environmental Services, Inc.	1	$/year	3,000	3,000	
NRC Environmental Services, Inc.	1	$/year	5,000	5,000	
Expenses					**$12,000**
General Operational Exper	1	$/year	6,000	6,000	
Federal Express	1	$/year	3,000	3,000	
H.D. Fowler Company	1	$/year	3,000	3,000	
W.W. Grainger, Inc.	1	$/year	2,000	2,000	
Print Time	1	$/year	1,000	1,000	
ESTIMATED YEARLY SVE OPERATIONAL COSTS					**$176,133**

Note:

1. These costs represent one third of the total SVE annual costs for labor; the remaining two-thirds is for vapor sampling.

Table C-3
Zone A – Vapor Sampling and Parameter Data Collection Labor Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$116,747**
Operation and Maintenance					
Principal	80	$/hour	180	$14,400	
Senior Engineer	180	$/hour	135	$24,300	
Project Environmental Scientist	220	$/hour	105	$23,100	
Technical Editor	27	$/hour	110	$2,933	
Draftsperson	8	$/hour	85	$680	
Eric Jensen	0.67	$/year	77,000	$51,333	
ESTIMATED VAPOR SAMPLING & PARAMETER DATA COLLECTION LABOR COSTS					**$116,747**

Tables C
Zone A
Cost Summaries

Table C-4
Zone A – Additional SVE Well Installation and Startup

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal	Notes
Labor					**$82,050**	
Principal	70	$/hour	$180.00	$12,600.00		-
Senior Engineer	200	$/hour	$135.00	$27,000.00		-
Project Environmental Scientist	140	$/hour	$105.00	$14,700.00		-
Technical Editor	50	$/hour	$110.00	$5,500.00		-
Draftsperson	50	$/hour	$85.00	$4,250.00		-
Eric Jensen	180	$/hour	$100.00	$18,000.00		-
Expenses					**$19,500**	
Lodging/Meals	1	LS	$14,000.00	$14,000.00		Assumes two workers in the field for 35 days.
Vehicle	1	LS	$2,500.00	$2,500.00		-
Equipment	1	LS	$3,000.00	$3,000.00		-
Subcontractors					**$158,000**	
Drilling Contractor	1	LS	$40,000.00	$40,000.00		Assumes three additional SVE wells to be installed.
Piping Contractor	1	LS	$45,000.00	$45,000.00		Assumes piping to/from existing wells and three new SVE wells to be connected.
Mechanical Engineering	1	LS	$48,000.00	$48,000.00		Assumes additional LEL, flow, vacuum, and solenoid points to be added.
Electrical Engineering	1	LS	$25,000.00	$25,000.00		Assumes additional programming code and PLC adjustments.
Estimated Additional SVE Well Installation/Startup Costs					**$259,550**	

Note:
LS = lump sum

Tables C
Zone A
Cost Summaries

Table C-5
Zone A – RTO Utility Consumption, Service, Compliance Sampling Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Years 1 to 2					**$40,900**
Stack Testing	1	$/year	$5,000	$5,000	
Fuel	1	$/year	$3,700	$3,700	
Annual Servicing	1	$/year	$7,500	$7,500	
Electricity	1	$/year	$21,000	$21,000	
Parts	1	$/year	$3,700	$3,700	
Years 3 to 5					**$25,700**
Stack Testing	1	$/year	$5,000	$5,000	
Fuel	1	$/year	$6,500	$6,500	
Annual Servicing	1	$/year	$7,500	$7,500	
Electricity	1	$/year	$3,000	$3,000	
Parts	1	$/year	$3,700	$3,700	
Years 6 to 30					**$36,200**
Stack Testing	1	$/year	$5,000	$5,000	
Fuel	1	$/year	$17,000	$17,000	
Annual Servicing	1	$/year	$7,500	$7,500	
Electricity	1	$/year	$3,000	$3,000	
Parts	1	$/year	$3,700	$3,700	

Table D-1
Zone A
Institutional Control Cost Summary

Task	Unit	Unit Assumption	Quantities/Costs				Reference/Comments
					Alt. A-8		
			Alts. A-1 to A-4	Alts. A-5, A-6, A-7, and A-9	Alt. A-2 (Years 1-10)	Alt. A-7 (Years 11-30)	
Construction Costs							
Fencing	linear foot	-	-	1,530	-	1,530	Based on Zone A plan view.
	$/linear foot	$29	-	$44,370	-	$32,054	Similar project.
Signage	lump sum	$1,000	-	$1,000	-	$722	Similar project.
Environmental Covenant	lump sum	$6,900	$6,900	$6,900	$6,900	-	Similar project.
Sales Tax	$	8.6%	-	$3,902	-	$2,819	Current sales tax is 8.6%.
Total Construction Costs	**$**	**-**	**$6,900**	**$56,172**	**$6,900**	**$35,595**	**-**
Non-Construction Costs							
O&M - Fencing	$/year	$5,000	$98,002	$98,002	$42,651	$55,351	For a 30-year time period.
Environmental Covenant	$/year	$500	$9,800	$9,800	$4,265	$5,535	Similar project.
Residential Water	$/year	$24,000	$470,411	$470,411	$204,725	$265,686	For a 30-year time period, based on 2016 Pasco Budget.
Beneficial Water Use Survey and Reporting	$/year	$2,200	$43,121	$43,121	$18,766	$24,355	Beneficial water use survey conducted annually of all residences within the GPA and results reported to Ecology (ICP 2013). Assumed 20-hour survey and 2-hour reporting.
Total Non-Construction Costs	**$**	**-**	**$621,334**	**$621,334**	**$270,407**	**$350,927**	-
Total Institutional Control Costs (NPV $)			**$628,234**	**$677,506**	**$277,307**	**$386,522**	-

Note:
1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Construction costs for Alternative A-8 are discounted for year 11.
NPV = net present value

Table E-1
Zone A
In Situ Chemical Oxidation (ISCO) Cost Summary

Task	Alt. A-3	Alt. A-4
Well Installation and Data Collection	$105,249	$464,257
Boring Logs	$6,259	$5,538
IDW Profiling and Disposal	$52,537	$55,723
ISCO Treatment Events	$226,662	$19,069,297
Injection Well Decommission	$19,330	-
Total ISCO Amendment Costs (NPV $)	**$410,037**	**$19,594,815**

Notes:

1. Detailed costs for ISCO treatments are provided in Appendix E, Attachment B.

2. Total costs are presented on a net present value basis (assuming a 3% discount rate).

IDW = investigation-derived waste

NPV = net present value

Table F-1
Zone A
SVE Well Drilling Cost Summary

Task	Alternative				
	A-5	A-6	A-7	A-9	A-8
	(Year 0)				(Year 11)
Clear and Level Land (subcontractor)	$23,026	$15,761	$15,761	$15,761	$11,386
Deep Horizontal Well Drilling (subcontractor)	$266,420	$266,420	$266,420	$266,420	$192,467
Shallow Horizontal Well Drilling (subcontractor)	$104,800	-	-	-	-
Well Installation Labor	$52,205	$38,350	$38,350	$38,350	$27,705
IDW Profiling and Disposal	$59,870	$45,027	$45,027	$45,027	$32,528
Borelogs	$10,320	$6,860	$6,860	$6,860	$4,956
SVE Piping from New Wells	$84,205	$64,706	$64,706	$64,706	$46,745
As-Built Reporting and O&M Manual Updates	$19,640	$16,420	$16,420	$16,420	$11,862
Total SVE Well Drilling (NPV $)	**$620,486**	**$453,544**	**$453,544**	**$453,544**	**$327,650**

Notes:

1. Detailed costs for well drilling are provided in Appendix E, Attachment C.
2. Costs for Alternative A-8 are discounted for year 11.
3. Total costs are presented on a net present value basis (assuming a 3% discount rate).

IDW = investigation-derived waste
NPV = net present value
O&M = operation and maintenance
SVE = soil vapor extraction

Tables G
Zone A
Cost Summaries

Table G-1
Zone A – Air Sparging and Ozone Treatment, Operation, and Maintenance Cost Summary

Year	Air Sparge Well Installation	SVE Well Installation	IDW Profiling and Disposal	Borelogs	SVE/ Sparge Piping	Compound Upgrades	Additional Sparge and SVE Equipment Upgrades	As-Built and O&M Plan Updates	Additional Operational Labor	Power Consumption	Decomm. Sparge Wells	System Decomm.
	Year 5	Year 5	Year 5	Year 5	Year 5	Year 5	Year 5	Year 5	Years 5 – 30	Years 5 – 30	Year 10 or 30	Year 10 or 30
	$126,865	$44,982	$71,660	$5,010	$70,255	$49,748	$107,508	$18,630	$31,160	$16,224	$19,369	$21,728
	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)	($/year)
1												
2												
3												
4												
5	$109,435	$38,802	$61,814	$4,322	$60,603	$42,913	$92,737	$16,070	$26,879	$13,995		
6									$26,096	$13,588		
7									$25,336	$13,192		
8									$24,598	$12,808		
9									$23,882	$12,434		
10									$23,186	$12,072	$14,412	$16,168
11									$22,511	$11,721		
12									$21,855	$11,379		
13									$21,218	$11,048		
14									$20,600	$10,726		
15									$20,000	$10,414		
16									$19,418	$10,110		
17									$18,852	$9,816		
18									$18,303	$9,530		
19									$17,770	$9,252		
20									$17,253	$8,983		
21									$16,750	$8,721		
22									$16,262	$8,467		
23									$15,789	$8,221		
24									$15,329	$7,981		
25									$14,882	$7,749		
26									$14,449	$7,523		
27									$14,028	$7,304		
28									$13,619	$7,091		
29									$13,223	$6,885		
30									$12,838	$6,684	$7,980	$8,952
Subtotals (Years 1 - 10)	**$109,435**	**$38,802**	**$61,814**	**$4,322**	**$60,603**	**$42,913**	**$92,737**	**$16,070**	**$149,976**	**$78,089**	**$14,412**	**$16,168**
Subtotals (Years 1 - 30)	**$109,435**	**$38,802**	**$61,814**	**$4,322**	**$60,603**	**$42,913**	**$92,737**	**$16,070**	**$494,925**	**$257,695**	**$7,980**	**$8,952**
Total Air Sparging and Ozone Treatment, Operation, and Maintenance Costs (NPV $)									**Alt. A-2 (Years 1 - 30)**		**$1,196,247**	
									Alt. A-8 (Years 1 - 10)		**$685,341**	

Notes:
1. Detailed costs for air sparging and ozone treatments are provided in Appendix E, Attachment D.
2. Decommisioning of wells for Alternative A-2 occur only at year 30. Decommisioning of wells for Alternative A-8 occur only at year 10.
3. Total costs are presented on a net present value basis (assuming a 3% discount rate).

Tables G
Zone A
Cost Summaries

Table G-2
Zone A – Air Sparge Well Installation Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$15,440**
Principal	8	$/hour	180	1,440	
Senior Engineer	32	$/hour	135	4,320	
Technical Editor	88	$/hour	110	9,680	
Contractor/Support					**$93,556**
Driller	1	$/year	93,156	93,156	
Utility Locate	1	$/year	400	400	
Expenses					**$3,836**
Equipment Expense	16	$/day	50	800	
Travel Expense	8	$/day	330	3,036	
Estimated Air Sparge Well Installation Costs					**$126,865**

Notes:

1. This cost estimate is for the installation of 12 air sparge wells to a depth of 88 feet below ground surface.
2. Assumes the wells can be installed in 12 field days.
3. Assumes three weeks of travel.
4. Assumes no sampling or analysis.
5. Based on quote by Cascade provided to EPI on March 13, 2014.
6. Assumes mini-sonic drill rig for installation.

Table G-3
Zone A – SVE Well Installation Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$10,915**
Principal	8	$/hour	180	1,440	
Senior Engineer	27	$/hour	135	3,645	
Technical Editor	53	$/hour	110	5,830	
Contractor/Support					**$27,956**
Driller	1	$/year	27,556	27,556	
Utility Locate	1	$/year	400	400	
Expenses					**$1,918**
Equipment Expense	8	$/day	50	400	
Travel Expense	4	$/day	330	1,518	
Estimated SVE Well Installation Costs					**$44,982**

Notes:

1. This cost estimate is for the installation of 4 SVE wells to a depth of 55 feet below ground surface.
2. Assumes the wells can be installed in 5 field days.
3. Assumes one week of travel.
4. Assumes no sampling or analysis.
5. Based on quote by Cascade provided to EPI on March 13, 2014.
6. Assumes mini-sonic drill rig for well installation.

Tables G
Zone A
Cost Summaries

Table G-4
Zone A – IDW Profiling and Disposal Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$9,940**
Principal	4	$/hour	180	720	
Senior Engineer	14	$/hour	135	1,890	
Project Environmental Scientist	30	$/hour	105	3,150	
Technical Editor	38	$/hour	110	4,180	
Contractor/Support					**$25,600**
Driller	1	$/year	4,000	4,000	
IDW	36	$/year	600	21,600	
Expenses					**$32,280**
Laboratory Expense	36	$/event	747	30,926	
Equipment Expense	1	LS	250	250	
Travel Expense	1	LS	960	1,104	
Estimated IDW Profiling and Disposal Costs					**$71,660**

Notes:

1. Assumes one trip to the site to perform sample collection.
2. Assumes 2 field personnel for 2 days of opening and sampling drums for profiling.
3. Assumes 4 drums of IDW are generated per SVE well.
4. Assumes 4 drums of IDW are generated for each sparge well in soils above the water table.
5. Assumes 3 drums of IDW below the water table for each air sparge well.
6. Assumes composite sampling of soils above or below the water table may be performed at each well location.

LS = lump sum

Table G-5
Zone A – Borelog Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$5,010**
Principal	6	$/hour	180	1,080	
Senior Engineer	12	$/hour	135	1,620	
Technical Editor	21	$/hour	110	2,310	
Estimated Borelogs Costs					**$5,010**

Notes:

1. This cost estimate is for the 16 borelogs associated with the installation of remediation wells.

Tables G
Zone A
Cost Summaries

Table G-6
Zone A – SVE and Air Sparge/Ozone Piping to Equipment Compound Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$24,290**
Principal	10	$/hour	180	1,800	
Senior Engineer	46	$/hour	135	6,210	
Project Engineer	20	$/hour	125	2,500	
Technical Editor	116	$/hour	110	12,760	
Drafter	12	$/hour	85	1,020	
Contractor/Support					**$35,800**
Utility Locate	2	$/year	400	800	
Contractor	1	LS	35,000	35,000	
Expenses					**$4,795**
Equipment Expense	20	$/day	50	1,000	
Travel Expense	1	LS	3,300	3,795	
				Estimated Piping Costs	**$70,255**

Notes:

1. Cost is for 500 feet of air sparge and SVE PVC piping.
2. Assumes installation can be performed in 15 field days.
3. Assumes three weeks of travel.
4. Assumes connection of piping to SVE/AS remediation equipment.

LS = lump sum

Table G-7
Zone A – Equipment Compound Upgrade Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$23,920**
Principal	6	$/hour	180	1,080	
Managing Engineer	6	$/hour	150	900	
Senior Engineer	56	$/hour	135	7,560	
Project Engineer	32	$/hour	125	4,000	
Technical Editor	48	$/hour	110	5,280	
Drafter	60	$/hour	85	5,100	
Contractor/Support					**$20,900**
Utility Locate	1	$/year	400	400	
Permit Fees	1	$/year	500	500	
Electrical	1	$/year	12,000	12,000	
Contractor	1	LS	8,000	8,000	
Expenses					**$1,793**
Equipment Expense	5	$/day	25	125	
Travel Expense	1	LS	1,450	1,668	
				Estimated Upgrades Costs	**$49,748**

Notes:

1. Cost is for upgrades of old NoVOCs building with updated electrical, communications, etc.
2. Electrical upgrades are included.
3. Assumes electrical engineer from HiLine will run communication wires and update PLCs and incorporate additional equipment into HMI.
4. Assumes one week of travel.
5. Assumes expansion can be performed in 10 field days by a contractor, with 5 days of EPI oversight.
6. Additional electrical transformer may be required for additional power consumption but is not included.

LS = lump sum

Tables G
Zone A
Cost Summaries

Table G-8
Zone A – Additional Sparge and SVE Equipment Upgrade Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$41,640**
Principal	10	$/hour	180	1,800	
Senior Engineer	106	$/hour	135	14,310	
Project Engineer	96	$/hour	125	12,000	
Geologist	124	$/hour	105	13,020	
Drafter	6	$/hour	85	510	
Contractor/Support					**$52,000**
Ozone Generator	1	LS	4,000	4,000	
Sparge Equipment	1	LS	21,000	21,000	
SVE Equipment	1	LS	27,000	27,000	
Expenses					**$6,068**
Equipment Expense	15	$/day	25	375	
Travel Expense	1	LS	4,950	5,693	
Estimated Additional Air Sparge/SVE Upgrades Costs					**$107,508**

Notes:

1. Assumes the cost for an additional skid-mounted SVE blower with motor and KO tank and controls.
2. Assumes the cost for an additional skid-mounted AS compressor and controls.
3. Assumes the cost for the procurement of an ozone generator.
4. Assumes installation can be completed in 15 field days.
5. Assumes an engineer on site for the first week to oversee installation and a staff scientist to oversee the last two weeks of installation.

LS = lump sum

Table G-9
Zone A – As-Built and O&M Manual Update Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$18,630**
Principal	2	$/hour	180	360	
Senior Engineer	42	$/hour	135	5,670	
Project Engineer	60	$/hour	125	7,500	
Drafter	60	$/hour	85	5,100	
ESTIMATED ADDITIONAL AS BUILT AND O&M MANUALS COSTS					**$18,630**

Notes:

1. This cost estimate is for updates to the O&M manual and as-builts due to newly procured equipment.

Tables G
Zone A
Cost Summaries

Table G-10
Zone A – Additional Equipment Maintenance and Labor Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$31,160**
Principal	16	$/hour	180	2,880	
Senior Engineer	40	$/hour	135	5,400	
Eric Jensen	208	$/hour	110	22,880	
Estimated Additional Equipment Maintenance/Labor Costs					**$31,160**

Notes:

1. Based on Eric Jensen's labor of an additional 4 hours per week to operate and maintain the equipment.

Table G-11
Zone A – Power Consumption Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Contractor/Support					**$14,108**
Sparge Compressor	1	LS	9175	9,175	
SVE Blower	1	LS	4,587	4,587	
Condensate Pumps	1	LS	250	250	
County Tax, Fees	1	LS	96	96	
Estimated Power Consumption Costs					**$16,224**

Notes:

1. Assumes 20 hp compressor operating continuously for one year.
2. Assumes 10 hp SVE blower operating continuously for one year.
3. Assumes electrical rate of $0.0702/KW-hour.
4. Electrical costs, taxes, and fees based on Franklin PUD invoice costs.
5. Assumes condensate will be injected into the regenerative thermal oxidizer.

LS = lump sum

Tables G
Zone A
Cost Summaries

Table G-12
Zone A – Decommission Sparge Wells Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$7,580**
Principal	2	$/hour	180	360	
Senior Engineer	16	$/hour	135	2,160	
Technical editor	46	$/hour	110	5,060	
Contractor/Support					**$9,000**
Driller	1	LS	9,000	9,000	
Expenses					**$1,439**
Equipment Expense	6	$/day	50	300	
Travel Expense	1	LS	990	1,139	
				Estimated Decommission Sparge Wells Costs	**$19,369**

Notes:

1. This cost estimate is for the decommissioning of 12 air sparge wells to a depth of 88 feet below ground surface and 4 SVE wells to 55 feet below ground surface.

2. Assumes the wells can be decommissioned in 4 field days.

LS = lump sum

Table G-13
Zone A – System Decommission Costs

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Labor					**$13,210**
Principal	2	$/hour	180	360	
Senior Engineer	6	$/hour	135	810	
Project Engineer	40	$/hour	125	5,000	
Technical Editor	32	$/hour	110	3,520	
Eric Jensen	32	$/hour	110	3,520	
Contractor/Support					**$6,000**
Contractor	1	LS	6,000	6,000	
Expenses					**$1,618**
Equipment Expense	4	$/day	25	100	
Travel Expense	1	LS	1,320	1,518	
				Estimated System Decommission Costs	**$21,728**

Notes:

1. This cost estimate is for decommissioning the additional SVE equipment.

2. Assumes completion of decommission in 5 field days.

3. Assumes one week of travel.

LS = lump sum

Tables H
Zone A
Area of Contamination (AOC)

Table H-1
Zone A – Area of Contamination (AOC) – AOC Cell and RCRA Cap Construction Cost Summary

Task	Unit	Unit Cost	Alts. A-5 and A-6		Alt. A-7		Alt. A-8 (Year 11)	Reference/Comments
			Quantity	Cost	Quantity	Cost	Cost	
Assumed Depth of AOC	FT	-	10	-	10	-	-	
On-Site AOC Cell Construction								
Contractor Mobilization and Demobilization	LS	$150,000	1	$150,000	1	$150,000	$108,363	
Clearing and Grubbing	AC	$5,000	7.7	$38,500	11.7	$58,500	$42,262	Area of RCRA Cap (see Table 1c of Appendix D)
Excavation Volume and Stockpiling	CY	$4.00	154,258	$617,032	245,935	$983,740	$710,675	Excavation volume for AOC (see Table 1c of Appendix D)
Anchor Trench Excavation/Backfill	LF	$15.00	2,200	$33,000	2,740	$41,100	$29,692	Perimeter at top of AOC cell
Primary GCL	FT^2	$0.65	336,463	$218,701	520,825	$338,536	$244,566	Sum of bottom waste area and layback side-slope area, plus 10% for material overlap (see Table 1c of Appendix D)
Primary Geomembrane	FT^2	$0.69	336,463	$232,159	520,825	$359,369	$259,616	Sum of bottom waste area and layback side-slope area, plus 10% for material overlap (see Table 1c of Appendix D)
Primary Geotextile	FT^2	$0.25	336,463	$84,116	520,825	$130,206	$94,064	Sum of bottom waste area and layback side-slope area, plus 10% for material overlap (see Table 1c of Appendix D)
Secondary GCL	FT^2	$0.65	336,463	$218,701	520,825	$338,536	$244,566	Sum of bottom waste area and layback side-slope area, plus 10% for material overlap (see Table 1c of Appendix D)
Secondary Geomembrane	FT^2	$0.69	336,463	$232,159	520,825	$359,369	$259,616	Sum of bottom waste area and layback side-slope area, plus 10% for material overlap (see Table 1c of Appendix D)
Secondary Geotextile	FT^2	$0.25	336,463	$84,116	520,825	$130,206	$94,064	Sum of bottom waste area and layback side-slope area, plus 10% for material overlap (see Table 1c of Appendix D)
Low Permeability Soil	CY	$4.00	33,986	$135,944	52,609	$210,434	$152,022	Sum of bottom waste area and layback side-slope area, multiplied by 3-foot depth (see Table 1c of Appendix D)
Temporary Silt Fence	LF	$3.50	2,500	$8,750	3,070	$10,745	$7,762	Perimeter of RCRA cap.
Temporary Fiber Roll	LF	$3.50	2,500	$8,750	3,070	$10,745	$7,762	Perimeter of RCRA cap.
As-Built Surveys	AC	$700.00	23.1	$16,170	35.1	$24,570	$17,750	Assumes three surveys: excavation, secondary, and primary geomembrane.
Leachate Collection and Removal System and Leak Detection System								
LCRS Drainage Layer Screening	CY	$6.00	11,329	$67,972	17,536	$105,217	$76,011	Bottom waste area plus layback area multiplied by 1-foot depth (see Table 1c of Appendix D).
LCRS Drainage Layer Installation	CY	$7.00	11,329	$79,301	17,536	$122,753	$88,680	Bottom waste area plus layback area multiplied by 1-foot depth (see Table 1c of Appendix D).
LDS Drainage Layer Screening	CY	$6.00	11,329	$67,972	17,536	$105,217	$76,011	Bottom waste area plus layback area multiplied by 1-foot depth (see Table 1c of Appendix D).
LDS Drainage Layer Installation	CY	$7.00	11,329	$79,301	17,536	$122,753	$88,680	TRUE
LCRS Piping	LF	$10.00	3,059	$30,588	4,735	$47,348	$34,205	Assumed piping spaced every 100 feet.
LDS Piping	LF	$10.00	3,059	$30,588	4,735	$47,348	$34,205	Assumed piping spaced every 100 feet.
Sump Riser Piping	LF	$15.92	180	$2,866	300	$4,776	$3,450	Assumed sumps spaced every 30 feet (6 sumps for A-5 and A-6, 10 sumps for A-7).
Gas Collection and Control System								
Gas Collection Permeable Soil Screening	CY	$6.00	12,459	$74,756	18,934	$113,606	$82,071	Top waste area multiplied by 1-foot depth (see Table 1c of Appendix D).
Gas Collection Permeable Soil Installation	CY	$7.00	12,459	$87,215	18,934	$132,540	$95,750	Top waste area multiplied by 1-foot depth (see Table 1c of Appendix D).
Gas Collection Piping	LF	$10.00	1,682	$16,820	2,556	$25,561	$18,466	Assumed piping spaced every 200 feet.
Geomembrane	FT^2	$0.69	336,400	$232,116	511,225	$352,745	$254,831	Area of RCRA cap (see Table 1c of Appendix D).
Geotextile	FT^2	$0.25	336,400	$84,100	511,225	$127,806	$92,330	Area of RCRA cap (see Table 1c of Appendix D).
Piping to RTO	LF	$10.00	2,500	$25,000	2,500	$25,000	$18,061	Distance from AOC to Zone A RTO system.
Subtotal Construction Costs for AOC Cell Construction			-	**$2,956,690**	-	**$4,478,727**	**$3,235,528**	

Tables H
Zone A
Area of Contamination (AOC)

Task	Unit	Unit Cost	Alts. A-5 and A-6		Alt. A-7		Alt. A-8 (Year 11)	Reference/Comments
			Quantity	Cost	Quantity	Cost	Cost	
RCRA Cap Construction on AOC Cell								
Contractor Mobilization and Demobilization	EA	$100,000	1	$100,000	1	$100,000	$72,242	
Engineered Fill Borrow and Hauling	CY	$4.00	24,919	$99,674	37,869	$151,474	$109,428	Area of RCRA cap multiplied by 2-foot depth.
GCL	FT^2	$0.65	336,400	$218,660	511,225	$332,296	$240,058	Area of RCRA cap (see Table 1c of Appendix D).
Geomembrane	FT^2	$0.69	336,400	$232,116	511,225	$352,745	$254,831	Area of RCRA cap (see Table 1c of Appendix D).
Geotextile	FT^2	$0.25	336,400	$84,100	511,225	$127,806	$92,330	Area of RCRA cap (see Table 1c of Appendix D).
Drainage Layer Screening	CY	$7.00	12,459	$87,215	18,934	$132,540	$95,750	Area of RCRA cap multiplied by 1-foot depth.
Drainage Layer Placement	CY	$7.00	12,459	$87,215	18,934	$132,540	$95,750	Area of RCRA cap multiplied by 1-foot depth.
Vegetative Cover Soil Placement	CY	$6.00	24,919	$149,511	37,869	$227,211	$164,142	Area of RCRA cap multiplied by 1-foot depth.
Hydroseeding	AC	$3,000.00	7.7	$23,100	11.7	$35,100	$25,357	Area of RCRA Cap (see Table 1c of Appendix D).
Silt Fence	LF	$3.50	2,500	$8,750	3,070	$10,745	$7,762	Perimeter of RCRA cap.
As-Built Surveys	AC	$700.00	15.4	$10,780	23.4	$16,380	$11,833	Assumes two surveys: GM and final cover surface.
Subtotal Construction Costs for RCRA Cap for AOC			-	**$1,101,121**	-	**$1,618,838**	**$1,169,483**	
Total AOC Cell and RCRA Cap Construction Costs ($)				**$4,057,811**		**$6,097,565**	**$4,405,010**	**-**

Notes:

1. Staging area assumed to be outside of the AOC cell.

2. Costs for Alternative A-8 are discounted for year 11. Quantities are the same as Alternative A-7.

3. Total costs are presented on a net present value basis (assuming a 3% discount rate).

AC = acre

CY = cubic yard

EA = each

FT = foot

FT^2 = feet squared

LF = linear foot

LS = lump sum

Tables H
Zone A
Area of Contamination (AOC)

Table H-2
Zone A – Area Of Contamination (AOC) – RCRA Cap Monitoring, Maintenance, and Inspection on AOC Cell Cost Summary

	Alts. A-5 and A-6 AOC Cap Maintenance						Alt. A-7 and A-8 AOC Cap Maintenance					
	Yearly Routine Settlement Monitoring			Cap Evaluation and Performance Monitoring	Cap Maintenance	Cap Inspection	Yearly Routine Settlement Monitoring			Cap Evaluation and Performance Monitoring	Cap Maintenance	Cap Inspection
	Year 1 to 10	Year 11 to 20	Year 21 to 30	Years 1 to 30	Years 1 to 30	Years 1 to 30	Year 1 to 10	Year 11 to 20	Year 21 to 30	Years 1 to 30	Years 1 to 30	Years 1 to 30
	$80,348	**$40,174**	**$20,180**	**$46,640**	**$31,719**	**$16,250**	**$102,555**	**$51,278**	**$25,780**	**$46,640**	**$39,884**	**$24,691**
Year	**($/year)**	**($/year)**	**($/year)**	**($/year)**	**($/year)**	**($/year)**	**($/year)**	**($/year)**	**($/year)**	**($/year)**	**($/year)**	**($/year)**
1	$78,008			$45,282	$30,795	$15,776	$99,568			$45,282	$38,722	$23,972
2	$75,736			$43,963	$29,898	$15,317	$96,668			$43,963	$37,595	$23,274
3	$73,530			$42,682	$29,027	$14,871	$93,853			$42,682	$36,500	$22,596
4	$71,388			$41,439	$28,182	$14,438	$91,119			$41,439	$35,437	$21,938
5	$69,309			$40,232	$27,361	$14,017	$88,465			$40,232	$34,404	$21,299
6	$67,290			$39,060	$26,564	$13,609	$85,888			$39,060	$33,402	$20,678
7	$65,331			$37,923	$25,790	$13,212	$83,387			$37,923	$32,429	$20,076
8	$63,428			$36,818	$25,039	$12,828	$80,958			$36,818	$31,485	$19,491
9	$61,580			$35,746	$24,310	$12,454	$78,600			$35,746	$30,568	$18,924
10	$59,787			$34,705	$23,602	$12,091	$76,311			$34,705	$29,678	$18,372
11		$29,023		$33,694	$22,914	$11,739		$37,044		$33,694	$28,813	$17,837
12		$28,177		$32,712	$22,247	$11,397		$35,965		$32,712	$27,974	$17,318
13		$27,357		$31,760	$21,599	$11,065		$34,918		$31,760	$27,159	$16,813
14		$26,560		$30,835	$20,970	$10,743		$33,901		$30,835	$26,368	$16,324
15		$25,786		$29,936	$20,359	$10,430		$32,913		$29,936	$25,600	$15,848
16		$25,035		$29,065	$19,766	$10,126		$31,954		$29,065	$24,854	$15,387
17		$24,306		$28,218	$19,190	$9,831		$31,024		$28,218	$24,131	$14,938
18		$23,598		$27,396	$18,631	$9,545		$30,120		$27,396	$23,428	$14,503
19		$22,911		$26,598	$18,089	$9,267		$29,243		$26,598	$22,745	$14,081
20		$22,243		$25,823	$17,562	$8,997		$28,391		$25,823	$22,083	$13,671
21			$10,848	$25,071	$17,050	$8,735			$13,858	$25,071	$21,440	$13,273
22			$10,532	$24,341	$16,554	$8,481			$13,454	$24,341	$20,815	$12,886
23			$10,225	$23,632	$16,072	$8,234			$13,063	$23,632	$20,209	$12,511
24			$9,927	$22,944	$15,603	$7,994			$12,682	$22,944	$19,620	$12,146
25			$9,638	$22,276	$15,149	$7,761			$12,313	$22,276	$19,049	$11,793
26			$9,357	$21,627	$14,708	$7,535			$11,954	$21,627	$18,494	$11,449
27			$9,085	$20,997	$14,279	$7,315			$11,606	$20,997	$17,955	$11,116
28			$8,820	$20,385	$13,863	$7,102			$11,268	$20,385	$17,432	$10,792
29			$8,563	$19,792	$13,460	$6,895			$10,940	$19,792	$16,925	$10,478
30			$8,314	$19,215	$13,068	$6,695			$10,621	$19,215	$16,432	$10,172
Subtotals (Years 1 - 30)	**$685,387**	**$254,996**	**$95,309**	**$914,165**	**$621,699**	**$318,500**	**$874,816**	**$325,473**	**$121,758**	**$914,165**	**$781,747**	**$483,955**
Subtotals (Years 11 - 30)	**-**	**-**	**-**	**-**	**-**	**-**	**$0**	**$325,473**	**$121,758**	**$516,316**	**$441,527**	**$273,336**
Total Cap Monitoring and Maintenance Costs (NPV $)				**Alts. A-5 and A-6 (Years 1 - 30)**		**$2,890,057**				**Alt. A-7 (Years 1 - 30)**		**$3,501,914**
										Alt. A-8 (Years 11 - 30)		**$1,678,409**

Notes:
1. See Tables H-3, H-4, H-5, and H-6 for basis of annual costs.
2. Total costs are presented on a net present value basis (assuming a 3% discount rate).
NPV = net present value

Tables H
Zone A
Area of Contamination (AOC)

Table H-3
Zone A – Area Of Contamination (AOC) – Routine Settlement Monitoring Costs Per Year

Task/Component	Unit Cost	Units	Alts. A-5 and A-6		Alts. A-7 and A-8	
			Number of Units	Task Subtotal	Number of Units	Task Subtotal
Years 1 to 10				**$80,348**		**$102,555**
Labor						
Principal	$180	$/hour	92	$16,568	140	$25,175
Senior Engineer	$135	$/hour	92	$12,426	140	$18,881
Project Environmental Scientist	$105	$/hour	46	$4,832	70	$7,343
Eric Jensen	$105	$/hour	85	$8,921	129	$13,556
Consultant						
Triad Associates	$9,400	events/year	4	$37,600	4	$37,600
Years 11 to 20				**$40,174**		**$51,278**
Labor						
Principal	$180	$/hour	46	$8,284	70	$12,588
Senior Engineer	$135	$/hour	46	$6,213	70	$9,441
Project Environmental Scientist	$105	$/hour	23	$2,416	35	$3,671
Eric Jensen	$105	$/hour	42	$4,461	65	$6,778
Consultant						
Triad Associates	$9,400	events/year	2	$18,800	2	$18,800
Years 21 to 30				**$20,180**		**$25,780**
Labor						
Principal	$180	$/hour	23	$4,142	35	$6,294
Senior Engineer	$135	$/hour	23	$3,107	35	$4,720
Project Environmental Scientist	$105	$/hour	12	$1,301	19	$1,977
Eric Jensen	$105	$/hour	21	$2,230	32	$3,389
Consultant						
Triad Associates	$9,400	events/year	1	$9,400	1	$9,400

Table H-4
Zone A – Area Of Contamination (AOC) – Cap Evaluation and Performance Reporting Costs Per Year

Task/Component	Unit Cost	Units	Alts. A-5 and A-6		Alts. A-7 and A-8	
			Number of Units	Task Subtotal	Number of Units	Task Subtotal
Years 1 to 30				**$46,640**		**$46,640**
Labor						
Principal	$180	$/hour	16	$2,880	16	$2,880
Senior Engineer	$135	$/hour	16	$2,160	16	$2,160
Consultant						
SCS Engineers	$10,400	events/year	4	$41,600	4	$41,600

Tables H
Zone A
Area of Contamination (AOC)

Table H-5
Zone A – Area Of Contamination (AOC) – Cap Maintenance Costs Per Year

Task/Component	Unit Cost	Units	Alts. A-5 and A-6		Alts. A-7 and A-8	
			Number of Units	Task Subtotal	Number of Units	Task Subtotal
Years 1 to 30				**$31,719**		**$39,884**
Labor						
Principal	$180	$/hour	14	$2,549	22	$3,873
Senior Engineer	$135	$/hour	42	$5,735	65	$8,714
Eric Jensen	$105	$/hour	71	$7,434	108	$11,297
Consultant						
Glacier Environmental Services	$8,000	events/year	2	$16,000	2	$16,000

Table H-6
Zone A – Area Of Contamination (AOC) – Cap Inspection Costs Per Year

Task/Component	Unit Cost	Units	Alts. A-5 and A-6		Alts. A-7 and A-8	
			Number of Units	Task Subtotal	Number of Units	Task Subtotal
Years 1 to 30				**$16,250**		**$24,691**
Labor						
Senior Engineer	$135	$/hour	21	$2,868	32	$4,357
Project Environmental Scientist	$105	$/hour	21	2,230	32	$3,389
Eric Jensen	$105	$/hour	106	$11,152	161	$16,945

Table I-1
Zone A
Additional Excavation Activities Costs Summary

Task	Unit	Unit Cost	Alts. A-5, A-6, A-7, and A-9 (Year 0)		Alt. A-8 (Year 11)		Reference/Comments
			Quantity	Cost	Quantity	Cost	
Natural Gas Pipeline							
Existing Natural Gas Pipeline Relocation	EA	$281,045	1	$281,045	1	$203,033	Cost estimate provided by Cascade Natural Gas Co-op (3/1/17). See Appendix E, Attachment H.
BDI Building							
Existing Building Demolition	SF	$6.28	2,400	$15,072	2400	$10,888	Assumed 30 ft by 80 ft steel building.
New Building Construction	SF	$50.00	2,400	$120,000	2400	$86,691	Assumed 30 ft by 80 ft steel building.
Dietrich Road							
Temporary Relocation During Construction	SY	$5.40	1,944	$10,500	1944	$7,585	Assume a 6-inch deep bank run gravel, spread and compacted, approximately 700 ft by 25 ft.
Reinstallation to Existing Alignment	SY	$5.40	1,944	$10,498	1944	$7,584	Assume a 6-inch deep bank run gravel, spread and compacted, approximately 700 ft by 25 ft.
Flexible Asphalt Paving	SY	$10.02	1,944	$19,483	1944	$14,075	Assume a 2-inch plant-mix asphalt paving, wearing course.
Total Construction Costs for Gas Pipeline, Building, and Road Relocation			-	**$456,598**	-	**$329,856**	

Notes:

1. Additional excavation activities are applicable to the Zone A alternatives that have a removal component (Alternatives A-5 through A-9).
2. Costs for Alternative A-8 are discounted for year 11.
3. Unit costs are based on best engineering judgement and RS Means unless otherwise specified.
4. Total costs are presented on a net present value basis (assuming a 3% discount rate).

