Appendix L

Cost Estimate Worksheets

Summary of Remedial Alternative Costs

Summary of Remedial Alternative Costs

Alternative	Capital Cost	Future O&M Cost	NPV (O&M Cost)	Total (Capital + Future Cost)	Total (Capital Cost + NPV for O&M)
Alternative 1: No Action	$ -	$ 2,920,000	$ 2,652,545	$ 2,920,000	$ 2,652,545
Alternative 2: ISCO + EISB	$ 23,150,981	$ 7,223,050	$ 6,837,863	$ 30,374,031	$ 29,988,843
Alternative 3: ISCO + MNA	$ 21,010,567	$ 2,920,000	$ 2,652,545	$ 23,930,567	$ 23,663,111
Alternative 4: ISSS + EISB	$ 26,300,379	$ 7,823,050	$ 7,325,058	$ 34,123,429	$ 33,625,436
Alternative 5: ISSS + MNA	$ 23,890,729	$ 3,520,000	$ 3,139,740	$ 27,410,729	$ 27,030,468
Alternative 6: ISSS + P&T	$ 24,884,810	$ 3,776,108	$ 2,889,988	$ 28,660,918	$ 27,774,798
Alternative 7: Slurry Wall + MNA	$ 7,879,148	$ 4,525,523	$ 3,956,216	$ 12,404,672	$ 11,835,364
Alternative 8a: Slurry Wall + Pumping Wells	$ 8,442,729	$ 4,781,631	$ 4,193,660	$ 13,224,361	$ 12,636,389
Alternative 8b: Slurry Wall + Pumping Trench	$ 8,736,052	$ 4,779,260	$ 4,199,635	$ 13,515,312	$ 12,935,687

Alternative 1: No Action

Alternative 1: No Action

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
Remedy Design						$ -	
Remedy Implementation Capital Cost						$ -	
Annual Operating, Maintenance and Monitoring Cost							
1.0	**Monitoring (SA & UHG)**						
8.1	Quarterly Monitoring & Reporting	1	LS/year	$ 120,000	$ 120,000		Quarterly sampling of 25 wells for 1 year. Based on 2x semi-annual costs.
8.2	Semi-Annual Monitoring & Reporting Program	10	LS/year	$ 60,000	$ 600,000		Semi-annual sampling of 25 wells for 10 years. Based on ESI 2016 estimate.
8.3	Annual Monitoring & Reporting	30	LS/year	$ 30,000	$ 900,000		Annual sampling of 25 wells for 30 years. Based on ½ semi-annual cost.
2.0	**Current Groundwater Extraction System**					**$ 260,000**	
9.1	GRU Treatment Fee (Current System)	28000	K Gal	$ 6.20	$ 173,600		10 yr ('06-'16) actual annual average; 2016 rate
9.2	Operation, Monitoring, Maintenance & Reporting	1	LS/year	$ 80,000	$ 80,000		Based on ESI 2016 estimate.
9.3	Equipment Replacement Cost	1	LS/year	$ 6,400	$ 6,400		Average annual cost with significant costs occurring at 5, 10, and 15 years.
Future Cost						**$ 2,920,000**	
3.0	**Monitoring (SA & UHG)**	**1**	LS	$1,620,000	$ 1,620,000	**$ 1,620,000**	Assume quarterly monitoring for 1 year, semi-annual monitoring for 10 years, and annual monitoring for 30 years.
4.0	**Current Groundwater Extraction System**	**5**	years	$ 260,000	$ 1,300,000	**$ 1,300,000**	Assume system shutdown/transition to MNA after 5 years.
Present Value Analysis		**Rate**	**Years**	**Cost**	**NPV**	**$ 2,652,545**	
5.0	**Monitoring (SA & UHG)**	**1.4%**			$(1,405,410)	**$ 1,405,410**	
6.0	**Current Groundwater Extraction System**	**1.4%**	5	$ 260,000	$(1,247,135)	**$ 1,247,135**	
					Total	**$ 2,920,000**	Capital Cost + Future Cost
					Total	**$ 2,652,545**	Capital Cost + Net Present Value of O&M

Alternative 2: ISCO + EISB

Alternative 2: ISCO + EISB

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
Remedy Design						**$ 2,109,450**	
1.0	**ISCO - UHG**					**$ 1,165,000**	
1.1	Follow-up ISCO Treatability Study	1	LS	$ 200,000	$ 200,000		
1.2	ISCO Pilot Study	1	LS	$ 965,000	$ 965,000		50 x 50 ft area, target 10 ft depth interval, 2 injections at 20% pore volume; quarterly monitoring for 1 year to evaluate effectiveness, define ROI, matrix demand, etc.
2.0	**EISB - UHG**					**$ 300,000**	
2.1	EISB Pilot test planning and implementation	1	LS	$ 300,000	$ 300,000		Pilot study involving 2 round of direct push injections of ORC slurry in the mid-UHG downgradient of lagoon area (1/10th size of full-scale system) and quarterly monitoring wells for 1 year to assess oxygen demand, extent of distribution, and level of mineral precipitation/fouling.
3.0	**Remedy Design**					**$ 250,000**	
3.1	Remedy Modeling, Engineering, and Design	1	LS	$ 250,000	$ 250,000		Desktop.
4.0	**Miscellaneous**					**$ 394,450**	
4.1	Project & Construction Management	1	%	8%	$ 137,200		Professional judgment
4.2	Data Analysis and Reporting	1	%	5%	$ 85,750		Professional judgment
4.3	Contingency	1	%	10%	$ 171,500		Professional judgment
Remedy Implementation Capital Cost						**$ 21,041,531**	
5.0	**Remedial Capital Cost**						
	Relocation of Existing Surface Water Pond					**$ 802,413**	
5.1	Demolition	1	LS	$ 394,220	$ 394,220		Clear vegetation in and around pond, pump out water & backfill with soil from new pond. Based on Weston 2014 estimate.
5.2	Construction	1	LS	$ 408,193	$ 408,193		Build new pond of same size with synthetic liner. Based on Weston 2014 estimate.
	Excavation of Vadose Zone Tar Deposits					**$ 1,980,000**	
5.3	Excavation	7,200	CY	$ 200	$ 1,440,000		Design, plan, excavate and backfill approximately 7,200 cubic yards (see Figure 4.1; source treatment area = 97,285 sq. ft. and assume excavation 0-10 ft.) of soil. Cost based on 2014 Weston estimate.
5.4	Off-site soil transfer/disposal	7,200	CY	$ 75	$ 540,000		Transport and dispose of approximately 7,200 cubic yards (see Figure 4.1; source treatment area = 97,285 sq. ft. and assume excavation 0-10 ft.) of soil to Clark Environmental for thermal treatment.
	ISCO System - SA					**$ 490,749**	
5.5	Injection Wells and Piping	14	wells	$ 9,500	$ 130,749		Assumes treatment of 10% of the treatment area (see Figure 4.1; source treatment area = 97,285 sq. ft.) where residual tar may be present. 15 ft ROI for each injection well to be screened over the bottom 10 ft of the surficial aquifer.
5.6	ISCO Treatments	3	LS/ Injection	$ 120,000	$ 360,000		Actual amount of oxidant to be used to be determined in the pilot study. Assumed treatment of 9,729 sq. ft. (10% of treatment area) over 10 ft. interval, which requires 22k gal peroxide activated persulfate at 10% pore volume (porosity = 0.3). Each subsequent injection would likely decrease in volume.
	ISCO System - UHG					**$ 12,393,600**	
5.7	Injection Wells and Piping	31	well clusters	$ 75,000	$ 2,325,000		Assumes 10 ft ROI in the source area treatment area (see Figure 4.1; source treatment area = 97,285 sq. ft.) and double casing for 10% of the 312 injection wells required to cover this area. 2 nested injection wells installed at each location to be screened over the top 10 ft. of the UHG and the bottom 15 ft. of the UHG.
5.8	Injection Wells and Piping	281	well clusters	$ 23,000	$ 6,463,000		Assumes 10 ft ROI in the source area treatment area (see Figure 4.1; source treatment area = 97,285 sq. ft.) and 90% of the 312 injection wells required to cover this area will not be double cased. 2 nested injection wells installed at each location to be screened over the top 10 ft. of the UHG and the bottom 15 ft. of the UHG.
5.9	Monitoring Wells	8	wells	$ 19,000	$ 152,000		Double-cased monitoring wells to be installed at each location within and near-field of the treatment area to monitor effectiveness. 4 wells will be screened in the top 10 ft. and 4 will be screened in the bottom 15 ft. of the UHG.
5.1	ISCO Treatments - UHG	3	LS/ Injection	$1,120,000	$ 3,360,000		Actual amount of oxidant to be used to be determined in the pilot study. Assumed treatment of 97,285 sq. ft. over 25 ft. interval (well screened over top 10 ft. of the UHG and bottom 15 ft. of the UHG), which requires 364k gal peroxide activated persulfate at 10% pore volume (porosity = 0.2). Each subsequent injection would likely decrease in volume.
5.11	Post Injection Monitoring	3	LS/event	$ 31,200	$ 93,600		Remedy effectiveness monitoring - 3 events per injection, low-flow sampling at 8 wells, VOCs and SVOCs analysis.
	PRB Installation					**$ 1,440,174**	
5.12	Trench Excavation (extended to 65' bgs) and placement of gravel (30 ft)	40,040	VSF	$ 30.00	$ 1,201,200		Assumed excavation of 3 trenches of lengths 287 ft, 223 ft, and 106 ft to a depth of 65 ft bgs (see Figure 4.1). Assumed bottom 30 ft of each of the 3 trenches/PRBs filled with pea gravel. Based on vendor costs.

