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020617-0013

July 28 1999



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Mr. David J. Newton
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Subject: Contract No. 68-W6-0042
Work Assignment No. 007-RICO-01A5
Rose Hill Regional Landfill RI/FS
Cost Comparison for Alternatives #4a and #4b

Dear Dave:

As per your request, attached is a informal memorandum outlining the cost comparison for Alternative #4a (Final FS); revised Alternative #4b (Final FS); and Alternative #4b (Original/Old) and #4b (current/New) based on review of the GZA Field Investigation Report of February 1999, for Rose Hill Regional Landfill Superfund Site.

If you have any questions or comments, do not hesitate to contact me at (781) 224-6022.

Very truly yours,
METCALF & EDDY, INC.

Deborah M. Simone
Project Manager

cc: D. King, USEPA (letter only)
C. Hagger, M&E (letter only)
D. Peters, M&E
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Memorandum

To: D. Simone **Date:** 28 July 1999
Location: Wakefield, MA **Project No.:** 020617-0013
From: S. Czarniecki SC
Subject: **Rose Hill Landfill - Comparison of Costs for Alternatives #4a and #4b
Original/Old and Current/New**

During the proposed plan phase and public comment period for the Rose Hill project, the U.S. EPA requested M&E to review the costs presented in the *Rose Hill Regional Landfill Final Feasibility Study (FS) Report, November 1998* and update them based on the results of the recent GZA field investigation as outlined in *Rose Hill Landfill Superfund Site Field Investigation Report, February 1999*. This memo briefly describes the modifications outlined in the attached cost comparison.

Alternative #4a

The costs for Alternative #4a [capping of both the Solid and Bulky Waste Areas, landfill gas (LFG) collection at the Solid Waste Area (SWA), and leachate collection and treatment downgradient of the Bulky Waste Area (BWA)] remain the same as was presented in the Final FS: a capital cost of \$7.2 million and an O&M cost of \$8.8 million for a total of \$16 million.

Alternative #4b - Revised FS Costs (Original/Old)

The capital costs for Alternative #4b [capping of the SWA, landfill mining of the BWA, LFG collection at the SWA, and leachate collection and treatment downgradient of the BWA during landfill mining] presented in the FS contained an error in landfill mining costs with regards to cost recovery of mined metals. This has been corrected in the attached comparison. Therefore, the costs for this alternative based on Final FS Report assumptions are as follows: a capital cost of \$8.3 million and an O&M cost of \$7.1 million for a total of \$15.4 million.

Alternative #4b - Subsequent to GZA Field Investigation (Current/New)

The attached cost comparison backup shows that the GZA field investigation results change the estimated costs for 3 of the 21 categories: 5.0 Landfill Mining, 7.0 Internal LF Gas Collection System, and 17.0 Environmental Monitoring: Annual. Other categories reviewed, but not changed, were 2.0 Capping: Solid Waste Area, 3.0 Grading & Site Prep.: Bulky Waste Area, 4.0 Capping: Bulky Waste Area, 18.0 Landfill Gas Collection and Treatment, 19.0 GW/Leachate

Collection & Treatment: 50 gpm, 20.0 Leachate Collection & Treatment: 5 gpm, and 21.0 Institutional Controls: Annual Costs. Discussion of each of these categories is presented below.

2.0 Capping: Solid Waste Area. The assumed volume of residuals to be placed on the SWA from mining of the BWA increased from approximately 31,000 cy to 190,000 cy. The assumed capping materials increase of 10% over Alternative #4a is believed to be adequate to cover the increased volume for an FS level of estimate accuracy. [No change from original Alternative #4b estimate.]

3.0 Grading & Site Prep.: Bulky Waste Area. There were no changes made in the FS assumptions due to the GZA field investigation. [No change from original Alternative #4b estimate.]

4.0 Capping: Bulky Waste Area. The assumption that all waste would be removed from the BWA was not changed. Therefore, no cap is necessary. [No change from original Alternative #4b estimate.]

5.0 Landfill Mining. The assumed volume of waste to be removed from the BWA increased from 114,000 cy to at least 190,000 cy (the bottom of the waste was not encountered in some of the test pits conducted by GZA). Scrap metal transport and revenue was eliminated since no bulky waste was encountered in the test pits. In the FS, soils were assumed to be recovered and backfilled into the excavation. Residuals would be transported and placed on the SWA. Current assumptions are that no soil recovery would occur, and the entire 190,000 cy would be transported to and placed on the SWA. The increased excavation volume increased the assumed volume of backfill soils needed to bring the BWA back to grade. Dewatering costs were assumed to remain the same, but should be reviewed further. The assumed length of the landfill mining activities increased by almost 80 working days.