EA = each

SY = square yard

ZONES C/D AND E

Table A-1
Zones C/D and E
Earthwork Unit Cost Summary

Earthwork Task	Units	Unit Cost	Source/Notes
Mobilization			
Surveying	DAY	$1,200.00	
Ground to Geomembrane - Clean Excavation			
Clean Soil Removal and Stockpile	CY	$3.20	Envirocon unit cost- Clean Soil Removal and Stockpile (Ground to Geomembrane)
Remove Geotextile	SF	$0.10	
Geomembrane to bottom of Over-excavation - Excavation			
Remove Geomembrane	SF	$0.10	
Excavation - Engineering Fill	CY	$4.70	Envirocon unit cost - Soil Excavation - Visqueen to Touchet
Excavation - Waste Material	CY	$4.70	Envirocon unit cost - Soil Excavation - Visqueen to Touchet
Excavation - Sideslopes, Access Ramp, and Over-excavation (2-ft)	CY	$4.70	Envirocon unit cost - Soil Excavation - Visqueen to Touchet
Remove Synthetic Liner at Bottom of Waste and Prepare Subbase	SY	$0.12	
Site Restoration			
Backfill - Common Borrow	TON	$14.25	Envirocon unit cost - Backfill: Visqueen to Touchet
RCRA Cap Installation	ac	$285,570	
Hydroseed	SF	$0.13	

Notes:
ac = acre
CY = cubic yard
RCRA = Resource Conservation and Recovery Act
SF = square foot
SY = square yard

Tables B
Zones C/D and E
Ground Water Monitoring

Table B-1
Zones C/D and E – Ground Water Monitoring and Reporting Cost Summary

Task	Unit	Unit Assumption	Quantities/Costs						Source/Notes
			Zones C/D			Zone E			
			Alts. CD-1 & CD-2	Alt. CD-3	No Action Alternative	Alts. E-1 & E-2	Alt. E-3	No Action Alternative	
Assumed No. of Monitoring Wells	-	-	4	4	4	2	2	2	A site-wide ground water compliance monitoring program will be developed after the CAP is finalized. Ground water protection, performance, and confirmational monitoring activities are anticipated for cost purposes in this FFS. Alternatives CD-3 and E-3 assume the installation of 3 new wells immediately after waste removal.
Sampling Frequency	-	-	Quarterly (5 yrs), Semi-annually (4 yrs), Annually (6 yrs)	Quarterly (5 yrs), Semi-annually (3 yrs), Annually (2 yrs)	Quarterly (5 yrs)	Quarterly (5 yrs), Semi-annually (4 yrs), Annually (6 yrs)	Quarterly (5 yrs), Semi-annually (3 yrs), Annually (2 yrs)	Quarterly (5 yrs)	Total ground water monitoring assumed to be 15 years (Alts. CD-1, CD-2, E-1, and E-2), 10 years (Alts. CD-3 and E-3), and 5 years (Atls. CD-0 and E-0). Assumptions for quarterly sampling is based on current sampling conducted in Zones C/D and E monitoring wells, as described in Table B-2 (below).
Construction Costs									
Well Installation Cost	$/well	$5,000	-	$20,000	-	-	$10,000	-	Cost to reinstall wells following waste removal.
Well Decommissioning	$/well	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	Well decommissioning assumed to occur at year 15 (Alts. CD-1, CD-2, E-1, and E-2), year 10 (Alts. CD-3 and E-3), and year 5 (No Action Alternative).
Year 5	NPV $	-	-	-	$8,626	-	-	$4,313	
Year 10	NPV $	-	-	$7,441	-	-	$3,720	-	
Year 15	NPV $	-	$6,419	-	-	$3,209	-	-	
Subtotal Construction Costs	**NPV $**	**-**	**$6,419**	**$27,441**	**$8,626**	**$3,209**	**$13,720**	**$4,313**	-
Sales Tax	%	8.6%	$552	$2,360	$742	$276	$1,180	$371	-
Total Construction Costs	**NPV $**	-	**$6,971**	**$29,801**	**$9,368**	**$3,485**	**$14,900**	**$4,684**	-
Non-Construction Costs (Labor, Analytical & Data Validation)									
Quarterly Monitoring	$/year	-	$30,834			$25,051			Quarterly monitoring assumed to occur at years 1-5 for all Zone C/D and E Alternatives.
Year 1	NPV $	-	$29,936			$24,322			
Year 2	NPV $	-	$29,064			$23,613			
Year 3	NPV $	-	$28,218			$22,925			
Year 4	NPV $	-	$27,396			$22,258			
Year 5	NPV $	-	$26,598			$21,609			
Total Net Present Value	**NPV $**	**-**	**$141,213**			**$114,727**			
Semi-annual Monitoring	$/year	-	$19,367			$14,818			Semi-annual monitoring assumed to occur at years 6-9 (Alts. CD-1, CD-2, E-1, and E-2), and years 6-8 (Alts. CD-3 and E-3).
Year 6	NPV $	-	$16,220	$16,220	-	$12,410	$12,410	-	
Year 7	NPV $	-	$15,747	$15,747	-	$12,048	$12,048	-	
Year 8	NPV $	-	$15,289	$15,289	-	$11,697	$11,697	-	
Year 9	NPV $	-	$14,843	-	-	$11,356	-	-	
Total Net Present Value	**NPV $**	**-**	**$62,099**	**$47,256**	**-**	**$47,511**	**$36,155**	**-**	
Annual Monitoring	$/year	-	$13,364			$9,249			Annual monitoring assumed to occur at years 10-15 (Alts. CD-1, CD-2, E-1, and E-2), and years 9-10 (Alts. CD-3 and E-3).
Year 9	NPV $	-	-	$10,242.1	-	-	$7,088	-	
Year 10	NPV $	-	$9,944	$9,944	-	$6,882	$6,882	-	
Year 11	NPV $	-	$9,654	-	-	$6,682	-	-	
Year 12	NPV $	-	$9,373	-	-	$6,487	-	-	
Year 13	NPV $	-	$9,100	-	-	$6,298	-	-	
Year 14	NPV $	-	$8,835	-	-	$6,115	-	-	
Year 15	NPV $	-	$8,578	-	-	$5,936	-	-	
Total Net Present Value	**NPV $**	**-**	**$55,483**	**$20,186**	**-**	**$38,399**	**$13,970**	**-**	
Total Ground Water Monitoring Costs (NPV $)			**$265,766**	**$238,455**	**$150,580**	**$204,123**	**$179,753**	**$119,411**	

Notes:
1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
CAP = Cleanup Action Plan
FFS = Focused Feasibility Study
NPV = net present value
yr = year

Tables B
Zones C/D and E
Ground Water Monitoring

Table B-2
Zones C/D and E – Ground Water Monitoring and Reporting Costs Per Year (for Quarterly, Semi-annual, and Annual Events)

Task	Unit	Unit	Zone C/D Quantities/Costs			Zone E Quantities/Costs			Source/Notes
			Quarterly Monitoring	Semi-Annual Monitoring	Annual Monitoring	Quarterly Monitoring	Semi-Annual Monitoring	Annual Monitoring	
Assumed No. of Monitoring Wells	-	-	4	4	4	2	2	2	Assumed initial quarterly sampling frequency based on 2016 GW Monitoring Program (Ecology, December 2016).
Sampling Frequency	events/year	-	4	2	1	4	2	1	
Annual Labor Costs									
Preparation time	hr/event	7	28	14	7	28	14	7	Based on current labor for Pasco ground water monitoring. Preparation time includes field notebook, labels, reservations, bottle order, etc. Assumed 2 persons needed per event.
Sample collection time	hr/well	0.75	12	6	3.0	6	3	1.5	
Equipment load/unload and calibration time	hr/event	5	20	10	5	20	10	5	
Drive to/from Pasco Landfill Site (roundtrip)	hr/event	8	32	16	8	32	16	8	
Truck rental/return	hr/event	2.5	10	5	2.5	10	5	2.5	
Total Labor Time	**hr**	-	**102.0**	**51.0**	**25.5**	**96.0**	**48.0**	**24.0**	
Field staff billing rate	$/hr	$100	$10,200	$5,100	$2,550	$9,600	$4,800	$2,400	
No. of field staff	person	2	2	2	2	2	2	2	
Total Field Work Cost	**$**	-	**$20,400**	**$10,200**	**$5,100**	**$19,200**	**$9,600**	**$4,800**	
Data management, reporting, and production	$	$115	$7,360	$7,360	$7,360	$3,680	$3,680	$3,680	Assumed a total of 16 hrs needed for data management, reporting, and production per well.
Total Labor Costs (Field Work, Data Management and Reporting)	**$**	-	**$27,760**	**$17,560**	**$12,460**	**$22,880**	**$13,280**	**$8,480**	-
Annual Analytical Costs									
VOCs (Method EPA-8260 and 8260-SIM)	$/sample	$168	$2,694	$1,347	$674	$1,347	$674	$337	Analytical costs based on agreed rates with ALS, valid through 2017. Landfill Parameters include nitrate, ammonia, sulfate, manganese, total dissolved solids, total alkalinity, bicarbonate, carbonate, hydroxide, chloride, total organic carbon, calcium, total iron, mangesium, potassium, and sodium.
Total Cr (Method EPA-200.8)	$/sample	$30	$60	$60	$30	$120	$120	$60	
Landfill Parameters (multiple methods)	$/sample	$272	$0	$0	$0	$544	$544	$272	
Total Analytical Costs	**$**	-	**$2,754**	**$1,407**	**$704**	**$2,011**	**$1,338**	**$669**	-
Annual Data Validation Costs									
Third Party Validation (Quarterly)	$/sample	$20	$320	-	-	$160	-	-	Includes validation data costs for the specified analytes only.
Third Party Validation (Semiannual and Annual)	$/sample	$50	-	$400	$200	-	$200	$100	
Total Data Validation Costs	**$**	-	**$320**	**$400**	**$200**	**$160**	**$200**	**$100**	
Ground Water Monitoring Costs Per Year ($)			**$30,834**	**$19,367**	**$13,364**	**$25,051**	**$14,818**	**$9,249**	-

Notes:
ALS = Analytical Laboratory Services
Cr = chromium
hr = hour
VOC = volatile organic compound

Tables C
Zones C/D and E
Cap Monitoring

Table C-1
Zones C/D and E – Cap Monitoring, Maintenance, and Replacement Cost Summary

Year	Routine Settlement Monitoring	Cap Evaluation and Performance Reporting	Cap Maintenance	Cap Inspection	Cap Replacement	
					Zones C/D	Zone E
	$2,940	$1,035	$1,365	$870	$200,000	$371,000
	($/yr)	($/yr)	($/yr)	($/yr)	(lump sum)	(lump sum)
1	$2,854	$1,005	$1,325	$845		
2	$2,771	$976	$1,287	$820		
3	$2,691	$947	$1,249	$796		
4	$2,612	$920	$1,213	$773		
5	$2,536	$893	$1,177	$750		
6	$2,462	$867	$1,143	$729		
7	$2,390	$842	$1,110	$707		
8	$2,321	$817	$1,078	$687		
9	$2,253	$793	$1,046	$667		
10	$2,188	$770	$1,016	$647		
11	$2,124	$748	$986	$629		
12	$2,062	$726	$957	$610		
13	$2,002	$705	$929	$592		
14	$1,944	$684	$902	$575		
15	$1,887	$664	$876	$558	$128,372	$238,131
16	$1,832	$645	$851	$542		
17	$1,779	$626	$826	$526		
18	$1,727	$608	$802	$511		
19	$1,677	$590	$778	$496		
20	$1,628	$573	$756	$482		
21	$1,580	$556	$734	$468		
22	$1,534	$540	$712	$454		
23	$1,490	$524	$692	$441		
24	$1,446	$509	$671	$428		
25	$1,404	$494	$652	$416		
26	$1,363	$480	$633	$403		
27	$1,324	$466	$615	$392		
28	$1,285	$452	$597	$380		
29	$1,248	$439	$579	$369		
30	$1,211	$426	$562	$358		
SUBTOTALS (Years 1-30)	**$32,547**	**$11,458**	**$26,755**	**$9,631**	**$128,372**	**$238,131**
TOTAL CAP MONITORING AND MAINTENANCE COSTS (NPV $)			**ALTS. CD-1 through CD-3, E-1 and E-3**		**$80,390**	
TOTAL CAP REPLACEMENT COSTS (NPV $)			**ALTS. CD-1, CD-2, and E-1**		**$128,372**	**$238,131**
SUBTOTALS (Years 1-10)	**$25,079**	**$8,829**	**-**	**$7,421**	**-**	**-**
TOTAL CAP MONITORING COSTS (NPV $)			**No Action Alternatives for Zones C/D and E**		**$41,329**	

Notes:

1. Cap replacement is assumed to occur at year 15 for Alternatives CD-1, CD-2, and E-1.

2. New RCRA caps are assumed to be installed immediately after waste removal for Alternatives CD-3 ($245,000 for 0.70 acre-cap) and E-3 ($455,000 for 1.30 acre-cap). Installation costs are included under "Backfill&Capping" task for each alternative and, therefore, are not included in this estimate.

3. Total costs are presented on a net present value basis (assuming a 3% discount rate).

RCRA = Resource Conservation and Recovery Act

yr = year

Tables C
Zones C/D and E
Cap Monitoring

Table C-2
Zones C/D and E – Routine Settlement Monitoring Costs Per Year

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Years 1-30					**$2,940**
Labor					
Principal	1	$/hr	$180	$180	
Senior Engineer	1	$/hr	$135	$135	
Project Environmental Scientist	5	$/hr	$105	$525	
Eric Jensen	20	$/hr	$105	$2,100	

Table C-3
Zones C/D and E – Cap Evaluation and Performance Reporting Costs Per Year

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Years 1-30					**$1,035**
Labor					
Principal	2	$/hr	$180	$360	
Senior Engineer	5	$/hr	$135	$675	

Table C-4
Zones C/D and E – Cap Maintenance Costs Per Year

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Years 1-30					**$1,365**
Labor					
Principal	1	$/hr	$180	$180	
Senior Engineer	1	$/hr	$135	$135	
Eric Jensen	10	$/hr	$105	$1,050	

Table C-5
Zones C/D and E – Cap Inspection Costs Per Year

Task/Component	Number of Units	Units	Unit Cost	Subtotal	Task Subtotal
Years 1-30					**$870**
Labor					
Senior Engineer	1	$/hr	$135	$135	
Project Environmental Scientist	1	$/hr	$105	105	
Eric Jensen	6	$/hr	$105	$630	

Table D-1
Zones C/D and E
Institutional Control Cost Summary

Task	Unit	Unit Assumption	Quantities/Costs				Source/Notes
			Zones C/D		Zone E		
			Alts. CD-1 and CD-2	Alt. CD-3	Alts. E-1 and E-2	Alt. E-3	
Construction Costs							
Fencing	linear foot	-	-	990	-	1,200	Based on Zones C/D and E plan views.
	$/linear foot	$29	-	$28,710	-	$34,800	Similar project.
Signage	lump sum	$1,000	-	$1,000	-	$1,000	Similar project.
Environmental covenant	lump sum	$6,000	$6,000	$6,000	$6,000	$6,000	Similar project.
Sales Tax	$	8.6%	$516	$3,071	$516	$3,595	Current sales tax is 8.6%.
Total Construction Costs	**$**	**-**	**$6,516**	**$38,781**	**$6,516**	**$45,395**	-
Non-construction Costs							
O&M - Fencing	$/yr	$1,250	$14,922	$14,922	$14,922	$14,922	For a 15-yr time period, based on similar project.
Environmental Covenant	$/yr	$500	$5,969	$5,969	$5,969	$5,969	For a 15-yr time period, based on similar project.
Beneficial Use Survey & Reporting	$/yr	$1,000	$11,938	$11,938	$11,938	$11,938	Annual beneficial water use survey conducted annually of all residences within the GPA and reporting results to Ecology (ICP, October 2013). Assumed 8 hr-survey and 2-hr reporting, for a 15-yr time period.
Total Non-construction Costs	**$**	**-**	**$32,829**	**$32,829**	**$32,829**	**$32,829**	-
TOTAL INSTITUTIONAL CONTROL COSTS (NPV $)			**$39,345**	**$71,610**	**$39,345**	**$78,224**	-

Notes:

1. New fences are assumed to be installed immediately after waste removal for Alternatives CD-3 and E-3.
2. Total costs are presented on a net present value basis (assuming a 3% discount rate).

Table E-1
Zones C/D and E
Lab Testing Cost Summary

Zone	Type of Soil/Waste	Testing Parameters	Cost per Sample
C/D	Wastes within this zone are assumed to be solids (no free liquids or saturated soils) consisting of bulk plywood resin waste, wood treatment and preservative waste, lime sludge, cutting oils, paint waste, solvent waste, and other bulk liquid waste.	RCRA, PCBs, Gx, Dx, and Chlor-detect field test (for HOCs)	$853
	Over-excavation (2 feet)	RCRA, PCBs, Gx, Dx, and Chlor-detect field test (for HOCs)	$853
	Underlying soils (confirmation testing, etc.)	GW COCs (VOCs and Metals)	$168
E	Primarily chlor-alkali waste, dry clay-like soils (no free liquids assumed)	RCRA, PCBs, D/F	$1,223
	Over-excavation (2 feet)	RCRA, PCBs, D/F	$1,223
	Underlying soils (confirmation testing, etc.)	GW COCs (VOCs and Metals)	$78

Notes:

1. RCRA testing includes toxicity, reactivity, ignitability, and corrosivity.
2. Chlor-detect field test ($15) is available for HOC screening.
3. HOCs could be prohibited from incineration because used oils burnings are not allowed to contain HOCs (UTS levels for LDR).
4. One composite sample per roll-off bin assumed. Roll-off bin holds 20 cubic yards of solids.
5. After excavation, confirmation sampling is assumed to be conducted using ISM (preparation method: dry, disaggregate, sieve, split, subsample) until a clean sample is obtained.

COC = contaminant of concern
GW = ground water
HOC = hydrophobic organic chemical
PCB = polychlorinated biphenyl
RCRA = Resource Conservation and Recovery Act
VOC = volatile organic compound

Table F-1
Zones C/D and E
Disposal Cost Summary

Zone	Disposal Task/Component	Unit Cost	
		Direct Disposal in Subtitle C Landfill	RCRA Stabilization and Disposal in Subtitle C Landfill
C/D	Bulk Loads—Disposal	$80.00	-
	Fuel, Environmental, and Administrative Fee (17.5%)	$14.00	-
	Oregon Department of Environmental Quality Hazardous Waste Fee	$2.50	-
	Transport to Arlington (@ 30 ton/load)	$25.00	-
	Truck Liner (by WMX)	$2.33	-
	Disposal Costs per Ton	**$123.83**	-
E	Bulk Loads—Disposal	$80.00	$164.00
	Fuel, Environmental, and Administrative Fee (17.5%)	$14.00	$28.70
	Oregon Department of Environmental Quality Hazardous Waste Fee	$2.50	$2.50
	Transport to Arlington (@ 30 ton/load)	$25.00	$25.00
	Truck Liner (by WMX)	$2.33	$2.33
	Disposal Costs per Ton	**$123.83**	**$222.53**

Notes:

1. Waste and soils in Zones C/D are assumed to be 100% directly disposed of in a Subtitle C landfill. Waste and soils in Zone E are assumed to be 80% directly disposed of in a Subtitle C landfill and 20% RCRA stabilized before Subtitle C landfill disposal.

2. Cost breakdown is based on the following assumptions:

- Fuel, environmental, and administrative fee: currently 17.5% of disposal only
- Oregon Department of Environmental Quality fee for hazardous waste: $2.50 per ton
- Unit costs based on total tonnage removed from the PSL site for disposal at CWM.

Table G-1
Zones C/D and E
In Situ Chemical Oxidation (ISCO) Cost Summary

Task	Zones C/D Alt. CD-2
Well Installation and Data Collection	$188,135
Boring Logs	$4,440
IDW Profiling and Disposal	$36,445
ISCO Treatment Events	$105,405
Total In Situ Chemical Oxidation Amendment Costs (NPV $)	**$334,426**

Notes:
1. Detailed costs for ISCO treatments are provided in Attachment B (Appendix E).
2. Total costs are presented on a net present value basis (assuming a 3% discount rate).
IDW = investigation-derived waste
ISCO = in situ chemical oxidation
NPV = net present value

ON-PROPERTY GROUND WATER (CENTRAL AREA)

Table A-1
On-Property Ground Water (Central Area)
Contingent Soil Vapor Extract (SVE) Treatment Cost Summary

Task	On-Property Ground Water (Central Area) Alt. ONP-1
SVE Well Installation	$32,594
IDW Profiling and Disposal	$15,718
Boring Logs	$1,682
SVE Piping and Equipment	$78,577
As-Built and O&M Plan Updates	$16,070
Additional Operational Labor	$115,038
Power Consumption	$37,094
System Decommission	$5,919
Total SVE Costs (NPV $)	**$302,691**

Notes:
1. Detailed costs for SVE treatment are provided in Attachment C (Appendix E).
2. Total costs are presented as net present value (assuming a 3% discount rate).
NPV = net present value

Tables B
On-Property Ground Water (Central Area)
Ground Water Monitoring

Table B-1
On-Property Ground Water (Central Area) – Ground Water Monitoring and Reporting Cost Summary

Task	Unit	Unit Assumption	Quantities/Costs		Source/Notes
			ONP-1	No Action Alternative	
Assumed No. of Monitoring Wells	-	-	4	4	A site-wide ground water compliance monitoring program will be developed after the CAP is finalized. Ground water protection, performance, and confirmational monitoring activities are anticipated for cost purposes in this FFS.
Sampling Frequency	-	-	Quarterly (5 yrs), Semi-annually (5 yrs), Annually (5 yrs)	Quarterly (5 yrs)	Total ground water monitoring assumed to be 5 years (No Action Alternative) and 15 years (Alternative ONP-1). Assumptions for quarterly sampling is based on current sampling conducted in ONP-1 monitoring wells, as described in Table B-2 (below).
Construction Costs					
Well Decommissioning	$/well	$2,500	$2,500	$2,500	Well decommissioning assumed to occur at year 15 (Alternative ONP-1) and year 5 (No Action Alternative).
Year 5	NPV $	-	-	$8,626	
Year 15	NPV $	-	$6,419	-	
Subtotal Construction Costs	**NPV $**	**-**	**$6,419**	**$8,626**	-
Sales Tax	%	8.6%	$552	$742	-
Total Construction Costs	**NPV $**	-	**$6,971**	**$9,368**	-
Non-Construction Costs (Labor, Analytical & Data Validation)					
Quarterly Monitoring	$/year	-	$31,378		Quarterly monitoring assumed to occur at years 1-5 for both Alternatives.
Year 1	NPV $	-	$30,464		
Year 2	NPV $	-	$29,577		
Year 3	NPV $	-	$28,716		
Year 4	NPV $	-	$27,879		
Year 5	NPV $	-	$27,067		
Total Net Present Value	**NPV $**	**-**	**$143,704**		
Semi-annual Monitoring	$/year	-	$19,911		Semi-annual monitoring assumed to occur at years 6-10 for Alternative ONP-1.
Year 6	NPV $	-	$16,675	-	
Year 7	NPV $	-	$16,190	-	
Year 8	NPV $	-	$15,718	-	
Year 9	NPV $	-	$15,260	-	
Year 10	NPV $	-	$14,816		
Total Net Present Value	**NPV $**	**-**	**$78,659**	**-**	
Annual Monitoring	$/year	-	$13,636		Annual monitoring assumed to occur at years 10-15 for Alternative ONP-1.
Year 11	NPV $	-	$9,851	-	
Year 12	NPV $	-	$9,564	-	
Year 13	NPV $	-	$9,285	-	
Year 14	NPV $	-	$9,015	-	
Year 15	NPV $	-	$8,752	-	
Total Net Present Value	**NPV $**	**-**	**$46,466**	**-**	
Total Ground Water Monitoring Costs (NPV $)			**$275,800**	**$153,072**	

Notes:
1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
FFS = Focused Feasibility Study
NPV = net present value
yr = year

Tables B
On-Property Ground Water (Central Area)
Ground Water Monitoring

Table B-2
On-Property Ground Water (Central Area) – Ground Water Monitoring and Reporting Costs Per Year (for Quarterly, Semi-annual, and Annual Events)

Task	Unit	Unit Assumption	ONP Quantities/Costs			Source/Notes
			Quarterly Monitoring	Semi-Annual Monitoring	Annual Monitoring	
Assumed No. of Monitoring Wells	-	-	4	4	4	Assumed initial quarterly sampling frequency based on 2016 GW Monitoring Program (Ecology, December 2016).
Sampling Frequency	events/year	-	4	2	1	
Annual Labor Costs						
Preparation time	hr/event	7	28	14	7	Based on current labor for Pasco ground water monitoring. Preparation time includes field notebook, labels, reservations, bottle order, etc. Assumed 2 persons needed per event.
Sample collection time	hr/well	0.75	12	6	3.0	
Equipment load/unload and calibration time	hr/event	5	20	10	5	
Drive to/from Pasco Landfill Site (roundtrip)	hr/event	8	32	16	8	
Truck rental/return	hr/event	2.5	10	5	2.5	
Total Labor Time	**hr**	**-**	**102.0**	**51.0**	**25.5**	
Field staff billing rate	$/hr	$100	$10,200	$5,100	$2,550	
No. of field staff	person	2	2	2	2	
Total Field Work Cost	**$**	**-**	**$20,400**	**$10,200**	**$5,100**	
Data management, reporting, and production	$	$115	$7,360	$7,360	$7,360	Assumed a total of 16 hrs needed for data management, reporting, and production per well.
Total Labor Costs (Field Work, Data Management and Reporting)	**$**	**-**	**$27,760**	**$17,560**	**$12,460**	-
Annual Analytical Costs						
VOCs (Method EPA-8260 and 8260-SIM)	$/sample	$168	$2,694	$1,347	$674	Analytical costs based on agreed rates with ALS, valid through 2017. Landfill Parameters include nitrate, ammonia, sulfate, manganese, total dissolved solids, total alkalinity, bicarbonate, carbonate, hydroxide, chloride, total organic carbon, calcium, total iron, mangesium, potassium, and sodium.
Total Cr (Method EPA-200.8)	$/sample	$30	$60	$60	$30	
Landfill Parameters (multiple methods)	$/sample	$272	$544	$544	$272	
Total Analytical Costs	**$**	**-**	**$3,298**	**$1,951**	**$976**	-
Annual Data Validation Costs						
Third Party Validation (Quarterly)	$/sample	$20	$320	-	-	Includes validation data costs for the specified analytes only.
Third Party Validation (Semiannual and Annual)	$/sample	$50	-	$400	$200	
Total Data Validation Costs	**$**	**-**	**$320**	**$400**	**$200**	
Ground Water Monitoring Costs Per Year ($)			**$31,378**	**$19,911**	**$13,636**	-

Notes:
ALS = Analytical Laboratory Services
Cr = chromium
hr = hour
VOC = volatile organic compound

APPENDIX E, ATTACHMENT B
BACKUP FOR ISCO AMENDMENTS AND STABILIZATION COST ESTIMATES

ZONE A

Zone A
Alternative A-3
Vertical ISCO Costs

ENVIRONMENTAL PARTNERS INC

YEAR	Present Value Factor	Well Installation and Data Collection	Boring Logs	IDW Profiling and Disposal	ISCO Treatment Events	Decommission Injection Wells
		Year 2	Year 2	Year 2	Year 5	Year 10
0	Current Value	$111,659	$6,640	$55,737	$262,763	$25,978
1	0.9709					
2	0.9426	$105,249	$6,259	$52,537		
3	0.9151					
4	0.8885					
5	0.8626				$226,662	
6	0.8375					
7	0.8131					
8	0.7894					
9	0.7664					
10	0.7441					$19,330
	Subtotal	$105,249	$6,259	$52,537	$226,662	$19,330

3%

Zone A
Alternative A-3
Total Vertical ISCO Costs Over 5 Years

$410,037

ENVIRONMENTAL PARTNERS INC

Job Name: Well Installation **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180					16.0							16.0	$2,880
Managing Engineer	$150												0.0	$0
Senior Engineer	$135			8.0		24.0							32.0	$4,320
Senior Scientist	$125												0.0	$0
Technical Editor	$110			16.0	16.0	80.0							112.0	$12,320
Technical Editor	$110												0.0	$0
Project Engineer	$105			8.0	16.0	80.0							104.0	$10,920
Project Scientist	$105			16.0	16.0	80.0							112.0	$11,760
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	376.0	$42,200

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller	$51,665	1	$51,665
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$51,665

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
COD	$120	9	$1,080
SOD	$120	9	$1,080
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$2,160

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day	10	$750
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	20	$500
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit	2	$40
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	10	$750
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$2,040

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	20	$3,000	
Rental Car	$100	10	$1,000	
Meals	$40	20	$800	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$4,800	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$42,200
EPI Expenses			$0
EPI Travel			$5,520
EPI Equipment			$2,040
		Sub-Total EPI	$49,760
Analytical			$2,160
Subcontractors			$51,665
		Sub-Total Subs	$53,825
Mark-up	15%		$8,074
TOTAL			**$111,659**

Notes:

Includes costs for preparing scopes of work,soliciting and evaluating bids, selection and contracting documents with contractors including: drillers, piping contractors, chemical delivery, Pasco water district, etc.
Assumes two consecutive weeks of fieldwork to install vertical wells under Zone A. Assumes three trips to the site by EPI field staff.
Assumes 1 soil sample will be collected from each well location and analyzed for COD and SOD.
Assumes 9 wells will be installed downgradient of Zone A, west of Dietrich Road.
Quote for drilling has been adjusted to account for 9 wells instead of 13, as originally proposed.

ENVIRONMENTAL PARTNERS INC

Job Name: Boring Logs **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ **(X Months)** **Estimator:** ARM

PROJECT PLANNING:

Personnel														
	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180												0.0	$0
Managing Engineer	$150												0.0	$0
Senior Engineer	$135						8.0						8.0	$1,080
Senior Scientist	$125												0.0	$0
Technical Editor	$110						32.0						32.0	$3,520
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						24.0						24.0	$2,040
Admin	$65												0.0	$0
												Total Hours	64.0	$6,640

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Waste Contractor			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150		$0	
Rental Car	$75		$0	
Meals	$30		$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$6,640
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$6,640
Analytical			$0
Subcontractors			$0
		Sub-Total Subs	$0
Mark-up	15%		$0
TOTAL			**$6,640**

ENVIRONMENTAL PARTNERS INC

Job Name: IDW Profiling and Disposal Fee Schedule: Standard Date: 13-Mar-14

Schedule: _____ (X Months) Estimator: ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	4.0											4.0	$720
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	4.0		6.0		2.0		2.0					14.0	$1,890
Senior Scientist	$125												0.0	$0
Technical Editor	$110	8.0		2.0	8.0	16.0		4.0					38.0	$4,180
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105			2.0	8.0	16.0		4.0					30.0	$3,150
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	86.0	$9,940

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Waste Contractor	$4,500	1	$4,500
Mobile Lab			$0
Utility Locate			$0
IDW	$300	63	$18,900
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$23,400

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162	18	$2,916
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100	18	$1,800
BTEX(8021)	$63		$0
PCB	$72	18	$1,296
TCLP Metals	$144	18	$2,592
TCLP for SVOCs	$369	18	$6,642
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$15,246

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day	2	$150
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	4	$100
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$250

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	4	$600	
Rental Car	$100	2	$200	
Meals	$40	4	$160	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$960	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$9,940
EPI Expenses			$0
EPI Travel			$1,104
EPI Equipment			$250
		Sub-Total EPI	$11,294
Analytical			$15,246
Subcontractors			$23,400
		Sub-Total Subs	$38,646
Mark-up	15%		$5,797
TOTAL			**$55,737**

Notes:

Assumes one trip to the site to perform sample collection.
Assumes 2 field personnel for 2 days of opening and sampling drums for profiling.
Assumes 4 drums of IDW are generated for each well from soils above the water table.
Assumes 3 drums of IDW are generated below the water table from each well.
Assumes composite sampling of soils above or below the water table may be performed at each well location.
Assumes non-hazardous waste.

ENVIRONMENTAL PARTNERS INC

Job Name: ISCO Application **Fee Schedule:** Standard **Date:** 24-Mar-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	8.0							4.0				12.0	$2,160
Managing Engineer	$150	8.0											8.0	$1,200
Senior Engineer	$135	40.0	80.0	8.0	8.0	32.0		8.0	12.0				188.0	$25,380
Senior Scientist	$125							40.0	16.0				56.0	$7,000
Technical Editor	$110			16.0	24.0	160.0	16.0						216.0	$23,760
Technical Editor	$110								16.0				16.0	$1,760
Project Engineer	$105			16.0	24.0	160.0	16.0	32.0					248.0	$26,040
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						12.0						12.0	$1,020
Admin	$65												0.0	$0
											Total Hours	756.0		$88,320

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Mixing Station Sub	$12,000	1	$12,000
Water Line	$9,000	1	$9,000
Power Line			$0
Utility Locate	$400	2	$800
Chemical Product	$104,680	1	$104,680
Water (100ft3)	$0.68	19300	$13,124
Vehicle rental			$0
		Cont./Support Subtotal:	$139,604

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day	20	$1,500
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	41	$1,025
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$2,525

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	41	$6,150	
Rental Car	$100	21	$2,100	
Meals	$40	41	$1,640	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$9,890	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$88,320
EPI Expenses			$0
EPI Travel			$11,374
EPI Equipment			$2,525
		Sub-Total EPI	$102,219
Analytical			$0
Subcontractors			$139,604
		Sub-Total Subs	$139,604
Mark-up	15%		$20,941
TOTAL			**$262,763**

Notes:

Assumes design and fabrication of a mixing and injection station for injection of products into wells.
Accounts for time with City of Pasco to coordinate new power water line extension.
Assumes one application event performed over the course of four weeks.
Assumes one site visit for an engineer to oversee construction of the mixing and injection station.
Assumes water will be installed to the former NoVOCs building for use in injections.
Assumes 21.8 tons of sodium persulfate at $2.11/lb (dry). Assumes 15.1 tons of ferrous sulfate at $0.42/lb (dry) are applied as a contingency upon detection of a release from Zone A.
Assumes hoses will be run from the mixing station to each wellhead.

ENVIRONMENTAL PARTNERS INC

Job Name: Decommission Injection Wells **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ **(X Months)** **Estimator:** JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	2.0											2.0	$360
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	4.0	6.0	6.0									16.0	$2,160
Senior Scientist	$125												0.0	$0
Technical Editor	$110			6.0	8.0	40.0		12.0					66.0	$7,260
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	84.0	$9,780

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller	$12,000	1	$12,000
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$12,000

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	5	$125
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	5	$375
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$500

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	5	$750	
Rental Car	$100	5	$500	
Meals	$80	5	$400	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$1,650	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$9,780
EPI Expenses			$0
EPI Travel			$1,898
EPI Equipment			$500
		Sub-Total EPI	$12,178
Analytical			$0
Subcontractors			$12,000
		Sub-Total Subs	$12,000
Mark-up	15%		$1,800
TOTAL			**$25,978**

Notes:
Assumes 9 wells will be installed downgradient of Zone A, west of Dietrich Road.
This cost estimate assumes the wells can be decommissioned in 5 field days.