Alternative 2: ISCO + EISB

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
5.13	Impervious cover	1,848	SF	$ 9.50	$ 17,556		Impervious cover to be constructed over 3 trenches of lengths 287 ft, 223 ft, and 106 ft (see Figure 4.1), each 3 ft wide, to reduce infiltration. Geosyntec's 2015 experience suggests 2x$4.75/SF due to the limited area.
5.14	Place native soils in slurry trench (5-35 ft bgs)	2,053	CY	$ 12.00	$ 24,640		Place backfill from the top of the UHG (top of the pea gravel that fills each trench/PRB) to 5 ft bgs, a total depth interval of 30 ft, for each of the 3 trenches/PRBs of lengths 287 ft, 223 ft, and 106 ft and width 3 ft. (see Figure 4.1). Based on Geosyntec estimate.
5.15	Purchase and placement of bentonite mix for backfilling trench in top 5 ft	342	CY	$ 50.00	$ 17,111		Bentonite mix will be placed in top 5 ft below impervious cover to further reduce infiltration for each of the 3 trenches/PRBs of lengths 287 ft, 223 ft, and 106 ft and width 3 ft. (see Figure 4.1). Assumed bentonite comprised 8% by weight of the dry soil. Based on Geosyntec estimate.
5.16	Off-site soil transfer/disposal	2,396	CY	$ 75	$ 179,667		Excavated soil from the top 5 ft and bottom 30 ft of excavation for each of the 3 trenches/PRBs of lengths 287 ft, 223 ft, and 106 ft and width 3ft. (see Figure 4.1) transported for thermal treatment at Clark Environmental.
6.0	**Miscellaneous**					**$ 3,934,595**	
6.1	Project & Construction Management	1	%	8%	$ 1,368,555		Professional judgment
6.2	Data Analysis and Reporting	1	%	5%	$ 855,347		Professional judgment
6.3	Contingency	1	%	10%	$ 1,710,694		Professional judgment
Annual Operating, Maintenance and Monitoring Cost							
7.0	**PRB System**					**$ 1,434,350**	
7.1	Slurry Mixing, Hydration, and placement	2	LS/event	135,367	$ 270,734		Assumed 0.5 porosity for entire PRB volume (each of the 3 trenches/PRBs of lengths 287 ft, 223 ft, and 106 ft and width 3 ft. (see Figure 4.1)), so slurry volume is 2053 CY * 0.5, or about 210,000 gallons. Slurry will be injected using direct push technology at $2,500/direct push point; assumes 50 points. Cost of slurry mixture change will be $10,367/change. PRB to be operated for 3 years with 2 ORC slurry injections per year. Unit cost from R.S. Means: $0.05 per Gallon.
7.2	ORC filling	2	LS/event	$ 581,808	$ 1,163,616		Assumed 10.35$/lbs ORC price based on vendor case study and 0.01 volumetric ORC in slurry material in each of the 3 trenches/PRBs of lengths 287 ft, 223 ft, and 106 ft and width 3 ft, with pea gravel in the bottom 30 ft. (see Figure 4.1). ORC density was assumed to be 3 g/cc. PRB to be operated for 3 years with 2 ORC slurry injections per year. Assumes partial treatment of contaminant mass due to prohibitively high oxygen demand of treatment area.
8.0	**MNA (SA & UHG)**						
8.1	Quarterly Monitoring & Reporting	1	LS/year	$ 120,000	$ 120,000		Quarterly sampling of 25 wells for 1 year. Based on 2x semi-annual costs.
8.2	Semi-Annual Monitoring & Reporting Program	10	LS/year	$ 60,000	$ 600,000		Semi-annual sampling of 25 wells for 10 years. Based on ESI 2016 estimate.
8.3	Annual Monitoring & Reporting	30	LS/year	$ 30,000	$ 900,000		Annual sampling of 25 wells for 30 years. Based on ½ semi-annual cost.
9.0	**Current Groundwater Extraction System**					**$ 260,000**	
9.1	GRU Treatment Fee (Current System)	28000	K Gal	$ 6.20	$ 173,600		10 yr ('06-'16) actual annual average; 2016 rate
9.2	Operation, Monitoring, Maintenance & Reporting	1	LS/year	$ 80,000	$ 80,000		Based on ESI 2016 estimate.
9.3	Equipment Replacement Cost	1	LS/year	$ 6,400	$ 6,400		Average annual cost with significant costs occurring at 5, 10, and 15 years.
Future Cost						**$ 7,223,050**	
10.0	**PRB System**	**3**	years	$1,434,350	$ 4,303,050	**$ 4,303,050**	Assume 3 years of PRB system operation.
11.0	**MNA (SA & UHG)**	**1**	LS	$1,620,000	$ 1,620,000	**$ 1,620,000**	Assume quarterly monitoring for 1 year, semi-annual monitoring for 10 years, and annual monitoring for 30 years.
12.0	**Current Groundwater Extraction System**	**5**	years	$ 260,000	$ 1,300,000	**$ 1,300,000**	Assume system shutdown/transition to MNA after 5 years.
Present Value Analysis		**Rate**	**Years**	**Cost**	**NPV**	**$ 6,837,863**	
13.0	**PRB System**	**1.4%**	3	$1,434,350	$(4,185,318)	**$ 4,185,318**	
14.0	**MNA (SA & UHG)**	**1.4%**			$(1,405,410)	**$ 1,405,410**	
15.0	**Current Groundwater Extraction System**	**1.4%**	5	$ 260,000	$(1,247,135)	**$ 1,247,135**	
					Total	**$ 30,374,031**	Capital Cost + Future Cost
					Total	**$ 29,988,843**	Capital Cost + Net Present Value of O&M

Alternative 3: ISCO + MNA

Alternative 3: ISCO + MNA

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
Remedy Design						**$ 1,740,450**	
1.0	**ISCO - UHG**					**$ 1,165,000**	
1.1	Follow-up ISCO Treatability Study	1	LS	$ 200,000	$ 200,000		
1.2	ISCO Pilot Study	1	LS	$ 965,000	$ 965,000		50 x 50 ft area, target 10 ft depth interval, 2 injections at 20% pore volume; quarterly monitoring for 1 year to evaluate effectiveness, define ROI, matrix demand,
2.0	**Remedy Design**					**$ 250,000**	
2.1	Remedy Modeling, Engineering, and Design	1	LS	$ 250,000	$ 250,000		Desktop.
3.0	**Miscellaneous**					**$ 325,450**	
3.1	Project & Construction Management	1	%	8%	$ 113,200		Professional judgment
3.2	Data Analysis and Reporting	1	%	5%	$ 70,750		Professional judgment
3.3	Contingency	1	%	10%	$ 141,500		Professional judgment
Remedy Implementation Capital Cost						**$19,270,117**	
4.0	**Remedial Capital Cost**						
	Relocation of Existing Surface Water Pond					**$ 802,413**	
4.1	Demolition	1	LS	$ 394,220	$ 394,220		Clear vegetation in and around pond, pump out water & backfill with soil from new pond. Based on Weston 2014 estimate.
4.2	Construction	1	LS	$ 408,193	$ 408,193		Build new pond of same size with synthetic liner. Based on Weston 2014 estimate.
	Excavation of Vadose Zone Tar Deposits					**$ 1,980,000**	
4.3	Excavation	7,200	CY	$ 200	$ 1,440,000		Design, plan, excavate and backfill approximately 7,200 cubic yards (see Figure 4.1; source treatment area = 97,285 sq. ft. and assume excavation 0-10 ft.) of soil. Cost based on 2014 Weston estimate.
4.4	Off-site soil transfer/disposal	7,200	CY	$ 75	$ 540,000		Transport and dispose of approximately 7,200 cubic yards (see Figure 4.1; source treatment area = 97,285 sq. ft. and assume excavation 0-10 ft.) of soil to Clark Environmental for thermal treatment.
	ISCO System - SA					**$ 490,749**	
4.5	Injection Wells and Piping	14	wells	$ 9,500	$ 130,749		Assumes treatment of 10% of the treatment area (see Figure 4.1; source treatment area = 97,285 sq. ft.) where residual tar may be present. 15 ft ROI for each injection well to be screened over the bottom 10 ft of the surficial aquifer.
4.6	ISCO Treatments	3	LS/ Injection	$ 120,000	$ 360,000		Actual amount of oxidant to be used to be determined in the pilot study. Assumed treatment of 9,729 sq. ft. (10% of treatment area) over 10 ft. interval, which requires 22k gal peroxide activated persulfate at 10% pore volume (porosity = 0.3). Each subsequent injection would likely decrease in volume.
	ISCO System - UHG					**$12,393,600**	
4.7	Injection Wells and Piping	31	well clusters	$ 75,000	$ 2,325,000		Assumes 10 ft ROI in the source area treatment area (see Figure 4.1; source treatment area = 97,285 sq. ft.) and double casing for 10% of the 312 injection wells required to cover this area.
4.8	Injection Wells and Piping	281	well clusters	$ 23,000	$ 6,463,000		Assumes 10 ft ROI in the source area treatment area (see Figure 4.1; source treatment area = 97,285 sq. ft.) and 90% of the 312 injection wells required to cover this area will not be double cased. 2 nested injection wells installed at each location to be screened over the top 10 ft. of the UHG and the bottom 15 ft. of the UHG.
4.9	Monitoring Wells	8	wells	$ 19,000	$ 152,000		Double-cased monitoring wells to be installed at each location within and near-field of the treatment area to monitor effectiveness. 4 wells will be screened in the top 10 ft. and 4 will be screened in the bottom 15 ft. of the UHG.
4.10	ISCO Treatments - UHG	3	LS/ Injection	$1,120,000	$ 3,360,000		Actual amount of oxidant to be used to be determined in the pilot study. Assumed treatment of 97,285 sq. ft. over 25 ft. interval (well screened over top 10 ft. of the UHG and bottom 15 ft. of the UHG), which requires 364k gal peroxide activated persulfate at 10% pore volume (porosity = 0.2).
4.11	Post Injection Monitoring	3	LS/event	$ 31,200	$ 93,600		Remedy effectiveness monitoring - 3 events per injection, low-flow sampling at 8 wells, VOCs and SVOCs analysis.
5.0	**Miscellaneous**					**$ 3,603,355**	
5.1	Project & Construction Management	1	%	8%	$ 1,253,341		Professional judgment
5.2	Data Analysis and Reporting	1	%	5%	$ 783,338		Professional judgment
5.3	Contingency	1	%	10%	$ 1,566,676		Professional judgment