7.0 Internal LF Gas Collection System. The assumed well lengths were increased due to the increased depth of waste. Also, an assumed increase in costs for piping and valves was added.

17.0 Environmental Monitoring: Annual. Costs for cap inspection and maintenance were reduced since the BWA will not require this following landfill mining. Costs for groundwater, ambient air and soil gas monitoring were also reduced.

18.0 Landfill Gas Collection and Treatment. By adding the BWA waste to the SWA, LFG generation is expected to increase. This may assist in reducing auxiliary fuel costs, but may also increase the length of time of operation. Therefore, no changes have been assumed at this time. [No change from original Alternative #4b estimate.]

19.0 GW/Leachate Collection & Treatment: 50 gpm, 20.0 Leachate Collection & Treatment: 5 gpm, and 21.0 Institutional Controls: Annual Costs. There were no changes made in the FS assumptions due to the GZA field investigation. [No change from original Alternative #4b estimate.]

The resulting costs for Alternative #4b (Current/New) based on current assumptions noted above are as follows: a capital cost of \$11.3 million and an O&M cost of \$6.7 million for a total of \$18.0 million.

Comparison of Costs for Alternatives #4a & #4b(Old & Current)
Rose Hill Regional Landfill

May 12, 1999

CAPITAL COSTS (in \$1,000's)	4a	Old 4b*	Current 4b
1.0 GRADING & SITE PREP.: SOLID WASTE AREA	100	100	100
2.0 CAPPING: SOLID WASTE AREA	2,442	2,686	2,686
3.0 GRADING & SITE PREP.: BULKY WASTE AREA	48	46	46
4.0 CAPPING: BULKY WASTE AREA	864	0	0
5.0 LANDFILL MINING	0	1,452	3,812
6.0 PERIMETER WETLANDS MITIGATION	40	40	40
7.0 INTERNAL LF GAS COLLECTION SYSTEM	681	681	734
8.0 PERIMETER LF GAS COLLECTION SYSTEM	338	338	338
9.0 LF GAS TREATMENT PLANT	338	338	338
10.0 GW DEPRESSION SYSTEM: COLLECTION	0	0	0
11.0 LEACHATE COLLECTION SYSTEM	99	99	99
12.0 50 GPM WATER TREATMENT PLANT	0	0	0
13.0 5 GPM WATER TREATMENT PLANT	507	507	507
14.0 ENVIRONMENTAL MONITORING: CAPITAL COST	94	94	94
15.0 DECONTAMINATION AREA - TREATMENT PLANT AREA	50	50	50
16.0 INSTITUTIONAL CONTROLS	+ 88	88	88
TOTAL DIRECT CAPITAL COST	5,689	6,517	8,930
REMEDIAL DESIGN ALLOWANCE	341	391	536
CONTINGENCY	+ 1,206	1,382	1,893
TOTAL CAPITAL COSTS	\$7,236	\$8,290	\$11,359
ANNUAL COSTS (Present Value in \$1,000's)			
17.0 ENVIRONMENTAL MONITORING: ANNUAL	3,051	3,051	2,698
18.0 LANDFILL GAS COLLECTION AND TREATMENT	2,787	2,787	2,787
19.0 GW/LEACHATE COLLECTION & TREATMENT: 50 GPM	0	0	0
20.0 LEACHATE COLLECTION & TREATMENT: 5 GPM	1,519	83	83
21.0 INSTITUTIONAL CONTROLS: ANNUAL COSTS	+ 0	0	0
TOTAL DIRECT ANNUAL COST	7,357	5,921	5,568
CONTINGENCY	1,471	1,184	1,114
TOTAL ANNUAL COSTS	\$8,828	\$7,105	\$6,682
TOTAL COST OF ALTERNATIVE (in \$1,000's)	\$16,064	\$15,395	\$18,041

* Landfill mining costs are different than those presented in the FS and Proposed Plan due to a calculation correction.

Note that Old 4b and Current 4b estimates have the same dewatering allowance (\$50,000). Further evaluation should be made to determine any increased costs for dewatering.