Zone A
Alternative A-4 ISCO Costs
Contingent ISCO Costs

ENVIRONMENTAL PARTNERS INC

YEAR	Present Value Factor	Well Installation and Data Collection	Boring Logs	IDW Profiling and Disposal	ISCO Treatment Event
		Year 2	Year 2	Year 2	Year 5
0	Current Value	$538,202	$6,420	$64,598	$22,106,542
1	0.9709				
2	0.9426				
3	0.9151				
4	0.8885				
5	0.8626	$464,257	$5,538	$55,723	$19,069,297
	Subtotal	**$464,257**	**$5,538**	**$55,723**	**$19,069,297**

3%

Zone A
Alternative A-4
Total ISCO Costs Over 5 Years

$19,594,815

ENVIRONMENTAL PARTNERS INC

Job Name: Well Installation **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ **(X Months)** **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180					24.0							24.0	$4,320
Managing Engineer	$150												0.0	$0
Senior Engineer	$135			8.0		40.0							48.0	$6,480
Senior Scientist	$125												0.0	$0
Technical Editor	$110			24.0	32.0	120.0							176.0	$19,360
Technical Editor	$110												0.0	$0
Project Engineer	$105			16.0	32.0	120.0							168.0	$17,640
Project Scientist	$105			24.0	32.0	120.0							176.0	$18,480
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	592.0	$66,280

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller	$391,390	1	$391,390
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$391,390

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
COD	$120	8	$960
SOD	$120	8	$960
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$1,920

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day	20	$1,500
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	60	$1,500
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit	4	$80
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	15	$1,125
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$4,205

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	60	$9,000	
Rental Car	$100	20	$2,000	
Meals	$40	60	$2,400	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$13,400	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$66,280
EPI Expenses			$0
EPI Travel			$15,410
EPI Equipment			$4,205
		Sub-Total EPI	$85,895
Analytical			$1,920
Subcontractors			$391,390
		Sub-Total Subs	$393,310
Mark-up	15%		$58,997
TOTAL			**$538,202**

Notes:

Assumes four consecutive weeks of fieldwork to install horizontal wells within Zone A. Assumes four trips to the site by EPI field staff.

Assumes one soil sample will be collected from each horizontal well and will be analyzed for COD and SOD.

ENVIRONMENTAL PARTNERS INC

Job Name: Boring Logs **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ **(X Months)** **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180												0.0	$0
Managing Engineer	$150												0.0	$0
Senior Engineer	$135						8.0						8.0	$1,080
Senior Scientist	$125												0.0	$0
Technical Editor	$110						30.0						30.0	$3,300
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						24.0						24.0	$2,040
Admin	$65												0.0	$0
												Total Hours	62.0	$6,420

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Waste Contractor			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150		$0	
Rental Car	$75		$0	
Meals	$30		$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$6,420
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$6,420
Analytical			$0
Subcontractors			$0
		Sub-Total Subs	$0
Mark-up	15%		$0
TOTAL			**$6,420**

Notes:

Assumes drilling mud will be containerized into 10yd3 roll off bins and will sampled by EPI and profiled by another waste contractor.

Assumes 3 samples will be collected from each roll off bin for profiling.

ENVIRONMENTAL PARTNERS INC

Job Name: IDW Profiling and Disposal **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	4.0											4.0	$720
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	4.0		6.0		2.0		2.0					14.0	$1,890
Senior Scientist	$125												0.0	$0
Technical Editor	$110	8.0		2.0	8.0	16.0		4.0					38.0	$4,180
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105			2.0	8.0	16.0		4.0					30.0	$3,150
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	86.0	$9,940

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Waste Contractor	$4,000	1	$4,000
Mobile Lab			$0
Utility Locate			$0
IDW	$600	24	$14,400
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$18,400

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162	33	$5,346
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100	33	$3,300
BTEX(8021)	$63		$0
PCB	$72	33	$2,376
TCLP Metals	$144	33	$4,752
TCLP for SVOCs	$369	33	$12,177
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$27,951

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day	2	$150
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	4	$100
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$250

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	4	$600	
Rental Car	$100	2	$200	
Meals	$40	4	$160	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$960	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$9,940
EPI Expenses			$0
EPI Travel			$1,104
EPI Equipment			$250
		Sub-Total EPI	$11,294
Analytical			$27,951
Subcontractors			$18,400
		Sub-Total Subs	$46,351
Mark-up	15%		$6,953
TOTAL			**$64,598**

Notes:

Assumes drilling mud will be containerized into 10yd3 roll off bins and will sampled by EPI and profiled by another waste contractor.
Assumes 3 samples will be collected from each roll off bin for profiling.
Assumes one trip to the site to perform sample collection.
Assumes 11 roll-off bins of drilling mud are generated.

ENVIRONMENTAL PARTNERS INC

Job Name: ISCO Treatment Events **Fee Schedule:** Standard **Date:** 28-Mar-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel														
	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	2.0											2.0	$360
Managing Engineer	$150	8.0											8.0	$1,200
Senior Engineer	$135	8.0		16.0		40.0		80.0					144.0	$19,440
Senior Scientist	$125												0.0	$0
Technical Editor	$110			16.0	32.0	120.0							168.0	$18,480
Technical Editor	$110												0.0	$0
Project Engineer	$105			32.0	32.0	120.0							184.0	$19,320
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	506.0	$58,800

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Contractor	$28,000	1	$28,000
Mobile Lab			$0
Utility Locate			$0
Chemical Product	$19,119,624	1	$19,119,624
Water (100ft3)	$0.68	18000	$12,240
Vehicle rental			$0
		Cont./Support Subtotal:	$19,159,864

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day	20	$1,500
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	41	$1,025
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$2,525

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	41	$6,150	
Rental Car	$100	21	$2,100	
Meals	$40	41	$1,640	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$9,890	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$58,800
EPI Expenses			$0
EPI Travel			$11,374
EPI Equipment			$2,525
		Sub-Total EPI	$72,699
Analytical			$0
Subcontractors			$19,159,864
		Sub-Total Subs	$19,159,864
Mark-up	15%		$2,873,980
TOTAL			**$22,106,542**

Notes:

Assumes design and fabrication of a mixing and injection station for injection of products into wells.
Accounts for time with City of Pasco to coordinate new power water line extension.
Assumes one application event performed over the course of four weeks.
Assumes one site visit for an engineer to oversee construction of the mixing and injection station.
Assumes water will be installed to the former NoVOCs building for use in injections.
Assumes 4530 tons of sodium persulfate at $2.11/lb (dry). Assumes 3.6 tons of ferrous sulfate at $0.42/lb (dry) are applied within Zone A.
Assumes hoses will be run from the mixing station to each horizontal injection well..

ZONES C AND D

Zones C and D
Alternative CD-2
Horizontal ISCO Costs

ENVIRONMENTAL PARTNERS INC

YEAR	Present Value Factor	Well Installation and Data Collection	Boring Logs	IDW Profiling and Disposal	ISCO Treatment Events
		Year 2	Year 2	Year 2	Year 5
0	Current Value	$199,593	$4,710	$38,665	$122,194
1	0.9709				
2	0.9426	$188,135	$4,440	$36,445	
3	0.9151				
4	0.8885				
5	0.8626				$105,405
	Subtotal	$188,135	$4,440	$36,445	$105,405
3%	**Summary**	**$192,575**		**$36,445**	**105,405**

Zones C&D
Alternative CD-2
Total Horizontal ISCO Costs Over 5 Years **$334,426**

ENVIRONMENTAL PARTNERS INC

Job Name: Well Installation **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180					20.0							20.0	$3,600
Managing Engineer	$150												0.0	$0
Senior Engineer	$135			8.0		40.0							48.0	$6,480
Senior Scientist	$125												0.0	$0
Technical Editor	$110			16.0	16.0	80.0							112.0	$12,320
Technical Editor	$110												0.0	$0
Project Engineer	$105			8.0	16.0	80.0							104.0	$10,920
Project Scientist	$105			16.0	16.0	80.0							112.0	$11,760
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	396.0	$45,080

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller	$125,385	1	$125,385
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$125,385

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
COD	$120	10	$1,200
SOD	$120	10	$1,200
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$2,400

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day	10	$750
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	20	$500
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit	2	$40
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	10	$750
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$2,040

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	20	$3,000	
Rental Car	$100	10	$1,000	
Meals	$40	20	$800	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$4,800	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$45,080
EPI Expenses			$0
EPI Travel			$5,520
EPI Equipment			$2,040
		Sub-Total EPI	$52,640
Analytical			$2,400
Subcontractors			$125,385
		Sub-Total Subs	$127,785
Mark-up	15%		$19,168
TOTAL			**$199,593**

Notes:

Includes costs for preparing scopes of work,soliciting and evaluating bids, selection and contracting documents with contractors including: horizontal drillers, piping contractors, chemical delivery, Pasco water district, etc.

Assumes two consecutive weeks of fieldwork to install horizontal wells under Zones C and D. Assumes two trips to the site by EPI field staff.

Assumes 10 soil samples will be collected from each zone and analyzed for COD and SOD.

Assumtions for lineal distance for horizontal drilling provided by Anchor QEA.

ENVIRONMENTAL PARTNERS INC

Job Name: Boring Logs **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel														
	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180												0.0	$0
Managing Engineer	$150												0.0	$0
Senior Engineer	$135						6.0						6.0	$810
Senior Scientist	$125												0.0	$0
Technical Editor	$110						20.0						20.0	$2,200
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						20.0						20.0	$1,700
Admin	$65												0.0	$0
												Total Hours	46.0	$4,710

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Waste Contractor			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150		$0	
Rental Car	$75		$0	
Meals	$30		$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$4,710
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$4,710
Analytical			$0
Subcontractors			$0
		Sub-Total Subs	$0
Mark-up	15%		$0
TOTAL			**$4,710**

Notes:
Assumes drilling mud will be containerized into 10yd3 roll off bins and will sampled by EPI and profiled by another waste contractor.
Assumes 3 samples will be collected from each roll off bin for profiling.

ENVIRONMENTAL PARTNERS INC

Job Name: Well Installation **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	4.0											4.0	$720
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	4.0		6.0		2.0		2.0					14.0	$1,890
Senior Scientist	$125												0.0	$0
Technical Editor	$110	8.0		2.0	8.0	8.0		4.0					30.0	$3,300
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105			2.0	8.0	8.0		4.0					22.0	$2,310
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	70.0	$8,220

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Waste Contractor	$8,000	1	$8,000
Mobile Lab			$0
Utility Locate			$0
IDW	$1,000	5	$5,000
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$13,000

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162	15	$2,430
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100	15	$1,500
BTEX(8021)	$63		$0
PCB	$72	15	$1,080
TCLP Metals	$144	15	$2,160
TCLP for SVOCs	$369	15	$5,535
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$12,705

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day	1	$75
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	2	$50
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$125

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	2	$300	
Rental Car	$100	2	$200	
Meals	$40	4	$160	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$660	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$8,220
EPI Expenses			$0
EPI Travel			$759
EPI Equipment			$125
		Sub-Total EPI	$9,104
Analytical			$12,705
Subcontractors			$13,000
		Sub-Total Subs	$25,705
Mark-up	15%		$3,856
TOTAL			**$38,665**

Notes:
Assumes drilling mud will be containerized into 10yd3 roll off bins and will sampled by EPI and profiled by another waste contractor.
Assumes 3 samples will be collected from each roll off bin for profiling.
Assumes one trip to the site to perform sample collection.

ENVIRONMENTAL PARTNERS INC

Job Name: ISCO Application **Fee Schedule:** Standard **Date:** 24-Mar-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel													Total Hours	Cost per Person
	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production					
Principal	$180	8.0							4.0				12.0	$2,160
Managing Engineer	$150	8.0											8.0	$1,200
Senior Engineer	$135	40.0	72.0	4.0	8.0	16.0		8.0	8.0				156.0	$21,060
Senior Scientist	$125							40.0	12.0				52.0	$6,500
Technical Editor	$110			8.0	16.0	80.0	16.0						120.0	$13,200
Technical Editor	$110								12.0				12.0	$1,320
Project Engineer	$105			4.0	16.0	80.0	8.0	24.0					132.0	$13,860
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						12.0						12.0	$1,020
Admin	$65												0.0	$0
												Total Hours	504.0	$60,320

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Mixing Station Sub	$15,000	1	$15,000
Water Line	$15,000	1	$15,000
Power Line	$12,000	1	$12,000
Utility Locate	$400	2	$800
Chemical Product	$4,077	1	$4,077
Water (100ft3)	$0.68	1070	$728
Vehicle rental			$0
		Cont./Support Subtotal:	$47,605

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day	10	$750
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	21	$525
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$1,275

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	21	$3,150	
Rental Car	$100	11	$1,100	
Meals	$40	21	$840	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$5,090	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$60,320
EPI Expenses			$0
EPI Travel			$5,854
EPI Equipment			$1,275
		Sub-Total EPI	$67,449
Analytical			$0
Subcontractors			$47,605
		Sub-Total Subs	$47,605
Mark-up	15%		$7,141
TOTAL			**$122,194**

Notes:
Assumes design and fabrication of a mixing and injection station for injection of products at Zones Cand D.
Accounts for time with City of Pasco to coordinate new power and water line extensions to Zones C and D.
Assumes one application event performed over the course of two weeks.
Assumes one site visit for an engineer to oversee construction of the mixing and injection station.
Assumes water and power utilities will be installed out to Zone s C and D.
Assumes 300 lbs of sodium persulfate at $2.11/lb (dry). Assumes 8,200 lbs of ferrous sulfate at $0.42/lb (dry).
Assumes hoses will be run from the mixing station to each horizontal well port outside of Zones C and D.

Horizontal Drilling for Zones C/D - Alternative CD-2

	units	# units	cost/unit	total
Preconstruction submittals / varience filing	hr	6	$125	$750
Mob/Demob	ls	1	$13,000	$13,000
Soil Drilling	lf	640	$125	$80,000
4" casing	lf	280	$24	$6,720
4" well screen	lf	360	$42	$15,120
Waste handling	ls	1	$1,500	$1,500
End seals, grouting	ea	4	$500	$2,000
Well end completion	ea	4	$600	$2,400
Development	ea	4	$600	$2,400
Drilling mud	bags	13	$115	$1,495
			TOTAL	**$125,385**

Note:
Assumes 2 weeks of work to complete

APPENDIX E, ATTACHMENT C
BACKUP FOR SOIL VAPOR EXTRACTION (SVE) COST ESTIMATES

ZONE A

Zone A
Alternative A-5
Total Well Drilling Cost Summary

Clear and Level Land	Deep Wells	Shallow Wells	Well Installation EPI Labor	IDW Profiling and Disposal	Borelogs	SVE Piping From New Wells	As-Built, O&M Manual
$23,026	$266,420	$104,800	$52,205	$59,870	$10,320	$84,205	$19,640

Zone A Alternative A-5 Total Costs for Horizontal SVE Well Drilling	**$620,486**

ENVIRONMENTAL PARTNERS INC

Job Name: Contractor costs to clear and level land for well installation

Fee Schedule: Standard

Date: 12-Mar-14

Schedule: _____ (X Months)

Estimator: JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	0.5											0.5	$90
Managing Engineer	$150	2.0											2.0	$300
Senior Engineer	$135	4.0		8.0									12.0	$1,620
Senior Scientist	$125	4.0		8.0	8.0	24.0							44.0	$5,500
Technical Editor	$110												0.0	$0
Technical Editor	$110												0.0	$0
Project Engineer	$110												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$105												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$90												0.0	$0
Admin	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	58.5	$7,510

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate	$400	1	$400
IDW			$0
Shipping (Smpl)			$0
Contractor	$12,000	1	$12,000
		Cont./Support Subtotal:	$12,400

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	1	$25
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$25

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	3	$450	
Rental Car	$100	3	$300	
Meals	$80	4	$320	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$1,070	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$7,510
EPI Expenses			$0
EPI Travel			$1,231
EPI Equipment			$25
		Sub-Total EPI	$8,766
Analytical			$0
Subcontractors			$12,400
		Sub-Total Subs	$12,400
Mark-up	15%		$1,860
TOTAL			**$23,026**

Notes:
This cost estimate is for standard clearing and leveling the land for the installation of remediation wells.
This cost estimate assumes the activity can be completed in three field days.
Assumes field oversight for one field day.

Zone A Alternative A-5
Deep Horizontal Drilling

	units	# units	cost/unit	total
Preconstruction submittals / varience filing	hr	12	$125	$1,500
Mob/Demob	ls	1	$13,000	$13,000
Soil Drilling	lf	1485	$125	$185,625
4" casing	lf	675	$24	$16,200
4" well screen	lf	810	$42	$34,020
Waste handling	ls	1	$3,000	$3,000
End seals, grouting	ea	3	$1,000	$3,000
Well end completion	ea	3	$1,200	$3,600
Development	ea	3	$1,200	$3,600
Drilling mud	bags	25	$115	$2,875
			Total	**$266,420**

Note:
Based on quote sent to EPI from Directional Technologies Drilling dated 2/28/14.

Zone A Alternative A-5
Shallow Horizontal Drilling

	units	# units	cost/unit	total
Preconstruction submittals / varience filing	hr	2	$125	$250
Mob/Demob	ls	1	$13,000	$13,000
Soil Drilling	lf	560	$125	$70,000
4" casing	lf	420	$24	$10,080
4" well screen	lf	140	$42	$5,880
Waste handling	ls	1	$1,500	$1,500
End seals, grouting	ea	2	$500	$1,000
Well end completion	ea	2	$600	$1,200
Development	ea	2	$600	$1,200
Drilling mud	bags	6	$115	$690
			Total	**$104,800**

Note:
Based on quote sent to EPI from Directional Technologies Drilling dated 2/28/14.

ENVIRONMENTAL PARTNERS INC

Job Name: SVE Well Installation EPI Labor Fee Schedule: Standard Date: 12-Mar-14

Schedule: _____ (X Months) Estimator: JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	8.0											8.0	$1,440
Managing Enginee	$150	8.0											8.0	$1,200
Senior Engineer	$135	24.0		8.0									32.0	$4,320
Senior Scientist	$125												0.0	$0
Technical Editor	$110	8.0		12.0	24.0	120.0							164.0	$18,040
Technical Editor	$110												0.0	$0
Project Engineer	$105			8.0	24.0	120.0							152.0	$15,960
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	364.0	$40,960

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate	$400	1	$400
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$400

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	30	$750
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	5	$375
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$1,125

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	30	$4,500	
Rental Car	$100	15	$1,500	
Meals	$80	30	$2,400	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$8,400	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS		
EPI Labor		$40,960
EPI Expenses		$0
EPI Travel		$9,660
EPI Equipment		$1,125
	Sub-Total EPI	$51,745
Analytical		$0
Subcontractors		$400
	Sub-Total Subs	$400
Mark-up	15%	$60
TOTAL		**$52,205**

Notes:
This cost estimate is for the installation of overseeing DTD to install three deep SVE wells and 2 shallow SVE wells under Zone.
This cost estimate assumes the wells can be installed in 15 field days
Assumes three weeks of travel.
Assumes no sampling or analysis is performed during well installation.

ENVIRONMENTAL PARTNERS INC

Job Name: IDW Profiling and Disposal **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	4.0											4.0	$720
Managing Engineer	$150	4.0											4.0	$600
Senior Engineer	$135	8.0		12.0		2.0		2.0					24.0	$3,240
Senior Scientist	$125												0.0	$0
Technical Editor	$110	8.0		4.0	8.0	24.0		4.0					48.0	$5,280
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105			2.0	8.0	24.0		4.0					38.0	$3,990
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	118.0	$13,830

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Waste Contractor	$9,000	1	$9,000
Mobile Lab			$0
Utility Locate			$0
IDW	$1,000	9	$9,000
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$18,000

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162	27	$4,374
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72	27	$1,944
TCLP Metals	$144	27	$3,888
TCLP for SVOCs	$369	27	$9,963
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$20,169

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day	3	$225
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	6	$150
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$375

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	6	$900	
Rental Car	$100	4	$400	
Meals	$40	6	$240	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$1,540	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$13,830
EPI Expenses			$0
EPI Travel			$1,771
EPI Equipment			$375
		Sub-Total EPI	$15,976
Analytical			$20,169
Subcontractors			$18,000
		Sub-Total Subs	$38,169
Mark-up	15%		$5,725
TOTAL			**$59,870**

Notes:
Assumes one trip to the site to perform sample collection.
Assumes 2 field personnel for 3 days of opening and sampling drums for profiling.
Assumes drilling mud will be containerized into nine 10yd3 roll off bins and will sampled by EPI and profiled by another waste contractor.
Assumes 3 samples will be collected from each roll off bin for profiling.
Assumes one trip to the site to perform sample collection.

ENVIRONMENTAL PARTNERS INC

Job Name: Borelogs **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ **(X Months)** **Estimator:** JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180						8.0		8.0				16.0	$2,880
Managing Engineer	$150												0.0	$0
Senior Engineer	$135						8.0		8.0				16.0	$2,160
Senior Scientist	$125												0.0	$0
Technical Editor	$110						40.0		8.0				48.0	$5,280
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	80.0	$10,320

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$10,320
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$10,320
Analytical			$0
Subcontractors			$0
		Sub-Total Subs	$0
Mark-up	15%		$0
TOTAL			**$10,320**

Notes:
This cost estimate is for the 16 borelogs associated with the installation of remediation wells.

ENVIRONMENTAL PARTNERS INC

Job Name: SVE Piping New Wells to Equipment Compound **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ **(X Months)** **Estimator:** JDB

PROJECT PLANNING:

Personnel														
	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	2.0											2.0	$360
Managing Engineer	$150	4.0											4.0	$600
Senior Engineer	$135	16.0	24.0	10.0									50.0	$6,750
Senior Scientist	$125		24.0				24.0						48.0	$6,000
Technical Editor	$110			20.0	16.0	80.0							116.0	$12,760
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						12.0						12.0	$1,020
Admin	$65												0.0	$0
												Total Hours	232.0	$27,490

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate	$400	2	$800
IDW			$0
Shipping (Smpl)			$0
Contractor	$45,000	1	$45,000
		Cont./Support Subtotal:	$45,800

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	10	$250
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$250

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	10	$1,500	
Rental Car	$100	10	$1,000	
Meals	$80	10	$800	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$3,300	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$27,490
EPI Expenses			$0
EPI Travel			$3,795
EPI Equipment			$250
		Sub-Total EPI	$31,535
Analytical			$0
Subcontractors			$45,800
		Sub-Total Subs	$45,800
Mark-up	15%		$6,870
TOTAL			**$84,205**

Notes:
Cost is for digging trenches and installing SVE piping from new SVE wells to existing SVE equipment.
Assumes installation can be performed in 10 field days.
Assumes two weeks travel.

ENVIRONMENTAL PARTNERS INC

Job Name: As-Built and O&M Manual updates **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ **(X Months)** **Estimator:** JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180												0.0	$0
Managing Engineer	$150												0.0	$0
Senior Engineer	$135						20.0	40.0					60.0	$8,100
Senior Scientist	$125						20.0	20.0					40.0	$5,000
Technical Editor	$110												0.0	$0
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90						16.0						16.0	$1,440
Drafter	$85						60.0						60.0	$5,100
Admin	$65												0.0	$0
												Total Hours	176.0	$19,640

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$19,640
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$19,640
Analytical			$0
Subcontractors			$0
		Sub-Total Subs	$0
Mark-up	15%		$0
TOTAL			**$19,640**

Notes:
This cost estimate is for updates to the O & M manual and as-builts due to newly installed wells and piping.

Zone A
Alternatives A-6, A-7, and A-8
Total Well Drilling Cost Summary

Clear and Level Land	Deep Wells	Well Installation EPI Labor	IDW Profiling and Disposal	Borelogs	SVE Piping From New Wells	As-Built, O&M Manual
$15,761	$266,420	$38,350	$45,027	$6,860	$64,706	$16,420

Zone A Alternatives A-6, A-7, and A-8 Total Costs for Horizontal SVE Well Drilling	**$453,544**

ENVIRONMENTAL PARTNERS INC

Job Name: Contractor costs to clear and level land for well installation

Fee Schedule: Standard

Date: 12-Mar-14

Schedule: _____ (X Months)

Estimator: JDB

PROJECT PLANNING:

Personnel														
	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	0.5											0.5	$90
Managing Engineer	$150	2.0											2.0	$300
Senior Engineer	$135	4.0		2.0									6.0	$810
Senior Scientist	$125			8.0	8.0	16.0							32.0	$4,000
Technical Editor	$110												0.0	$0
Technical Editor	$110												0.0	$0
Project Engineer	$110												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$105												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$90												0.0	$0
Admin	$85												0.0	$0
												Total Hours	40.5	$5,200

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate	$400	1	$400
IDW			$0
Shipping (Smpl)			$0
Contractor	$8,000	1	$8,000
		Cont./Support Subtotal:	$8,400

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	2	$50
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$50

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	2	$300	
Rental Car	$100	2	$200	
Meals	$80	3	$240	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$740	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$5,200
EPI Expenses			$0
EPI Travel			$851
EPI Equipment			$50
		Sub-Total EPI	$6,101
Analytical			$0
Subcontractors			$8,400
		Sub-Total Subs	$8,400
Mark-up	15%		$1,260
TOTAL			**$15,761**

Notes:
This cost estimate is for standard clearing and leveling the land for the installation of remediation wells.
This cost estimate assumes the activity can be completed in one field day.
Assumes field oversight for one field day.

Zone A Alternatives A-6 and A-7
Deep Horizontal Drilling

	units	# units	cost/unit	total
Preconstruction submittals / varience filing	hr	12	$125	$1,500
Mob/Demob	ls	1	$13,000	$13,000
Soil Drilling	lf	1485	$125	$185,625
4" casing	lf	675	$24	$16,200
4" well screen	lf	810	$42	$34,020
Waste handling	ls	1	$3,000	$3,000
End seals, grouting	ea	3	$1,000	$3,000
Well end completion	ea	3	$1,200	$3,600
Development	ea	3	$1,200	$3,600
Drilling mud	bags	25	$115	$2,875
			Total	**$266,420**

Note:
Based on quote sent to EPI from Directional Technologies Drilling dated 2/28/14.

ENVIRONMENTAL PARTNERS INC

Job Name: SVE Well Installation EPI Labor **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ (X Months) **Estimator:** JDB

PROJECT PLANNING:

Personnel														
	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	8.0											8.0	$1,440
Managing Engineer	$150	8.0											8.0	$1,200
Senior Engineer	$135	24.0		8.0									32.0	$4,320
Senior Scientist	$125												0.0	$0
Technical Editor	$110	8.0		8.0	16.0	80.0							112.0	$12,320
Technical Editor	$110												0.0	$0
Project Engineer	$105			8.0	16.0	80.0							104.0	$10,920
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	264.0	$30,200

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate	$400	1	$400
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$400

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	20	$500
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	10	$750
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$1,250

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	20	$3,000	
Rental Car	$100	10	$1,000	
Meals	$80	20	$1,600	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$5,600	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$30,200
EPI Expenses			$0
EPI Travel			$6,440
EPI Equipment			$1,250
		Sub-Total EPI	$37,890
Analytical			$0
Subcontractors			$400
		Sub-Total Subs	$400
Mark-up	15%		$60
TOTAL			**$38,350**

Notes:
This cost estimate is for the installation of overseeing DTD to install three deep SVE wells and 2 shallow SVE wells under Zone.
This cost estimate assumes the wells can be installed in 10 field days
Assumes two weeks of travel.
Assumes no sampling or analysis is performed during well installation.

ENVIRONMENTAL PARTNERS INC

Job Name: IDW Profiling and Disposal **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	4.0											4.0	$720
Managing Engineer	$150	4.0											4.0	$600
Senior Engineer	$135	8.0		12.0		2.0		2.0					24.0	$3,240
Senior Scientist	$125												0.0	$0
Technical Editor	$110	8.0		4.0	8.0	16.0		4.0					40.0	$4,400
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105			2.0	8.0	16.0		4.0					30.0	$3,150
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	102.0	$12,110

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Waste Contractor	$8,000	1	$8,000
Mobile Lab			$0
Utility Locate			$0
IDW	$1,000	6	$6,000
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$14,000

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162	18	$2,916
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72	18	$1,296
TCLP Metals	$144	18	$2,592
TCLP for SVOCs	$369	18	$6,642
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$13,446

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day	2	$150
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	4	$100
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$250

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	4	$600	
Rental Car	$100	2	$200	
Meals	$40	4	$160	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$960	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$12,110
EPI Expenses			$0
EPI Travel			$1,104
EPI Equipment			$250
		Sub-Total EPI	$13,464
Analytical			$13,446
Subcontractors			$14,000
		Sub-Total Subs	$27,446
Mark-up	15%		$4,117
TOTAL			**$45,027**

Notes:

Assumes one trip to the site to perform sample collection.
Assumes 2 field personnel for 2 days of opening and sampling drums for profiling.
Assumes drilling mud will be containerized into six 10yd3 roll off bins and will sampled by EPI and profiled by another waste contractor.
Assumes 3 samples will be collected from each roll off bin for profiling.
Assumes one trip to the site to perform sample collection.

ENVIRONMENTAL PARTNERS INC

Job Name: Borelogs **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ **(X Months)** **Estimator:** JDB

PROJECT PLANNING:

Personnel

	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180						6.0		6.0				12.0	$2,160
Managing Engineer	$150												0.0	$0
Senior Engineer	$135						8.0		4.0				12.0	$1,620
Senior Scientist	$125												0.0	$0
Technical Editor	$110						24.0		4.0				28.0	$3,080
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	52.0	$6,860

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$6,860
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$6,860
Analytical			$0
Subcontractors			$0
		Sub-Total Subs	$0
Mark-up	15%		$0
TOTAL			**$6,860**

Notes:
This cost estimate is for the 16 borelogs associated with the installation of remediation wells.

ENVIRONMENTAL PARTNERS INC

Job Name: SVE Piping New Wells to Equipment Compound **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ (X Months) **Estimator:** JDB

PROJECT PLANNING:

Personnel														
	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	2.0											2.0	$360
Managing Engineer	$150	4.0											4.0	$600
Senior Engineer	$135	16.0	20.0	10.0									46.0	$6,210
Senior Scientist	$125		20.0				20.0						40.0	$5,000
Technical Editor	$110			20.0	16.0	60.0							96.0	$10,560
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						12.0						12.0	$1,020
Admin	$65												0.0	$0
												Total Hours	200.0	$23,750

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate	$400	2	$800
IDW			$0
Shipping (Smpl)			$0
Contractor	$32,000	1	$32,000
		Cont./Support Subtotal:	$32,800

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	8	$200
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$200

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	8	$1,200	
Rental Car	$100	8	$800	
Meals	$80	8	$640	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$2,640	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$23,750
EPI Expenses			$0
EPI Travel			$3,036
EPI Equipment			$200
		Sub-Total EPI	$26,986
Analytical			$0
Subcontractors			$32,800
		Sub-Total Subs	$32,800
Mark-up	15%		$4,920
TOTAL			**$64,706**

Notes:
Cost is for digging trenches and installing SVE piping from new SVE wells to existing SVE equipment.
Assumes installation can be performed in 7.5 days field days.
Assumes two weeks travel.

ENVIRONMENTAL PARTNERS INC

Job Name: As-Built and O&M Manual updates **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ **(X Months)** **Estimator:** JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180												0.0	$0
Managing Engineer	$150												0.0	$0
Senior Engineer	$135						18.0	32.0					50.0	$6,750
Senior Scientist	$125						16.0	16.0					32.0	$4,000
Technical Editor	$110												0.0	$0
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90						12.0						12.0	$1,080
Drafter	$85						54.0						54.0	$4,590
Admin	$65												0.0	$0
												Total Hours	148.0	$16,420

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$16,420
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$16,420
Analytical			$0
Subcontractors			$0
		Sub-Total Subs	$0
Mark-up	15%		$0
TOTAL			**$16,420**

Notes:
This cost estimate is for updates to the O & M manual and as-builts due to newly installed wells and piping.

ON-PROPERTY GROUND WATER (CENTRAL AREA)

On-property Ground Water (Central Area)
Alternative ONP-1
ONP-1 Contingent SVE Treatment Costs

ENVIRONMENTAL PARTNERS INC

YEAR	Present Value Factor	SVE Well Install	IDW Profiling and Disposal	Borelogs	SVE Piping Equipment	As-Built and O&M Plan Updates	Additional Operational Labor	Power Consumption	System Decomm.
		Year 5	Year 5	Year 5	Year 5	Year 5	Years 5, 10, 15, 20, 25, and 30	Years 5, 10, 15, 20, 25, and 30	Year 30
0	Current Value	$37,785	$18,222	$1,950	$91,093	$18,630	$31,160	$10,048	$14,366
1	0.9709								
2	0.9426								
3	0.9151								
4	0.8885								
5	0.8626	$32,594	$15,718	$1,682	$78,577	$16,070	$26,879	$8,667	
6	0.8375								
7	0.8131								
8	0.7894								
9	0.7664								
10	0.7441						$23,186	$7,476	
11	0.7224								
12	0.7014								
13	0.6810								
14	0.6611								
15	0.6419						$20,000	$6,449	
16	0.6232								
17	0.6050								
18	0.5874								
19	0.5703								
20	0.5537						$17,253	$5,563	
21	0.5375								
22	0.5219								
23	0.5067								
24	0.4919								
25	0.4776						$14,882	$4,799	
26	0.4637								
27	0.4502								
28	0.4371								
29	0.4243								
30	0.4120						$12,838	$4,139	$5,919
	Subtotal	**$32,594**	**$15,718**	**$1,682**	**$78,577**	**$16,070**	**$115,038**	**$37,094**	**$5,919**

3%

On-property Ground Water
Alternative ONP-1 **$302,691**
Total Costs for Contingent SVE Treatment Over 30 Years

Note:
1. Assumes a contingent system is operated every five years for one full year to remove contingent downgradient releases.

ENVIRONMENTAL PARTNERS INC

Job Name: SVE well installation **Fee Schedule:** Standard **Date:** 13-May-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel														
	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180												0.0	$0
Managing Engineer	$150	4.0											4.0	$600
Senior Engineer	$135	12.0		8.0									20.0	$2,700
Senior Scientist	$125												0.0	$0
Technical Editor	$110			12.0	8.0	40.0							60.0	$6,600
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	84.0	$9,900

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller	$22,000	1	$22,000
Geophysics			$0
Mobile Lab			$0
Utility Locate	$400	1	$400
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$22,400

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/OR	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmer	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	4	$100
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	4	$300
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$400

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	4	$600	
Rental Car	$100	5	$500	
Meals	$80	5	$400	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$1,500	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$9,900
EPI Expenses			$0
EPI Travel			$1,725
EPI Equipment			$400
		Sub-Total EPI	$12,025
Analytical			$0
Subcontractors			$22,400
		Sub-Total Subs	$22,400
Mark-up	15%		$3,360
TOTAL			**$37,785**

Notes:
This cost estimate is for the installation of 3 SVE wells to a depth of 55 feet bgs.
This cost estimate assumes the wells can be installed in 4 field days
Assumes one week of travel.
Assumes no sampling or analysis during well installation.
Based on quote by Cascade provided to EPI on March 13, 2014.
Assumes mini-sonic drill rig for well installation.

ENVIRONMENTAL PARTNERS INC

Job Name: IDW Profiling and Disposal **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ **(X Months)** **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	4.0											4.0	$720
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	4.0		4.0		1.0		2.0					11.0	$1,485
Senior Scientist	$125												0.0	$0
Technical Editor	$110	8.0		2.0	8.0	8.0		4.0					30.0	$3,300
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	45.0	$5,505

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Waste Contractor	$1,100	1	$1,100
Mobile Lab			$0
Utility Locate			$0
IDW	$600	12	$7,200
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$8,300

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162	3	$486
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72	3	$216
TCLP Metals	$144	3	$432
TCLP for SVOCs	$369	3	$1,107
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$2,241

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day	1	$75
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORI	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmen	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	1	$25
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$100

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	1	$150	
Rental Car	$100	2	$200	
Meals	$40	2	$80	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$430	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$5,505
EPI Expenses			$0
EPI Travel			$495
EPI Equipment			$100
		Sub-Total EPI	$6,100
Analytical			$2,241
Subcontractors			$8,300
		Sub-Total Subs	$10,541
Mark-up	15%		$1,581
TOTAL			**$18,222**

Notes:
Assumes one trip to the site to perform sample collection.
Assumes 1 field worker for 1 day of opening and sampling drums for profiling.
Assumes 4 drums of IDW are generated per SVE well.