Alternative 3: ISCO + MNA							
Item	**Description**	**Qty**	**Units**	**Unit Rate**	**Item Cost**	**Total**	**Notes**
Annual Operating, Maintenance and Monitoring Cost							
6.0	**MNA (SA & UHG)**						
6.1	Quarterly Monitoring & Reporting	1	LS/year	$ 120,000	$ 120,000		Quarterly sampling of 25 wells for 1 year. Based on 2x semi-annual costs.
6.2	Semi-Annual Monitoring & Reporting Program	10	LS/year	$ 60,000	$ 600,000		Semi-annual sampling of 25 wells for 10 years. Based on ESI 2016 estimate.
6.3	Annual Monitoring & Reporting	30	LS/year	$ 30,000	$ 900,000		Annual sampling of 25 wells for 30 years. Based on ½ semi-annual cost.
7.0	**Current Groundwater Extraction System**					**$ 260,000**	
7.1	GRU Treatment Fee (Current System)	28000	K Gal	$ 6.20	$ 173,600		10 yr ('06-'16) actual annual average; 2016 rate
7.2	Operation, Monitoring, Maintenance & Reporting	1	LS/year	$ 80,000	$ 80,000		Based on ESI 2016 estimate.
7.3	Equipment Replacement Cost	1	LS/year	$ 6,400	$ 6,400		Average annual cost with significant costs occurring at 5, 10, and 15 years.
Future Cost						**$ 2,920,000**	
8.0	**MNA (SA & UHG)**	1	LS	$1,620,000	$ 1,620,000	**$ 1,620,000**	Assume quarterly monitoring for 1 year, semi-annual monitoring for 10 years, and annual monitoring for 30 years
9.0	**Current Groundwater Extraction System**	5	years	$ 260,000	$ 1,300,000	**$ 1,300,000**	Assume system shutdown/transition to MNA after 5 years.
Present Value Analysis		**Rate**	**Years**	**Cost**	**NPV**	**$ 2,652,545**	
10.0	**MNA (SA & UHG)**	1.4%			$(1,405,410)	**$ 1,405,410**	
11.0	**Current Groundwater Extraction System**	1.4%	5	$ 260,000	$(1,247,135)	**$ 1,247,135**	
					Total	**$23,930,567**	Capital Cost + Future Cost
					Total	**$23,663,111**	Capital Cost + Net Present Value of O&M

Alternative 4: ISSS + EISB

Alternative 4: ISSS + EISB

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
Remedy Design						**$ 768,750**	
1.0	**ISSS - UHG**					**$ 75,000**	
1.1	Bench-scale study	1	LS	$ 75,000	$ 75,000		Bench scale treatability study to determine soil to cement ratio of stabilizer needed to achieve target aquifer conductivity.
2.0	**EISB - UHG**					**$ 300,000**	
2.1	EISB Pilot test planning and implementation	1	LS	$ 300,000	$ 300,000		Pilot study involving 2 round of direct push injections of ORC slurry in the mid-UHG downgradient of lagoon area (1/10th size of full-scale system) and quarterly monitoring wells for 1 year to assess oxygen demand, extent of distribution, and level of mineral precipitation/fouling.
3.0	**Remedy Design**					**$ 250,000**	
3.1	Remedy Modeling, Engineering, and Design	1	LS	$ 250,000	$ 250,000		Desktop.
4.0	**Miscellaneous**					**$ 143,750**	
4.1	Project & Construction Management	1	%	8%	$ 50,000		Professional judgment
4.2	Data Analysis and Reporting	1	%	5%	$ 31,250		Professional judgment
4.3	Contingency	1	%	10%	$ 62,500		Professional judgment
Remedy Implementation Capital Cost						**$25,531,629**	
5.0	**Remedial Capital Cost**						
	Relocation of Existing Surface Water Pond					**$ 802,413**	
5.1	Demolition	1	LS	$ 394,220	$ 394,220		Clear vegetation in and around pond, pump out water & backfill with soil from new pond. Based on Weston 2014 estimate.
5.2	Construction	1	LS	$ 408,193	$ 408,193		Build new pond of same size with synthetic liner. Based on Weston 2014 estimate.
	Excavation of Vadose Zone Tar Deposits					**$ 1,980,000**	
5.3	Excavation	7,200	CY	$ 200	$ 1,440,000		Design, plan, excavate and backfill approximately 7,200 cubic yards (see Figure 4.1; source treatment area = 97,285 sq. ft. and assume excavation 0-10 ft.) of soil. Cost based on 2014 Weston estimate.
5.4	Off-site soil transfer/disposal	7,200	CY	$ 75	$ 540,000		Transport and dispose of approximately 7,200 cubic yards (see Figure 4.1; source treatment area = 97,285 sq. ft. and assume excavation 0-10 ft.) of soil to Clark Environmental for thermal treatment.
	In Situ Solidification/Stabilization for Surficial Aquifer and UHG (from 10' bgs to 65' bgs)					**$15,853,840**	
5.5	ISSS Soil Mixing (construction/materials/labor)	198,173	CY	$ 80	$15,853,840		Treatment of source area (see Figure 4.1; source treatment area = 97,285 sq. ft.) from 10-65 ft bgs. Volume = area x depth = 97,285 sq. ft. x (65' - 10') = 5,350,675 CF = 198,173 CY. Excess stabilized soil will be placed under surface cover. Geosyntec's 2013 experience suggests $57-84/CY. Assumed $80/CY.
	Surface Cover (2.2 acres)					**$ 680,995**	
5.6	Impervious Cover	97,285	SF	$ 7.00	$ 680,995		Impervious cover over area treated by ISSS (see Figure 4.1; source treatment area = 97,285 sq. ft.). Geosyntec's 2014 experience suggests $7/SF. Assumed $7/SF.
	PRB Installation					**$ 1,440,174**	
5.7	Trench Excavation(extended to 65' bgs) and placement of gravel (30 ft)	40,040	VSF	$ 30	$ 1,201,200		Assumed excavation of 3 trenches of lengths 287 ft, 223 ft, and 106 ft to a depth of 65 ft bgs (see Figure 4.1). Assumed bottom 30 ft of each of the 3 trenches/PRBs filled with pea gravel. Based on vendor costs.
5.8	Impervious cover	1,848	SF	$ 9.50	$ 17,556		Dewatering of the trenches during construction period (only needed if the cost is not already included in trench excavation cost.)
5.9	Place native soils in slurry trench (5-35 ft bgs)	2,053	CY	$ 12	$ 24,640		Assumed excavation of 3 trenches of lengths 287 ft, 223 ft, and 106 ft to a depth of 65 ft bgs (see Figure 4.1). Unit cost from R.S. Means.
5.10	Purchase and placement of bentonite mix for backfilling trench in top 5 ft	342	CY	$ 50	$ 17,111		Impervious cover to be constructed over 3 trenches of lengths 287 ft, 223 ft, and 106 ft (see Figure 4.1), each 6.6 ft wide, to reduce infiltration. Geosyntec's 2015 experience suggests $4.75/SF. Assumed $4.75/SF.
5.11	Off-site soil transfer/disposal	2,396	CY	$ 75	$ 179,667		Assumed bottom 30 ft of each of the 3 trenches/PRBs of lengths 287 ft, 223 ft, and 106 ft and width 6.6 ft. (see Figure 4.1) filled with pea gravel. Unit cost determined from R.S. Means .
6.0	**Miscellaneous**					**$ 4,774,207**	
6.1	Project & Construction Management	1	%	8%	$ 1,660,594		Professional judgment
6.2	Data Analysis and Reporting	1	%	5%	$ 1,037,871		Professional judgment
6.3	Contingency	1	%	10%	$ 2,075,742		Professional judgment
Annual Operating, Maintenance and Monitoring Cost							
7.0	**Soil Cover/Slurry Wall Maintenance**					**$ 20,000**	
7.1	Soil Cover Maintenance	1	LS	$ 20,000	$ 20,000		Assumed $20K.
8.0	**PRB System**					**$ 1,434,350**	
8.1	Slurry Mixing, Hydration, and placement	2	LS/event	$ 135,367	$ 270,734		Assumed 0.5 porosity for entire PRB volume (each of the 3 trenches/PRBs of lengths 287 ft, 223 ft, and 106 ft and width 3 ft. (see Figure 4.1)), so slurry volume is 2053 CY * 0.5, or about 210,000 gallons. Slurry will be injected using direct push technology at $2,500/direct push point; assumes 50 points. Cost of slurry mixture change will be $10,367/change. PRB to be operated for 3 years with 2 ORC slurry injections per year. Unit cost from R.S. Means: $0.05 per Gallon.
8.2	ORC filling	2	LS/event	$ 581,808	$ 1,163,616		Assumed 10.35$/lbs ORC price based on vendor case study and 0.01 volumetric ORC in slurry material in each of the 3 trenches/PRBs of lengths 287 ft, 223 ft, and 106 ft and width 3 ft, with pea gravel in the bottom 30 ft. (see Figure 4.1). ORC density was assumed to be 3 g/cc. PRB to be operated for 3 years with 2 ORC slurry injections per year. Assumes partial treatment of contaminant mass due to prohibitively high oxygen demand of treatment area.