ENVIRONMENTAL PARTNERS INC

Job Name: Borelogs **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ **(X Months)** **Estimator:** JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180								2.0				2.0	$360
Managing Engineer	$150												0.0	$0
Senior Engineer	$135						2.0		2.0				4.0	$540
Senior Scientist	$125												0.0	$0
Technical Editor	$110						8.0						8.0	$880
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85								2.0				2.0	$170
Admin	$65												0.0	$0
												Total Hours	16.0	$1,950

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/OR	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmer	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$1,950
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$1,950
Analytical			$0
Subcontractors			$0
		Sub-Total Subs	$0
Mark-up	15%		$0
TOTAL			**$1,950**

Notes:
This cost estimate is for the 16 borelogs associated with the installation of remediation wells.

ENVIRONMENTAL PARTNERS INC

Job Name: SVE, piping to Equipment Compound Fee Schedule: Standard Date: 13-May-14

Schedule: _____ (X Months) Estimator: ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	2.0											2.0	$360
Managing Engineer	$150	8.0											8.0	$1,200
Senior Engineer	$135	16.0		12.0			8.0						36.0	$4,860
Senior Scientist	$125												0.0	$0
Technical Editor	$110			20.0	24.0	120.0							164.0	$18,040
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						12.0						12.0	$1,020
Admin	$65												0.0	$0
												Total Hours	222.0	$25,480

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate	$400	2	$800
IDW			$0
Shipping (Smpl)			$0
Contractor	$50,000	1	$50,000
		Cont./Support Subtotal:	$50,800

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE>	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE>	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/OR	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmen	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	15	$375
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	15	$1,125
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$1,500

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	15	$2,250	
Rental Car	$100	15	$1,500	
Meals	$80	15	$1,200	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$4,950	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$25,480
EPI Expenses			$0
EPI Travel			$5,693
EPI Equipment			$1,500
		Sub-Total EPI	$32,673
Analytical			$0
Subcontractors			$50,800
		Sub-Total Subs	$50,800
Mark-up	15%		$7,620
TOTAL			**$91,093**

Notes:
Cost is for SVE piping from the new SVE wells, across Dietrich Road and to the SVE compound.
Assumes installation can be performed in 15 field days.
Assumes three weeks travel.
Assumes purchase of a new dedicated blower, 3 knockout tanks, and connection of piping to SVE remediation equipment effluent for treatment by the oxidizer.
Assumes manual flow, temperature and pressure readings without incorporation into the existing PLC.

ENVIRONMENTAL PARTNERS INC

Job Name: As-Built and O&M Manual updates **Fee Schedule:** Standard **Date:** 13-May-14

Schedule: _____ **(X Months)** **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	2.0											2.0	$360
Managing Engine	$150												0.0	$0
Senior Engineer	$135	2.0	20.0				20.0						42.0	$5,670
Senior Scientist	$125		40.0				20.0						60.0	$7,500
Technical Editor	$110												0.0	$0
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						60.0						60.0	$5,100
Admin	$65												0.0	$0
												Total Hours	164.0	$18,630

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wB1	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wB1	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORI	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmer	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$18,630
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$18,630
Analytical			$0
Subcontractors			$0
		Sub-Total Subs	$0
Mark-up	15%		$0
TOTAL			**$18,630**

Notes:
This cost estimate is for updates to the O & M manual and as-builts due to newly procured equipment

ENVIRONMENTAL PARTNERS INC

Job Name: Additional equipment maintenance and labor **Fee Schedule:** Standard **Date:** 13-May-14

Schedule: _____ **(X Months)** **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	16.0											16.0	$2,880
Managing Engine	$150												0.0	$0
Senior Engineer	$135	40.0											40.0	$5,400
Senior Scientist	$125												0.0	$0
Technical Editor	$110												0.0	$0
Technical Editor	$110			208.0									208.0	$22,880
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	264.0	$31,160

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBT	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBT	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/OR	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmer	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS		
EPI Labor		$31,160
EPI Expenses		$0
EPI Travel		$0
EPI Equipment		$0
	Sub-Total EPI	$31,160
Analytical		$0
Subcontractors		$0
	Sub-Total Subs	$0
Mark-up	15%	$0
TOTAL		**$31,160**

Notes:
Based on Eric Jensen labor of an additional 4 hours per week to operate and maintain the equipment.

ENVIRONMENTAL PARTNERS INC

Job Name: Power Consumption **Fee Schedule:** Standard **Date:** 13-May-14

Schedule: _____ (X Months) **Estimator:** ARM

PROJECT PLANNING:

Personnel														
	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180												0.0	$0
Managing Engineer	$150												0.0	$0
Senior Engineer	$135												0.0	$0
Senior Scientist	$125												0.0	$0
Technical Editor	$110												0.0	$0
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	0.0	$0

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Moisture Separator	$1,300	3	$3,900
SVE blower	$4,587	1	$4,587
Condensate pumps	$250	1	$250
County tax, fees			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$8,737

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTE	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORI	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmen	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$0
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$0
Analytical			$0
Subcontractors			$8,737
		Sub-Total Subs	$8,737
Mark-up	15%		$1,311
TOTAL			**$10,048**

Notes:

Assume 10 hp SVE blower operating continously for one year
Assumes electrical rate of $0.0702 / KW-hour
Electrical costs, taxes and fees based on Franklin PUD invoice costs.
Assumes condensate will be injected into the regenerative thermal oxidizer.

ENVIRONMENTAL PARTNERS INC

Job Name: Decommission additional SVE equipment **Fee Schedule:** Standard **Date:** 13-May-14

Schedule: _____ **(X Months)** **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	2.0											2.0	$360
Managing Engine	$150												0.0	$0
Senior Engineer	$135	6.0											6.0	$810
Senior Scientist	$125												0.0	$0
Technical Editor	$110			8.0	8.0	16.0							32.0	$3,520
Technical Editor	$110					16.0							16.0	$1,760
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	56.0	$6,450

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Contractor	$6,000	1	$6,000
		Cont./Support Subtotal:	$6,000

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wB	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VC	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wB	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/OR	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmen	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	2	$50
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$50

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	2	$300	
Rental Car	$100	3	$300	
Meals	$80	3	$240	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$840	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$6,450
EPI Expenses			$0
EPI Travel			$966
EPI Equipment			$50
		Sub-Total EPI	$7,466
Analytical			$0
Subcontractors			$6,000
		Sub-Total Subs	$6,000
Mark-up	15%		$900
TOTAL			**$14,366**

Notes:
This cost estimate is for decommissioning the additional SVE equipment.
This cost estimate assumes completion of this in 2 field days.
Assumes one week travel.

APPENDIX E, ATTACHMENT D
BACKUP FOR AIR SPARGING AND OZONE TREATMENT COST ESTIMATES

Zone A

Alternative A-2

Contingent Air Sparge and Ozone Treatment Costs

ENVIRONMENTAL PARTNERS INC

YEAR	Present Value Factor	Sparge Well Install	SVE Well Install	IDW Profiling and Disposal	Borelogs	SVE/Sparge Piping	Compound Expansion	Additional Sparge and SVE Equipment Upgrades	As-Built and O&M Plan Updates	Additional Operational Labor	Power Consumption	Decomm. Sparge Wells	System Decomm.
		Year 5	Year 5	Year 5	Year 5	Year 5	Year 5	Year 5	Year 5	Years 5 - 30	Years 5 - 30	Year 30	Year 30
0	Current Value	$126,865	$44,982	$71,660	$5,010	$70,255	$49,748	$107,508	$18,630	$31,160	$16,224	$19,369	$21,728
1	0.9709												
2	0.9426												
3	0.9151												
4	0.8885												
5	0.8626	$109,435	$38,802	$61,814	$4,322	$60,603	$42,913	$92,737	$16,070	$26,879	$13,995		
6	0.8375									$26,096	$13,588		
7	0.8131									$25,336	$13,192		
8	0.7894									$24,598	$12,808		
9	0.7664									$23,882	$12,434		
10	0.7441									$23,186	$12,072		
11	0.7224									$22,511	$11,721		
12	0.7014									$21,855	$11,379		
13	0.6810									$21,218	$11,048		
14	0.6611									$20,600	$10,726		
15	0.6419									$20,000	$10,414		
16	0.6232									$19,418	$10,110		
17	0.6050									$18,852	$9,816		
18	0.5874									$18,303	$9,530		
19	0.5703									$17,770	$9,252		
20	0.5537									$17,253	$8,983		
21	0.5375									$16,750	$8,721		
22	0.5219									$16,262	$8,467		
23	0.5067									$15,789	$8,221		
24	0.4919									$15,329	$7,981		
25	0.4776									$14,882	$7,749		
26	0.4637									$14,449	$7,523		
27	0.4502									$14,028	$7,304		
28	0.4371									$13,619	$7,091		
29	0.4243									$13,223	$6,885		
30	0.4120									$12,838	$6,684	$7,980	$8,952
	Subtotal	**$109,435**	**$38,802**	**$61,814**	**$4,322**	**$60,603**	**$42,913**	**$92,737**	**$16,070**	**$494,925**	**$257,695**	**$7,980**	**$8,952**

3%

Zone A Alternative A-2
Total Costs for Contingent Air Sparging & Ozone Treatment Over 30 Years **$1,196,247**

ENVIRONMENTAL PARTNERS INC

Job Name: Decommission Sparge Wells **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ **(X Months)** **Estimator:** JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	2.0											2.0	$360
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	4.0	6.0	6.0									16.0	$2,160
Senior Scientist	$125												0.0	$0
Technical Editor	$110			6.0	8.0	24.0		8.0					46.0	$5,060
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	64.0	$7,580

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller	$9,000	1	$9,000
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$9,000

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/OR	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmer	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	3	$75
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	3	$225
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$300

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	3	$450	
Rental Car	$100	3	$300	
Meals	$80	3	$240	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$990	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$7,580
EPI Expenses			$0
EPI Travel			$1,139
EPI Equipment			$300
		Sub-Total EPI	$9,019
Analytical			$0
Subcontractors			$9,000
		Sub-Total Subs	$9,000
Mark-up	15%		$1,350
TOTAL			**$19,369**

Notes:
This cost estimate is for the decommissioning of 8 air sparge wells to a depth of 88 feet bgs and 3 SVE wells to 55 feet bgs.
This cost estimate assumes the wells can be decommissioned in 4 field days.

ENVIRONMENTAL PARTNERS INC

Job Name: Air sparge well installation Fee Schedule: Standard Date: 12-Mar-14

Schedule: _____ (X Months) Estimator: JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	8.0											8.0	$1,440
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	8.0	16.0	8.0									32.0	$4,320
Senior Scientist	$125												0.0	$0
Technical Editor	$110			8.0	16.0	64.0							88.0	$9,680
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	128.0	$15,440

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller	$93,156	1	$93,156
Geophysics			$0
Mobile Lab			$0
Utility Locate	$400	1	$400
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$93,556

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORP)	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/Well De	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Development	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	8	$200
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	8	$600
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Meter	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$800

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	8	$1,200	
Rental Car	$100	8	$800	
Meals	$80	8	$640	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$2,640	
Mileage	$0.565	0	$0.00	Not Marked-u

TOTALS

EPI Labor			$15,440
EPI Expenses			$0
EPI Travel			$3,036
EPI Equipment			$800
		Sub-Total EPI	$19,276
Analytical			$0
Subcontractors			$93,556
		Sub-Total Subs	$93,556
Mark-up	15%		$14,033
TOTAL			**$126,865**

Notes:
This cost estimate is for the installation of 8 air aparge wells to a depth of 88 feet bgs.
This cost estimate assumes the wells can be installed in 8 field days.
Assumes two weeks travel.
Assumes no sampling or analysis.
Based on quote by Cascade provided to EPI on March 13, 2014.
Assumes mini-sonic drill rig for installation.

ENVIRONMENTAL PARTNERS INC

Job Name: SVE well installation **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ (X Months) **Estimator:** JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	8.0											8.0	$1,440
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	9.0	12.0	6.0									27.0	$3,645
Senior Scientist	$125												0.0	$0
Technical Editor	$110			9.0	8.0	36.0							53.0	$5,830
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	88.0	$10,915

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller	$27,556	1	$27,556
Geophysics			$0
Mobile Lab			$0
Utility Locate	$400	1	$400
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$27,956

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/OR	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmer	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	4	$100
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	4	$300
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$400

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	4	$600	
Rental Car	$100	4	$400	
Meals	$80	4	$320	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$1,320	
Mileage	$0.565	0	$0.00	Not Marked-u

TOTALS

EPI Labor			$10,915
EPI Expenses			$0
EPI Travel			$1,518
EPI Equipment			$400
		Sub-Total EPI	$12,833
Analytical			$0
Subcontractors			$27,956
		Sub-Total Subs	$27,956
Mark-up	15%		$4,193
TOTAL			**$44,982**

Notes:
This cost estimate is for the installation of 3 SVE wells to a depth of 55 feet bgs.
This cost estimate assumes the wells can be installed in 4 field days
Assumes one week travel.
Assumes no sampling or analysis.
Based on quote by Cascade provided to EPI on March 13, 2014.
Assumes mini-sonic drill rig for well installation.

ENVIRONMENTAL PARTNERS INC

Job Name: IDW Profiling and Disposal **Fee Schedule:** Standard **Date:** 13-Mar-14

Schedule: _____ **(X Months)** **Estimator:** ARM

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	4.0											4.0	$720
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	4.0		6.0		2.0		2.0					14.0	$1,890
Senior Scientist	$125												0.0	$0
Technical Editor	$110	8.0		2.0	8.0	16.0		4.0					38.0	$4,180
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105			2.0	8.0	16.0		4.0					30.0	$3,150
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	86.0	$9,940

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Waste Contractor	$4,000	1	$4,000
Mobile Lab			$0
Utility Locate			$0
IDW	$600	36	$21,600
Shipping (Smpl)			$0
Vehicle rental			$0
		Cont./Support Subtotal:	$25,600

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162	36	$5,832
SVOC(8270)	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
TPH-HCID	$120		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72	36	$2,592
TCLP Metals	$144	36	$5,184
TCLP for SVOCs	$369	36	$13,284
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$26,892

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day	2	$150
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORI	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmer	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	4	$100
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$250

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	4	$600	
Rental Car	$100	2	$200	
Meals	$40	4	$160	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$960	
Mileage	$0.565	0	$0.00	Not Marked-u

TOTALS		
EPI Labor		$9,940
EPI Expenses		$0
EPI Travel		$1,104
EPI Equipment		$250
	Sub-Total EPI	$11,294
Analytical		$26,892
Subcontractors		$25,600
	Sub-Total Subs	$52,492
Mark-up	15%	$7,874
TOTAL		**$71,660**

Notes:

Assumes one trip to the site to perform sample collection.
Assumes 2 field personnel for 2 days of opening and sampling drums for profiling.
Assumes 4 drums of IDW are generated per SVE well.
Assumes 4 drums of IDW are generated for each sparge well in soils above the water table.
Assumes 3 drums of IDW below the water table for each air sparge well.
Assumes composite sampling of soils above or below the water table may be performed at each well location.

ENVIRONMENTAL PARTNERS INC

Job Name: Borelogs **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ **(X Months)** **Estimator:** JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180						2.0		4.0				6.0	$1,080
Managing Engineer	$150												0.0	$0
Senior Engineer	$135						4.0		8.0				12.0	$1,620
Senior Scientist	$125												0.0	$0
Technical Editor	$110						21.0						21.0	$2,310
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	39.0	$5,010

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/OR	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmer	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS		
EPI Labor		$5,010
EPI Expenses		$0
EPI Travel		$0
EPI Equipment		$0
	Sub-Total EPI	$5,010
Analytical		$0
Subcontractors		$0
	Sub-Total Subs	$0
Mark-up	15%	$0
TOTAL		**$5,010**

Notes:
This cost estimate is for the 16 borelogs associated with the installation of remediation wells.

ENVIRONMENTAL PARTNERS INC

Job Name: SVE, air-sparge/ozone piping to Equipment Compound

Fee Schedule: Standard

Date: 12-Mar-14

Schedule: _____ (X Months)

Estimator: JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	10.0											10.0	$1,800
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	16.0	20.0	10.0									46.0	$6,210
Senior Scientist	$125		10.0				10.0						20.0	$2,500
Technical Editor	$110			20.0	16.0	80.0							116.0	$12,760
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						12.0						12.0	$1,020
Admin	$65												0.0	$0
												Total Hours	204.0	$24,290

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate	$400	2	$800
IDW			$0
Shipping (Smpl)			$0
Contractor	$35,000	1	$35,000
		Cont./Support Subtotal:	$35,800

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/OR	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmer	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	10	$250
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day	10	$750
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$1,000

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	10	$1,500	
Rental Car	$100	10	$1,000	
Meals	$80	10	$800	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$3,300	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$24,290
EPI Expenses			$0
EPI Travel			$3,795
EPI Equipment			$1,000
		Sub-Total EPI	$29,085
Analytical			$0
Subcontractors			$35,800
		Sub-Total Subs	$35,800
Mark-up	15%		$5,370
TOTAL			**$70,255**

Notes:
Cost is for 500-feet of air sparge and SVE pvc piping.
Assumes installation can be performed in 10 field days.
Assumes two weeks travel.
Assumes connection of piping to SVE/AS remediation equipment.

ENVIRONMENTAL PARTNERS INC

Job Name: Equipment Compound Upgrades **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ (X Months) **Estimator:** JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	6.0											6.0	$1,080
Managing Engineer	$150	6.0											6.0	$900
Senior Engineer	$135	8.0	24.0	8.0			16.0						56.0	$7,560
Senior Scientist	$125		16.0	8.0			8.0						32.0	$4,000
Technical Editor	$110				8.0	40.0							48.0	$5,280
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						60.0						60.0	$5,100
Admin	$65												0.0	$0
												Total Hours	208.0	$23,920

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Electrical Engin.	9000		$0
Utility Locate	$400	1	$400
Permit Fees	$500	1	$500
Electrical	$12,000	1	$12,000
Contractor	$8,000	1	$8,000
		Cont./Support Subtotal:	$20,900

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORI	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmen	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	5	$125
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$125

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	5	$750	
Rental Car	$100	5	$500	
Meals	$40	5	$200	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$1,450	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS			
EPI Labor			$23,920
EPI Expenses			$0
EPI Travel			$1,668
EPI Equipment			$125
		Sub-Total EPI	$25,713
Analytical			$0
Subcontractors			$20,900
		Sub-Total Subs	$20,900
Mark-up	15%		$3,135
TOTAL			**$49,748**

Notes:
Cost is for upgrades of old NoVOCs building with updated electrical, communications, etc..
Electrical upgrades are included.
Assumes electrical engineer from HiLine will run communication wires and update PLC's and incorporate additional equipment into HMI.
Assumes one week of travel.
Assumes expansion can be performed in 10 field days by a contractor, with 5 days of EPI oversight.
Additional electrical transformer may be required for additional power consumption, but is not included.

ENVIRONMENTAL PARTNERS INC

Job Name: Additional sparge and SVE equipment upgrades Fee Schedule: Standard Date: 12-Mar-14

Schedule: _____ (X Months) Estimator: JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	10.0											10.0	$1,800
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	14.0	72.0				20.0						106.0	$14,310
Senior Scientist	$125		48.0		8.0	40.0							96.0	$12,000
Technical Editor	$110												0.0	$0
Technical Editor	$110												0.0	$0
Project Engineer	$105			28.0	16.0	80.0							124.0	$13,020
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						6.0						6.0	$510
Admin	$65												0.0	$0
												Total Hours	342.0	$41,640

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Ozone Generator	$4,000	1	$4,000
Sparge Equipment	$21,000	1	$21,000
SVE Equipment	$27,000	1	$27,000
Other			$0
		Cont./Support Subtotal:	$52,000

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/OR	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmen	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	15	$375
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$375

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	15	$2,250	
Rental Car	$100	15	$1,500	
Meals	$80	15	$1,200	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$4,950	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS		
EPI Labor		$41,640
EPI Expenses		$0
EPI Travel		$5,693
EPI Equipment		$375
	Sub-Total EPI	$47,708
Analytical		$0
Subcontractors		$52,000
	Sub-Total Subs	$52,000
Mark-up	15%	$7,800
TOTAL		**$107,508**

Notes:
Assumes the cost for an additional skid mounted SVE blower with motor and KO tank and controls.
Assumes the cost for an additional skid mounted AS compressor and controls.
Assumes the cost for the procurement of an ozone generator
Assumes installation can be completed in 15 field days.
Assumes an engineer on site for the first week to oversee installation and a staff scientist to oversee the last two weeks of installation.

ENVIRONMENTAL PARTNERS INC

Job Name: As-Built and O&M Manual updates **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ **(X Months)** **Estimator:** JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	2.0											2.0	$360
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	2.0	20.0				20.0						42.0	$5,670
Senior Scientist	$125		40.0				20.0						60.0	$7,500
Technical Editor	$110												0.0	$0
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85						60.0						60.0	$5,100
Admin	$65												0.0	$0
												Total Hours	164.0	$18,630

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORI	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmer	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$18,630
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$18,630
Analytical			$0
Subcontractors			$0
		Sub-Total Subs	$0
Mark-up	15%		$0
TOTAL			**$18,630**

Notes:
This cost estimate is for updates to the O & M manual and as-builts due to newly procured equipment

ENVIRONMENTAL PARTNERS INC

Job Name: Additional equipment maintenance and labor **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ **(X Months)** **Estimator:** JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	16.0											16.0	$2,880
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	40.0											40.0	$5,400
Senior Scientist	$125												0.0	$0
Technical Editor	$110												0.0	$0
Technical Editor	$110			208.0									208.0	$22,880
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	264.0	$31,160

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$0

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORI	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmer	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$31,160
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$31,160
Analytical			$0
Subcontractors			$0
		Sub-Total Subs	$0
Mark-up	15%		$0
TOTAL			**$31,160**

Notes:
Based on Eric Jensen labor of an additional 4 hours per week to operate and maintain the equipment.

ENVIRONMENTAL PARTNERS INC

Job Name: Power Consumption **Fee Schedule:** Standard **Date:** 12-Mar-14

Schedule: _____ (X Months) **Estimator:** JDB

PROJECT PLANNING:

Personnel														
	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180												0.0	$0
Managing Engineer	$150												0.0	$0
Senior Engineer	$135												0.0	$0
Senior Scientist	$125												0.0	$0
Technical Editor	$110												0.0	$0
Technical Editor	$110												0.0	$0
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	0.0	$0

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Sparge Compressor	$9,175	1	$9,175
SVE blower	$4,587	1	$4,587
Condensate pumps	$250	1	$250
County tax, fees	$96	1	$96
IDW			$0
Shipping (Smpl)			$0
Other			$0
		Cont./Support Subtotal:	$14,108

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORI	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmen	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day		$0
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$0

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel			$0	
Rental Car			$0	
Meals			$0	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$0	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$0
EPI Expenses			$0
EPI Travel			$0
EPI Equipment			$0
		Sub-Total EPI	$0
Analytical			$0
Subcontractors			$14,108
		Sub-Total Subs	$14,108
Mark-up	15%		$2,116
TOTAL			**$16,224**

Notes:
Assumes 20 hp compressor operating continuously for one year
Assume 10 hp SVE blower operating continously for one year
Assumes electrical rate of $0.0702 / KW-hour
Electrical costs, taxes and fees based on Franklin PUD invoice costs.
Assumes condensate will be injected into the regenerative thermal oxidizer.

ENVIRONMENTAL PARTNERS INC

Job Name: Decommission additional SVE, sparge/ozone equipment

Fee Schedule: Standard

Date: 12-Mar-14

Schedule: _____ (X Months)

Estimator: JDB

PROJECT PLANNING:

Personnel	Rate	Scoping Contract Mgt	EPI Design	Fieldwork Setup H&S Plan	Travel	Fieldwork	Tables Figures	Reporting	Final Review Production				Total Hours	Cost per Person
Principal	$180	2.0											2.0	$360
Managing Engineer	$150												0.0	$0
Senior Engineer	$135	6.0											6.0	$810
Senior Scientist	$125		16.0		8.0	16.0							40.0	$5,000
Technical Editor	$110			8.0	8.0	16.0							32.0	$3,520
Technical Editor	$110					32.0							32.0	$3,520
Project Engineer	$105												0.0	$0
Project Scientist	$105												0.0	$0
Junior Engineer	$90												0.0	$0
Junior Scientist	$90												0.0	$0
Drafter	$85												0.0	$0
Admin	$65												0.0	$0
												Total Hours	112.0	$13,210

CONTRACTOR/SUPPORT EXPENSE:

Contractor	Cost per Unit	Number of Units	Subtotal
Driller			$0
Geophysics			$0
Mobile Lab			$0
Utility Locate			$0
IDW			$0
Shipping (Smpl)			$0
Contractor	$6,000	1	$6,000
		Cont./Support Subtotal:	$6,000

LABORATORY EXPENSE:

Analysis	Cost per Sample	No. of Samples	Subtotal
Soil			
VOC(8260)	$162		$0
SVOC(8270)	$315		$0
cPAHs	$171		$0
MTCA Metals	$77		$0
NW TPH-HCID	$54		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$100		$0
BTEX(8021)	$63		$0
PCB	$72		$0
TCLP Metals	$144		$0
TCLP for SVOCs	$369		$0
TCLP ZHE for VOCs	$270		$0
Water			
VOC	$162		$0
SVOC	$315		$0
cPAHs	$171		$0
Metals - MTCA	$77		$0
NW TPH-HCID	$68		$0
NW TPH-GX	$59		$0
NW TPH-GX wBTEX	$72		$0
NW TPH-DX	$77		$0
HVOCs(8010)	$99		$0
BTEX(8021)	$63		$0
PCB	$72		$0
		Laboratory Subtotal:	$0

EPI EQUIPMENT EXPENSE:

Item	Cost per Unit	No. of Units	Subtotal
Sampling Charges			
Soil -	$50.00/day		$0
Soil - (VOC)	$75.00/day		$0
GW -	$100.00/day		$0
GW - (DO/ORP)	$125.00/day		$0
Soil/GW	$150.00/day		$0
Soil/GW (DO/ORI	$175.00/day		$0
SVE Pilot Test	$350.00/day		$0
Asbestos	$50.00/day		$0
Air	$75.00/day		$0
Surface Water	$75.00/day		$0
Chemical Inject	$75.00/day		$0
Product Reml/We	$20.00/day		$0
Remd Sys O&M	$50.00/day		$0
Well Developmen	$20.00/day		$0
Truck - <50 Miles	$50.00/day		$0
Truck - >50 Miles	$100.00/day		$0
Level D PPE	$25.00/day	4	$100
Level C PPE	$70.00/day		$0
Filters	$25/unit		$0
Disposable Bailer	$25/unit		$0
Tedlar Bags	$20/unit		$0
Hach Kit	$5/unit		$0
Detector Tubes	$20/unit		$0
Grundfos Pump	$150.00/day		$0
Video Camcorder	$60.00/day		$0
Borehole Camera	$150.00/day		$0
GPS Unit	$150.00/day		$0
PID with Calib Kit	$75.00/day		$0
CGI / LEL Meter	$50.00/day		$0
Oil/Water Probe	$35.00/day		$0
Water Level Mete	$15.00/day		$0
Turbidity Meter	$20.00/day		$0
		Equipment Subtotal:	$100

EPI Expenses

Item	Cost per Unit	Number of Units	Subtotal
Report Printing			$0
Shipping Costs			$0
Other:			$0
Other:			$0
		EPI Expense Subtotal:	$0

Travel Expenses

Item	Cost per Unit	Number of Units	Subtotal	
Airfare			$0	
Hotel	$150	4	$600	
Rental Car	$100	4	$400	
Meals	$80	4	$320	
Other			$0	
Parking/Tolls			$0	
Shipping Equip			$0	
Other			$0	
		Travel Expense Subtotal:	$1,320	
Mileage	$0.565	0	$0.00	Not Marked-up

TOTALS

EPI Labor			$13,210
EPI Expenses			$0
EPI Travel			$1,518
EPI Equipment			$100
		Sub-Total EPI	$14,828
Analytical			$0
Subcontractors			$6,000
		Sub-Total Subs	$6,000
Mark-up	15%		$900
TOTAL			**$21,728**

Notes:
This cost estimate is for decommissioning the additional SVE equipment.
This cost estimate assumes completion of this in 4 field days.
Assumes one week travel.

APPENDIX E, ATTACHMENT E
BACKUP FOR IN SITU THERMAL TREATMENT COST ESTIMATES

Pasco Landfill Remediation Parameters

www.thermalrs.com

		Area 1	Area 2	Area 3	Area 4
Electrical Resistance Heating Treatment Area:	95,462 sq. ft	23,866	23,866	23,866	23,866
Average Shallow Extent of ERH:	5 ft	5	5	5	5
Average Deep Extent of ERH:	25 ft	25	25	25	25
Typical Depth to Groundwater:	55 ft				
Treatment Volume:	70,700 cu. yd	17,700	17,700	17,700	17,700
Total Organic Carbon Content of Soil:	0.81%	0.81%	0.81%	0.81%	0.81%
Number of Electrodes:	380	95	95	95	95
Electrode Boring Diameter (in.):		12	12	12	12
Average Distance Between Electrodes:	17 ft	17	17	17	17
Avg. Total Depth of Electrodes:	25 ft	25	25	25	25
Avg. Depth to Top of Electrode Conductive Zone:	7 ft	7	7	7	7
Number of Co-located Vapor Recovery Wells:	380	95	95	95	95
Number of Temperature Monitoring Points:	36 (5 sensors each)				
Is a New Surface Cap Required?	no				
Controlling Contaminant:		xylene	toluene	xylene	toluene
Average Clean-up Percent:	96%	97%	98%	70%	80%
Client-provided VOC Mass Estimate:	300,000 lb	The Client-estimated mass of 300000 lb results in an avg. conc. of 1571 mg/kg.			
Vapor Recovery Air Flow Rate:	3040 scfm using a 140-hp vapor recovery blower				
Condensate Production Rate:	7 gpm				
Vapor Treatment Method:	none				
Assumed Activated Carbon Required:	0,000 lb				
Power Control Unit (PCU) Capacity:	4500 kW				
Average Electrical Heating Power Input:	2462 kW				
Total Heating Treatment Time:	176 - 234 days				
Design Remediation Energy (kWh):	11,540,000	An additional 580,000 kWh is used by surface equipment.			
Assumed Number of Confirmatory Borings:	36	With 4 soil samples per boring. Budget for 230 total confirmatory samples.			

Budgetary (+/- 20%) Standard Fixed Price for Pasco Landfill

Price Charged by TRS Group	Price	Percent	
Electrode Materials Mobilization:	$1,279,000	22%	Payment due before starting field work.
Subsurface Installation:	$268,000	4%	
Surface Installation and Start-up:	$1,059,000	16%	
Remediation System Operation:	$1,740,000	27%	
Demobilization and Final Report:	$44,000	1%	
Total TRS Price	**$4,390,000**	**70.0%**	Based on payment terms of net 30 days.

The above cost estimate is valid for 30 days from 03/11/2014.

Estimated Costs by Others	Cost	Percent	Key Assumptions
Drilling and Soil Sampling:	$833,000	12%	assumes $59 per ft
Drill Cuttings and Waste Disposal:	$56,000	1%	assumes $150 per ton
Electrical Permit and Utility Connection to PCU:	$105,000	2%	This is a highly variable cost.
Electrical Energy Usage:	$970,000	15%	assumes $0.08 per kWh
Carbon Usage, Transportation & Regeneration:	$0	0%	
Condensate Disposal:	$0	0%	condensate disposal by TRS
Other Operational Costs:	$30,000	0%	includes vapor sampling
Total Estimated Costs by Others	**$1,994,000**	**30%**	

carbon neutral info

Total Estimated Remediation Cost: **$6,384,000** **$93 per cu. yd**

Go Carbon Neutral (No Net CO_2), Add: **$78,600** **1%** ***Ask us how!***

TRS recommends using site knowledge or getting quotes to verify "Costs by Others".

Prepared for Sylian Rodriguez, 206-903-3340, srodriguez@anchorqea.com

Some Included Items for Remediation of Pasco Landfill

Design, Work Plans, Permits:	TRS Scope	Shared Scope	Scope by Others	Estimated Cost by Others (included above)
Design or "Kick-off" Meeting	□	■	□	
Work Plan	□	■	□	
Health and Safety Plan	□	■	□	
QA/QC Plan	□	□	□	
Sample Analysis Plan	□	□	□	
Air Permit	□	■	□	
Sewer Discharge Permit	□	■	□	
Regulatory Negotiations and Client Interface	□	□	■	difficult for TRS to estimate
Subsurface Installation:				
Pre-installation Building Structural Survey	□	□	□	
Electrode Materials and Well Screen	■	□	□	
Drilling Subcontractor for Electrodes	□	□	■	$559,870 for 9,500 ft
Drilling Subcontractor for VR Wells	□	□	□	co-located with electrodes
Drilling Subcontractor for TMPs	□	□	■	$25,270 for 900 ft
Drilling Subcontractor for New MWs	□	□	□	
Abandonment/Replacement of Existing PVC Wells	□	□	■	difficult for TRS to estimate
Concrete Coring	□	□	■	$43,260 for 416 cores.
Utility Locator Survey	□	□	■	$1290
Installation (pre-ERH) Soil Sample Analysis	□	□	■	$21,600 for 144 samples.
Drill Cutting Disposal	□	□	■	$55,800 for 372 tons
Drill Cutting Disposal Labor	□	□	■	$5090
Forklift or Skid-Steer for Drilling	□	□	■	$4440
Photoionization Detector for Drilling	□	□	■	$3540
Boring Logs and Report	□	□	■	$5510
TRS On-Site Electrode Installation Supervision	■	□	□	assumes 39 work days of drilling
Traffic-rated Well Vaults and Installation	□	□	□	
Trenching and Restoration	□	□	□	
New Surface Cap	□	□	□	not required
Biological Amendment and Addition	□	□	□	
Surface Installation and Start-up:				
Surface Remediation Equipment Mobilization	■	□	□	
Crane to Offload/Position Equipment	■	□	□	
Perimeter Fence and Security System	■	□	□	
Vapor Recovery Piping	■	□	□	
Steam Condenser	■	□	□	
40 hp VR Blowers	■	□	□	
Granular Activated Carbon and Regeneration	□	□	□	
0 scfm Fuel Oxidizer	□	□	□	
Oil-Water Separator	□	□	□	not required
Equipment Sound Wall	■	□	□	
Electrical Permit and Utility Connection to PCU	□	□	■	assumed to be $105,000
Telephone Connection to PCU	■	□	□	
Garden Hose Connection to Condenser	■	□	□	
Remediation System Operation:				
ERH Control and Temperature Monitoring	■	□	□	
Vapor Sampling and Analysis	□	□	■	$9,270 for 62 samples.
Condensate/Discharge Sampling and Analysis	□	□	■	$3,140 for 21 samples.
Sampling Labor and Operational Checks	□	□	■	$17,980 for 180 hours.
Groundwater Sampling and Analysis	□	□	■	difficult for TRS to estimate
Electricity Usage	□	□	■	$970,000 for 12,120,000 kWh.
Offset for Carbon Dioxide Emissions	□	□	□	
Water/Condensate Disposal	■	□	□	
Separate Phase Product Disposal	□	□	□	none expected
Demobilization and Final Report:				
Drilling Subcontractor for Confirmatory Borings	□	□	■	$40,720 for 1,450 ft
Soil Sample Analysis	□	□	■	$34,500 for 230 samples.
Well Abandonment	□	□	■	$67,430 for 380 wells.
Demobilize Surface Equipment	■	□	□	
Final Report	□	■	□	

APPENDIX E, ATTACHMENT F
BASIS FOR NON-CONSTRUCTION ENGINEERING-RELATED TASKS AND SUPPORT COSTS

APPENDIX E, ATTACHMENT F, EXHIBIT 1 BASIS FOR NON-CONSTRUCTION ENGINEERING-RELATED TASKS MEMORANDUM

ANCHOR QEA

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MEMORANDUM

To:	Halah Voges and Michael Riley, Anchor QEA	**Date:**	August 31, 2017
From:	Sylian Rodriguez and Casey Janisch, Anchor QEA	**Project:**	Pasco Landfill NPL Site, 100722-01.07
Re:	Basis for Non-Construction Engineering-Related Tasks		

This memorandum summarizes the basis and rationale for the engineering-related tasks included in the development of non-construction costs for Zones A, C/D, E, and the On-property Ground Water Area alternatives in the Draft Final Focused Feasibility Study (FFS).

Two main engineering-related tasks have been identified under non-construction costs:

- Design, Project Management, and Permitting
- Construction Management and Inspection

DESIGN, PROJECT MANAGEMENT, AND PERMITTING

Design, project management, and permitting is a combined line item in the Draft Final FFS, established as an overall percentage (17%) of the total construction costs.

The design task includes all professional services used to design the remedial action. Activities that are part of remedial design include pre-design collection and analysis of field data, engineering survey for design, treatability studies (e.g., pilot-scale), and the various design components such as design analysis, plans, specifications, cost estimate, and schedule at the preliminary (30% design), intermediate (60% and 90% design), and final (100% design) design phases. The 30%, 60%, and 90% Engineering Design Report (EDR) packages will include client and Washington State Department of Ecology (Ecology) draft submittals, revisions based on comments, and final submittals, as well as various plans (air monitoring plan, waste characterization plan, health and safety plan, confirmation sampling plan, groundwater compliance monitoring plan, and construction quality assurance plan). The 100% EDR bid package will include a final set of plans and specifications for bidding purposes, identify a short list of bidders, prepare and review requests for information (RFI), and provide responses to these requests. U.S. Environmental Protection Agency (EPA)

guidance on developing and documenting cost estimates during the Feasibility Study (FS) stage (EPA 2000) recommends an average of 8% of the total construction costs be put toward remedial design of complex projects.

The project management task includes all professional services such as planning and reporting (i.e., weekly and/or monthly status reports during construction activities), community relations support during construction and operation/maintenance, bid and contract administration, and legal services outside of institutional controls (e.g., licensing). In addition, costs for budget tracking, invoicing, and reporting, along with schedule, staff, and Ecology management, are accounted for in the project management task. Furthermore, project team communications, client/Ecology meetings and meeting materials, web sharing, and document management are also included in this task. EPA guidance on developing and documenting cost estimates during the FS stage (EPA 2000) recommends an average of 5% of the total construction costs be put toward project management of complex projects.

The permitting task will include obtaining, reviewing, and complying with various substantive requirements and construction permits. Permitting can account for up to 2% of the total construction costs.

Lastly, pre-bid investigations, public meetings, and the entire bid process (including communicating with bidders, bid evaluation, selection of contractor/s, and negotiation of contract/s) are additional activities accounted for in the combined line item of design, project management, and permitting, at an estimated 2% of the overall percentage established of this non-construction cost.

The sum of these cost components (8%, 5%, 2%, 2%) is the basis for the overall percentage of 17% assumed for design, project management, permitting, and additional activities.

CONSTRUCTION MANAGEMENT AND INSPECTION

Construction management and inspection is a combined line item in the Draft Final FFS, established as an overall percentage (8%) of the total construction costs.

The construction management and inspection task includes all professional services to manage the implementation and/or construction of the remedial action. Major activities that are part of construction management include developing a construction management plan, reviewing contractor submittals and work plans, tracking and addressing contractor RFIs during construction, and managing the subconsultant's various activities. Minor activities within construction management involve staff management/communications, preconstruction and regular progress meetings, tracking quantities and reviewing progress payment requests, daily construction reports with photos to document site activities, and addressing and controlling change order requests. Major inspection activities include verification of specifications, coordination with specialty inspectors, and detailed material assessments. This combined line item also includes sampling and coordination with analytical laboratories, filing and record management, preparation of as-built record drawings, and a closeout report. EPA guidance on developing and documenting cost estimates during the FS stage (EPA 2000) recommends an average of 8% of the total construction costs be put toward construction management and inspection of complex projects.

REFERENCE

EPA (U.S. Environmental Protection Agency), 2000. *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*. U.S. Environmental Protection Agency and U.S. Army Corps of Engineers. EPA 540-R-00-002. July 2000.

APPENDIX E, ATTACHMENT F, EXHIBIT 2 ZONE A ALTERNATIVE ASSUMPTIONS MEMORANDUM (PREPARED BY ENVIROCON)

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Date: **August 31, 2017**

To: **IWAG Technical Committee**

From: **Envirocon, Inc.**

RE: **Pasco Landfill NPL Site – Zone A Alternative Assumptions**

Envirocon was tasked by the IWAG to develop costing tables for a number of scenarios for the remediation of Zone A at the Pasco Landfill National Priority List (NPL) Site that were originally submitted to the IWAG on March 6, 2014. Provided below are assumptions and information that were used to generate specific cost items of Zone A Alternative A-9 (Excavation to Top of the Upper Pasco Gravels and Off-site Disposal [50% - 50% Disposal Scenario]). It should be noted that Envirocon was not influenced or prejudiced in any way by the IWAG in developing these costs and that these costs represent our best professional judgement. Further, these costs should be considered preliminary and subject to change (as all complex projects are) once design activities are undertaken and actual field conditions encountered. It is for these reasons that at this stage of a project, considerable contingencies should be added to the costs below.

Envirocon solicited pricing from waste disposal facilities to address the transportation and disposal of waste materials. Disposal options included Subtitle D disposal for non-hazardous wastes, Subtitle C disposal (both direct and stabilization) landfill disposal, disposal via Organic Recovery Unit and incineration. The pricing also addressed the transport and disposal of wastes in individual drums, as bulk solids, and in bulk liquid form. The pricing is significantly variable and dependent on the individual waste stream constituents (landfill disposal and incineration), BTU value (incineration) and form (drum overpacking vs. bulked drums). Pricing was based on 2014 rates. It should be noted that transport costs are greatly influenced by fuel prices.

Task 1.1: Mobilization and Support

1.1.1 Work Plan Technical Support and Report $50,000

This is a variable cost that is dependent upon the level of effort required to meet regulatory and project specific requirements. Listed below are the levels of effort (hours) for the individuals expected to be involved in this task.

Project Manager	80 hours
Project Engineer, Certified Industrial Hygienist	160 hours
Project Director	40 hours

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Also included are costs for a third party engineering firm to assist with tasks that cannot be performed in house, and associated production and travel costs for meetings.

1.1.2 Preconstruction Planning, Permitting and Design $93,500

This is a variable cost that is dependent upon level of effort required to meet regulatory and project specific requirements. Listed below are the levels of effort (hours) for the individuals expected to be involved in this task.

Project Manager, Project Engineer	160 hours
Certified Industrial Hygienist	60 hours
Project Director, Site Safety Officer	40 hours

Also included are costs for a third party engineering firm to assist with tasks that cannot be performed in house, and associated production and travel costs for meetings.

Task 1.2: Mobilization and Site Preparation

1.2.1 Mobilization $150,000

This item includes the travel costs (airfare, mileage, and incidentals) of the personnel to the project site. To the extent practicable and with consideration to personnel health and safety, Envirocon will hire qualified local individuals to supplement experienced current employees. This will reduce mobilization costs associated with travel.

The transport of equipment and materials and any on-site assembly or set up is addressed in this item. This includes the mobilization of an estimated 12 individual pieces of heavy equipment (i.e., excavators, loaders, water trucks, articulated trucks) and support equipment (i.e., field trailers, site pickup trucks). Installation of signage, temporary security fencing, site utilities and other items necessary for commencement of project operations are also included in this item.

1.2.2 Surveying $85,000

Included in this item are Envirocon personnel to locate and mark boundaries, lay out work zones, measure excavation depths and perform grade checks during backfill operations. The cost associated with GPS base station and rover, which will be dedicated for the duration of the project, are part of this item. Costs for the Project Engineer, Field Engineer and site pickup truck are addressed in this item.

Project Engineer	10 days
Field Engineer	25 days

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It does not include third party surveying for official documentation, although data produced by Envirocon can be used as supplemental for as-built drawings and records.

1.2.6 Drum Staging and Handling Area Construction $340,000

A drum staging area (2 acres) will be established for the management of drums and other containers recovered from the landfill. This area will provide a location where they can be safely staged, identified, opened, categorized and processed in preparation for disposal. It will include both a concrete pad and a storage area with a prepared gravel surface. The 10-inch thick concrete pad (10,000 psi with reinforced mesh) with an approximate dimension of 100' by 200'. It will be underlain with crushed rock, geotextile, impermeable liner, and a sand cushioning layer. It will be constructed in a manner suitable for heavy equipment operation (i.e., excavator, loader, articulated truck) with a floor slope that will direct free liquids to a sump for collection. An extruded curb will be constructed on the perimeter to prevent stormwater run-on/run-off and concrete Ecology blocks will provide interior barriers for segregation of debris, soil, and other solid waste. Storage tanks, roll-off boxes containing waste and full drums (intact) will be staged on gravel surface adjacent to the concrete processing pad. The concrete pad processing area and the gravel area for drum staging will be secured with chain link temporary fence. Empty drums (new) and roll-off boxes, along with supplies, and equipment will be staged outside the temporary security fence, but within an area having orange construction fence for demarcation.

Operators; Truck Drivers, Laborers	10 days
Excavator; Dozer, Artic Truck (2 each); Water Truck; Roller	10 days
Concrete Subcontractor	One time

1.2.7 Sediment and Erosion Controls $26,500

Sediment and erosion control BMP's will be installed at the perimeter of active work areas and internal to work zones to prevent the run-off of surface water or erosion of contaminated soils onto less impacted areas. These will be inspected and maintained on a regular basis and following every storm event. These BMP's will be composed primarily of silt fence, wattles, and hay bales. Berms and ditches will also be constructed as appropriate to control stormwater run-on/run-off. This item includes equipment operator, backhoe and laborers necessary for installation and maintenance. Installation and maintenance spanned 10 days for the project.

Operators; Laborers (2 each)	10 days
Backhoe	10 days

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Task 1.3: Demobilization and Project Closeout

1.3.1 Drum Staging and Handling Area Decommissioning $210,500

The primary cost associated with this item is the demolition, transportation, and disposal of the concrete pad used for the processing drums (bulking and/or sludge stabilization) as a hazardous waste, and other miscellaneous rubble and debris. In the event the concrete processing pad can be effectively decontaminated, this item will be reduced substantially with waste transported off-site for Subtitle D disposal. The decommissioning of the drum staging and handling area was estimated at 10 days and involved heavy equipment (excavator, loader), heavy equipment operators (2 each) and laborers (2 each).

1.3.2 Demobilization $100,000

This item includes the travel costs (airfare, mileage, and incidentals) for individuals leaving the project site. Also included is the decontamination, disassembly, loading, and return transport of all rented and company-owned equipment that was brought to the site to perform the work. Utility disconnects and other activities required to secure the site will also be performed.

1.3.3 Support of Report Preparation $50,000

This is a variable cost that is dependent upon level of effort required to meet regulatory and project specific requirements. Included are the levels of effort (hours) for the individuals below:

Project Manager, Project Engineer	120 hours
Project Director, Certified Industrial Hygienist, Site Safety Officer	40 hours

This item includes the travel costs (airfare, mileage, and incidentals) of the personnel.

Task 1.4: Support Costs

1.4.1 Operations Supervisory and Support Costs $3,720,000

This item was estimated at an average monthly rate of $310,000 for a period of 12 months. It includes all management personnel not directly assigned to individual project tasks. The supervisory project personnel and estimated durations are as follows:

Project Manager, Superintendent, Project Engineer, Field Engineer, Site Administration and Mechanic	300 days
Project Director, CIH	30 days
Haz Cat Technician (2 ea)	150 days

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Included with this item are the per diem and lodging costs for the above-referenced supervisory personnel. The per diem and lodging costs for craft personnel (operators, truck drivers, laborers, etc.) have also been included in this item for convenience.

Certain pieces of equipment that span various project operations have also been included in the item as indirect task costs. They include water trucks (2 each), backhoe (with forks), gator (2 each); site pickup trucks (4 each), mechanics truck and lube truck (equipment fueling).

These costs are budgetary and are directly influenced by the durations of individual project tasks. If during excavation it is found that most of the drums are severely degraded and do not have to be handled individually, then removal operations would be revised for handling bulk solid waste. This could result in higher production rates for waste excavation and handling, thereby reducing overall schedule and project costs.

1.4.2 Health and Safety Supervisory Support Costs $204,000

This item was estimated at an average monthly rate of $17,000 for a period of 12 months. It includes all health and safety supervisory personnel not directly assigned to individual project tasks. The health and safety project personnel and estimated durations are as follows:

Site Safety Officer	150 days
Health & Safety Technician (2 each)	100 days

Included with this item are the per diem and lodging costs for the above-referenced supervisory personnel.

1.4.3 Personnel/Perimeter Air Monitoring Costs $78,000

This item addresses cost for a wide variety of monitoring costs, including that for both personnel, perimeter monitoring air monitoring instrumentation, supplies and outside lab services to ensure worker safety and protection of local population and environment. Real time monitoring instrumentation and associated support items include:

Multi RAE instrumentation	Calibration gases and regulators
MIE DataRAM	
Multi RAE PID (H2S, CO, O2)	Calibration gases and regulators
Heat Stress Monitor	
Draeger Pump	Draeger Tubes (various)
Weather Station	
Bios Dry Cal	
Sound Level Meter/Dosimeter	
Aircheck Kit (5 pack)	

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Ludlum Model 3 Radiation Survey Instrument

In addition to the real time air monitoring that would be performed, air samples would be collected initially and then periodically and submitted to an off-site laboratory for analysis. The particular sample types and media used will be determined based on the constituents of waste known to have been deposited in the landfill and on potential unknown waste streams. Examples of off-site laboratory analysis include:

Metals Panel	
Inorganic Acid Panel	
Single Pesticide	
Comprehensive Pesticide Screen	
Zectran Herbicide	
Total Airborne Dust	
Respirable Quartz	
Airborne Organic Vapors	Benzene, Toluene, TCE
Solvent Panel	30 compounds
Summa Canister Analysis	VOC's
Airborne Asbestos	

1.4.4 Training, Medical, and Incentives $50,400

The Pasco Landfill project involves a variety of waste streams, many of which are regulated hazardous wastes that can present a health and safety hazard to project personnel. Because of the known and potential health hazards present, project personnel will be required to undergo training and physical examinations. This training and medical monitoring are required by law and readily embraced by Envirocon to protect its employees. Envirocon also has a safety incentive program that requires a safety incentive plan specific to each project to encourage safe work practices.

Training	40 Hour HAZWOPER
	8 Hour Refresher
	Site Specific Training
Medical	Baseline Entry Physical
	Drug Screen (including random)
	Annual Physical
	Exit Physical
Safety Incentive Plan	Specific to Pasco Landfill Project

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1.4.5 Health and Safety and Personal Protective Equipment (PPE) $252,000

The Pasco Landfill project involves a variety of waste streams, many of which are regulated hazardous wastes that can present a real health and safety hazard to project personnel. Because of the known and potential health hazards present, project personnel will be required to wear personnel protective equipment during many of the project operations. It is expected that Level B, Level C and Level D PPE will be necessary to perform the work. The PPE requirements by task will be conservatively established in the site-specific Health & Safety Plan (HASP) to ensure worker protection. The upgrade/downgrade of PPE will be made as site conditions determine appropriate. Any change in the PPE level of protection will be reviewed and approved by the assigned CIH. The minimum PPE and other health and safety equipment anticipated are identified below.

Miscellaneous Safety Equipment and Supplies	Shower Trailer Decon and Sanitation Supplies Fire Extinguishers Cooling Vests Fall Protection Harnesses Magnetic Utility Locator Project Signs Spill Kits and Sorbents Cones, Hazard Tape, Barricades Shower Trailer
Level D PPE	Hard Hats, Safety Glasses; Gloves Rain Gear, Hard Hat Liners Tyvek/Cloth Coveralls Nitrile Inner/Outer Gloves Nuisance Dust Masks
Level C PPE	Level D Equipment (above) Respirators and Cartridges Tyvek/Tychem Coveralls PVC Boots
Level B PPE	Level C PPE (above) Supplied Air Respirators Air Compressor Supplied Air Cylinders

Table 1 - Cost Line Items (Prepared by Envirocon)
Alternative A-9 (Excavation to Top of Upper Pasco Gravels + Off-site Disposal)
Detailed Cost Estimates

	Task	Unit	Quantity	Unit Cost	% of Units	Total
Construction Costs						
1.1	**Mobilization and Support**					
1.1.1	Work Plan Technical Assistance and Report	LS	1	$50,000.00	100%	$50,000
	Project Manager (80 hrs); Project Engineer & CIH (160 hrs); Project Director (40 hrs); third party engineer; and associated production and travel costs for meetings.					
1.1.2	Preconstruction Planning, Permitting, and Design	LS	1	$93,500.00	100%	$93,500
	Project Manager and Project Engineer (160 hrs); Project Engineer & CIH (60 hrs); Project Director and Site Safety Officer (40 hrs); third party engineer; and associated production and travel costs for meetings.					
1.2	**Mobilization and Site Preparation**					
1.2.1	Mobilization	LS	1	$150,000.00	100%	$150,000
	Labor, equipment and materials to transport, offload and assemble or set up as necessary.					
	Includes personnel airfare, mileage and associated travel costs					
1.2.2	Surveying	LS	1	$85,000.00	100%	$85,000
	Project Engineer - 10 days; Field Engineer - 25 days; support truck; GPS Base Station and Rover; support; materials					
1.2.3	Bonds & Insurance	LS	1	$55,255,728	1%	$552,557
1.2.4	Temporary Facilities	MO	12	$15,000.00	100%	$180,000
1.2.5	Well Abandonment	EA	15	$1,500.00	100%	$22,500
1.2.6	Drum Staging and Handling Area Construction	LS	1	$340,000.00	100%	$340,000
	Excavator; Dozer; Artic Truck; Roller; Water Truck; Operators; Laborers; Truck Drivers (10 days) *Concrete pad with sump for drum opening/processing and waste stabilization; Ecology blocks for containment; 2 acre laydown area for equipment, material staging and drum storage*					
1.2.7	Sediment and Erosion Controls	LS	1	$26,500.00	100%	$26,500
	Labor, equipment and materials to install silt fenceand other BMP's for runoff and erosion control					
	Operator; Laborer (2 ea); backhoe (10 days)					
1.3	**Demobilization/Project Closeout**					
1.3.1	Drum Staging and Handling Area Decommissioning	LS	1	$210,500.00	100%	$210,500
	Heavy equipment for breaking concrete processing pad; transport and disposal of rubble and misc. debris as haz waste; grade to drain					
1.3.2	Demobilization	LS	1	$100,000.00	100%	$100,000
	Labor, equipment and materials to decontaminate equipment, disassemble and prep for transport as necessary *Includes equipment return transport costs; personnel airfare, mileage and associated travel costs*					
1.3.3	Support of Report Preparation	LS	1	$50,000.00	100%	$50,000
	Includes wages for CIH and Project Director (40 hrs); Project Manager and Project Engineer (120 hrs); and Site Safety Officer (40 hrs)					
1.4	**Support Costs**					
1.4.1	Operations Supervisory & Support Costs - w/ per diem, lodging, and other items	MO	12	$310,000.00	100%	$3,720,000
	Wages; per diem; lodging; travel (rotations) for Project Manager, Superintendent, Project Engineer, Field Engineer, Field Admin, and Mechanic for twelve month period. (300 work days); Field Characterization Technician (2 ea @150 days). *Project Director and CIH (30 days)* *Also includes per diem and lodging for craft personnel (but not wages).* *Also includes equipment not assigned to specific tasks - water trucks; backhoe w/ forks; gators.* *Other project support items - field trailers; utilities; copiers and office supplies; cell phones; site pickup trucks, etc.*					
1.4.2	Health & Safety Supervisory Support Costs	MO	12	$17,000.00	100%	$204,000
	Wages; per diem; lodging; travel (rotations) for Site Safety Officer (150 days), Health & Safety Tech (2 each @ 100 days).					
1.4.3	Personnel/Perimeter Air Monitoring	MO	12	$6,500.00	100%	$78,000
	Personnel and perimeter air monitoring instrumentation, supplies and outside lab services to ensure worker safety and protection of local population and environment.					
1.4.4	Training, Medical & Incentives	MO	12	$4,200.00	100%	$50,400
	Training (40-hr and 8-hr refresher; site specific); physicals (drug screen; baseline; annual; exit) and safety incentive for all project personnel.					
1.4.5	Health & Safety and PPE	MO	12	$21,000.00	100%	$252,000
	Equipment and materials necessary for the health and safety of site peronnel including Level B, Level C and Level D personal protective equipment (PPE).					
	Also includes miscellaneous safety supplies - fire extinguishers; signage; first aid kits; decon supplies, etc.					
	Contractor Planning, Mobilization, and Project Support - Subtotal	**LS**	**1**	**$6,164,957**	**100%**	**$6,164,957**
2	**Ground to Geomembrane - Clean Excavation**					
2.1	Clean Soil Removal and Stockpile (Ground to Geomembrane)	TN	13,500	$3.20	100%	$43,200
3	**Geomembrane to Top of Visqueen - Excavation and Disposal**					
3.1	Soil Excavation and Stockpile Geomembrane to Top of Visqueen	TN	46,500	$3.45	100%	$160,425
3.2	Soil T&D - Subtitle D Landfill	TN	46,500	$32.23	100%	$1,498,695
4	**Visqueen to Top of Touchet Beds - Excavation and Disposal**					
4.1	Soil Excavation - Visqueen to Touchet Beds	TN	93,300	$4.70	100%	$438,510
4.3.1	Soil T&D - Subtitle C Landfill: Direct Disposal	TN	93,300	$123.83	50%	$5,776,670
	Waste Management (Arlington, OR) - transport (w/ liner); disposal and associated fees (fuel, environmental and admin fee); ODEQ Haz Fee					
4.3.2	Soil T&D - Subtitle C Landfill: With RCRA Stabilization	TN	93,300	$223.53	50%	$10,427,675
	Waste Management (Arlington, OR) - transport (w/ liner); disposal and associated fees (fuel, environmental and admin fee); ODEQ Haz Fee					
5	**Visqueen to Top of Touchet Beds - Layback**					
5.1	Layback Excavation - Geomembrane to Visqueen	TN	45,300	$4.10	100%	$185,730
5.2	Layback Soil T&D - Subtitle D Landfill	TN	45,300	$32.23	25%	$365,005
	Finley Buttes - transport (w/o liner); disposal and associated fees (fuel, environmental and admin fee); ODEQ Fee					
6	**Top of Touchet Beds to Top of Upper Pasco Gravels - Excavation and Disposal**					
6.1	Soil Excavation - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	91,500	$5.86	100%	$536,190
6.3.1	Soil T&D - Subtitle C Landfill: Direct Disposal	TN	91,500	$123.83	50%	$5,665,223
	Waste Management (Arlington, OR) - transport (w/ liner); disposal and associated fees (fuel, environmental and admin fee); ODEQ Haz Fee					
6.3.2	Soil T&D - Subtitle C Landfill: With RCRA Stabilization	TN	91,500	$223.53	40%	$8,181,198
	Waste Management (Arlington, OR) - transport (w/ liner); disposal and associated fees (fuel, environmental and admin fee); ODEQ Haz Fee					
6.4	Soil T&D - Incineration (Clean Harbors)	TN	91,500	$609.00	10%	$5,572,350
	Clean Harbors - disposal and associated fees (fuel, environmental and admin fee); State Fee					
7	**Top of Touchet Beds to Top of Upper Pasco Gravels - Layback**					
7.1	Layback - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	82,200	$4.50	100%	$369,900
7.2	Layback Soil T&D - Subtitle D Landfill	TN	20,000	$32.23	100%	$644,600
	Finley Buttes - transport (w/o liner); disposal and associated fees (fuel, environmental and admin fee); ODEQ Fee					

Table 1 - Cost Line Items (Prepared by Envirocon)
Alternative A-9 (Excavation to Top of Upper Pasco Gravels + Off-site Disposal)
Detailed Cost Estimates

	Task	Unit	Quantity	Unit Cost	% of Units	Total
8	**Site Restoration**					
8.1.1	Backfill - Visqueen to Top of Touchet Beds	TN	93,300	$10.25	100%	$956,325
8.1.2	Backfill of Layback - Visqueen to Top of Touchet Beds	TN	45,300	$6.20	100%	$280,860
8.2.1	Backfill - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	91,500	$10.25	100%	$937,875
8.2.2	Backfill of Layback - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	82,200	$6.20	100%	$509,640
8.3	RCRA Cap Installation	AC	2	$285,570	100%	$571,140
9	**Stacked Drums - Handling and Disposal (Hazardous Wastes: Liquids and Sludges)**					
9.1	Removal of Extraction	EA	16,100	$50.16	100%	$807,576
9.2	Lab Analysis for Hazardous Waste Drums - Offsite Lab (5%)	EA	16,100	$650.00	5%	$523,250
9.3	Drum Handling w/ Overpacks	EA	16,100	$76.05	25%	$306,101
9.4.1	Overpack T&D - Subtitle C Landfill: Direct Disposal	EA	16,100	$124.40	20%	$400,568
	Waste Management (Arlington, OR) - disposal and associated fees (fuel, environmental and admin fee); ODEQ Haz Fee					
9.4.2	Overpack T&D - Incineration (liquids)	EA	16,100	$376.70	5%	$303,244
	Clean Harbors - disposal and associated fees (fuel, environmental and admin fee); State Fee					
9.5.1	Bulked Drum Waste T&D Subtitle C Landfill: Direct Disposal	TN	4,930	$123.83	50%	$305,241
	Waste Management (Arlington, OR) - transport (w/ liner); disposal and associated fees (fuel, environmental and admin fee); ODEQ Haz Fee					
9.5.2	Bulked Drum Waste T&D Subtitle C Landfill: With RCRA Stabilization	TN	4,930	$223.53	50%	$551,001
10	**Stacked Drums - Handling and Disposal (Casting Sands)**					
10.1	Removal of Drums	EA	8,900	$50.16	100%	$446,424
10.2	Lab Analysis for Casting Sands Drums - Offsite Lab (5%)	EA	8,900	$650.00	5%	$289,250
10.3.1	Casting Sands T&D - Subtitle D Landfill: Direct Disposal	TN	3,630	$32.23	100%	$116,995
	Finley Buttes - transport (w/o liner); disposal and associated fees (fuel, environmental and admin fee); ODEQ Fee					
12	**Bulk Liquids**					
12.1	Liquids Recovery - Labor & Equip	LS	1	$75,000.00	100%	$75,000
12.2	Solvents Liquids - T&D	TN	1,000	$717.10	50%	$358,550
	Clean Harbors - disposal and associated fees (fuel, environmental and admin fee); State Fee					
12.3	Aqueous Liquids - T&D	TN	1,000	$923.59	50%	$461,795
	Excavation and Disposal - Subtotal	**LS**	**1**	**$48,066,204**	**100%**	**$48,066,204**

Note:

1. Cost template and quantities for Alternative A-9 was updated by Anchor QEA for the Draft Final FFS. None of the assumptions regarding level of effort or number of hours were updated.

APPENDIX E, ATTACHMENT G
ZONE A CONTINGENCY AND SENSITIVITY ANALYSES

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MEMORANDUM

To:	Halah Voges and Michael Riley, Anchor QEA	**Date:**	August 31, 2017
From:	Sylian Rodriguez and Casey Janisch, Anchor QEA	**Project:**	Pasco Landfill NPL Site, 100722-01.07
Re:	Zone A Contingency and Sensitivity Analyses		

This memorandum summarizes the contingency and sensitivity analyses conducted for the revised Zone A alternatives and updated cost estimates in the Draft Final Focused Feasibility Study (FFS), per the Washington State Department of Ecology's (Ecology's) comments on the 2014 Draft FFS, provided on June 13, 2016[1]. The conclusions of these analyses have been carried forward and incorporated as applicable in the Zone A alternatives (see Section 5.4 of the Draft Final FFS).

CONTINGENCY ANALYSIS

U.S. Environmental Protection Agency (EPA) guidance on developing and documenting cost estimates during the Feasibility Study (FS) stage (EPA 2000) defines contingency as a cost element that must be incorporated into any cost estimate to cover unknowns, unforeseen circumstances, or unanticipated conditions that are not possible to evaluate from the data on hand at the time the estimate is prepared. EPA guidance indicates that contingency is used to reduce the risk of possible cost overruns and is based on either a qualitative or quantitative assessment of "cost growth" and/or "cost risk" potential. EPA guidance states "… factors that affect the potential for cost growth in remediation projects include the project definition and the complexity of the media, waste, and technical aspects of the project." Cost growth potential can be evaluated with detailed quantitative methods, including element by element risk scoring/weighting techniques and risk analysis software (e.g., CostRisk, developed by the U.S. Army Corp of Engineers [USACE]). At the FS stage, however, a more common

[1] Zone A contingency and sensitivity analyses were originally generated during the development of the Draft FFS in the summer of 2014. After submittal of the Draft FFS to Ecology, these analyses were later distributed and discussed with Ecology on November 19, 2014, and March 26, 2015 (during an All Potentially Liable Person/Ecology Meetings), in response to Ecology's preliminary identification of FFS-related topics for discussion, per Ecology's e-mail communication (Ecology 2014). The conclusions of the 2014 contingency/sensitivity analyses are consistent with the ones presented in this memorandum because the current set of Zone A alternatives, their scope, and associated basic cleanup action components have not significantly changed.

approach is to assign a project contingency percentage based on best professional engineering judgement and known specific project scope, conditions, and complexity, and is typically applied as a percentage of the total construction and non-construction costs, rather than applied to individual cost elements.

As defined by EPA guidance, the two main types of contingency are scope and bid, which are described as follows:

- The **scope contingency** represents costs, unforeseeable at the time of estimate preparation, which are likely to become known as the remedial design proceeds. For this reason, scope contingency is sometimes referred to as "design" contingency, which is the term commonly used by the USACE. In general, at the early stages of remedial design (e.g., FS, which represents 0% to 10% design completion), concepts are not typically developed enough to identify all project components or quantities. Contributing factors include limited experience with certain technologies, potential requirements due to regulatory or policy changes, and inaccuracies in defining field quantities or characteristics. In addition, scope contingency would be expected to be higher for newer or emerging remedial technologies than for more well-documented systems. Scope contingency should decrease as design progresses (i.e., should be 0% at the 100% design stage). Therefore, the scope contingency generally ranges from 10% to 25% (EPA 2000).
- The **bid contingency** represents costs, unforeseeable at the time of estimate preparation, which are likely to become known as the remedial action construction and implementation proceeds. For this reason, bid contingency is sometimes referred to as "construction" contingency, which is the term commonly used by the USACE. Bid contingency accounts for changes that occur after the construction contract is awarded. This contingency represents a reserve for quantity overruns, modifications, change orders, and/or claims during construction. Considerations include the technological, geotechnical, and other unknowns applicable to the construction phase. Examples include changes due to adverse weather, material or supply shortages, or new regulations/policies. Therefore, the bid contingency generally ranges from 10% to 20% (EPA 2000).

The relationship of scope, bid, and total contingency as a project moves through its various phases is shown in Exhibit 5-5 of the EPA guidance (EPA 2000).

Per EPA guidance, for a cost estimate developed during the FS stage, the same level of risk associated with remedial design for construction costs can be carried over to non-construction costs. In addition, the relative number of unknowns associated with operating and maintaining a remedial action would be expected to be at least the same or greater than those associated with construction (EPA 2000). Therefore, EPA guidance recommends that typical overall combined contingency for an FS be between 20% and 45%.

Contingency analyses were conducted for Zone A alternatives to establish the overall project contingency percentage, based on the effects of the uncertainty associated with both scope and bid contingencies. Scope and bid contingency percentages were applied to individual cost line items of these alternatives and varied in potentially low, middle, and high contingency scenarios, as follows:

a. The potential **low contingency scenario** assumed the lowest scope and bid contingency percentages (as recommended by the EPA guidance) and set at 10% for most of the individual cost line items, based on a minimum uncertainty for an FS-level evaluation of alternatives.
b. The potential **middle contingency scenario** assumed higher scope and bid contingency percentages (compared to the low contingency scenario) for those individual cost line items with a relative higher level of uncertainty during design and construction.
c. The potential **high contingency scenario** assumed the highest scope and bid contingency percentages (as recommended by the EPA guidance) for most of the individual cost line items that have the highest level of uncertainty during design and construction, based on a maximum uncertainty for an FS-level evaluation of alternatives.

Three of the Zone A alternatives in the Draft Final FFS (see Section 5.4) were selected for contingency analyses: Alternative A-2 (representative of long-term operation of the enhanced Soil Vapor Extraction [SVE] system), Alternative A-6 (representative of excavation of drummed waste and impacted soils to the top of the Touchet Beds and on-site Area of Contamination

[AOC[2]] disposal), and Alternative A-9 (representative of excavation of drummed waste and impacted soils to the top of the Upper Pasco Gravels and off-site disposal).

Contingency analyses considered the individual remedial activities and associated cost line items that intrinsically have a relatively high degree of uncertainty during both remedial design and implementation, and that could significantly impact the overall cost of the project. Remedial action components of the three Zone A alternatives that could be subject to potential cost increase at the time of design and/or construction were considered in the contingency analyses and included the following:

- **Alternative A-2:** although the contingent air sparging/ozone treatment system is a proven and highly effective remediation technology, treatability and pilot testing would be required to determine the optimum operating conditions, prior to full field implementation; therefore, this remedial activity has some uncertainty during design and construction that needs to captured under scope and bid contingencies. All other remedial activities under Alternative A-2 represent very low levels of uncertainty and minimum cost risk in the future because cost estimates are for the most part based on actual costs for previously implemented technical scope (i.e., ground water monitoring and reporting; cap monitoring, maintenance, and inspection; SVE system operation, maintenance and repairs).
- **Alternatives A-6 and A-9:** excavation-based alternatives have very high uncertainty associated with the following: 1) the lateral and vertical extent, quantity, and current condition of the drummed waste and impacted soil buried under Zone A; and 2) deep excavation, which is by nature difficult and risky to implement. Therefore, the excavation/disposal remedial activities[3] are considered the cost line items with the greatest potential for cost increase because they could easily incur overruns, modifications, change orders, and/or claims as excavation and on-site/off-site disposal take place. There is also relatively high uncertainty related to regulatory oversight and change of conditions during excavation/disposal that could result in rapid escalation of costs. Moreover, the in situ thermal treatment under Alternative A-6 may have the potential for a high degree of success, but it is an additional source of great uncertainty

[2] AOC as defined in Section 5.4.5.1 of the Draft Final FFS.

[3] Excavation and disposal remedial activities include excavation, pre-treatment, and on-site AOC and/or off-site disposal of impacted soils, and removal, overpacking, handling, and off-site disposal of stacked drums and bulked liquids (see Section 5.4 of the Draft Final FFS).

and will require pilot-scale testing prior to full-scale implementation to determine the optimum design and operating conditions. Finally, the construction of the on-site AOC and placement of Zone A excavated materials under Alternative A-6 is another remedial activity with moderate level of uncertainty during design and construction that needs to be captured under scope and bid contingencies.

Table 1 presents the contingency analysis for Alternative A-2, with resulting overall project contingencies of 16%, 21%, and 31%, for the potential low, middle, and high contingency scenarios, respectively. The largest variation in scope and bid contingencies were applied to the contingent air sparging/ozone treatment system, capturing the uncertainty for this remedial activity during design and construction. All other remedial activities under Alternative A-2 had a minimal impact on the overall cost of the project, consistent with the very low levels of uncertainty associated with these activities. Thus, the overall project contingency assumed in the Draft Final FFS is 20% for Zone A alternatives relying on long-term operation of the SVE system (Alternatives A-1, A-2, and A-3).

Table 2 presents the contingency analysis for Alternative A-6, with resulting overall project contingencies of 20%, 28%, and 40%, for the potential low, middle, and high contingency scenarios, respectively. Table 3 presents the contingency analysis for Alternative A-9, with resulting overall project contingencies of 25%, 39%, and 55%, for the potential low, middle, and high contingency scenarios, respectively. Due to the inherent magnitude and complexity of the Zone A Conceptual Site Model and the proposed excavation-based alternatives for this zone (as described in Sections 2 and 5 of the Draft Final FFS, respectively), excavation/disposal costs under Alternatives A-6 and A-9 could rapidly escalate due to unknown, unforeseen, and unanticipated conditions during implementation. Construction costs could easily increase to plan, manage, mitigate, and control high-risk activities and any technical difficulties (such as unknown condition and state of drums; potential uncontrolled releases; deep excavation; possible physical hazards to workers and exposure during extensive segregation and handling of waste/soil and drum overpacking, etc.), and pose the most potential for overruns, modifications, change orders, and/or claims. Therefore, the high contingency scenarios account for the high "cost risk potential" for significant scope/bid changes that may occur between the FS and the final design of the Zone A remediation project and are reasonable, considering the magnitude and complexity of Zone A. Thus, the overall project contingencies assumed in the

Draft Final FFS are 40% for Zone A excavation-based alternatives with on-site AOC disposal and/or treatment other than SVE operation (Alternatives A-4, A-5, A-6, and A-7) and 55% with off-site disposal (Alternative A-9).