Alternative 4: ISSS + EISB

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
9.0	**MNA (SA & UHG)**						
9.1	Quarterly Monitoring & Reporting	1	LS/year	$ 120,000	$ 120,000		Quarterly sampling of 25 wells for 1 year. Based on 2x semi-annual costs.
9.2	Semi-Annual Monitoring & Reporting Program	10	LS/year	$ 60,000	$ 600,000		Semi-annual sampling of 25 wells for 10 years. Based on ESI 2016 estimate.
9.3	Annual Monitoring & Reporting	30	LS/year	$ 30,000	$ 900,000		Annual sampling of 25 wells for 30 years. Based on ½ semi-annual cost.
10.0	**Current Groundwater Extraction System**					**$ 260,000**	
10.1	GRU Treatment Fee(Current System)	28000	K Gal	$ 6.20	$ 173,600		10 yr ('06-'16) actual annual average; 2016 rate
10.2	Operation, Monitoring, Maintenance & Reporting	1	LS/year	$ 80,000	$ 80,000		Based on ESI 2016 estimate.
10.3	Equipment Replacement Cost	1	LS/year	$ 6,400	$ 6,400		Average annual cost with significant costs occurring at 5, 10, and 15 years.
Future Cost						**$ 7,823,050**	
11.0	**PRB System**	3	years	$1,434,350	$ 4,303,050	**$ 4,303,050**	Assume 3 years of PRB system operation.
12.0	**MNA (SA & UHG)**	1	LS	$1,620,000	$ 1,620,000	**$ 1,620,000**	Assume quarterly monitoring for 1 year, semi-annual monitoring for 10 years, and annual monitoring for 30 years
13.0	**Current Groundwater Extraction System**	5	years	$ 260,000	$ 1,300,000	**$ 1,300,000**	Assume system shutdown/transition to MNA after 5 years.
Present Value Analysis		**Rate**	**Years**	**Cost**	**NPV**	**$ 7,325,058**	
14.0	**Soil Cover/Slurry Wall Maintenance**	1.4%	30	$ 20,000	$ (487,195)	**$ 487,195**	
15.0	**PRB System**	1.4%	3	$1,434,350	$ (4,185,318)	**$ 4,185,318**	
16.0	**MNA (SA & UHG)**	1.4%			$ (1,405,410)	**$ 1,405,410**	
17.0	**Current Groundwater Extraction System**	1.4%	5	$ 260,000	$ (1,247,135)	**$ 1,247,135**	
					Total	**$34,123,429**	Capital Cost + Future Cost
					Total	**$33,625,436**	Capital Cost + Net Present Value of O&M

Alternative 5: ISSS + MNA

Alternative 5: ISSS + MNA

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
Remedy Design						**$ 399,750**	
1.0	**ISSS - UHG**					**$ 75,000**	
1.1	Bench-scale study	1	LS	$ 75,000	$ 75,000		Bench scale treatability study to determine soil to cement ratio of stabilizer needed to achieve target aquifer conductivity.
2.0	**Remedy Design**					**$ 250,000**	
2.1	Remedy Modeling, Engineering, and Design	1	LS	$ 250,000	$ 250,000		Desktop.
3.0	**Miscellaneous**					**$ 74,750**	
3.1	Project & Construction Management	1	%	8%	$ 26,000		Professional judgment
3.2	Data Analysis and Reporting	1	%	5%	$ 16,250		Professional judgment
3.3	Contingency	1	%	10%	$ 32,500		Professional judgment
Remedy Implementation Capital Cost						**$ 23,490,979**	
4.0	**Remedial Capital Cost**						
	Relocation of Existing Surface Water Pond					**$ 802,413**	
4.1	Demolition	1	LS	$ 394,220	$ 394,220		Clear vegetation in and around pond, pump out water & backfill with soil from new pond. Based on Weston 2014 estimate.
4.2	Construction	1	LS	$ 408,193	$ 408,193		Build new pond of same size with synthetic liner. Based on Weston 2014 estimate.
	Excavation of Vadose Zone Tar Deposits					**$ 1,980,000**	
4.3	Excavation	7,200	CY	$ 200	$ 1,440,000		Design, plan, excavate and backfill approximately 7,200 cubic yards (see Figure 4.1; source treatment area = 97,285 sq. ft. and assume excavation 0-10 ft.) of soil. Cost based on 2014 Weston estimate.
4.4	Off-site soil transfer/disposal	7,200	CY	$ 75	$ 540,000		Transport and dispose of approximately 7,200 cubic yards (see Figure 4.1; source treatment area = 97,285 sq. ft. and assume excavation 0-10 ft.) of soil to Clark Environmental for thermal treatment.
	In Situ Solidification/Stabilization for Surficial Aquifer and UHG (from 10' bgs to 65' bgs)					**$ 15,853,840**	
4.5	ISSS Soil Mixing (construction/materials/labor)	198,173	CY	$ 80	$ 15,853,840		Treatment of source area (see Figure 4.1; source treatment area = 97,285 sq. ft.) from 10-65 ft bgs. Volume = area x depth = 97,285 sq. ft. x (65' - 10') = 5,350,675 CF = 198,173 CY. Excess stabilized soil will be placed under surface cover. Geosyntec's 2013 experience suggests $57-84/CY. Assumed $80/CY.
	Surface Cover (2.2 acres)					**$ 462,104**	
4.6	Impervious Cover	97,285	SF	$ 4.75	$ 462,104		Impervious cover over area treated by ISSS (see Figure 4.1; source treatment area = 97,285 sq. ft.). Geosyntec's 2015 experience suggests $4.75/SF. Assumed $4.75/SF.
5.0	**Miscellaneous**					**$ 4,392,622**	
5.1	Project & Construction Management	1	%	8%	$ 1,527,869		Professional judgment
5.2	Data Analysis and Reporting	1	%	5%	$ 954,918		Professional judgment
5.3	Contingency	1	%	10%	$ 1,909,836		Professional judgment
Annual Operating, Maintenance and Monitoring Cost							
6.0	**Soil Cover/Slurry Wall Maintenance**					**$ 20,000**	
6.1	Soil Cover Maintenance	1	LS	$ 20,000	$ 20,000		Assumed $20K.
7.0	**MNA (SA & UHG)**						
7.1	Quarterly Monitoring & Reporting	1	LS/year	$ 120,000	$ 120,000		Quarterly sampling of 25 wells for 1 year. Based on 2x semi-annual costs.
7.2	Semi-Annual Monitoring & Reporting Program	10	LS/year	$ 60,000	$ 600,000		Semi-annual sampling of 25 wells for 10 years. Based on ESI 2016 estimate.
7.3	Annual Monitoring & Reporting	30	LS/year	$ 30,000	$ 900,000		Annual sampling of 25 wells for 30 years. Based on ½ semi-annual cost.
8.0	**Current Groundwater Extraction System**					**$ 260,000**	
8.1	GRU Treatment Fee (Current System)	28000	K Gal	$ 6.20	$ 173,600		10 yr ('06-'16) actual annual average; 2016 rate
8.2	Operation, Monitoring, Maintenance & Reporting	1	LS/year	$ 80,000	$ 80,000		Based on ESI 2016 estimate.
8.3	Equipment Replacement Cost	1	LS/year	$ 6,400	$ 6,400		Average annual cost with significant costs occurring at 5, 10, and 15 years.