SENSITIVITY ANALYSIS

Sensitivity analyses were conducted for Alternatives A-2, A-6, and A-9 to establish the project cost impact of individual or combined technical input parameters (i.e., quantities). In the development of Zone A alternative cost estimates, the sensitivity analysis considered those input parameters that intrinsically have a relatively high degree of uncertainty and that with a small change in their value, could significantly affect the overall cost of the project. Input parameters considered in the sensitivity analysis of the Zone A alternative cost estimates included the following:

- Alternative A-2: variations in assumptions for the contingent air sparging/ozone treatment system and its long-term operation and maintenance.
- Alternative A-6: variations in assumptions related to:
  - Excavation, pre-treatment, and on-site AOC and/or off-site disposal of impacted soils (within the different Zone A soil layers)
  - Removal, overpacking, handling, and off-site disposal of stacked drums
  - Recovery and off-site disposal of bulked liquids
  - Field hazard categorization of stacked drums and off-site laboratory analysis
  - The required capacity of the on-site AOC
- Alternative A-9: variations in assumptions related to:
  - Excavation, pre-treatment, and off-site disposal of impacted soils (within the different Zone A soil layers)
  - Removal, overpacking, handling, and off-site disposal of stacked drums
  - Recovery and off-site disposal of bulked liquids
  - Field hazard categorization of stacked and off-site laboratory analysis

Three sensitivity cases were considered for Alternative A-2: a base case and lower and upper bound cases (see Table 4 for the assumption summary for this alternative). An additional sensitivity case was considered for Alternatives A-6 and A-9, in addition to the ones for

Alternative A-2, given the high uncertainty of many more factors in the Zone A excavation-based alternatives; the sensitivity cases for these Zone A alternatives included a base case, and a lower, middle, and upper bound cases (see Tables 5 and 6 for the assumption summary for Alternatives A-6 and A-9, respectively). The base case represents the most reasonable quantity assumptions of expected conditions and anticipated remedial actions for the Zone A alternatives and serves as a baseline for comparison with the other sensitivity cases. The lower bound case uses the least conservative assumptions, while the middle bound case is a slightly more conservative approach than the base case. The upper bound case contains the most conservative assumptions, or worst case scenario.

Tables 7 through 9 present the results of a detailed cost sensitivity analysis for the three Zone A alternatives. From the sensitivity analysis performed on Alternative A-2[4], the base case cost indicates that changes in the contingent air sparging/ozone treatment system assumptions and its long-term operation and maintenance have a low degree of uncertainty. As presented in Table 7, while the lower bound case resulted in 98% of the project costs of the base case scenario ($17.8 versus $18.2 million, respectively), the upper bound case resulted in 105% of the project costs of the base case scenario ($19.1 versus $18.2 million, respectively). From the sensitivity analyses performed on Alternatives A-6[5] and A-9[6], variations in the excavation, pre-treatment, and on-site/off-site disposal assumptions of impacted soils, stacked drums, and recovered bulked liquids have a high degree of uncertainty, triggering significant changes in the overall project costs. As presented in Table 8, the lower, middle, and upper bound cases for Alternative A-6 resulted in 96%, 118%, and 138%, respectively, of the project costs of the base case scenario (total project costs ranging from $59.9 to $85.5 million, including long-term costs and contingency). A larger cost spread is shown, however, for the lower, middle, and upper bound cases for Alternative A-9 (Table 9), which resulted in 85%, 131%, and 159%, respectively, of the project costs of the base case scenario (project costs ranging from $108.3 to $204.2 million, including long-term costs and contingency). The cost spread indicated that the most conservative assumptions, or worst case scenario, could result in a significant increase in project costs in the event the Site conditions are

[4] Cost estimate for Alternative A-2 used a 20% overall project contingency, per the outcome of the contingency analysis in this memorandum.
[5] Cost estimate for Alternative A-6 used a 40% overall project contingency, per the outcome of the contingency analysis in this memorandum.
[6] Cost estimate for Alternative A-9 used a 55% overall project contingency, per the outcome of the contingency analysis in this memorandum.

substantially different from the current understanding of the Zone A waste area, and remedial actions would need to be drastically revised.

The three separate sensitivity analyses concluded that the assumptions used for the various cost elements in the base case scenarios are technically reasonable and accurately reflect expected conditions and anticipated remedial actions for the Zone A alternatives. The base case costs were in close comparison to the lower bound case costs (the least conservative assumptions) for Alternatives A-2, A-6, and A-9, regardless of the scope of the alternative. Therefore, it was determined that the costs for the base case scenarios are an adequate estimate of the current scope of these Zone A alternatives in the Draft Final FFS. In addition, when the specific contingency percentages are incorporated, the overall project cost covers the likelihood of increased and unanticipated costs, accounted for in the middle and upper bound case scenarios of the sensitivity analyses.

REFERENCE

Ecology (Washington State Department of Ecology), 2014. Pasco Landfill: Preliminary Identification of FFS-related topics for further discussion. Email communication by Charles Gruenenfelder, Pasco Sanitary Landfill Site Manager, Washington State Department of Ecology. November 7, 2014.

EPA (U.S. Environmental Protection Agency), 2000. *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*. U.S. Environmental Protection Agency and U.S. Army Corps of Engineers. EPA 540-R-00-002. July 2000.

ATTACHMENTS

Table 1 – Alternative A-2 (Enhanced SVE Treatment and Air Sparging/Ozone Treatment) Contingency Analysis: Low, Middle, and High Scenarios
Table 2 – Alternative A-6 (On-site AOC and Thermal Treatment in Touchet Beds) Contingency Analysis: Low, Middle, and High Scenarios
Table 3 – Alternative A-9 (Off-site Disposal) Contingency Analysis: Low, Middle, and High Scenarios
Table 4 – Cost Sensitive Analysis for Alternative A-2: Remedy Assumption Summary
Table 5 – Cost Sensitivity Analysis for Alternative A-6: Remedy Assumption Summary

ZONE A CONTINGENCY AND SENSITIVITY ANALYSES TABLES

Table 1
Alternative A-2 (Enhanced SVE Treatment and Air Sparging/Ozone Treatment)
Contingency Analysis: Low, Middle, and High Scenarios

Task	Unit	Quantity	Unit Cost	Likely Total Cost (No Contingency)	Contingency									Rationale for Uncertainties included in Contingency
					Low Scenario			Middle Scenario			High Scenario			
					Scope	Bid	Cost	Scope	Bid	Cost	Scope	Bid	Cost	
Construction Costs														
Mobilization/Demobilization/Site Preparation	LS	1	$240,261	$240,261	10%	10%	$288,313	10%	10%	$288,313	15%	10%	$300,326	**Bid** - Costs based on past project experience, not likely to significantly change **Risk/Scope** - Regulatory constraints could slightly affect site preparation/facilities/mobilization costs
Air Sparging and Ozone Treatment	LS	1	$443,627	$443,627	10%	10%	$532,353	15%	15%	$576,715	25%	20%	$643,259	**Bid** - Estimate based on past experience in similar projects **Risk/Scope** - Relatively low uncertainty related to implementation of treatment; pilot studies would be required
Ground Water Well Decommissioning	LS	1	$23,521	$23,521	10%	10%	$28,225	10%	10%	$28,225	15%	10%	$29,401	**Bid** - Very low uncertainty; costs are based on actual costs for GW well decommisioning **Risk/Scope** - Very low uncertainty; costs are based on actual costs for known technical scope
Additional SVE Well Installation (for Enhanced SVE)	LS	1	$244,651	$244,651	10%	10%	$293,581	15%	10%	$305,813	20%	15%	$330,279	**Bid** - Very low uncertainty; costs are based on actual costs for SVE well installation **Risk/Scope** - Very low uncertainty; costs are based on actual costs for known technical scope
Cap Replacements (Years 1 and 15)	LS	1	$782,933	$782,933	10%	10%	$939,520	15%	10%	$978,666	20%	15%	$1,056,959	**Bid** - Cost provided by SCS with high level of confidence, based on recent work with similar scope on Zone A **Risk/Scope** - Very low uncertainty; costs are based on actual costs for known technical scope
Institutional Controls (Environmental Covenant)	LS	1	$6,900	$6,900	10%	10%	$8,280	10%	10%	$8,280	15%	10%	$8,625	**Bid** - Very low uncertainty; costs are based on actual costs for IC EC **Risk/Scope** - Very low uncertainty; costs are based on actual costs for IC EC
Subtotal - Construction Costs	-	-	-	***$1,741,893***			***$2,090,272***			***$2,186,014***			***$2,368,850***	
Sales Tax	-	-	8.6%	$149,803			$179,763			$187,997			$203,721	
Total - Construction Costs	-	-	-	***$1,892,000***			***$2,270,000***			***$2,374,000***			***$2,573,000***	
Non-Construction Costs														
Design, Project Management, and Permitting	-	-	17%	$321,640										
Construction Management and Inspection	-	-	8%	$151,360										
Ground Water Monitoring and Reporting	LS	1	$1,232,272	$1,232,272										
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,377,378	$2,377,378										
SVE System Operation, Maintenance, and Repairs	LS	1	$7,862,938	$7,862,938										
Air Sparging and Ozone Operation/Maintenance	LS	1	$752,619	$752,619										
Institutional Controls Operation and Maintenance	LS	1	$621,334	$621,334										
Total - Non-Construction Costs	-	-	-	***$13,320,000***	10%	5%	***$15,318,000***	15%	5%	***$15,984,000***	20%	10%	***$17,316,000***	**Bid** - Costs are based on actual costs for GW monitoring, cap O&M, and ICs **Risk/Scope** - Compliance monitoring program has not been developed; O&M may be higher with aging infrastructure
Total Project Costs														
Total Project Cost (Excluding Contingency)	-	-	-	**$15,212,000**										
Total Project Cost (Including Contingency)	-	-	-	-			**$17,588,000**			**$18,358,000**			**$19,889,000**	

Overall Project Contingency	**Low Scenario:**	**16%**	**Middle Scenario:**	**21%**	**High Scenario:**	**31%**	

Notes:
1. Costs for Alternative A-2 as presented in Table 5.4-1 of the Draft Final FFS.
2. Total costs are presented on a net present value basis (assuming a 3% discount rate).
3. Per EPA guidance (EPA 2000), scope contingency represents costs, unforeseeable at the time of estimate preparation, which are likely to become known as the remedial design proceeds; it generally ranges between 10%-25%. Bid contingency represents costs, unforeseeable at the time of estimate preparation, which are likely to become known as the remedial action construction and implementation proceeds; it generally ranges between 10%-20%.

EC = environmental covenant
EPA = Environmental Protection Agency
FFS = Focused Feasibility Study
GW = ground water
IC = institutional controls
O&M = operations and maintenance
SVE = Soil Vapor Extraction

Table 2
Alternative A-6 (On-site AOC and Thermal Treatment in Touchet Beds)
Contingency Analysis: Low, Middle, and High Scenarios

Task	Unit	Quantity	Unit Cost	Likely Total Cost (No Contingency)	Contingency									Rationale for Uncertainties included in Contingency
					Low Scenario			Middle Scenario			High Scenario			
					Scope	Bid	Cost	Scope	Bid	Cost	Scope	Bid	Cost	
Construction Costs														
Contractor Planning, Mobilization, and Project Support	LS	1	$5,861,738	$5,861,738	10%	10%	$7,034,086	10%	10%	$7,034,086	15%	10%	$7,327,172	**Bid** - Cost provided by Envirocon with high level of confidence, based on past experience in similar projects **Risk/Scope** - Regulatory oversight and reviews could be more complex and lenghly than expected; regulatory constraints could slightly affect site preparation activities/facilities/mobilization costs
Excavation and Disposal	LS	1	$6,567,178	$6,567,178	20%	10%	$8,537,331	25%	25%	$9,850,766	50%	20%	$11,164,202	**Bid** - Low certainty in costs presented by Envirocon, based on potential overruns, modifications, change orders and/or claims during excavation and disposal **Risk/Scope** - Relatively high uncertainty related to regulatory oversight and change of conditions during excavation and disposal could result in rapid escalation of costs
Additional Activities Associated with Excavation	LS	1	$456,598	$456,598	10%	10%	$547,918	15%	10%	$570,747	25%	15%	$639,237	**Bid** - Low uncertainty in costs related to gas pipeline relocation adjacent to Zone A excavation **Risk/Scope** - Relatively low uncertainty in costs related to gas pipeline relocation adjacent to Zone A excavation
Construction and Placement in On-site AOC	LS	1	$5,096,316	$5,096,316	10%	10%	$6,115,579	15%	10%	$6,370,395	25%	15%	$7,134,842	**Bid** - Cost provided by Envirocon with high level of confidence, based on past project experience **Risk/Scope** - Regulatory oversight and reviews could be more complex and lenghtly than expected; change in conditions in the field could result in higher costs
SVE Well Drilling	LS	1	$453,544	$453,544	10%	10%	$544,253	15%	15%	$589,607	25%	20%	$657,639	**Bid** - Costs assumed with high level of confidence, based on past project bids **Risk/Scope** - change in drilling conditions under Zone A in the field could result in higher costs
Treatment of the Touchet Beds	EA	1	$6,384,000	$6,384,000	15%	10%	$7,980,000	20%	15%	$8,618,400	25%	20%	$9,256,800	**Bid** - Estimate provided by TRS Group Inc. with low familiarity of Site conditions (no site visit) and limited communication with technical team **Risk/Scope** - Soil cleanup goals have not been determined; confirmational sampling has not been discussed with Ecology; change in conditions in the field coud result in higher costs; thermal treatment pilot study would be required
Ground Water Well Installation and Decommissioning	LS	1	$58,253	$58,253	10%	10%	$69,904	10%	10%	$69,904	15%	10%	$72,816	**Bid** - Very low uncertainty; costs are based on actual costs for GW well installation/decommisioning **Risk/Scope** - Very low uncertainty; costs are based on actual costs for known technical scope
Institutional Controls (Fencing, Signage, EC)	LS	1	$56,172	$56,172	10%	10%	$67,406	10%	10%	$67,406	15%	10%	$70,215	**Bid** - Very low uncertainty; costs are based on actual costs for IC fencing/signage/EC **Risk/Scope** - Very low uncertainty; costs are based on actual costs for IC fencing/signage/EC
Subtotal - Construction Costs	-	-	-	***$24,933,798***			***$30,896,476***			***$33,171,311***			***$36,322,923***	
Sales Tax	-	-	8.6%	$2,144,307			$2,657,097			$2,852,733			$3,123,771	
Total - Construction Costs	-	-	-	***$27,078,000***			***$33,554,000***			***$36,024,000***			***$39,447,000***	
Non-Construction Costs														
Design, Project Management, and Permitting	-	-	17%	$4,603,260										
Construction Management and Inspection	-	-	8%	$2,166,240										
Ground Water Monitoring and Reporting	LS	1	$1,247,794	$1,247,794										
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,059,129	$2,059,129										
AOC RCRA Cap Monitoring and Maintenance	LS	1	$2,890,057	$2,890,057										
SVE System Operation, Maintenance, and Repairs	LS	1	$3,724,189	$3,724,189										
Institutional Controls Operation and Maintenance	LS	1	$621,334	$621,334										
Total - Non-Construction Costs	-	-	-	***$17,312,000***	10%	5%	***$19,909,000***	15%	5%	***$20,774,000***	20%	10%	***$22,506,000***	**Bid** - Costs are based on actual costs for GW monitoring, cap O&M, and ICs **Risk/Scope** - Compliance monitoring program has not been developed; O&M may be higher with aging infrastructure
Total Project Costs														
Total Project Cost (Excluding Contingency)	-	-	-	**$44,390,000**										
Total Project Cost (Including Contingency)	-	-	-	-			**$53,463,000**			**$56,798,000**			**$61,953,000**	

Overall Project Contingency	**Low Scenario:**	**20%**	**Middle Scenario:**	**28%**	**High Scenario:**	**40%**	

Notes:

1. Costs for Alternative A-6 as presented in Table 5.4-1 of the Draft Final FFS.
2. Total costs are presented on a net present value basis (assuming a 3% discount rate).
3. Cost template and unit costs provided by Envirocon.
4. Per EPA guidance (EPA 2000), scope contingency represents costs, unforeseeable at the time of estimate preparation, which are likely to become known as the remedial design proceeds; it generally ranges between 10%-25%. Bid contingency represents costs, unforeseeable at the time of estimate preparation, which are likely to become known as the remedial action construction and implementation proceeds; it generally ranges between 10%-20%.

AOC = area of contamination; EA = each; GW = ground water; IC = institutional control; LS = lump sum; RCRA = Resource Conservation and Recovery Act; SVE = soil vapor extraction

Table 3
Alternative A-9 (Off-site Disposal)
Contingency Analysis: Low, Middle, and High Scenarios

Task	Unit	Quantity	Unit Cost	Likely Total Cost (No Contingency)	Contingency									Rationale for Uncertainties included in Contingency
					Low Scenario			Middle Scenario			High Scenario			
					Scope	Bid	Cost	Scope	Bid	Cost	Scope	Bid	Cost	
Construction Costs														
Contractor Planning, Mobilization, and Project Support	LS	1	$6,164,957	$6,164,957	10%	10%	$7,397,949	10%	10%	$7,397,949	15%	10%	$7,706,197	**Bid** - Cost provided by Envirocon with high level of confidence, based on past experience in similar projects **Risk/Scope** - Regulatory oversight and reviews could be more complex and lengthy than expected; regulatory constraints could slightly affect site preparation activities/facilities/mobilization costs
Excavation and Disposal	LS	1	$48,066,204	$48,066,204	20%	10%	$62,486,065	25%	25%	$72,099,306	50%	20%	$81,712,547	**Bid** - Low certainty in costs presented by Envirocon, based on potential overruns, modifications, change orders and/or claims during excavation and disposal **Risk/Scope** - Relatively high uncertainty related to regulatory oversight and change of conditions during excavation and disposal could result in rapid escalation of costs
Additional Activities Associated with Excavation	LS	1	$456,598	$456,598	10%	10%	$547,918	15%	10%	$570,747	25%	15%	$639,237	**Bid** - Low uncertainty in costs related to gas pipeline relocation adjacent to Zone A excavation **Risk/Scope** - Relatively low uncertainty in costs related to gas pipeline relocation adjacent to Zone A excavation
SVE Well Drilling	LS	1	$453,544	$453,544	10%	10%	$544,253	15%	15%	$589,607	25%	20%	$657,639	**Bid** - Costs assumed with high level of confidence, based on past project bids **Risk/Scope** - change in drilling conditions under Zone A in the field could result in higher costs
Ground Water Well Installation and Decommissioning	LS	1	$58,253	$58,253	10%	10%	$69,904	10%	10%	$69,904	15%	10%	$72,816	**Bid** - Very low uncertainty; costs are based on actual costs for GW well installation/decommissioning **Risk/Scope** - Very low uncertainty; costs are based on actual costs for known technical scope
Institutional Controls (Fencing, Signage, EC)	LS	1	$56,172	$56,172	10%	10%	$67,406	10%	10%	$67,406	15%	10%	$70,215	**Bid** - Very low uncertainty; costs are based on actual costs for IC fencing/signage/EC **Risk/Scope** - Very low uncertainty; costs are based on actual costs for IC fencing/signage/EC
Subtotal - Construction Costs	-	-	-	***$55,255,728***			***$71,113,494***			***$80,794,919***			***$90,858,650***	
Sales Tax	-	-	8.6%	$4,751,993			$6,115,760			$6,948,363			$7,813,844	
Total - Construction Costs	-	-	-	***$60,008,000***			***$77,229,000***			***$87,743,000***			***$98,672,000***	
Non-Construction Costs														
Design, Project Management, and Permitting	-	-	17%	$10,201,360										
Construction Management and Inspection	-	-	8%	$4,800,640										
Ground Water Monitoring and Reporting	LS	1	$1,247,794	$1,247,794										
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,059,129	$2,059,129										
SVE System Operation, Maintenance, and Repairs	LS	1	$3,724,189	$3,724,189										
Institutional Controls Operation and Maintenance	LS	1	$621,334	$621,334										
Total - Non-Construction Costs	-	-	-	***$22,654,000***	10%	5%	***$26,052,000***	15%	5%	***$27,185,000***	20%	10%	***$29,450,000***	**Bid** - Costs are based on actual costs for GW monitoring, cap O&M, and ICs **Risk/Scope** - Compliance monitoring program has not been developed; O&M may be higher with aging infrastructure
Total Project Costs														
Total Project Cost (Excluding Contingency)	-	-	-	**$82,662,000**										
Total Project Cost (Including Contingency)	-	-	-	-			**$103,281,000**			**$114,928,000**			**$128,122,000**	

Overall Project Contingency	**Low Scenario:**	**25%**	**Middle Scenario:**	**39%**	**High Scenario:**	**55%**	

Notes:

1. Costs for Alternative A-9 as presented in Table 5.4-1 of the Draft Final FFS.
2. Total costs are presented on a net present value basis (assuming a 3% discount rate).
3. Cost template and unit costs provided by Envirocon.
4. Per EPA guidance (EPA 2000), scope contingency represents costs, unforeseeable at the time of estimate preparation, which are likely to become known as the remedial design proceeds; it generally ranges between 10%-25%. Bid contingency represents costs, unforeseeable at the time of estimate preparation, which are likely to become known as the remedial action construction and implementation proceeds; it generally ranges between 10%-20%.

AOC = area of contamination; EA = each; GW = ground water; IC = institutional control; LS = lump sum; RCRA = Resource Conservation and Recovery Act; SVE = soil vapor extraction

Table 4

Cost Sensitivity Analysis for Alternative A-2

Remedy Assumption Summary

Task	Remedy Assumptions		
	Lower Bound	**Base Case**	**Upper Bound**
Air Sparging and Ozone Treatment	75%	100%	150%
Air Sparging and Ozone Operation and Maintenance	75%	100%	150%

Notes:

1. Base case and bounding cost estimates for Alternative A-2 presented in Table 7 of this Attachment.

= Changes made for Lower Bound Case

= Changes made for Upper Bound Case

Table 5
Cost Sensitivity Analysis for Alternative A-6
Remedy Assumption Summary

Task	Remedy Assumptions			
	Lower Bound	**Base Case**	**Middle Bound**	**Upper Bound**
Soil Excavation: Ground to Geomembrane	13,500 tons remain on site 100% reuse for site restoration	13,500 tons remains on site 100% reuse for site restoration	13,500 tons remains on site 100% reuse for site restoration	13,500 tons remains on site 100% reuse for site restoration
Soil Excavation: Geomembrane to Top of Visqueen	46,500 tons impacted soil 100% remains on-site and disposed of in the AOC	46,500 tons impacted soil 100% remains on-site and disposed of in the AOC	46,500 tons impacted soil 85% remains on site and disposed of in the AOC 15% transported off-site to subtitle C for direct disposal	46,500 tons impacted soil 70% remains on-site and disposed of in the AOC 30% transported off-site 15% subtitle C direct disposal 15% subtitle C with stabilization
Soil Excavation: Visqueen to Top of Touchet Beds	93,300 tons impacted soil 100% remains on-site and disposed of in the AOC	93,300 tons impacted soil 100% remains on-site and disposed of in the AOC	93,300 tons impacted soil 80% remains on-site and disposed of in the AOC 20% impacted soil transported off-site 10% subtitle C direct disposal 10% subtitle C with stabilization	93,300 tons impacted soil 70% impacted soil remains on-site and disposed of in the AOC 30% impacted soil transported off-site 20% subtitle C direct disposal 5% subtitle C with stabilization 5% incineration
Soil Excavation: Visqueen to Top of Touchet Beds - Layback	45,300 tons clean soil 100% reuse as backfill	45,300 tons clean soil 100% reuse as backfill	45,300 tons clean soil 100% reuse as backfill	45,300 tons clean soil 100% reuse as backfill
Stacked Drums: Hazardous Wastes (Liquids and Sludges)	16,100 drums excavated 85% disposed of on-site 15% disposed of off-site 12% subtitle C direct disposal 3% incineration liquids	16,100 drums excavated 75% disposed of on-site 25% disposed of off-site 20% subtitle C direct disposal 5% incineration liquids	16,100 drums excavated 65% disposed of on-site 35% disposed of off-site 25% subtitle C direct disposal 10% incineration liquids	16,100 drums excavated 50% disposed of on-site 50% disposed of off-site 20% subtitle C direct disposal 20% incineration liquids 10% incineration solids
Stacked Drums: Casting Sands	8,900 drums excavated 100% disposed of on site	8,900 drums excavated 100% disposed of on-site	8,900 drums excavated 90% on-site 10% off site to subtitle C direct disposal	8,900 drums excavated 80% on-site 20% off-site to subtitle C direct disposal
Bulk Liquids	500 tons disposed off-site 50% solvents 50% aqueous liquids	1000 tons disposed off-site 50% solvents 50% aqueous liquids	1500 tons disposed off-site 50% solvents 50% aqueous liquids	2000 tons disposed off-site 50% solvents 50% aqueous liquids

Notes:
1. Base case and bounding cost estimates for Alternative A-6 presented in Table 8 of this Attachment.

= Changes made for Lower Bound Case
= Changes made for Upper Bound Case
= Changes made for Middle Bound Case

Table 6
Cost Sensitivity Analysis for Alternative A-9
Remedy Assumption Summary

Task	Disposal Assumptions			
	Lower Bound	**Base Case [1]**	**Middle Bound**	**Upper Bound [2]**
Soil Excavation: Ground to Geomembrane	13,500 tons remain on site 100% reuse for site restoration	13,500 tons remain on site 100% reuse for site restoration	13,500 tons remain on site 100% reuse for site restoration	13,500 tons remain on site 100% reuse for site restoration
Soil Excavation: Geomembrane to Top of Visqueen	46,500 tons impacted soil 100% for off-site disposal at subtitle D	46,500 tons impacted soil 100% for off-site disposal at subtitle D	46,500 tons impacted soil 100% for off-site disposal 50% subtitle D 25% subtitle C direct disposal 25% subtitle C with stabilization	46,500 tons impacted soil 100% for off-site disposal 50% subtitle C direct disposal 50% subtitle C with stabilization
Soil Excavation: Visqueen to Top of Touchet Beds	93,300 tons impacted soil 100% for off-site disposal 75% subtitle C direct disposal 25% subtitle C with stabilization	93,300 tons impacted soil 100% off-site disposal 50% subtitle C direct disposal 50% subtitle C with stabilization	93,300 tons impacted soil 100% for off-site disposal 30% subtitle C direct disposal 55% subtitle C with stabilization 15% incineration	93,300 tons impacted soil 100% for off-site disposal 10% subtitle C direct disposal 65% subtitle C with stabilization 25% incineration
Layback Soil Excavation: Visqueen to Top of Touchet Beds	45,300 tons soil excavated 10% for off-site disposal at subtitle D 90% reuse for backfill	45,300 tons soil excavated 25% for off-site disposal at subtitle D 75% reuse for backfill	45,300 tons soil excavated 50% for off-site disposal at subtitle D 50% reuse for backfill	45,300 tons soil excavated 100% for off-site disposal at subtitle D
Soil Excavation: Top of Touchet Beds to Top of Upper Pasco Gravels	91,500 tons impacted soil 100% for off-site disposal 75% subtitle C direct disposal 25% subtitle C with stabilization	91,500 tons impacted soil 100% off-site disposal 50% subtitle C direct disposal 40% subtitle C with stabilization 10% incineration	91,500 tons impacted soil 100% for off-site disposal 30% subtitle C direct disposal 55% subtitle C with stabilization 15% incineration	91,500 tons impacted soil 100% for off-site disposal 10% subtitle C direct disposal 65% subtitle C with stabilization 25% incineration
Layback Soil Excavation: Top of Touchet Beds to Top of Upper Pasco Gravels	82,200 tons soil excavated 20,000 tons for off-site disposal 100% subtitle D	82,200 tons soil excavated 20,000 tons for off-site disposal 100% subtitle D	82,200 tons soil excavated 20,000 tons for off-site disposal 90% subtitle D 10% subtitle C direct disposal	82,200 tons soil excavated 20,000 tons for off-site disposal 80% subtitle D 20% subtitle C direct disposal
Stacked Drums: Hazardous Wastes (Liquids and Sludges)	16,100 drums for off-site disposal 20% overpacks 15% subtitle C direct disposal 5% incineration liquids 80% (5,255 tons) bulked drums 75% subtitle C direct disposal 25% subtitle C with stabilization	16,100 drums for off-site disposal 25% overpacks 20% subtitle C direct disposal 5% incineration liquids 75% (4,930 tons) bulked drums 50% subtitle C direct disposal 50% subtitle C with stabilization	16,100 drums for off-site disposal 50% overpacks 15% subtitle C direct disposal 25% incineration liquids 10% incineration solids 50% (3,285 tons) bulked drums 25% subtitle C direct disposal 75% subtitle C with stabilization	16,100 drums for off-site disposal 100% off-site disposal 100% overpacks 10% subtitle C direct disposal 65% incineration liquids 25% incineration solids
Stacked Drums: Casting Sands	8,900 drums for off-site disposal 100% subtitle D	8,900 drums for off-site disposal 100% subtitle D	8,900 drums for off-site disposal 50% subtitle D 50% subtitle C direct disposal	8,900 drums for off-site disposal 100% subtitle C direct disposal
Bulk Liquids	500 tons for off-site disposal 50% solvents 50% aqueous liquids	1,000 tons for off-site disposal 50% solvents 50% aqueous liquids	2,000 tons for off-site disposal 50% solvents 50% aqueous liquids	-

Table 6

Cost Sensitivity Analysis for Alternative A-9

Remedy Assumption Summary

Notes:

1. Base case assumptions are based on Envirocon's 50%-50% scenario.
2. Upper bound assumptions are based on Envirocon's worst case scenario.
3. Base case and bounding cost estimates for Alternative A-9 presented in Table 9 of this Attachment.

= Changes made for Lower Bound Case

= Changes made for Upper Bound Case

= Changes made for Middle Bound Case

Table 7
Cost Sensitivity Analysis for Alternative A-2
Base Case and Bounding Cost Estimates

Task	Unit	Quantity	Unit Cost	Sensitivity					
				Lower Bound		Base Case		Upper Bound	
				% of Units	Cost	% of Units	Cost	% of Units	Cost
Construction Costs									
Mobilization/Demobilization/Site Preparation									
Mobilization and Demobilization	-	-	8%	100%	$111,258	100%	$120,131	100%	$137,876
Bonds and Insurance	-	-	3%	100%	$41,722	100%	$45,049	100%	$51,703
Site Preparation	-	-	5%	100%	$69,536	100%	$75,082	100%	$86,172
Air Sparging and Ozone Treatment									
Sparge Well Installation	LS	1	$109,435	75%	$82,076	100%	$109,435	150%	$164,153
SVE Well Installation	LS	1	$38,802		$29,102		$38,802		$58,203
IDW Profiling and Disposal	LS	1	$61,814		$46,361		$61,814		$92,722
Borelogs	LS	1	$4,322		$3,241		$4,322		$6,483
SVE/Sparge Piping	LS	1	$60,603		$45,452		$60,603		$90,904
Compound Expansion	LS	1	$42,913		$32,184		$42,913		$64,369
Additional Sparge and SVE Equipment Upgrades	LS	1	$92,737		$69,553		$92,737		$139,105
As-Built and O&M Plan Updates	LS	1	$16,070		$12,053		$16,070		$24,106
Decommission Sparge Wells	LS	1	$7,980		$5,985		$7,980		$11,969
System Decommission	LS	1	$8,952		$6,714		$8,952		$13,427
Ground Water Well Decommissioning	LS	1	$23,521	100%	$23,521	100%	$23,521	100%	$23,521
Additional SVE Well Installation (for Enhanced SVE)	LS	1	$244,651	100%	$244,651	100%	$244,651	100%	$244,651
Cap Replacements (Years 1 and 15)	LS	1	$782,933	100%	$782,933	100%	$782,933	100%	$782,933
Institutional Controls (EC)	LS	1	$6,900	100%	$6,900	100%	$6,900	100%	$6,900
Subtotal - Construction Costs	-	-	-		***$1,613,241***		***$1,741,893***		***$1,999,197***
Sales Tax	-	-	8.6%		$138,739		$149,803		$171,931
Total - Construction Costs	-	-	-		***$1,752,000***		***$1,892,000***		***$2,171,000***
Non-Construction Costs									
Design, Project Management, and Permitting	-	-	17%	100%	$297,840	100%	$321,640	100%	$369,070
Construction Management and Inspection	-	-	8%	100%	$140,160	100%	$151,360	100%	$173,680
Ground Water Monitoring and Reporting	LS	1	$1,232,272	100%	$1,232,272	100%	$1,232,272	100%	$1,232,272
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,377,378	100%	$2,377,378	100%	$2,377,378	100%	$2,377,378
SVE System Operation, Maintenance, and Repairs	LS	1	$7,862,938	100%	$7,862,938	100%	$7,862,938	100%	$7,862,938
Air Sparging and Ozone Operation/Maintenance									
Additional Operational Labor	LS	1	$494,925	75%	$371,194	100%	$494,925	150%	$742,387
Power Consumption	LS	1	$257,695		$193,271		$257,695		$386,542
Institutional Controls Operation and Maintenance	LS	1	$621,334	100%	$621,334	100%	$621,334	100%	$621,334
Total - Non-Construction Costs	-	-	-		***$13,096,000***		***$13,320,000***		***$13,766,000***
Total Project Costs									
Contingency (+20%)	-	-	20%		$2,969,600		$3,042,400		$3,187,400
Total Project Cost (Excluding Contingency)					**$14,848,000**		**$15,212,000**		**$15,937,000**
Total Project Costs (Including Contingency)					**$17,818,000**		**$18,254,000**		**$19,124,000**

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).

EC = environmental covenant

IDW = investigation-derived waste

LS = lump sum

O&M = operations and maintenance

SVE = soil vapor extraction

Base Case

Changes made for Lower Bound Case

Changes made for Upper Bound Case

Table 8
Cost Sensitivity Analysis for Alternative A-6
Base Case and Bounding Cost Estimates

Task	Unit	Quantity	Unit Cost	Sensitivity								Assumptions
				Lower Bound		Base Case		Middle Bound		Upper Bound		
				% of Units	Cost	% of Units	Cost	% of Units	Cost	% of Units	Cost	
Construction Costs												
Mobilization and Support												
Work Plan Technical Assistance and Report	LS	1	$50,000.00	100%	$50,000	100%	$50,000	100%	$50,000	100%	$50,000	
Preconstruction Planning, Permitting, and Design	LS	1	$93,500.00	100%	$93,500	100%	$93,500	100%	$93,500	100%	$93,500	
Mobilization and Site Preparation												
Mobilization	LS	1	$150,000.00	100%	$150,000	100%	$150,000	100%	$150,000	100%	$150,000	
Surveying	LS	1	$85,000.00	100%	$85,000	100%	$85,000	100%	$85,000	100%	$85,000	
Bonds and Insurance	LS	1	variable	1%	$237,878	1%	$249,338	1%	$306,925	1%	$372,170	Variable unit cost since it is defined as 1% of the subtotal construction costs, which change between bounding cases.
Temporary Facilities	MO	12	$15,000.00	100%	$180,000	100%	$180,000	100%	$180,000	100%	$180,000	
Well Abandonment	EA	15	$1,500.00	100%	$22,500	100%	$22,500	100%	$22,500	100%	$22,500	
Drum Staging and Handling Area Construction	LS	1	$340,000.00	100%	$340,000	100%	$340,000	100%	$340,000	100%	$340,000	
Sediment and Erosion Controls	LS	1	$26,500.00	100%	$26,500	100%	$26,500	100%	$26,500	100%	$26,500	
Demobilization/Project Closeout												
Drum Staging and Handling Area Decommissioning	LS	1	$210,500.00	100%	$210,500	100%	$210,500	100%	$210,500	100%	$210,500	
Demobilization	LS	1	$100,000.00	100%	$100,000	100%	$100,000	100%	$100,000	100%	$100,000	
Support of Report Preparation	LS	1	$50,000.00	100%	$50,000	100%	$50,000	100%	$50,000	100%	$50,000	
Support Costs												
Operations Supervisory & Support Costs - w/ per diem, lodging, and other items	MO	12	$310,000.00	100%	$3,720,000	100%	$3,720,000	100%	$3,720,000	100%	$3,720,000	
Health & Safety Supervisory Support Costs	MO	12	$17,000.00	100%	$204,000	100%	$204,000	100%	$204,000	100%	$204,000	
Personnel/Perimeter Air Monitoring	MO	12	$6,500.00	100%	$78,000	100%	$78,000	100%	$78,000	100%	$78,000	
Training, Medical & Incentives	MO	12	$4,200.00	100%	$50,400	100%	$50,400	100%	$50,400	100%	$50,400	
Health & Safety and PPE	MO	12	$21,000.00	100%	$252,000	100%	$252,000	100%	$252,000	100%	$252,000	
Contractor Planning, Mobilization, and Project Support - Subtotal					**$5,850,278**		**$5,861,738**		**$5,919,325**		**$5,984,570**	
Ground to Geomembrane - Clean Excavation												
Clean Soil Removal and Stockpile (Ground to Geomembrane)	TN	13,500	$3.20	100%	$43,200	100%	$43,200	100%	$43,200	100%	$43,200	
Geomembrane to Top of Visqueen - Excavation and Disposal												
Soil Excavation - Geomembrane to Top of Visqueen	TN	46,500	$3.45	100%	$160,425	100%	$160,425	100%	$160,425	100%	$160,425	
Soil T&D - Subtitle C Landfill: Direct Disposal	TN	46,500	$123.83	0%	$0	0%	$0	15%	$863,714	15%	$863,714	
Soil T&D - Subtitle C Landfill: With RCRA Stabilization	TN	46,500	$223.53	0%	$0	0%	$0	0%	$0	15%	$1,559,122	
Visqueen to Top of Touchet Beds - Excavation and Disposal												
Soil Excavation - Visqueen to Top of Touchet Beds	TN	93,300	$4.70	100%	$438,510	100%	$438,510	100%	$438,510	100%	$438,510	
Soil T&D - Subtitle C Landfill: Direct Disposal	TN	93,300	$123.83	0%	$0	0%	$0	10%	$1,155,334	20%	$2,310,668	
Soil T&D - Subtitle C Landfill: With RCRA Stabilization	TN	93,300	$223.53	0%	$0	0%	$0	10%	$2,085,535	5%	$1,042,767	
Soil T&D - Incineration (Clean Harbors)	TN	93,300	$609.00	0%	$0	0%	$0	0%	$0	5%	$2,840,985	
Visqueen to Top of Touchet Beds- Layback												
Layback Excavation - Visqueen to Top of Touchet Beds	TN	45,300	$4.10	100%	$185,730	100%	$185,730	100%	$185,730	100%	$185,730	
Site Restoration												
Backfill - Visqueen to Top of Touchet	TN	93,300	$10.25	100%	$956,325	100%	$956,325	100%	$956,325	100%	$956,325	
Backfill of Layback - Visqueen to Top of Touchet Beds	TN	45,300	$5.30	100%	$240,090	100%	$240,090	100%	$240,090	100%	$240,090	
RCRA Cap Installation	AC	2	$285,570	100%	$571,140	100%	$571,140	100%	$571,140	100%	$571,140	
Stacked Drums - Handling and Disposal (Hazardous Wastes: Liquids and Sludges)												
Drum Extraction	EA	16,100	$50.16	100%	$807,576	100%	$807,576	100%	$807,576	100%	$807,576	
Lab Analysis - Offsite Lab (5%)	EA	16,100	$650.00	3%	$313,950	5%	$523,250	10%	$1,046,500	10%	$1,046,500	
Drum Handling w/ Overpacks	EA	16,100	$76.05	15%	$183,661	25%	$306,101	35%	$428,542	50%	$612,203	
Overpack T&D - Subtitle C Landfill: Direct Disposal	EA	16,100	$124.40	12%	$240,341	20%	$400,568	25%	$500,710	20%	$400,568	
Overpack T&D - Incineration (liquids)	EA	16,100	$376.70	3%	$181,946	5%	$303,244	10%	$606,487	20%	$1,212,974	
Overpack T&D Incineration (solids)	EA	16,100	$580.90	0%	$0	0%	$0	0%	$0	10%	$935,249	
Stacked Drums - Handling and Disposal (Casting Sands)												
Drum Extraction - Casting Sands	EA	8,900	$50.16	100%	$446,424	100%	$446,424	100%	$446,424	100%	$446,424	
Lab Analysis Casting Sands - Offsite Lab (5%)	EA	8,900	$650.00	3%	$173,550	5%	$289,250	10%	$578,500	10%	$578,500	
Casting Sands T&D - Subtitle C Landfill: Direct Disposal	TN	3,630	$124.40	0%	$0	0%	$0	10%	$45,157	20%	$90,314	
Bulk Liquids												
Liquids Recovery - Labor & Equip	LS	1	$75,000.00	100%	$75,000	100%	$75,000	100%	$75,000	100%	$75,000	
Solvents Liquids - T&D	TN	variable	$717.10	50%	$179,275	50%	$358,550	50%	$537,825	50%	$717,100	Variable tonnage assumed for disposal of bulk liquids: Lower Bound = 500 TN; Base Case = 1,000 TN; Middle Bound = 1,500 TN; Upper Bound = 2,000 TN
Aqueous Liquids - T&D	TN	variable	$923.59	50%	$230,898	50%	$461,795	50%	$692,693	50%	$923,590	
Excavation and Disposal - Subtotal					**$5,428,040**		**$6,567,178**		**$12,465,416**		**$19,058,674**	
Additional Activities Associated with Excavation												
Natural Gas Pipeline Relocation	LS	1	$281,045	100%	$281,045	100%	$281,045	100%	$281,045	100%	$281,045	
BDI Buidling Demolition and Reconstruction	LS	1	$135,072	100%	$135,072	100%	$135,072	100%	$135,072	100%	$135,072	
Dietrich Road Realignment	LS	1	$40,481	100%	$40,481	100%	$40,481	100%	$40,481	100%	$40,481	
Additional Activities Associated with Excavation - Subtotal					**$456,598**		**$456,598**		**$456,598**		**$456,598**	
Construction & Placement in On-Site AOC												
Construction of On-site AOC Cell	LS	1	$2,956,690	100%	$2,956,690	100%	$2,956,690	100%	$2,956,690	100%	$2,956,690	
Handling/Placement of Drummed Waste in AOC	TN	148,358	$7.00	100%	$1,043,103	100%	$1,038,505	81%	$841,420	68%	$707,347	
RCRA Cap Construction on AOC Cell	LS	1	$1,101,121	100%	$1,101,121	100%	$1,101,121	100%	$1,101,121	100%	$1,101,121	
Construction and Placement in On-site AOC - Subtotal	**LS**	**1**			**$5,100,914**		**$5,096,316**		**$4,899,232**		**$4,765,158**	
SVE Well Drilling	LS	1	$453,544	100%	$453,544	100%	$453,544	100%	$453,544	100%	$453,544	
Thermal Treatment												
Treatment of the Touchet Beds	EA	1	$6,384,000	100%	$6,384,000	100%	$6,384,000	100%	$6,384,000	100%	$6,384,000	
Ground Water Well Installation and Decommissioning	LS	1	$58,253	100%	$58,253	100%	$58,253	100%	$58,253	100%	$58,253	
Institutional Controls (Fencing, Signage, EC)	LS	1	$56,172	100%	$56,172	100%	$56,172	100%	$56,172	100%	$56,172	
Subtotal - Construction Costs	-	-	-		***$23,787,799***		***$24,933,798***		***$30,692,540***		***$37,216,969***	
Sales Tax	-	-	8.6%		$2,045,751		$2,144,307		$2,639,558		$3,200,659	
Total - Construction Costs	-	-	-		***$25,834,000***		***$27,078,000***		***$33,332,000***		***$40,418,000***	
Non-Construction Costs												
Design, Project Management, and Permitting	-	-	17%	100%	$4,391,780	100%	$4,603,260	100%	$5,666,440	100%	$6,871,060	
Construction Management and Inspection	-	-	8%	100%	$2,066,720	100%	$2,166,240	100%	$2,666,560	100%	$3,233,440	
Ground Water Monitoring and Reporting	LS	1	$1,247,794	100%	$1,247,794	100%	$1,247,794	100%	$1,247,794	100%	$1,247,794	
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,059,129	100%	$2,059,129	100%	$2,059,129	100%	$2,059,129	100%	$2,059,129	
AOC RCRA Cap Monitoring and Maintenance	LS	1	$2,890,057	100%	$2,890,057	100%	$2,890,057	100%	$2,890,057	100%	$2,890,057	
SVE System Operation, Maintenance, and Repairs	LS	1	$3,724,189	100%	$3,724,189	100%	$3,724,189	100%	$3,724,189	100%	$3,724,189	
Institutional Controls Operation and Maintenance	LS	1	$621,334	100%	$621,334	100%	$621,334	100%	$621,334	100%	$621,334	
Total - Non-Construction Costs	-	-	-		***$17,001,000***		***$17,312,000***		***$18,876,000***		***$20,647,000***	
Total Project Costs												
Contingency (+40%)	-	-	40%		$17,134,000		$17,756,000		$20,883,200		$24,426,000	
Total Project Cost (Excluding Contingency)					$42,835,000		$44,390,000		$52,208,000		$61,065,000	
Total Project Costs (Including Contingency)					**$59,969,000**		**$62,146,000**		**$73,091,000**		**$85,491,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Cost template and unit costs provided by Envirocon.

AC = acre
AOC = area of contamination
EA = each
EC = environmental covenant
LS = lump sum
MO = month
PPE = personal protective equipment
RCRA = Resource Conservation and Recovery Act
SVE = soil vapor extraction
T&D = transportation and disposal
TN = ton

Base Case
Changes made for Lower Bound Case
Changes made for Middle Bound Case
Changes made for Upper Bound Case

Table 9
Cost Sensitivity Analysis for Alternative A-9
Base Case and Bounding Cost Estimates

Task	Unit	Quantity	Unit Cost	Sensitivity								Assumptions
				Lower Bound		Base Case		Middle Bound		Upper Bound		
				% of Units	Cost	% of Units	Cost	% of Units	Cost	% of Units	Cost	
Construction Costs												
Mobilization and Support												
Work Plan Technical Assistance and Report	LS	1	$50,000.00	100%	$50,000	100%	$50,000	100%	$50,000	100%	$50,000	
Preconstruction Planning, Permitting, and Design	LS	1	$93,500.00	100%	$93,500	100%	$93,500	100%	$93,500	100%	$93,500	
Mobilization and Site Preparation												
Mobilization	LS	1	$150,000.00	100%	$150,000	100%	$150,000	100%	$150,000	100%	$150,000	
Surveying	LS	1	$85,000.00	100%	$85,000	100%	$85,000	100%	$85,000	100%	$85,000	
Bonds and Insurance	LS	1	variable	1%	$458,383	1%	$552,557	1%	$740,744	1%	$913,980	Variable unit cost since it is defined as 1% of the subtotal construction costs, which change between bounding cases.
Temporary Facilities	MO	12	$15,000.00	100%	$180,000	100%	$180,000	100%	$180,000	100%	$180,000	
Well Abandonment	EA	15	$1,500.00	100%	$22,500	100%	$22,500	100%	$22,500	100%	$22,500	
Drum Staging and Handling Area Construction	LS	1	$340,000.00	100%	$340,000	100%	$340,000	100%	$340,000	100%	$340,000	
Sediment and Erosion Controls	LS	1	$26,500.00	100%	$26,500	100%	$26,500	100%	$26,500	100%	$26,500	
Demobilization/Project Closeout												
Drum Staging and Handling Area Decommissioning	LS	1	$210,500.00	100%	$210,500	100%	$210,500	100%	$210,500	100%	$210,500	
Demobilization	LS	1	$100,000.00	100%	$100,000	100%	$100,000	100%	$100,000	100%	$100,000	
Support of Report Preparation	LS	1	$50,000.00	100%	$50,000	100%	$50,000	100%	$50,000	100%	$50,000	
Support Costs												
Operations Supervisory & Support Costs - w/ per diem, lodging, and other items	MO	12	$310,000.00	100%	$3,720,000	100%	$3,720,000	100%	$3,720,000	100%	$3,720,000	
Health & Safety Supervisory Support Costs	MO	12	$17,000.00	100%	$204,000	100%	$204,000	100%	$204,000	100%	$204,000	
Personnel/Perimeter Air Monitoring	MO	12	$6,500.00	100%	$78,000	100%	$78,000	100%	$78,000	100%	$78,000	
Training, Medical & Incentives	MO	12	$4,200.00	100%	$50,400	100%	$50,400	100%	$50,400	100%	$50,400	
Health & Safety and PPE	MO	12	$21,000.00	100%	$252,000	100%	$252,000	100%	$252,000	100%	$252,000	
Contractor Planning, Mobilization, and Project Support - Subtotal					**$6,070,783**		**$6,164,957**		**$6,353,144**		**$6,526,380**	
Ground to Geomembrane - Clean Excavation												
Clean Soil Removal and Stockpile (Ground to Geomembrane)	TN	13,500	$3.20	100%	$43,200	100%	$43,200	100%	$43,200	100%	$43,200	
Geomembrane to Top of Visqueen - Excavation and Disposal												
Soil Excavation - Geomembrane to Top of Visqueen	TN	46,500	$3.45	100%	$160,425	100%	$160,425	100%	$160,425	100%	$160,425	
Soil T&D - Subtitle D Landfill	TN	46,500	$32.23	100%	$1,498,695	100%	$1,498,695	50%	$749,348	0%	$0	
Soil T&D - Subtitle C Landfill: Direct Disposal	TN	46,500	$123.83	0%	$0	0%	$0	25%	$1,439,524	50%	$2,879,048	
Soil T&D - Subtitle C Landfill: With RCRA Stabilization	TN	46,500	$223.53	0%	$0	0%	$0	25%	$2,598,536	50%	$5,197,073	
Visqueen to Top of Touchet Beds - Excavation and Disposal												
Soil Excavation - Visqueen to Top of Touchet Beds	TN	93,300	$4.70	100%	$438,510	100%	$438,510	100%	$438,510	100%	$438,510	
Soil T&D - Subtitle D Landfill	TN	93,300	$32.23	0%	$0	0%	$0	0%	$0	0%	$0	
Soil T&D - Subtitle C Landfill: Direct Disposal	TN	93,300	$123.83	75%	$8,665,004	50%	$5,776,670	30%	$3,466,002	10%	$1,155,334	
Soil T&D - Subtitle C Landfill: With RCRA Stabilization	TN	93,300	$223.53	25%	$5,213,837	50%	$10,427,675	55%	$11,470,442	65%	$13,555,977	
Soil T&D - Incineration (Clean Harbors)	TN	93,300	$609.00	0%	$0	0%	$0	15%	$8,522,955	25%	$14,204,925	
Visqueen to Top of Touchet Beds - Layback												
Layback Excavation - Visqueen to Top of Touchet Beds	TN	45,300	$4.10	100%	$185,730	100%	$185,730	100%	$185,730	100%	$185,730	
Layback Soil T&D - Subtitle D Landfill	TN	45,300	$32.23	10%	$146,002	25%	$365,005	50%	$730,010	100%	$1,460,019	
Top of Top of Touchet Beds to Top of Upper Pasco Gravels - Excavation and Disposal												
Excavate Top of Touchet Beds to Top of Upper Pasco Gravels	TN	91,500	$5.86	100%	$536,190	100%	$536,190	100%	$536,190	100%	$536,190	
Soil T&D - Subtitle D Landfill	TN	91,500	$32.23	0%	$0	0%	$0	0%	$0	0%	$0	
Soil T&D - Subtitle C Landfill: Direct Disposal	TN	91,500	$123.83	75%	$8,497,834	50%	$5,665,223	30%	$3,399,134	10%	$1,133,045	
Soil T&D - Subtitle C Landfill: With RCRA Stabilization	TN	91,500	$223.53	25%	$5,113,249	40%	$8,181,198	55%	$11,249,147	65%	$13,294,447	
Soil T&D - Incineration (Clean Harbors)	TN	91,500	$609.00	0%	$0	10%	$5,572,350	15%	$8,358,525	25%	$13,930,875	
Top of Touchet Beds to Top of Upper Pasco Gravels - Layback												
Layback - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	82,200	$4.50	100%	$369,900	100%	$369,900	100%	$369,900	100%	$369,900	
Layback Soil T&D - Subtitle D Landfill	TN	20,000	$32.23	100%	$644,600	100%	$644,600	90%	$580,140	80%	$515,680	
Layback Soil T&D - Subtitle C Landfill: Direct Disposal	TN	20,000	$123.83	0%	$0	0%	$0	10%	$247,660	20%	$495,320	
Site Restoration												
Backfill - Visqueen to Top of Touchet Beds (new, clean backfill)	TN	93,300	$10.25	100%	$956,325	100%	$956,325	100%	$956,325	100%	$956,325	
Backfill of Layback - Visqueen to Top of Touchet Beds	TN	45,300	$6.20	100%	$280,860	100%	$280,860	100%	$280,860	100%	$280,860	
Backfill - Top of Top of Touchet Beds to Top of Upper Pasco Gravels	TN	91,500	$10.25	100%	$937,875	100%	$937,875	100%	$937,875	100%	$937,875	
Backfill of Layback - Top of Touchet Beds to Top of Upper Pasco Gravels	TN	82,200	$6.20	100%	$509,640	100%	$509,640	100%	$509,640	100%	$509,640	
RCRA Cap Installation	AC	2	$285,570	100%	$571,140	100%	$571,140	100%	$571,140	100%	$571,140	
Stacked Drums - Handling and Disposal (Hazardous Wastes: Liquids and Sludges)												
Removal of Drums	EA	16,100	$50.16	100%	$807,576	100%	$807,576	100%	$807,576	100%	$807,576	
Lab Analysis - Offsite Lab (5%)	EA	16,100	$650.00	3%	$313,950	5%	$523,250	10%	$1,046,500	10%	$1,046,500	
Drum Handling w/ Overpacks	EA	16,100	$76.05	20%	$244,881	25%	$306,101	50%	$612,203	100%	$1,224,405	
Overpack T&D - Subtitle C Landfill: Direct Disposal	EA	16,100	$124.40	15%	$300,426	20%	$400,568	15%	$300,426	10%	$200,284	
Overpack T&D - Incineration (liquids)	EA	16,100	$376.70	5%	$303,244	5%	$303,244	25%	$1,516,218	65%	$3,942,166	
Overpack T&D Incineration (solids)	EA	16,100	$580.90	0%	$0	0%	$0	10%	$935,249	25%	$2,338,123	
Bulked Drum Waste T&D Subtitle C Landfill: Direct Disposal	TN	variable	$123.83	75%	$488,045	50%	$305,241	25%	$101,695	0%	$0	Variable tonnage assumed for bulked drum waste based on mass balance between total tonnage and overpacked drum tonnage: Lower bound = 5,255 TN; Base case = 4,930 TN; Middle bound = 3,285 TN; Upper bound = 0 TN
Bulked Drum Waste T&D Subtitle C Landfill: With RCRA Stabilization	TN	variable	$223.53	25%	$293,663	50%	$551,001	75%	$550,722	0%	$0	
Stacked Drums - Handling and Disposal (Casting Sands)												
Removal of Drums	EA	8,900	$50.16	100%	$446,424	100%	$446,424	100%	$446,424	100%	$446,424	
Lab Analysis Casting Sands - Offsite Lab (5%)	EA	8,900	$650.00	3%	$173,550	5%	$289,250	10%	$578,500	10%	$578,500	
Casting Sands T&D - Subtitle D Landfill: Direct Disposal	TN	3,630	$32.23	100%	$116,995	100%	$116,995	50%	$58,497	0%	$0	
Casting Sands T&D - Subtitle C Landfill: Direct Disposal	TN	3,630	$124.40	0%	$0	0%	$0	50%	$225,786	100%	$451,572	
Bulk Liquids												
Liquids Recovery - Labor & Equip	LS	1	$75,000.00	100%	$75,000	100%	$75,000	100%	$75,000	0%	$0	
Solvents Liquids - T&D	TN	variable	$717.10	50%	$179,275	50%	$358,550	50%	$717,100	0%	$0	Variable tonnage assumed for disposal of bulk liquids: Lower bound = 500 TN; Base case = 1,000 TN; Middle bound = 2,000 TN; Upper bound = 0 TN
Aqueous Liquids - T&D	TN	variable	$923.59	50%	$230,898	50%	$461,795	50%	$923,590	0%	$0	
Excavation and Disposal - Subtotal					**$38,742,941**		**$48,066,204**		**$66,696,702**		**$83,847,085**	
Additional Activities Associated with Excavation												
Natural Gas Pipeline Relocation	LS	1	$281,045	100%	$281,045	100%	$281,045	100%	$281,045	100%	$281,045	
BDI Buidling Demolition and Reconstruction	LS	1	$135,072	100%	$135,072	100%	$135,072	100%	$135,072	100%	$135,072	
Dietrich Road Realignment	LS	1	$40,481	100%	$40,481	100%	$40,481	100%	$40,481	100%	$40,481	
Additional Activities Associated with Excavation - Subtotal					**$456,598**		**$456,598**		**$456,598**		**$456,598**	
SVE Well Drilling	LS	1	$453,544	100%	$453,544	100%	$453,544	100%	$453,544	100%	$453,544	
Ground Water Well Installation and Decommissioning	LS	1	$58,253	100%	$58,253	100%	$58,253	100%	$58,253	100%	$58,253	
Institutional Controls (Fencing, Signage, EC)	LS	1	$56,172	100%	$56,172	100%	$56,172	100%	$56,172	100%	$56,172	
Subtotal - Construction Costs	-	-	-		***$45,838,291***		***$55,255,728***		***$74,074,413***		***$91,398,032***	
Sales Tax	-	-	8.6%		$3,942,093		$4,751,993		$6,370,399		$7,860,231	
Total - Construction Costs	-	-	-		***$49,780,000***		***$60,008,000***		***$80,445,000***		***$99,258,000***	

Table 9
Cost Sensitivity Analysis for Alternative A-9
Base Case and Bounding Cost Estimates

Task	Unit	Quantity	Unit Cost	Sensitivity								Assumptions
				Lower Bound		Base Case		Middle Bound		Upper Bound		
				% of Units	Cost	% of Units	Cost	% of Units	Cost	% of Units	Cost	
Non-Construction Costs												
Design, Project Management, and Permitting	-	-	17%	100%	$8,462,600	100%	$10,201,360	100%	$13,675,650	100%	$16,873,860	
Construction Management and Inspection	-	-	8%	100%	$3,982,400	100%	$4,800,640	100%	$6,435,600	100%	$7,940,640	
Ground Water Monitoring and Reporting	LS	1	$1,247,794	100%	$1,247,794	100%	$1,247,794	100%	$1,247,794	100%	$1,247,794	
Cap Monitoring, Maintenance, and Inspection	LS	1	$2,059,129	100%	$2,059,129	100%	$2,059,129	100%	$2,059,129	100%	$2,059,129	
SVE System Operation, Maintenance, and Repairs	LS	1	$3,724,189	100%	$3,724,189	100%	$3,724,189	100%	$3,724,189	100%	$3,724,189	
Institutional Controls Operation and Maintenance	LS	1	$621,334	100%	$621,334	100%	$621,334	100%	$621,334	100%	$621,334	
Total - Non-Construction Costs	-	-	-		***$20,097,000***		***$22,654,000***		***$27,764,000***		***$32,467,000***	
Total Project Costs												
Contingency (+55%)	-	-	55%		$38,432,350		$45,464,100		$59,514,950		$72,448,750	
Total Project Cost (Excluding Contingency)					$69,877,000		$82,662,000		$108,209,000		$131,725,000	
Total Project Costs (Including Contingency)					**$108,309,000**		**$128,126,000**		**$167,724,000**		**$204,174,000**	

Notes:

1. Total costs are presented on a net present value basis (assuming a 3% discount rate).
2. Cost template and unit costs provided by Envirocon.

AC = acre
EA = each
EC = environmental covenant
LS = lump sum
MO = month
PPE = personal protective equipment
RCRA = Resource Conservation and Recovery Act
SVE = soil vapor extraction
T&D = transportation and disposal
TN = ton

Base Case
Changes made for Lower Bound Case
Changes made for Middle Bound Case
Changes made for Upper Bound Case

APPENDIX E, ATTACHMENT H
NATURAL GAS PIPELINE RELOCATION COST BACKUP

Cascade Natural Gas - 8" Attalia Relocate Cost Estimate

Updated by Thomas Henderson on 3/1/2017

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL DIRECT COSTS	CONT. RATE	CONT. $	TOTAL COST
MATERIALS							
8" Pipe	600	LF	$ 13.00	$ 7,800.00	5.00%	$ 390.00	$ 8,190.00
Bottom Out Stopper	4	EA	$ 400.00	$ 1,600.00	10.00%	$ 160.00	$ 1,760.00
Misc Fittings (wrap, etc.)	1	LS	$ 5,000.00	$ 5,000.00	0.00%	$ -	$ 5,000.00
TOTAL: MATERIALS				**$ 14,400.00**		**$ 550.00**	**$ 14,950.00**
CNGC LABOR							
Installation							
Central Stores Leader	16	HR	$ 46.77	$ 748.32			
Corrosion Technician	8	HR	$ 70.00	$ 560.00			
Valve Station Fabrication Labor	0	LS	$ 4,500.00	$ -			
Crew Labor	0	HR	$ 216.64	$ -			
Sub-Total: Installation	**24**	**HR**		**$ 1,308.32**			
Inspection/Documentation/Management							
Division Supervision & Inspection - Manager Field Operations	120	HR	$ 70.00	$ 8,400.00			
Distribution Clerk	10	HR	$ 43.76	$ 437.60			
Control Equipment Mechanic	40	HR	$ 50.84	$ 2,033.60			
Sub-Total: Inspection/Documentation/Management	**170**	**HR**		**$ 10,871.20**			
TOTAL: CNGC LABOR	**194**	**Hours**		**$ 12,179.52**	**10.00%**	**$ 1,217.95**	**$ 13,397.47**
RESOURCES							
CNGC Equipment							
Control Equipment/Tap Truck	40	HR	$ 31.80	$ 1,272.00			
Air Compressors	10	HR	$ 11.10	$ 111.00			
Sub-Total: CNGC Equipment	**32**	**HR**		**$ 1,383.00**			
Travel, Food and Lodging Expenses							
Division Supervision & Inspection - Manager Field Operations	3	WEEK	$ 200.00	$ 600.00			
Crew Meals	5	EA	$ 10.00	$ 50.00			
Mileage	1,000	MILE	$ 0.51	$ 510.00			
Miscellaneous expenses	1	EA	$ 3,000.00	$ 3,000.00			
Sub-Total: Travel, Food & Lodging				**$ 4,160.00**			
Permits/Easements							
State Permits	0	EA	$ 2,000.00	$ -			
County/City Permits	1	EA	$ 500.00	$ 500.00			
Easement	1	EA	$ 2,000.00	$ 2,000.00			
Sub-Total: Permits/Easements				**$ 2,500.00**			
Miscellaneous							
Incidentals	0	EA	$ 5,000.00	$ -			
Sub-Total: Miscellaneous				**$ -**			
TOTAL: RESOURCES				**$ 8,043.00**	**10.00%**	**$ 804.30**	**$ 8,847.30**
CONTRACTOR/CONSULTANT							
Survey	1	EA	$ 5,000.00	$ 5,000.00			
General Contractors - Pipe Installation (TBD)	1	EA	$ 150,000.00	$ 150,000.00			
Sub-Total: Contractor/Consultant				**$ 155,000.00**			
Sales Tax	**8.5%**			**$ 13,175.00**			
TOTAL: CONTRACTOR/CONSULTANT				**$ 168,175.00**	**10.00%**	**$ 16,817.50**	**$ 184,992.50**
TOTAL MAIN INSTALL COSTS				**$ 202,797.52**		**$ 19,389.75**	**$ 222,187.27**
Overhead					**26.49%**		**$ 58,857.41**
TOTAL PROJECT COST							**$ 281,044.68**

GENERAL NOTES: Relocate for Pasco Landfill

APPENDIX F
TECHNOLOGY SCREENING AND AMENDMENT SELECTION FOR CONTINGENCY ACTIONS PASCO LANDFILL NPL SITE

Prepared for

Industrial Waste Area Generator Group III

Prepared by

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August 2017

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MEMORANDUM

To:	Halah Voges and Michael Riley Anchor QEA, LLC	**Date:**	August 31, 2017
From:	Jessica Goin, Sylian Rodriguez, and Casey Janisch, Anchor QEA, LLC	**Project:**	Pasco Landfill NPL Site, 100722-01.07
Re:	Technology Screening and Amendment Selection for Contingency Actions		

This memorandum summarizes the technology screening and amendment selection considered for the contingency actions in Alternatives A-3, A-4, and CD-2, as described in Section 5 of the Draft Final Focused Feasibility Study (FFS) for the Pasco Sanitary Landfill National Priority List Site (Site). These remedial alternatives include biological or chemical amendment additions to treat the ground water downgradient of Zone A and the vadose zone in Zones A and C/D.

Biological amendments considered were the addition of nutrients or growth factors to support biodegradation (biostimulation), the addition of organisms known to degrade the target organic compounds (bioaugmentation), and the addition of terminal electron-accepting processes (TEAPs) to promote activity of specific microorganisms. Chemical amendments considered include reagents that abiotically oxidize organic compounds (in situ chemical oxidation [ISCO]), abiotically reduce organic compounds (in situ chemical reduction [ISCR]), or sequester metals in situ (solidification/stabilization [S/S]).

BIOLOGICAL AMENDMENTS

Biostimulation

Biostimulation includes the following: 1) the addition of a readily consumed organic substrate to support microbial growth, such as molasses, whey, lactate, or soybean oil; 2) the addition of growth factors such as vitamins or minerals; or 3) altering geochemical conditions to support biological activity, for example, the addition of TEAPs, such as oxygen, nitrate, sulfate, or iron oxides.

Bioaugmentation

Bioaugmentation is the addition of organisms with the demonstrated ability to degrade chemicals of concern (COC). An example of bioaugmentation would be the addition of *Dehaloccocoides* cultures to a site where chlorinated solvents were a COC and where reducing conditions exist or are achievable through biostimulation. Bioaugmentation is typically applied where geochemical conditions and contaminant concentrations are consistent with biodegradation or when microorganisms with demonstrated effectiveness for the COC have been cultured, but the extant microbial community is not effectively removing mass.

The effectiveness of biological amendments may be limited where multiple organic contaminants are a concern, as the geochemical conditions and microbial populations that support the biodegradation of one organic compound may limit or prevent biodegradation of other organic compounds.

CHEMICAL AMENDMENTS

In Situ Chemical Oxidation

ISCO amendments considered were ozone (O_3), hydrogen peroxide, hydrogen peroxide with ferrous iron ($FeSO_4$; Fenton's reagent), permanganate, and persulfate. All of these amendments have demonstrated ability to degrade organic compounds, such as chlorinated solvents (e.g., tetrachloroethene [PCE]; trichloroethene [TCE]; vinyl chloride; benzene, toluene, ethylbenzenes, and xylenes [BTEX]), oxygenates (e.g., methyl tert butyl ether), chlorinated benzenes, and many other compounds. ISCO has several advantages, including the complete destruction of organic compounds to carbon dioxide and water, rapid treatment timeframe, and the ability to bring residual concentrations to very low levels. Potential disadvantages of chemical amendments are rapid kinetics that may cause explosive reactions with contaminants, hazard in handling strong oxidants, and the potential destruction of soil microorganisms (if ongoing biodegradation is desired following treatment).

In Situ Chemical Reduction

ISCR amendments considered include zero valent iron (ZVI) and a commercial ISCR reagent, emulsified ZVI (Liquid Iron™). ISCR effectiveness has been demonstrated for the abiotic

destruction of compounds that are more readily degraded under reducing conditions, such as the chlorinated solvents PCE and TCE.

Solidification/Stabilization

S/S is used to sequester metals in situ. S/S amendments typically form cement around soil grains, with the metals captured on the grains or in the cement pore space. In addition to a cement (e.g., Portland cement), S/S amendments often comprise additives to alter the physical properties of the cemented soil (i.e., reduce fracturing, increase elasticity) or to convert metals to insoluble minerals, in addition to binding them in the cement structure. S/S amendments may be applied through soil mixing or by injecting the amendments as a slurry (soil grouting).

AMENDMENT SELECTION FOR REMEDIAL ALTERNATIVES

Alternative A-3: Treatment of Ground Water Downgradient of Zone A

Alternative A-3 considers treatment of ground water downgradient of Zone A as a contingency action. The selection of ground water amendments is based on the treatment of polycyclic aromatic hydrocarbons (PAHs) at the maximum concentrations observed historically in ground water beneath and downgradient of Zone A. Amendment analysis assumes that treatment would occur for the full volume of shallow ground water (i.e., the upper 5 feet) beneath Zone A.

Biological amendments are not recommended because this remedial alternative is targeted to treat PAHs, which are recalcitrant to biodegradation. Regardless of the readiness of biodegradation, high hydraulic conductivity and readily available oxygen limit the effectiveness of biological amendments because biodegradation rates are slow compared to the rate of replacement with oxygenated, unamended ground water beneath Zone A. ISCR is not recommended because the effectiveness of this technology has not been demonstrated for PAH compounds, and readily available oxygen would rapidly consume ISCR amendments. Therefore, the ISCO technology is recommended for this remedial alternative, with preference to a sodium persulfate amendment. Strong ISCO oxidants such as ozone and Fenton's reagent have potentially explosive reactions with organic compounds, whereas sodium persulfate has a relatively high oxidation potential but slower reaction kinetics

(reducing the risk of explosive reactions) and, therefore, is highly effective on degrading PAHs. Sodium persulfate would be delivered as a concentrated solution and mixed with Fenton's reagent for activation and then injected into ground water.

The screening of biological and chemical technologies and rationale for consideration to address the treatment of ground water downgradient of Zone A are summarized in Table 1. Table 2 presents the advantages and disadvantages of the amendments and final selected approach.

Amendment Calculations

For the selected amendment (sodium persulfate and Fenton's reagent for activation), the following calculations were performed:

1. A proxy PAH compound was established based on seven PAHs detected at maximum concentrations in the shallow ground water of Zone A:
    a. Assumed the sum of the maximum concentrations in ground water for the seven PAHs as the maximum proxy PAH concentration
    b. Calculated a weighted average for the number of carbon atoms, hydrogen atoms, and molecular weight to represent the combined properties of the proxy PAH compound (see the following table):

Compound	Number of Detected Concentrations	Maximum Concentration in Ground Water (µg/L)	Number of Carbon Atoms	Number of Hydrogen Atoms	Molecular Weight (g/mol)
Benzo(a)anthracene	2	0.051	18	12	228.29
Benzo(a)pyrene	1	0.044	20	12	252.31
Benzo(b)fluoranthene	1	0.046	20	12	252.31
Benzo(k)fluoranthene	3	0.045	20	12	252.31
Chrysene	2	0.056	18	12	228.28
Dibenzo(a,h)anthracene	4	0.048	22	14	278.35
Indeno(1,2,3-c,d)pyrene	7	0.057	22	12	276.33
Combined Properties for Calculations (i.e., Proxy PAH Compound $C_{19.99}H_{12.28}$)		**0.347**	**19.99**	**12.28**	**252.45**

Notes:
µg/L = micrograms per liter
g/mol = grams per mole
PAH = polycyclic aromatic hydrocarbon

2. The volume of ground water that would be treated was determined:
    a. The treated area is assumed to be 110,300 square feet (ft^2), which is the average area between the geomembrane area (87,289 ft^2) and the fence area (133,327 ft^2); see Table 1a of Appendix D of the Draft Final FFS.
    b. A 5-foot-deep interval of shallow ground water is assumed to be treated.
    c. The total treated volume of ground water would therefore be 551,500 cubic feet (ft^3) or 4,125,500 gallons.
    d. Assuming a 35% porosity (based on site-specific data and consistent with typical porosities), the saturated treated volume (pore-space volume) would be 1,444,000 gallons.
3. The oxygen demand was determined.
    a. Based on a reported flow rate below Zone A of 7 feet per day and an approximate length of Zone A of 300 feet, the average residence time would be 43 days, which indicates that the ground water volume would be fully replaced 8.4 times per year. Therefore, the oxidant demand is conservatively calculated for 10 pore-space volumes per year.
    b. The total treated pore-space volume would be 14,440,000 gallons.

   c. The oxygen demand is then calculated as 3.83×10^{-3} moles per gallon ground water, based on the maximum proxy PAH concentration, assuming that two oxygens are needed for each carbon, and 0.5 oxygens are needed per hydrogen (see Equation 1 in Table 2).

4. The mass of oxidant required was determined.
   a. The mass of oxidant required for treatment is calculated as 0.91 grams per gallon ground water, based on the oxygen demand and the moles of oxygen released per mole of the oxidant added (see Equation 2 in Table 2).
   b. The oxidant demand is overestimated by 50% in this analysis to provide for an additional safety factor that includes a single amendment injection needed and, therefore, a conservative estimate in the Draft Final FFS[1].
5. The reagent mass required was determined. The total reagent mass required for the treatment of ground water downgradient of Zone A is, therefore, 21.8 tons of sodium persulfate (at 56% concentration) and 15.1 tons of Fenton's reagent (at 250 milligrams per liter [mg/L] concentration).

Alternative A-4: Treatment of Zone A Vadose Zone

Alternative A-4 considers treatment of the Zone A vadose zone as a contingency action. The selection of vadose zone amendments is based on the treatment of organic compounds that are potentially not responsive to the ongoing soil vapor extraction (SVE) system.

Biological amendments are not recommended because current Site data indicate that biodegradation is currently active in the Zone A vadose zone. Further, the continuous supply of oxygenated air in replacement air for SVE would limit the ability to modify subsurface conditions to support degradation of compounds that are more readily degraded under reducing conditions. ISCR is not recommended because readily available oxygen would rapidly consume the ISCR amendments. Therefore, the ISCO technology is recommended for this remedial alternative, as subsurface conditions are already oxidizing and the organic compounds detected at maximum concentrations in the available historical

[1] For costing purposes in the Draft Final FFS, a single amendment injection is assumed because the volume of the injection would be sufficient to treat the potential transient event of impacted ground water under Zone A for one year. If required, multiple injections are assumed to be included in the overall project cost contingency under Alternative A-3 (see Section 5.4.3 of the Draft Final FFS for further details).

soil data of Zone A would be effectively destroyed by this technology. The abundance of organic material in the Zone A vadose zone increases the risk of using ISCO reagents with very rapid kinetic rates, such as ozone or Fenton's reagent; therefore, a strong oxidant with lower reaction rates, such as sodium persulfate, is preferred. Although it is assumed that the contingency action in this remedial alternative would be selected to remove organic compounds not responsive to SVE, amendment calculations are based on the median soil summed concentration of organic compounds, with xylene and acetone as proxy compounds for treatment calculations, because SVE is non-selective.