Alternative 5: ISSS + MNA

Item	Description	Qty	Units	Unit Rate	Item Cost		Total	Notes
Future Cost						**$**	**3,520,000**	
9.0	**Soil Cover/Slurry Wall Maintenance**	30	years	$ 20,000	$ 600,000	**$**	**600,000**	
10.0	**MNA (SA & UHG)**	1	LS	$1,620,000	$ 1,620,000	**$**	**1,620,000**	Assume quarterly monitoring for 1 year, semi-annual monitoring for 10 years, and annual monitoring for 30 years
11.0	**Current Groundwater Extraction System**	5	years	$ 260,000	$ 1,300,000	**$**	**1,300,000**	Assume system shutdown/transition to MNA after 5 years.
Present Value Analysis		**Rate**	**Years**	**Cost**	**NPV**	**$**	**3,139,740**	
12.0	**Soil Cover/Slurry Wall Maintenance**	1.4%	30	$ 20,000	$ (487,195)	**$**	**487,195**	
13.0	**MNA (SA & UHG)**	1.4%			$ (1,405,410)	**$**	**1,405,410**	
14.0	**Current Groundwater Extraction System**	1.4%	5	$ 260,000	$ (1,247,135)	**$**	**1,247,135**	
					Total	**$**	**27,410,729**	Capital Cost + Future Cost
					Total	**$**	**27,030,468**	Capital Cost + Net Present Value of O&M

Alternative 6: ISSS + P&T

Alternative 6: ISSS + P&T

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
Remedy Design						**$ 1,014,750**	
1.0	**ISSS - UHG**					**$ 75,000**	
1.1	Bench-scale study	1	LS	$ 75,000	$ 75,000		Bench scale treatability study to determine soil to cement ratio of stabilizer needed to achieve target aquifer conductivity.
2.0	**Remedy Design**					**$ 750,000**	
2.1	Remedy Design Investigation	1	LS	$ 350,000	$ 350,000		Installation of investigation borings every 200 ft. along the proposed slurry wall perimeter. Sampling and laboratory analysis included.
2.2	Pumping Rate Study	1	LS	$ 150,000	$ 150,000		Pumping test using 1 well ($75k) and 1 monitoring well ($19k) to determine sustainable pumping rates, drawdown, and yield.
2.3	Remedy Modeling, Engineering, and Design	1	LS	$ 250,000	$ 250,000		Desktop.
3.0	**Miscellaneous**					**$ 189,750**	
3.1	Project & Construction Management	1	%	8%	$ 66,000		Professional judgment
3.2	Data Analysis and Reporting	1	%	5%	$ 41,250		Professional judgment
3.3	Contingency	1	%	10%	$ 82,500		Professional judgment
Remedy Implementation Capital Cost						**$ 23,870,060**	
4.0	**Remedial Capital Cost**						
	Relocation of Existing Surface Water Pond					**$ 802,413**	
4.1	Demolition	1	LS	$ 394,220	$ 394,220		Clear vegetation in and around pond, pump out water & backfill with soil from new pond. Based on Weston 2014 estimate.
4.2	Construction	1	LS	$ 408,193	$ 408,193		Build new pond of same size with synthetic liner. Based on Weston 2014 estimate.
	Excavation of Vadose Zone Tar Deposits					**$ 1,980,000**	
4.3	Excavation	7,200	CY	$ 200	$ 1,440,000		Design, plan, excavate and backfill approximately 7,200 cubic yards (see Figure 4.1; source treatment area = 97,285 sq. ft. and assume excavation 0-10 ft.) of soil. Cost based on 2014 Weston estimate.
4.4	Off-site soil transfer/disposal	7,200	CY	$ 75	$ 540,000		Transport and dispose of approximately 7,200 cubic yards (see Figure 4.1; source treatment area = 97,285 sq. ft. and assume excavation 0-10 ft.) of soil to Clark Environmental for thermal treatment.
	In Situ Solidification/Stabilization for Surficial Aquifer and UHG (from 10' bgs to 65' bgs)					**$ 15,853,840**	
4.5	ISSS Soil Mixing (construction/materials/labor)	198,173	CY	$ 80	$ 15,853,840		Treatment of source area (see Figure 4.1; source treatment area = 97,285 sq. ft.) from 10-65 ft bgs. Volume = area x depth = 97,285 sq. ft. x (65' - 10') = 5,350,675 CF = 198,173 CY. Excess stabilized soil will be placed under surface cover. Geosyntec's 2013 experience suggests $57-84/CY. Assumed $80/CY.
	Surface Cover (2.2 acres)					**$ 462,104**	
4.6	Impervious Cover	97285.0	SF	$ 4.75	$ 462,104		Impervious cover over area treated by ISSS (see Figure 4.1; source treatment area = 97,285 sq. ft.). Geosyntec's 2015 experience suggests $4.75/SF. Assumed $4.75/SF.
	Installation of Downgradient Well Point System					**$ 308,196**	
4.11	Approximate well installation cost	3	EA	$ 75,000	$ 225,000		Installation of 3 UHG pumping wells to deliver a combined pumping rate of 2.5 gpm.
4.12	Submersible Pumps	3	EA	$ 1,732	$ 5,196		1 submersible pump for each of 3 UHG pumping wells, able to convey water from 65 ft bgs to surface at flow rate of up to 2.5 gpm. Cost from R.S. Means for 4" Submersible Pump, 0.3-7.0 GPM, Head ≤140', 1/3hp.
4.13	Piping Tie-in	600	LF	$ 130	$ 78,000		Shallow trench for buried piping to convey water discharge from wells to existing interceptor trench and electric cables for pumps.
5.0	**Miscellaneous**					**$ 4,463,507**	
5.1	Project & Construction Management	1	%	8%	$ 1,552,524		Professional judgment
5.2	Data Analysis and Reporting	1	%	5%	$ 970,328		Professional judgment
5.3	Contingency	1	%	10%	$ 1,940,655		Professional judgment
Annual Operating, Maintenance and Monitoring Cost							
6.0	**Soil Cover/Slurry Wall Maintenance**					**$ 20,000**	
6.1	Soil Cover Maintenance	1	LS	$ 20,000	$ 20,000		Assumed $20K.
7.0	**Pumping Well**					**$ 25,611**	
7.1	Equipment Replacement Cost (pumps)	1	LS	$ 9,464	$ 9,464		Assume replacement of 2 submersible pumps per year. O&M labor ($6,000/year)
7.2	Pumped Water Treatment Fee	1314	K Gal	$ 6.20	$ 8,147		Assumes a combined pumping rate of 2.5 gpm.
7.3	Operation, Monitoring, Maintenance & Reporting	1	LS	$ 8,000	$ 8,000		Proportional to volume for groundwater interceptor trench O&M costs
8.0	**MNA (SA & UHG)**						
8.1	Quarterly Monitoring & Reporting	1	LS/year	$ 120,000	$ 120,000		Quarterly sampling of 25 wells for 1 year. Based on 2x semi-annual costs.
8.2	Semi-Annual Monitoring & Reporting Program	10	LS/year	$ 60,000	$ 600,000		Semi-annual sampling of 25 wells for 10 years. Based on ESI 2016 estimate.
8.3	Annual Monitoring & Reporting	30	LS/year	$ 30,000	$ 900,000		Annual sampling of 25 wells for 30 years. Based on ½ semi-annual cost.
9.0	**Current Groundwater Extraction System**					**$ 260,000**	
9.1	GRU Treatment Fee (Current System)	28000	K Gal	$ 6.20	$ 173,600		10 yr ('06-'16) actual annual average; 2016 rate
9.2	Operation, Monitoring, Maintenance & Reporting	1	LS/year	$ 80,000	$ 80,000		Based on ESI 2016 estimate.
9.3	Equipment Replacement Cost	1	LS/year	$ 6,400	$ 6,400		Average annual cost with significant costs occurring at 5, 10, and 15 years.

Alternative 6: ISSS + P&T

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
Future Cost						**$ 3,776,108**	
10.0	**Soil Cover**	30	years	$ 20,000	$ 600,000	**$ 600,000**	
11.0	**Pumping Well**	10	years	$ 25,611	$ 256,108	**$ 256,108**	
12.0	**MNA (SA & UHG)**	1	LS	$1,620,000	$ 1,620,000	**$ 1,620,000**	
13.0	**Current Groundwater Extraction System**	5	years	$ 260,000	$ 1,300,000	**$ 1,300,000**	Assume system shutdown/transition to MNA after 5 years.
Present Value Analysis		**Rate**	**Years**	**Cost**	**NPV**	**$ 2,889,988**	
14.0	**Soil Cover**	1.4%	30	$ 20,000	$ (487,195)	**$ 487,195**	
15.0	**Pumping Well**	1.4%	10	$ 25,611	$ (237,444)	**$ 237,444**	
16.0	**MNA (SA & UHG)**	1.4%			$ (1,405,410)	**$ 1,405,410**	
17.0	**Current Groundwater Extraction System**	1.4%	5	$ 260,000	$ (1,247,135)	**$ 1,247,135**	
					Total	**$ 28,660,918**	Capital Cost + Future Cost
					Total	**$ 27,774,798**	Capital Cost + Net Present Value of O&M

Alternative 7: Slurry Wall + MNA

Alternative 7: Slurry Wall + MNA

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
Remedy Design						**$ 756,450**	
1.0	**Slurry Wall**					**$ 15,000**	
1.1	Bench-scale treatability study	1	LS	$ 15,000	$ 15,000		Mix design study to evaluate strength and long-term compatibility of soil-bentonite mix; does not include other pre-design testing (borings, soil sampling, analysis). Value based on Geosyntec 2015 estimate.
2.0	**Remedy Design**					**$ 600,000**	
2.1	Remedy Design Investigation	1	LS	$ 350,000	$ 350,000		Installation of investigation borings every 200 ft. along the proposed slurry wall perimeter. Sampling and laboratory analysis included.
2.2	Remedy Modeling, Engineering, and Design	1	LS	$ 250,000	$ 250,000		Desktop.
3.0	**Miscellaneous**					**$ 141,450**	
3.1	Project & Construction Management	1	%	8%	$ 49,200		Professional judgment
3.2	Data Analysis and Reporting	1	%	5%	$ 30,750		Professional judgment
3.3	Contingency	1	%	10%	$ 61,500		Professional judgment
Remedy Implementation Capital Cost						**$ 7,122,698**	
4.0	**Remedial Capital Cost**						
	Relocation of Existing Surface Water Pond					**$ 802,413**	
4.1	Demolition	1	LS	$ 394,220	$ 394,220		Clear vegetation in and around pond, pump out water & backfill with soil from new pond. Based on Weston 2014 estimate.
4.2	Construction	1	LS	$ 408,193	$ 408,193		Build new pond of same size with synthetic liner. Based on Weston 2014 estimate.
	Slurry Wall (Extended to Middle Clay at 68' bgs)					**$ 3,085,149**	
4.3	Slurry Trench Installation	135,116	vsf	$ 22.00	$ 2,972,552		Assume wall around lagoon footprint and accessible downgradient plume; vsf = perimeter x depth; perimeter = 1987 ft (see Figure 4.2), assumed 6 ft width, and depth = 68 ft (approximately 3 ft. key into middle clay layer) Geosyntec's 2010 experience suggests $20/SF. Assumed $22/SF.
4.4	Off-site soil transfer/disposal	1,501	CY	$ 75.00	$ 112,597		Assume 10% of the excavated soil must be disposed of (transported for thermal treatment at Clark Environmental). The remaining 90% of soil will be reused in the slurry wall mixture.
	Surface Cover (5.5 Acres)					**$ 1,135,250**	
4.5	Impervious cover	239,000	SF	$ 4.75	$ 1,135,250		Surface area within slurry wall = 239,000 sq ft (see Figure 4.2) Geosyntec's 2015 experience suggests $4.75/SF. Assumed $4.75/SF.
	Well Installation and Pumping System Inside Slurry Wall					**$ 768,000**	Assume installation of 4 SA wells and 7 UHG wells; 11 pneumatic pumps used on an as-needed basis; water to be discharged to interceptor trench through buried piping.
4.6	Well Installation-SA	4	well	$ 15,000	$ 60,000		Gainesville precipitation/year = 50 in. Conservatively assume that 10% of the precipitation infiltrates through the cap. Total cap surface area = 239,000 SF (see Figure 4.2). Total water per year ~ 0.7 MGY equivalent to 1.4 gpm in SA inside slurry wall. Lateral infiltration through the slurry wall was calculated to be 0.58 gpm assuming a head difference of 2 ft. over the 6 ft. thickness, a wall conductivity of 10E-6 cm/s, a saturated thickness of 60 ft, and a perimeter of 1987 ft.
4.7	Well Installation-UHG	7	well	$ 75,000	$ 525,000		
4.8	Pumps and Fixtures	11	pump	$ 3,000	$ 33,000		Assume 11 pneumatic pumps used on an as-needed basis with little to no automation. Water to be discharged to interceptor trench through piping.
4.9	Pump House	1	LS	$ 50,000	$ 50,000		Includes pump house on a pad, electrical drop, rotary screw compressor, air filters, water meters, PLC, etc. Based on Geosyntec estimate.
4.10	Trench and Buried Piping	3,000	LF	$ 50	$ 150,000		Shallow trench for buried piping to convey water discharge from slurry wall area to existing interceptor trench. Buried piping to also include compressed air to supply pumps.
5.0	**Miscellaneous**					**$ 1,331,887**	
5.1	Project & Construction Management	1	%	8%	$ 463,265		Professional judgment
5.2	Data Analysis and Reporting	1	%	5%	$ 289,541		Professional judgment
5.3	Contingency	1	%	10%	$ 579,081		Professional judgment
Annual Operating, Maintenance and Monitoring Cost							
6.0	**Soil Cover/Slurry Wall Maintenance**					**$ 53,517**	
6.1	Soil Cover Maintenance	1	LS	$ 20,000	$ 20,000		Assumed $20K.
6.2	Pumping System Operation & Maintenance	1	LS	$ 27,000	$ 27,000		Assumes 2 new pumps annually ($6k) and 1 well repair annually ($5k). Electrical for the compressor ($4,000/year). O&M labor ($12,000/year).
6.3	GRU Treatment Fee	1051	K Gal	$ 6.20	$ 6,517		Assumed 2 gpm to be pumped from inside the slurry wall.
7.0	**MNA (SA & UHG)**						
7.1	Quarterly Monitoring & Reporting	1	LS/year	$ 120,000	$ 120,000		Quarterly sampling of 25 wells for 1 year. Based on 2x semi-annual costs.
7.2	Semi-Annual Monitoring & Reporting Program	10	LS/year	$ 60,000	$ 600,000		Semi-annual sampling of 25 wells for 10 years. Based on ESI 2016 estimate.
7.3	Annual Monitoring & Reporting	30	LS/year	$ 30,000	$ 900,000		Annual sampling of 25 wells for 30 years. Based on ½ semi-annual cost.
8.0	**Current Groundwater Extraction System**					**$ 260,000**	
8.1	GRU Treatment Fee(Current System)	28000	K Gal	$ 6.20	$ 173,600		10 yr ('06-'16) actual annual average; 2016 rate
8.2	Operation, Monitoring, Maintenance & Reporting	1	LS/year	$ 80,000.00	$ 80,000		Based on ESI 2016 estimate.
8.3	Equipment Replacement Cost	1	LS/year	$ 6,400	$ 6,400		Average annual cost with significant costs occurring at 5, 10, and 15 years.
Future Cost						**$ 4,525,523**	
9.0	**Soil Cover/Slurry Wall Maintenance**	30	years	$ 53,517	$ 1,605,523	**$ 1,605,523**	
10.0	**MNA (SA & UHG)**	1	LS	$ 1,620,000	$ 1,620,000	**$ 1,620,000**	Assume quarterly monitoring for 1 year, semi-annual monitoring for 10 years, and annual monitoring for 30 years
11.0	**Current Groundwater Extraction System**	5	years	$ 260,000	$ 1,300,000	**$ 1,300,000**	Assume system shutdown/transition to MNA after 5 years.
Present Value Analysis		**Rate**	**Years**	**Cost**	**NPV**	**$ 3,956,216**	
12.0	**Soil Cover/Slurry Wall Maintenance**	1.4%	30	$ 53,517	$ (1,303,672)	**$ 1,303,672**	
13.0	**MNA (SA & UHG)**	1.4%			$ (1,405,410)	**$ 1,405,410**	
14.0	**Current Groundwater Extraction System**	1.4%	5	$ 260,000	$ (1,247,135)	**$ 1,247,135**	
					Total	**$12,404,672**	Capital Cost + Future Cost
					Total	**$11,835,364**	Capital Cost + Net Present Value of O&M