The screening of biological and chemical technologies and rationale for consideration to address the treatment of the Zone A vadose zone are summarized in Table 3. Table 4 presents the advantages and disadvantages of the amendments and final selected approach.

Amendment Calculations

For the selected amendment (sodium persulfate and Fenton's reagent for activation), the following calculations were performed:

1. General assumptions:
    a. BTEX and ketones are the dominant COCs for the Zone A vadose zone. The maximum BTEX concentration measured in soil prior to the SVE system expansion was 25,000 milligrams per kilogram (mg/kg)[2].
    b. Given the operation of the SVE system, a proxy compound was generated to represent the strong contribution of BTEX to total organic constituents, median concentrations prior to SVE expansion, and removal of COC mass through SVE operation. This proxy compound was assumed to be set at 10% of the maximum summed concentration reported and consists of 2,500 mg/kg of BTEX and 260 mg/kg of ketones.
    c. The oxidant demand is then calculated for 2,500 mg/kg of total xylene (the predominant BTEX compound) and 260 mg/kg of acetone (the predominant ketone).

[2] Overall, samples with elevated concentrations contained BTEX in larger concentrations than other compounds; the median concentration for samples with multiple organic constituents detected was an order of magnitude less than the maximum sample.

   i. Total xylene has eight carbons and ten hydrogens, and a molecular weight of 106 grams per mole (g/mol).
   ii. Acetone has three carbons and six hydrogens, and a molecular weight of 58.08 g/mol.

2. The pore-space volume in the treatment area was determined.
   a. The treated area is assumed to be 110,300 ft^2 (see Table 1a of Appendix D of the Draft Final FFS), based on the proposed injection array.
   b. A 12-foot interval of the vadose zone between the top of the Touchet Beds to the top of the Upper Pasco Gravels would be treated.
   c. The total treated volume would be 1,324,000 ft^3 or 9,904,000 gallons. With a porosity of 35%, the pore-space volume would be 3,466,000 gallons.
3. The oxygen demand was determined.
   a. The total pore-space volume is multiplied by 1.6 kilograms per liter (kg/L) of bulk density (based on the reported grain size) for a total soil mass treated of 60,000,000 kilograms (kg).
   b. The soil mass is then multiplied by the representative treatment sample (2,500 mg/kg of total xylenes and 260 mg/kg of acetone) to determine the total xylene and acetone mass to be oxidized:
      i. Mass of xylene to be oxidized: 150,000 kg
      ii. Mass of acetone to be oxidized: 15,600 kg
   c. The oxygen demand is then calculated as 1.92×10^{-1} moles per kilogram (mol/kg) soil, assuming each carbon requires two oxygens and each hydrogen requires 0.5 oxygens (see Equation 1 in Table 4).
4. The mass of oxidant required was determined.
   a. The mass of oxidant required for treatment is calculated as 45.7 g/kg soil, based on the oxygen demand and the moles of oxygen released per mole of the oxidant added (see Equation 2 in Table 4).
   b. The oxidant demand is overestimated by 50% in this analysis to provide for an additional safety factor and, therefore, a conservative cost estimate for the Draft Final FFS.
5. The reagent mass required was determined. The total reagent mass required for the treatment of the Zone A vadose zone is, therefore, 4,530 tons of sodium persulfate (at 30% concentration) and 3.6 tons of Fenton's reagent (at 250 mg/L concentration).

Alternative CD-2: Treatment of Zones C/D Vadose Zone

Alternative CD-2 considers treatment of the Zones C/D vadose zone as a contingency action. The historical soil data for Zones C/D has a maximum summed concentration of organic compounds of 710,000 micrograms per kilogram (µg/kg), with acetone concentrations predominantly much greater than other detected organic compounds (e.g., methyl ethyl ketone at 2,700 µg/kg; methyl isobutyl ketone at 1,100 µg/kg; and methylene chloride, xylenes, and toluene at less than 100 µg/kg). Because methyl ethyl ketone and methyl isobutyl ketone are chemically similar to acetone and detected at much lower concentrations, acetone is used as a proxy for all organic compounds in the Zones C/D vadose zone.

Biological amendments are not recommended, and although there is no reason to suspect that biodegradation is not occurring presently in Zones C/D and oxygen is unlikely to be a limiting factor, it is known that acetone biodegradation is more favorable under aerobic conditions. ISCR is not recommended because effectiveness has not been demonstrated for the organic compounds present in this zone. Therefore, the ISCO technology would be the recommended approach for this remedial alternative. However, ISCO treatment, including hydrogen peroxide, should not be considered because acetone and hydrogen peroxide can react to generate explosive triacetone peroxide. Although other ISCO amendments—such as ozone, sodium permanganate, or sodium persulfate—would effectively destroy the organic compounds present, the latter one is recommended as high solubility, and oxidizing power would limit the number of applications required to remove the organic compounds. It is important to note that ISCO treatment may mobilize metals temporarily; however, metals in Zones C/D soil have been detected at relatively low concentrations (less than 20 mg/kg, except for zinc at 50 mg/kg). Monitoring activities would be required for this contingency action to assess reaction byproducts; however, complete degradation is anticipated. Although some heat may be generated during treatment, any monitoring needed for pressure increases or temperature changes would be evaluated during a pilot study and treatment work plan.

The screening of biological and chemical amendments and rationale for consideration to address treatment of the Zones C/D vadose zone are summarized in Table 5. Table 6 presents the advantages and disadvantages of the amendments and final selected approach.

Amendment Calculations

For the selected amendment (sodium persulfate and Fenton's reagent for activation), the following calculations were performed:

1. General assumptions:
    a. Acetone is used as a proxy for all organic compounds in the Zones C/D vadose zone, including the three ketones detected at much lower concentrations.
    b. The maximum acetone concentration of 710,000 µg/kg is assumed for the full treatment area in Zones C/D.
        i. Acetone has two carbon atoms and six hydrogen atoms, and a molecular weight of 58.08 g/mol.
2. The pore-space volume in the treatment area was determined.
    a. The treated area is assumed to be 30,490 ft^2 (area within the geomembrane boundary) as a conservative assumption beyond the Zones C/D waste limit (see Table 2a of Appendix D of the Draft Final FFS).
    b. A 10-foot interval of the vadose zone would be treated. Note that the average waste depths are 6 and 9 feet for Zone C and Zone D, respectively (see Tables 2a and 2b of Appendix D of the Draft Final FFS).
    c. The total treated volume would be 304,900 ft^3 or 2,280,800 gallons. With a porosity of 35%, the pore-space volume would be 800,000 gallons.
3. The oxygen demand was determined.
    a. The total pore-space volume is multiplied by 1.6 kg/L of bulk density (based on the reported grain size) for a total soil mass of 4,840,000 kg.
    b. The soil mass is then multiplied by the maximum acetone concentration (710,000 µg/kg of acetone) to determine the total mass of acetone to be oxidized:
        i. Mass of acetone to be oxidized: 3,440 kg
    c. The oxygen demand is then calculated as 0.055 mol/kg soil, assuming that each carbon requires two oxygens and each hydrogen requires 0.5 oxygens (see Equation 1 in Table 6).
4. The mass of oxidant required was determined.
    a. The mass of oxidant required for treatment is calculated as 13.1 g/kg soil, based on the oxygen demand and the moles of oxygen released per mole of the oxidant added (see Equation 2 in Table 6).

   b. The oxidant demand is overestimated by 50% in this analysis to provide for an additional safety factor and, therefore, a conservative cost estimate for the Draft Final FFS.

5. The reagent mass required was determined. The total reagent mass required for the treatment of the Zones C/D vadose zone is, therefore, a total of 105 tons of sodium persulfate (at 9% concentration) and 4.1 tons of Fenton's reagent (at 250 mg/L concentration).

TABLES

Table 1
Technology Screening: Treatment of Ground Water Downgradient of Zone A (Alternative A-3)

Type of Technology		Amendment	Summary Description	Retained for Consideration (Y/N)?	Comments
Biological Amendments	Biostimulation	Nutrient addition	Addition of essential nutrients lacking in the microbial ecosystem, such as phosphorous, nitrogen, and vitamins	No	Recalcitrant COCs at low concentrations, biodegradation unlikely
	Bioaugmentation	Addition of organisms known to degrade COCs	Addition of microorganisms known to degrade the COCs at the site, e.g., addition of *dehalococcoides* spp. where chlorinated solvents are a concern	No	Recalcitrant COCs at low concentrations, biodegradation unlikely
	Electron acceptor addition	Oxygen	Oxygen addition to encourage aerobic biodegradation where oxygen is limiting	No	Oxygen unlikely to be limiting; recalcitrant COCs at low concentrations, biodegradation unlikely
		Sulfate, nitrate	Where oxygen is limited, sulfate and nitrate as electron acceptors can provide successful biodegradation of many COCs	No	Recalcitrant COCs at low concentrations, biodegradation unlikely; oxygen likely present
		Iron oxide	After oxygen and nitrate have been consumed, some organisms are able to degrade a variety of compounds with iron/manganese oxides as the electron acceptor	No	Recalcitrant COCs at low concentrations, biodegradation unlikely; oxygen likely present
Chemical Amendments	ISCR	ZVI	ZVI has been widely applied in environmental remediation as an amendment to drive abiotic reduction of many contaminants	No	ISCR effectiveness has not been demonstrated for PAHs
		Commercial ISCR reagents	Commercial amendments, such as the Liquid Iron™ by Regenesis are available to supply reduced iron in an emulsified form	No	ISCR effectiveness has not been demonstrated for PAHs

Table 1
Technology Screening: Treatment of Ground Water Downgradient of Zone A (Alternative A-3)

Type of Technology		Amendment	Summary Description	Retained for Consideration (Y/N)?	Comments
Chemical Amendments	ISCO	Fenton's Reagent	Hydrogen peroxide (H_2O_2) with a source of iron (Fe[II]) such as ferrous sulfate ($FeSO_4$); a strong oxidant (capable of degrading many compounds) and kinetically rapid	Yes	Retained for consideration, see Table 2
		Hydrogen peroxide	Similar to Fenton's; however, the absence of Fe[II] yields slower reaction kinetics	Yes	Retained for consideration, see Table 2
		Ozone	A strong oxidant, rapid kinetics	Yes	Retained for consideration, see Table 2
		Potassium permanganate ($KMnO_4$)	Slower kinetic rates than for Fenton's, H_2O_2 or ozone; capable of degrading many contaminants, comparatively innocuous regarding handling and application danger	Yes	Retained for consideration, see Table 2
		Sodium permanganate ($NaMnO_4$)	Sodium permanganate activity is similar to that of potassium permanganate, with greater solubility in water; $KMnO_4$ and $NaMnO_4$ are considered separately due to handling and application differences	Yes	Retained for consideration, see Table 2
		Sodium persulfate	Relatively high solubility in water, oxidizing power as great as Fenton's or ozone, with relatively slow kinetics and therefore less explosion risk	Yes	Retained for consideration, see Table 2

Notes:
COC = chemical of concern
ISCO = in situ chemical oxidation
ISCR = in situ chemical reduction
PAH = polycyclic aromatic hydrocarbon
ZVI = zero valent iron

Table 2
Amendment Selection: Treatment of Ground Water Downgradient of Zone A (Alternative A-3)

Potential ISCO Approaches	Description	Advantages	Disadvantages	Summary	Amendment Amount (tons)
Ozone (O_3)	Ozone gas generated on site, either from atmospheric oxygen or an oxygen feed stock, and 'sparged' into ground water	Rapid reaction; strong oxidant destroys most contaminants	Continuous process, often takes extensive time to generate and inject significant oxidizing power	Would likely require multiple ozone generators to treat in a reasonable time frame	Not Recommended
Fenton's Reagent (H_2O_2 + Fe[II])	Combination of H_2O_2 and reduced iron (e.g. ferrous sulfate[$FeSO_4$]) injected as a concentrated solution	Rapid reaction; strong oxidant destroys most contaminants	Potential high-pressure issues with injection system; requires acidic to neutral conditions for full effectiveness	Not Recommended, potentially explosive	Not Recommended
Hydrogen Peroxide (H_2O_2)	H_2O_2 would be delivered as a concentrated solution (up to 35%) and injected into ground water			Not Recommended, potentially explosive	Not Recommended
Potassium Permanganate ($KMnO_4$)	Potassium permanganate would be transported to the site as a solid, with aqueous solutions of up to 4% prepared on site, and injected into ground water	Less explosive than ozone, hydrogen peroxide-based amendments, effective PAH degradation	Can only be applied at relatively low concentrations (high volume to inject)	1 gallon 4% potassium permanganate per 125 gallons of groundwater	Not Recommended
Sodium Permanganate ($NaMnO_4$)	Sodium permanganate would be transported to the site as a concentrated (40%) solution and injected into ground water	Can be applied at a higher percentage than potassium permanganate (i.e., less volume to inject)	More explosive reaction than $KMnO_4$; potential handling danger	1 gallon 40% sodium permanganate per 1,400 gallons of groundwater	Not Recommended
Sodium Persulfate ($Na_2S_2O_8$)	$Na_2S_2O_8$ would be delivered as a concentrated solution and mixed with $FeSO_4$ for activation, then injected into ground water	Strong oxidant (more so than H_2O_2) and effective on PAHs; effective under alkaline conditions	Relatively slow reaction time; requires activation	1 gallon 56% sodium persulfate and 4.8 pounds of $FeSO_4$ per 2,300 gallons of groundwater	21.8 tons of Na_2S_2O8 and 15.1 tons of $FeSO_4$

Notes:

1. The analysis for Alternative A-3 assumes that PAHs be the targeted chemical group to be treated in shallow ground water (i.e., upper 5 feet) at concentrations similar to previously detected concentrations and that ground water beneath the entire area of Zone A would be treated (i.e., injection upgradient).
2. Ground water velocity is assumed to be 7 feet/day (based on site observations) for a residence time (distance/velocity) beneath Zone A of 43 days, and therefore, it is assumed 8.4 pore-space volumes per year would require treatment (rounded to 10 pore-space volumes).
3. Pore-space volume is approximately 1,444,000 gallons, calculated as the Zone A area (110,300 square feet) multiplied by 5-foot interval of shallow ground water and by 35% porosity.
4. The following PAHs have been historically detected at maximum concentrations at Zone A ground water: benzo(a)anthracene ($C_{18}H_{12}$) 0.051 µg/L, benzo(a)pyrene ($C_{20}H_{12}$) 0.044 µg/L, benzo(b)fluoranthene ($C_{20}H_{12}$) 0.046 µg/L, benzo(k)fluoranthene ($C_{20}H_{12}$) 0.045 µg/L, chrysene ($C_{18}H_{12}$) 0.056 µg/L, dibenzo(a,h)anthracene ($C_{22}H_{14}$) 0.048 µg/L, and indeno(1,2,3-c,d)pyrene ($C_{22}H_{12}$) 0.057 µg/L. Proxy PAH ($C_{19.99}H_{12.28}$) has a sum maximum concentration of 0.347 micrograms per liter and an average molecular weight of 252.45 grams per mole.
5. Reported yearly dose is based on addition of 150% of the calculated oxidant demand for sodium persulfate with 250 ppm of ferrous sulfate activator.

$FeSO_4$ = ferrous sulfate

ISCO = in situ chemical oxidation

PAH = polyaromatic hydrocarbon

ppm = part per million

Table 2

Amendment Selection: Treatment of Ground Water Downgradient of Zone A (Alternative A-3)

Equation 1:

$$Oxygen\ Demand\ \left(\frac{mol}{L\ GW}\right) = \frac{mg\ COC}{L\ GW} * \frac{g}{1000\ mg} * \frac{mol}{g\ COC} * \frac{mol\ C}{mol\ COC} * \frac{2\ mol\ O}{mol\ C}$$
$$+ \frac{mg\ COC}{L\ GW} * \frac{g}{1000\ mg} * \frac{mol}{g\ COC} * \frac{mol\ H}{mol\ COC} * \frac{0.5\ mol\ O}{mol\ H}$$

$COC = predominant\ organic\ constituent \quad GW = groundwater$

$C = carbon \quad O = oxygen \quad H = hydrogen$

$L = liter \quad mg = milligram \quad g = gram \quad mol = moles$

Equation 2:

$$Oxidant\ Demand\ \left(\frac{lb}{gal\ GW}\right) = Oxygen\ Demand \frac{mol}{L\ GW} * \frac{3.79\ L}{gal\ GW} * \frac{mol\ oxidant}{mol\ O} * \frac{g\ oxidant}{mol\ oxidant} * \frac{lb}{453.59g}$$

$O_3 = ozone \rightarrow \frac{1\ mol\ O}{mol\ O_3}; \quad MW = 48.0$

$H_2O_2 = hydrogen\ peroxide \rightarrow \frac{1\ mol\ O}{mol\ H_2O_2}; \quad MW = 34.0\ \frac{g}{mol}$

$KMnO_4 = potassium\ permanganate \rightarrow \frac{2\ mol\ O}{mol\ KMnO_4}; \quad MW = 158.0\ \frac{g}{mol}$

$NaMnO_4 = sodium\ permanganate \rightarrow \frac{2\ mol\ O}{mol\ NaMnO_4}; \quad MW = 141.9\ \frac{g}{mol}$

$Na_2S_2O_8 = sodium\ persulfate \rightarrow \frac{4\ mol\ O}{mol\ Na_2S_2O_8}; \quad MW = 238.1\ \frac{g}{mol}$

$lb = pound(s) \quad gal = gallon(s) \quad MW = molecular\ weight$

Table 3
Technology Screening: Treatment of Zone A Vadose Zone (Alternative A-4)

Type of Technology		Amendment	Summary Description	Retained for Consideration (Y/N)?	Comments
Biological Amendments	Biostimulation	Nutrient Addition	Addition of essential nutrients lacking in the microbial ecosystem, such as phosphorous, nitrogen, and vitamins	No	Isotopic analysis of carbon dioxide and methane recovered in the SVE system, and observed biological growths in extraction wells indicate biodegradation is active at the site, with no indication of nutrient limitations
	Bioaugmentation	Addition of Organisms Known to Degrade COCs	Addition of microorganisms known to degrade the COCs at the site, e.g., addition of *dehalococcoides spp.* where chlorinated solvents are a concern	No	As with biostimulation, current site conditions indicate that biodegradation is active in the Zone A vadose zone, no indication that microorganisms (and fungi) capable of degrading the COCs are not available
	Electron Acceptor Addition	Oxygen	Oxygen addition to encourage aerobic biodegradation where oxygen is limiting	No	The existing SVE system maintains sufficient oxygen in the vadose zone
		Sulfate; Nitrate	Where oxygen is limited, sulfate and nitrate as electron acceptors can provide successful biodegradation of many COCs	No	Oxygen is not limiting (although isotopic data suggests some areas may be reducing)
		Iron Oxide	After oxygen and nitrate have been consumed, some organisms are able to degrade a variety of compounds with iron/manganese oxides as the electron acceptor	No	Oxygen is not limiting; dominant COCs are more amenable to aerobic degradation

Table 3
Technology Screening: Treatment of Zone A Vadose Zone (Alternative A-4)

Type of Technology		Amendment	Summary Description	Retained for Consideration (Y/N)?	Comments
Chemical Amendments	ISCR	ZVI	ZVI has been widely applied in environmental remediation as an amendment to drive abiotic reduction of many contaminants	No	ISCR effectiveness has not been demonstrated for predominant organic constituents; continuous oxygen supply in SVE replacement air would limit the effectiveness and longevity; delivery would be challenging without cap removal
		Commercial ISCR Reagents	Commercial amendments such as the Liquid Iron™ by Regenesis are available to supply reduced iron in an emulsified form	No	ISCR effectiveness has not been demonstrated for predominant organic constituents; continuous oxygen supply in SVE replacement air would limit the effectiveness and longevity; the emulsified form would be more practical to apply, and effectiveness has been demonstrated for chlorinated ethenes
Chemical Amendments	ISCO	Fenton's Reagent	Hydrogen peroxide (H_2O_2) with a source of iron (Fe[II]) such as ferrous sulfate ($FeSO_4$); a strong oxidant (capable of degrading many compounds) and kinetically rapid	Yes	Retained for consideration, see Table 4
		Hydrogen Peroxide	Similar to Fenton's; however, the absence of Fe[II] yields slower reaction kinetics	Yes	Retained for consideration, see Table 4
		Ozone	Strong oxidant, rapid kinetics	Yes	Retained for consideration, see Table 4
		Potassium Permanganate ($KMnO_4$)	Slower kinetic rates than for Fenton's, H_2O_2, or ozone; capable of degrading many contaminants, comparatively innocuous regarding handling and application danger	Yes	Retained for consideration, see Table 4

Table 3
Technology Screening: Treatment of Zone A Vadose Zone (Alternative A-4)

Type of Technology		Amendment	Summary Description	Retained for Consideration (Y/N)?	Comments
Chemical Amendments	ISCO	Sodium Permanganate ($NaMnO_4$)	Sodium permanganate activity is similar to that of potassium permanganate, with greater solubility in water; $KMnO_4$ and $NaMnO_4$ are considered separately due to handling and application differences	Yes	Retained for consideration, see Table 4
		Sodium Persulfate	Relatively high solubility in water, oxidizing power as great as Fenton's or ozone, with relatively slow kinetics and therefore less explosion risk	Yes	Retained for consideration, see Table 4

Notes:

1. It is assumed that this remedial alternative would be selected to address compounds resistant to volatilization (and therefore extraction in the SVE system); however, the predominant oxygen demand would be for degradation of ketones and BTEX compounds, which are the dominant organic compounds in the Zone A vadose zone.

2. Assumes 2,500 milligrams per kilogram (mg/kg) total BTEX and 250 mg/kg total ketones (i.e., 10% of the maximum summed concentration of organic constituents, with BTEX concentration an order of magnitude greater than the ketones, based on the historical soil data in Zone A).

BTEX = benzene, toluene, ethylbenzenes, and xylenes

COC = chemical of concern

ISCO = in situ chemical oxidation

ISCR = in situ chemical reduction

SVE = soil vapor extraction

ZVI = zero valent iron

Table 4
Amendment Selection: Treatment of Zone A Vadose Zone (Alternative A-4)

Potential ISCO Approaches	Description	Advantages	Disadvantages	Summary	Amendment Amount (tons)
Ozone (O_3)	Ozone gas generated on site, either from atmospheric oxygen or an oxygen feed stock, and delivered to the vadose zone	Gas delivery may be simpler in the vadose zone	Continuous process, often takes extensive time to meet oxidant demand	Not recommended, potentially explosive	Not Recommended
Fenton's Reagent (H_2O_2 + Fe[II])	Combination of H_2O_2 and reduced iron (e.g., ferrous sulfate[$FeSO_4$]) injected as a solution	Rapid reaction	Potential for generation of explosive triacetone peroxide; potentially explosive	Not recommended, potentially explosive	Not Recommended
Hydrogen Peroxide (H_2O_2)	H_2O_2 would be delivered to the site as a concentrated solution (up to 35%), diluted if necessary, and injected	Rapid reaction, strong oxidant	Potential for generation of explosive triacetone peroxide; potentially explosive	Not recommended, potentially explosive	Not Recommended
Potassium Permanganate ($KMnO_4$)	$KMnO_4$ would be transported to the site as a solid, with aqueous solutions of up to 4% prepared on site and injected	Less explosive than Fenton's reagent or H_2O_2 alone	Longer reaction time may limit usefulness if solution drains rapidly	As the maximum solubility is 4%, 10 applications would be required	Not Recommended
Sodium Permanganate ($NaMnO_4$)	$NaMnO_4$ would be transported to the site as a concentrated (40%) solution, diluted as needed at site, then injected	Higher solubility and more rapid reaction than potassium permanganate	More explosive reaction than potassium permanganate	35% solution in 3,900,000 gallons total (490,000 gallons of water)	Not Recommended
Sodium Persulfate ($Na_2S_2O_8$)	$Na_2S_2O_8$ would be delivered as a concentrated solution (up to 56%), diluted to the target concentration mixed with 250 mg/L ferrous iron for activation, then injected	Strong oxidant; effective under alkaline conditions	Relatively slow reaction times	30% solution in 3,466,000 gallons total (1,800,000 gallons of water)	4,530 tons $Na_2S_2O_8$ and 3.6 tons $FeSO_4$

Notes:

1. Area delineated by the injection well array (110,300 square feet) with a 12-foot depth interval treated, for a total volume of soil treated is 1,324,000 cubic feet (37,480,000 liters). The total soil mass treated would be 60,000,000 kilograms, assuming 1.6 grams per cubic centimeter bulk density.

2. The analysis for Alternative A-4 assumes that low-volatility organic compounds (not responsive to SVE) would be the targeted COCs in the Zone A vadose zone. However, the more abundant volatile compounds would also consume oxidant. COC are predominantly BTEX, but ketones are also abundant. The maximum concentration measured in the historical soil data (prior to SVE expansion) was 25,000 milligrams per kilogram (mg/kg), predominantly BTEX. Overall, samples with elevated concentrations contained BTEX in larger concentrations than other compounds; the median concentration for samples with multiple organic constituents detected was an order of magnitude less than the maximum sample.

3. A proxy compound was generated to represent the strong contribution of BTEX to total organic constituents, median concentrations prior to SVE expansion, and removal of COC mass through SVE operation. This proxy compound, set at 10% of the maximum summed concentration reported, consists of 2,500 mg/kg BTEX (represented by total xylenes) and 260 mg/kg ketones (represented by acetone).

4. Total pore-space volume of 3,466,000 gallons is based on 35% porosity and the total treated volume.

5. Reported amendment addition is 150% of the calculated oxidant demand.

BTEX = benzene, toluene, ethylbenzenes, and xylenes

COC = chemical of concern

ISCO = in situ chemical oxidation

ppm = parts per million

SVE = soil vapor extraction

Table 4
Amendment Selection: Treatment of Zone A Vadose Zone (Alternative A-4)

Equation 1:

$$Oxygen\ Demand\ \left(\frac{mol}{kg\ Soil}\right) = \frac{mg\ COC}{kg\ Soil} * \frac{g}{1000\ mg} * \frac{mol}{g\ COC} * \frac{mol\ C}{mol\ COC} * \frac{2\ mol\ O}{mol\ C} + \frac{mg\ COC}{kg\ Soil} * \frac{g}{1000\ mg} * \frac{mol}{g\ COC} * \frac{mol\ H}{mol\ COC} * \frac{0.5\ mol\ O}{mol\ H}$$

$COC = predominant\ organic\ constituent\ (repeat\ for\ each)$

$C = carbon \quad O = oxygen \quad H = hydrogen$

$mg = milligram \quad kg = kilogram \quad g = gram \quad mol = moles$

Equation 2:

$$Oxidant\ Demand\ \left(\frac{lb}{kg\ Soil}\right) = Oxygen\ Demand \frac{mol}{kg\ Soil} * \frac{mol\ oxidant}{mol\ O} * \frac{g\ oxidant}{mol\ oxidant} * \frac{lb}{453.59g}$$

$O_3 = ozone \rightarrow \frac{1\ mol\ O}{mol\ O_3}; \quad MW = 48.0$

$H_2O_2 = hydrogen\ peroxide \rightarrow \frac{1\ mol\ O}{mol\ H_2O_2}; \quad MW = 34.0 \frac{g}{mol}$

$KMnO_4 = potassium\ permanganate \rightarrow \frac{2\ mol\ O}{mol\ KMnO_4}; \quad MW = 158.0 \frac{g}{mol}$

$NaMnO_4 = sodium\ permanganate \rightarrow \frac{2\ mol\ O}{mol\ NaMnO_4}; \quad MW = 141.9 \frac{g}{mol}$

$Na_2S_2O_8 = sodium\ persulfate \rightarrow \frac{4\ mol\ O}{mol\ Na_2S_2O_8}; \quad MW = 238.1 \frac{g}{mol}$

$lb = pound(s) \quad MW = molecular\ weight$

Table 5
Technology Screening: Treatment of Zone C/D Vadose Zone

Type of Technology		Amendment	Summary Description	Retained for Consideration (Y/N)?	Comments
Biological Amendments	Biostimulation	Nutrient Addition	Addition of essential nutrients lacking in the microbial ecosystem, such as phosphorous, nitrogen, and vitamins	No	No evidence that nutrients or growth factors are limiting biodegradation
	Bioaugmentation	Addition of Organisms Known to Degrade COCs	Addition of microorganisms known to degrade the contaminants of concern (COCs) at the site, e.g., addition of *dehalococcoides* spp. where chlorinated solvents are a concern	No	No evidence that organisms capable to degrade the COCs are not present
	Electron Acceptor Addition	Oxygen	Oxygen addition to encourage aerobic biodegradation where oxygen is limiting	No	No indication that TEAP addition would be beneficial; any existing biodegradation likely occurs in microzones, unknown how effectively these zones could be changed with reagent addition
		Sulfate; Nitrate	Where oxygen is limited, sulfate and nitrate as electron acceptors can provide successful biodegradation of many COCs	No	
		Iron Oxide	After oxygen and nitrate have been consumed, some organisms are able to degrade a variety of compounds with iron/manganese oxides as the electron acceptor	No	
Chemical Amendments	ISCR	ZVI	ZVI has been widely applied in environmental remediation as an amendment to drive abiotic reduction of many contaminants	No	ISCR effectiveness has not been demonstrated for predominant organic constituents
		Commercial ISCR Reagents	Commercial amendments such as the Liquid Iron™ by Regenesis are available to supply reduced iron in an emulsified form	No	ISCR effectiveness has not been demonstrated for predominant organic constituents

Table 5
Technology Screening: Treatment of Zone C/D Vadose Zone

Type of Technology		Amendment	Summary Description	Retained for Consideration (Y/N)?	Comments
Chemical Amendments	ISCO	Fenton's Reagent	Hydrogen peroxide (H_2O_2) with a source of iron (Fe[II]) such as ferrous sulfate ($FeSO_4$); a strong oxidant (capable of degrading many compounds) with high kinetic rates	Yes	Retained for consideration, see Table 6
		H_2O_2	Similar to Fenton's, however, the absence of Fe[II] yields slower reaction kinetics	Yes	Retained for consideration, see Table 6
		Ozone (O_3)	A strong oxidant, rapid kinetics	Yes	Retained for consideration, see Table 6
		Potassium Permanganate ($KMnO_4$)	Slower kinetic rates than for Fenton's, H_2O_2 or O_3; capable of degrading many contaminants, comparatively innocuous regarding handling and application danger	Yes	Retained for consideration, see Table 6
		Sodium Permanganate ($NaMnO_4$)	Sodium permanganate activity is similar to that of potassium permanganate, with greater solubility in water; $KMnO_4$ and $NaMnO_4$ are considered separately due to handling and application differences	Yes	Retained for consideration, see Table 6
		Sodium Persulfate ($Na_2S_2O_8$)	Relatively high solubility in water, oxidizing power as great as Fenton's or ozone, with relatively slow kinetics and therefore less explosion risk	Yes	Retained for consideration, see Table 6

Notes:

COC = chemical of concern

ISCO = in situ chemical oxidation

ISCR = in situ chemical reduction

TEAP = terminal electron-accepting processes

ZVI = zero valent iron

Table 6
Amendment Selection: Treatment of Zone C/D Vadose Zone (Alternative CD-2)

Potential ISCO Approaches	Description	Advantages	Disadvantages	Summary	Amendment Amount (tons)
Ozone (O_3)	Ozone gas generated on site, either from atmospheric oxygen or an oxygen feed stock, and delivered to the vadose zone	Gas delivery may be simpler in the vadose zone	Continuous process, often takes extensive time to meet oxidant demand	Would likely require multiple ozone generators to treat in a reasonable time frame	Not Recommended
Fenton's Reagent (H_2O_2 + Fe[II])	Combination of H_2O_2 and reduced iron (e.g., ferrous sulfate [$FeSO_4$]) injected as a solution	Rapid reaction	Potential for generation of explosive triacetone peroxide; potentially explosive	Not recommended, potentially explosive	Not Recommended
Hydrogen Peroxide (H_2O_2)	H_2O_2 would be delivered to the site as a concentrated solution (up to 35%), diluted if necessary, and injected	Rapid reaction, strong oxidant	Potential for generation of explosive triacetone peroxide; potentially explosive	Not recommended, potentially explosive	Not Recommended
Potassium Permanganate ($KMnO_4$)	Potassium permanganate would be transported to the site as a solid, with aqueous solutions of up to 4% prepared on site and injected	Less explosive than Fenton's or H_2O_2 alone	Longer reaction time may limit usefulness	Three applications as 4% is the maximum solubility	Not Recommended
Sodium Permanganate ($NaMnO_4$)	Sodium permanganate would be transported to the site as a concentrated (40%) solution, diluted as needed at site, then injected	Higher solubility and more rapid reaction than potassium permanganate	More explosive reaction than potassium permanganate	One application 10.7% $NaMnO_4$ in 802,000 gallons of solution	Not Recommended
Sodium Persulfate ($Na_2S_2O_8$)	$Na_2S_2O_8$ would be delivered as a concentrated solution, diluted to the target concentration mixed with 250 mg/L ferrous iron for activation, then injected	Strong oxidant; effective under alkaline conditions	Relatively slow reaction times	One application with 250 mg/L $FeSO_4$ and 9% $Na_2S_2O_8$ in 800,000 gallons	105 tons $Na_2S_2O_8$ and 4.1 tons $FeSO_4$

Notes:

1. Area delineated by the injection well array (30,490 square feet) with a 10-foot depth interval treated, for a total volume of soil treated is 304,900 cubic feet (2,280,800 gallons). The total soil mass treated would be 4,840,000 kilograms, assuming 1.6 grams per cubic centimeter bulk density.
2. Based on historical soil data in Zone C/D, the maximum concentration measured is 710,000 micrograms per kilogram (µg/kg) for acetone. This concentration much greater than other detected organic compounds (e.g., methyl ethyl ketone at 2,700 µg/kg, methyl isobutyl ketone at 1,100 µg/kg, and methylene chloride, xylenes, and toluene at less than 100 µg/kg). As methyl ethyl ketone and methyl isobutyl ketone are chemically similar to acetone, and detected at much lower concentrations, acetone is used as a proxy for all organic compounds in the Zone C/D vadose zone.
3. Total pore-space volume of 800,000 gallons, based on a porosity of 35% and the total treated volume.
4. Reported amendment addition is 150% of the calculated oxidant demand.

ISCO = in situ chemical oxidation

mg/L = milligrams per liter

Table 6
Amendment Selection: Treatment of Zone C/D Vadose Zone (Alternative CD-2)

Equation 1:

$$Oxygen\ Demand\ \left(\frac{mol}{kg\ Soil}\right) = \frac{mg\ COC}{kg\ Soil} * \frac{g}{1000\ mg} * \frac{mol}{g\ COC} * \frac{mol\ C}{mol\ COC} * \frac{2\ mol\ O}{mol\ C} + \frac{mg\ COC}{kg\ Soil} * \frac{g}{1000\ mg} * \frac{mol}{g\ COC} * \frac{mol\ H}{mol\ COC} * \frac{0.5\ mol\ O}{mol\ H}$$

$COC = predominant\ organic\ constituent\ (repeat\ for\ each)$

$C = carbon \quad O = oxygen \quad H = hydrogen$

$mg = milligram \quad kg = kilogram \quad g = gram \quad mol = moles$

Equation 2:

$$Oxidant\ Demand\ \left(\frac{lb}{kg\ Soil}\right) = Oxygen\ Demand\ \frac{mol}{kg\ Soil} * \frac{mol\ oxidant}{mol\ O} * \frac{g\ oxidant}{mol\ oxidant} * \frac{lb}{453.59g}$$

$O_3 = ozone \rightarrow \frac{1\ mol\ O}{mol\ O_3}; \quad MW = 48.0$

$H_2O_2 = hydrogen\ peroxide \rightarrow \frac{1\ mol\ O}{mol\ H_2O_2}; \quad MW = 34.0\ \frac{g}{mol}$

$KMnO_4 = potassium\ permanganate \rightarrow \frac{2\ mol\ O}{mol\ KMnO_4}; \quad MW = 158.0\ \frac{g}{mol}$

$NaMnO_4 = sodium\ permanganate \rightarrow \frac{2\ mol\ O}{mol\ NaMnO_4}; \quad MW = 141.9\ \frac{g}{mol}$

$Na_2S_2O_8 = sodium\ persulfate \rightarrow \frac{4\ mol\ O}{mol\ Na_2S_2O_8}; \quad MW = 238.1\ \frac{g}{mol}$

$lb = pound(s) \quad MW = molecular\ weight$