Alternative 8a: Slurry Wall + Pumping Wells

Alternative 8a: Slurry Wall + Pumping Wells

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
Remedy Design						**$ 940,950**	
1.0	**Slurry Wall**					**$ 15,000**	
1.1	Bench-scale treatability study	1	LS	$ 15,000	$ 15,000		Mix design study to evaluate strength and long-term compatibility of soil-bentonite mix; does not include other pre-design testing (borings, soil sampling, analysis). Value based on Geosyntec 2015 estimate.
2.0	**Remedy Design**					**$ 750,000**	
2.1	Remedy Design Investigation	1	LS	$ 350,000	$ 350,000		Installation of investigation borings every 200 ft. along the proposed slurry wall perimeter. Sampling and laboratory analysis included.
2.2	Pumping Test	1	LS	$ 150,000	$ 150,000		Pumping test using 1 well ($75k) and 1 monitoring well ($19k) to determine sustainable pumping rates, drawdown, and yield
2.3	Remedy Modeling, Engineering, and Design	1	LS	$ 250,000	$ 250,000		Desktop.
3.0	**Miscellaneous**					**$ 175,950**	
3.1	Project & Construction Management	1	%	8%	$ 61,200		Professional judgment
3.2	Data Analysis and Reporting	1	%	5%	$ 38,250		Professional judgment
3.3	Contingency	1	%	10%	$ 76,500		Professional judgment
Remedy Implementation Capital Cost						**$ 7,501,779**	
4.0	**Remedial Capital Cost**						
	Relocation of Existing Surface Water Pond					**$ 802,413**	
4.1	Demolition	1	LS	$ 394,220	$ 394,220		Clear vegetation in and around pond, pump out water & backfill with soil from new pond. Based on Weston 2014 estimate.
4.2	Construction	1	LS	$ 408,193	$ 408,193		Build new pond of same size with synthetic liner. Based on Weston 2014 estimate.
	Slurry Wall (Extended to Middle Clay at 68' bgs)					**$ 3,085,149**	
4.3	Slurry Trench Installation	135,116	vsf	$ 22.00	$ 2,972,552		Assume wall around lagoon footprint and accessible downgradient plume; vsf = perimeter x depth; perimeter = 1987 ft (see Figure 4.2), assumed 6 ft width, and depth = 68 ft (approximately 3 ft. key into middle clay layer) Geosyntec's 2010 experience suggests $20/SF. Assumed $22/SF.
4.4	Off-site soil transfer/disposal	1,501	CY	$ 75.00	$ 112,597		Assume 10% of the excavated soil must be disposed of (transported for thermal treatment at Clark Environmental). The remaining 90% of soil will be reused in the slurry wall mixture.
	Surface Cover (5.5 Acres)					**$ 1,135,250**	
4.5	Impervious cover	239,000	SF	$ 4.75	$ 1,135,250		Surface area within slurry wall = 239,000 sq ft (see Figure 4.2) Geosyntec's 2015 experience suggests $4.75/SF. Assumed $4.75/SF.
	Well Installation and Pumping System Inside Slurry Wall					**$ 768,000**	Assume installation of 4 SA wells and 7 UHG wells; 11 pneumatic pumps used on an as-needed basis; water to be discharged to interceptor trench through buried piping.
4.6	Well Installation-SA	4	well	$ 15,000	$ 60,000		Gainesville precipitation/year = 50 in. Conservatively assume that 10% of the precipitation infiltrates through the cap. Total cap surface area = 239,000 SF (see Figure 4.2). Total water per year ~ 0.7 MGY equivalent to 1.4 gpm in SA inside slurry wall. Lateral infiltration through the slurry wall was calculated to be 0.58 gpm assuming a head difference of 2 ft. over the 6 ft. thickness, a wall conductivity of 10E-6 cm/s, a saturated thickness of 60 ft, and a perimeter of 1987 ft.
4.7	Well Installation-UHG	7	well	$ 75,000	$ 525,000		
4.8	Pumps and Fixtures	11	pump	$ 3,000	$ 33,000		Assume 11 pneumatic pumps used on an as-needed basis with little to no automation. Water to be discharged to interceptor trench through piping.
4.9	Pump House	1	LS	$ 50,000	$ 50,000		Includes pump house on a pad, electrical drop, rotary screw compressor, air filters, water meters, PLC, etc. Based on Geosyntec estimate.
4.10	Trench and Buried Piping	3,000	LF	$ 50	$ 150,000		Shallow trench for buried piping to convey water discharge from slurry wall area to existing interceptor trench. Buried piping to also include compressed air to supply pumps.
	Installation of Downgradient Well Point System					**$ 308,196**	
4.11	Approximate well installation cost	3	EA	$ 75,000	$ 225,000		Installation of 3 UHG pumping wells to deliver a combined pumping rate of 2.5 gpm.
4.12	Submersible Pumps	3	EA	$ 1,732	$ 5,196		1 submersible pump for each of 3 UHG pumping wells, able to convey water from 65 ft bgs to surface at flow rate of up to 2.5 gpm. Cost from R.S. Means for 4" Submersible Pump, 0.3-7.0 GPM, Head ≤140', 1/3hp.
4.13	Piping Tie-in	600	LF	$ 130	$ 78,000		Shallow trench for buried piping to convey water discharge from wells to existing interceptor trench and electric cables for pumps.
5.0	**Miscellaneous**					**$ 1,402,772**	
5.1	Project & Construction Management	1	%	8%	$ 487,921		Professional judgment
5.2	Data Analysis and Reporting	1	%	5%	$ 304,950		Professional judgment
5.3	Contingency	1	%	10%	$ 609,901		Professional judgment
Annual Operating, Maintenance and Monitoring Cost							
6.0	**Soil Cover/Slurry Wall Maintenance**					**$ 53,517**	
6.1	Soil Cover Maintenance	1	LS	$ 20,000	$ 20,000		Assumed $20K.
6.2	Pumping System Operation & Maintenance	1	LS	$ 27,000	$ 27,000		Assumes 2 new pumps annually ($6k) and 1 well repair annually ($5k). Electrical for the compressor ($4,000/year). O&M labor ($12,000/year).
6.3	GRU Treatment Fee	1051	K Gal	$ 6.20	$ 6,517		Assumed 2 gpm to be pumped from inside the slurry wall.
7.0	**Pumping Well**					**$ 25,611**	
7.1	Equipment Replacement Cost (pumps)	1	LS	$ 9,464	$ 9,464		Assume replacement of 2 submersible pumps per year. O&M labor ($6,000/year)
7.2	Pumped Water Treatment Fee	1314	K Gal	$ 6.20	$ 8,147		Assumes a combined pumping rate of 2.5 gpm.
7.3	Operation, Monitoring, Maintenance & Reporting	1	LS	$ 8,000	$ 8,000		Proportional to volume for groundwater interceptor trench O&M costs
8.0	**MNA (SA & UHG)**						
8.1	Quarterly Monitoring & Reporting	1	LS/year	$ 120,000	$ 120,000		Quarterly sampling of 25 wells for 1 year. Based on 2x semi-annual costs.
8.2	Semi-Annual Monitoring & Reporting Program	10	LS/year	$ 60,000	$ 600,000		Semi-annual sampling of 25 wells for 10 years. Based on ESI 2016 estimate.
8.3	Annual Monitoring & Reporting	30	LS/year	$ 30,000	$ 900,000		Annual sampling of 25 wells for 30 years. Based on ½ semi-annual cost.

Alternative 8a: Slurry Wall + Pumping Wells

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
9.0	**Current Groundwater Extraction System**					**$ 260,000**	
9.1	GRU Treatment Fee(Current System)	28000	K Gal	$ 6.20	$ 173,600		10 yr ('06-'16) actual annual average; 2016 rate
9.2	Operation, Monitoring, Maintenance & Reporting	1	LS/year	$ 80,000.00	$ 80,000		Based on ESI 2016 estimate.
9.3	Equipment Replacement Cost	1	LS/year	$ 6,400	$ 6,400		Average annual cost with significant costs occurring at 5, 10, and 15 years.
Future Cost						**$ 4,781,631**	
10.0	**Soil Cover/Slurry Wall Maintenance**	30	years	$ 53,517	$ 1,605,523	**$ 1,605,523**	
11.0	**Pumping Well**	10	years	$ 25,611	$ 256,108	**$ 256,108**	
12.0	**MNA (SA & UHG)**	1	LS	$ 1,620,000	$ 1,620,000	**$ 1,620,000**	Assume quarterly monitoring for 1 year, semi-annual monitoring for 10 years, and annual monitoring for 30 years
13.0	**Current Groundwater Extraction System**	5	years	$ 260,000	$ 1,300,000	**$ 1,300,000**	Assume system shutdown/transition to MNA after 5 years.
Present Value Analysis		**Rate**	**Years**	**Cost**	**NPV**	**$ 4,193,660**	
14.0	**Soil Cover/Slurry Wall Maintenance**	1.4%	30	$ 53,517	$ (1,303,672)	**$ 1,303,672**	
15.0	**Pumping Well**	1.4%	10	$ 25,611	$ (237,444)	**$ 237,444**	
16.0	**MNA (SA & UHG)**	1.4%			$ (1,405,410)	**$ 1,405,410**	
17.0	**Current Groundwater Extraction System**	1.4%	5	$ 260,000	$ (1,247,135)	**$ 1,247,135**	
					Total	**$13,224,361**	Capital Cost + Future Cost
					Total	**$12,636,389**	Capital Cost + Net Present Value of O&M

Alternative 8b: Slurry Wall + Pumping Trench

Alternative 8b: Slurry Wall + Pumping Trench

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
Remedy Design						**$ 940,950**	
1.0	**Slurry Wall**					**$ 15,000**	
1.1	Bench-scale treatability study	1	LS	$ 15,000	$ 15,000		Mix design study to evaluate strength and long-term compatibility of soil-bentonite mix; does not include other pre-design testing (borings, soil sampling, analysis). Value based on Geosyntec 2015 estimate.
2.0	**Remedy Design**					**$ 750,000**	
2.1	Remedy Design Investigation	1	LS	$ 350,000	$ 350,000		Installation of investigation borings every 200 ft. along the proposed slurry wall perimeter. Sampling and laboratory analysis included.
2.2	Pumping Rate Study	1	LS	$ 150,000	$ 150,000		Pumping test using 1 well ($75k) and 1 monitoring well ($19k) to determine sustainable pumping rates, drawdown, and yield.
2.3	Remedy Modeling, Engineering, and Design	1	LS	$ 250,000	$ 250,000		Desktop.
3.0	**Miscellaneous**					**$ 175,950**	
3.1	Project & Construction Management	1	%	8%	$ 61,200		Professional judgment
3.2	Data Analysis and Reporting	1	%	5%	$ 38,250		Professional judgment
3.3	Contingency	1	%	10%	$ 76,500		Professional judgment
Remedy Implementation Capital Cost						**$ 7,795,102**	
4.0	**Remedial Capital Cost**						
	Relocation of Existing Surface Water Pond					**$ 802,413**	
4.1	Demolition	1	LS	$ 394,220	$ 394,220		Clear vegetation in and around pond, pump out water & backfill with soil from new pond. Based on Weston 2014 estimate.
4.2	Construction	1	LS	$ 408,193	$ 408,193		Build new pond of same size with synthetic liner. Based on Weston 2014 estimate.
	Slurry Wall (Extended to Middle Clay at 68' bgs)					**$ 3,085,149**	
4.3	Slurry Trench Installation	135,116	vsf	$ 22.00	$ 2,972,552		Assume wall around lagoon footprint and accessible downgradient plume; vsf = perimeter x depth; perimeter = 1987 ft (see Figure 4.2), assumed 6 ft width, and depth = 68 ft (approximately 3 ft. key into middle clay layer) Geosyntec's 2010 experience suggests $20/SF. Assumed $22/SF.
4.4	Off-site soil transfer/disposal	1,501	CY	$ 75.00	$ 112,597		Assume 10% of the excavated soil must be disposed of (transported for thermal treatment at Clark Environmental). The remaining 90% of soil will be reused in the slurry wall mixture.
	Surface Cover (5.5 Acres)					**$ 1,135,250**	
4.5	Impervious cover	239,000	SF	$ 4.75	$ 1,135,250		Surface area within slurry wall = 239,000 sq ft (see Figure 4.2) Geosyntec's 2015 experience suggests $4.75/SF. Assumed $4.75/SF.
	Well Installation and Pumping System Inside Slurry Wall					**$ 768,000**	Assume installation of 4 SA wells and 7 UHG wells; 11 pneumatic pumps used on an as-needed basis; water to be discharged to interceptor trench through buried piping.
4.6	Well Installation-SA	4	well	$ 15,000	$ 60,000		Gainesville precipitation/year = 50 in. Conservatively assume that 10% of the precipitation infiltrates through the cap. Total cap surface area = 239,000 SF (see Figure 4.2). Total water per year ~ 0.7 MGY equivalent to 1.4 gpm in SA inside slurry wall. Lateral infiltration through the slurry wall was calculated to be 0.58 gpm assuming a head difference of 2 ft. over the 6 ft. thickness, a wall conductivity of 10E-6 cm/s, a saturated thickness of 60 ft, and a perimeter of 1987 ft.
4.7	Well Installation-UHG	7	well	$ 75,000	$ 525,000		
4.8	Pumps and Fixtures	11	pump	$ 3,000	$ 33,000		Assume 11 pneumatic pumps used on an as-needed basis with little to no automation. Water to be discharged to interceptor trench through piping.
4.9	Pump House	1	LS	$ 50,000	$ 50,000		Includes pump house on a pad, electrical drop, rotary screw compressor, air filters, water meters, PLC, etc. Based on Geosyntec estimate.
4.10	Trench and Buried Piping	3000	LF	$ 50	$ 150,000		Shallow trench for buried piping to convey water discharge from slurry wall area to existing interceptor trench. Buried piping to also include compressed air to supply pumps.
	UHG Trench					**$ 546,670**	
4.11	Trench Excavation (extended to 65' bgs) and placement of gravel (30 ft)	13000	VSF	$ 30.00	$ 390,000		Trench will be 65 ft deep, 200 ft long, and 3 ft wide. Assumed bottom 30 ft of the trench filled with pea gravel. Based on vendor costs.
4.14	Isolation layer of bentonite to separate UHG and SA	44	CY	$ 50.00	$ 2,222		Hydraulically isolate UHG from SA by capping top of trench with bentonite layer at level of Upper Clay. Layer assumed to cover entire plan view of trench (3 ft x 200 ft) and be 2 ft thick. Assumed bentonite comprised 8% by weight of the dry soil. Based on Geosyntec estimate.
4.15	Backfill above pumping trench	733	CY	$ 12.00	$ 8,800		Backfill native soil from top of isolation layer to ground surface 33 ft (depth to top of isolation layer) x 3 ft (width of trench) x 200 ft (length of trench)
4.16	Off-site soil transfer/disposal	711	CY	$ 75.00	$ 53,333		Excavated soil (trench and cap thickness of 32 ft x area of 200 ft x 3 ft) transported for thermal treatment at Clark Environmental.
4.17	Impervious cover	600	SF	$ 9.50	$ 5,700		Assumes impervious cover placed over trench 3 ft wide and 200 ft long to reduce infiltration into SA. Geosyntec's 2015 experience suggests 2x$4.75/SF due to the limited area.
4.18	Sump Pump	2	EA	$ 4,307	$ 8,614		Required pumping rate from trench (200 ft x 3 ft) of 7.5 gpm, with head difference from base of trench to ground surface of 65 ft. Unit price determined from R.S. Means for Sump Pump 300 GPM, single stage, 70' Head.
4.19	Piping Tie-in	600	ft	$ 130	$ 78,000		Shallow trench for buried piping to convey water discharge from wells to existing interceptor trench and electric cables for pumps.
5.0	**Miscellaneous**					**$ 1,457,621**	
5.1	Project & Construction Management	1	%	8%	$ 506,998		Professional judgment
5.2	Data Analysis and Reporting	1	%	5%	$ 316,874		Professional judgment
5.3	Contingency	1	%	10%	$ 633,748		Professional judgment
Annual Operating, Maintenance and Monitoring Cost							
6.0	**Soil Cover/Slurry Wall Maintenance**					**$ 53,517**	
6.1	Soil Cover Maintenance	1	LS	$ 20,000	$ 20,000		Assumed $20K.
6.2	Pumping System Operation & Maintenance	1	LS	$ 27,000	$ 27,000		Assumes 2 new pumps annually ($6k) and 1 well repair annually ($5k). Electrical for the compressor ($4,000/year). O&M labor ($12,000/year).
6.3	GRU Treatment Fee	1051	K Gal	$ 6.20	$ 6,517		Assumed 2 gpm to be pumped from inside the slurry wall.
7.0	**UHG Trench**					**$ 50,747**	
7.1	Equipment Replacement Cost (pumps)	1	EA	$ 10,307	$ 10,307		Unit price determined from R.S. Means for Sump Pump 300 GPM, single stage, 70' Head. O&M labor ($6,000/year)
7.2	GRU Treatment Fee (Current System)	3942	K Gal	$ 6.20	$ 24,440		Assumed pumping rate of 7.5 gpm.
7.3	Operation, Monitoring, Maintenance & Reporting	1	LS	$ 16,000	$ 16,000		Proportional to volume for groundwater interceptor trench O&M costs.

Alternative 8b: Slurry Wall + Pumping Trench

Item	Description	Qty	Units	Unit Rate	Item Cost	Total	Notes
8.0	**MNA (SA & UHG)**						
8.1	Quarterly Monitoring & Reporting	1	LS/year	$ 120,000	$ 120,000		Quarterly sampling of 25 wells for 1 year. Based on 2x semi-annual costs.
8.2	Semi-Annual Monitoring & Reporting Program	10	LS/year	$ 60,000	$ 600,000		Semi-annual sampling of 25 wells for 10 years. Based on ESI 2016 estimate.
8.3	Annual Monitoring & Reporting	30	LS/year	$ 30,000	$ 900,000		Annual sampling of 25 wells for 30 years. Based on ½ semi-annual cost.
9.0	**Current Groundwater Extraction System**					**$ 260,000**	
9.1	GRU Treatment Fee(Current System)	28000	K Gal	$ 6.20	$ 173,600		10 yr ('06-'16) actual annual average; 2016 rate.
9.2	Operation, Monitoring, Maintenance & Reporting	1	LS/year	$ 80,000.00	$ 80,000		Based on ESI 2016 estimate.
9.3	Equipment Replacement Cost	1	LS/year	$ 6,400	$ 6,400		Average annual cost with significant costs occurring at 5, 10, and 15 years.
Future Cost						**$ 4,779,260**	
10.0	**Soil Cover/Slurry Wall Maintenance**	30	years	$ 53,517	$ 1,605,523	**$ 1,605,523**	
11.0	**UHG Trench**	5	years	$ 50,747	$ 253,737	**$ 253,737**	
12.0	**MNA (SA & UHG)**	1	LS	$ 1,620,000	$ 1,620,000	**$ 1,620,000**	Assume quarterly monitoring for 1 year, semi-annual monitoring for 10 years, and annual monitoring for 30 years
13.0	**Current Groundwater Extraction System**	5	years	$ 260,000	$ 1,300,000	**$ 1,300,000**	Assume system shutdown/transition to MNA after 5 years.
Present Value Analysis		**Rate**	**Years**	**Cost**	**NPV**	**$ 4,199,635**	
14.0	**Soil Cover/Slurry Wall Maintenance**	1.4%	30	$ 53,517	$ (1,303,672)	**$ 1,303,672**	
15.0	**UHG Trench**	1.4%	5	$ 50,747	$ (243,419)	**$ 243,419**	
16.0	**MNA (SA & UHG)**	1.4%			$ (1,405,410)	**$ 1,405,410**	
17.0	**Current Groundwater Extraction System**	1.4%	5	$ 260,000	$ (1,247,135)	**$ 1,247,135**	
					Total	**$13,515,312**	Capital Cost + Future Cost
					Total	**$12,935,687**	Capital Cost + Net Present Value of O&M