**Breakdown of Alternative #4b (Current) Costs
Rose Hill Regional Landfill**

DETAILED COST TABLE: ALTERNATIVE #		4b Current	SENSITIVITY:		BASE	
ITEM	UNIT	UNIT COST (\$ / unit)	QUAN- TITY	COST (\$1,000's)		
CAPITAL COSTS:						
1.0	GRADING & SITE PREP.: SOLID WASTE AREA [same as #4a]					
1.1	Clearing and Grubbing	acre	335.00	22.9	8	
1.2	Silt Fencing	lf	2.00	4,400	9	
1.3	Drainage Ditches	lf	0.36	1,240	0	
1.4	Detention Basins	cy	4.00	3,025	12	
1.5	Fence 8' Chain Link	lf	15.00	4,700	71	
	Total				100	
2.0	CAPPING: SOLID WASTE AREA [same as #4a except for 10% additional quantity for consolidation of BWA]					
2.1	Vegetation	sy	0.35	121,920	43	
2.2	Topsoil: 6"	sy	3.50	121,920	427	
2.3	Cover Layer: 18"	cy	12.00	60,960	732	
2.4	Drainage Layer: Composite	sy	3.60	121,920	439	
2.5	Geomembrane	sf	0.43	1,097,276	472	
2.6	Low Permeability Layer: 12"	cy	8.00	40,640	325	
2.7	Protective Layer: 6"	cy	12.00	20,320	244	
2.8	Wetlands Replacement	acre	50,000	0.1	5	
	Total				2,686	
3.0	GRADING & SITE PREP.: BULKY WASTE AREA [same as #4a except for no Det. Basin or Drainage Ditches]					
3.1	Clearing and Grubbing	acre	335.00	7	2	
3.2	Silt Fencing	lf	2.00	2,200	4	
3.2	Drainage Ditches	lf	0.36	0	0	
3.4	Detention Basins	cy	4.00	0	0	
3.5	Fence 8' Chain Link	lf	15.00	2,600	39	
	Total				46	
4.0	CAPPING: BULKY WASTE AREA [no cap in LF Mining]					
4.1	Vegetation	sy	0.35	0	0	
4.2	Topsoil: 6"	sy	3.50	0	0	
4.3	Cover Layer: 18"	cy	12.00	0	0	
4.4	Drainage Layer: Composite	sy	3.60	0	0	
4.5	Geomembrane	sf	0.43	0	0	
4.6	Low Permeability Layer: 12"	cy	8.00	0	0	
4.7	Gas Vent Layer: Composite	sy	3.60	0	0	
4.8	Passive Gas Vents	lf	196.00	0	0	
	Total				0	
5.0	LANDFILL MINING [New quantities based on GZA report]					
5.1	Waste Removal and Segregation	cy	9.00	190,000	1,710	
5.2	Scrap Metal Transport	cy	5.00	0	0	
5.3	Transport Non-recyclables to Solid Waste Area	cy	1.50	190,000	285	
5.4	Backfill With Reclaimed Soil	cy	2.15	0	0	
5.5	Backfill With Clean Fill	cy	11.00	150,000	1,650	
5.6	Vegetation	sy	0.35	35,816	13	
5.7	Miscellaneous Allowances	ls	97,000	1	97	
5.8	Scrap Metal Revenue	lb	0.02	0	0	
5.9	Supervision & Monitoring Labor	day	300.00	190	57	
	Total				3,812	
6.0	PERIMETER WETLANDS MITIGATION [same as #4a]					
6.1	Wetlands & Buffer Zone replacement	ls	80,000	1	40	
	Total				40	

**Breakdown of Alternative #4b (Current) Costs
Rose Hill Regional Landfill**

DETAILED COST TABLE: ALTERNATIVE #		4b Current	SENSITIVITY:		BASE
ITEM	UNIT	UNIT COST (\$ / unit)	QUAN- TITY	COST (\$1,000's)	
7.0	INTERNAL LF GAS COLLECTION SYSTEM [same as #4a except minor increases in piping costs]				
7.1	Vault, Gauges, Fittings and Other Costs	well	4,250	36	153
7.2	Screen, Casing and Other Well Footage Costs	lf	196.00	1,080	212
7.3	Header Pipe: HDPE [increase final costs by 10% to account for temp. work above waste]				
7.3a	10" HDPE Header Pipe, buried	lf	27.60	500	15
7.3b	8" HDPE Header Pipe, buried	lf	23.60	3,780	98
7.3c	6" HDPE Header Pipe, buried	lf	18.50	2,890	59
7.3d	"Blueboard" thermal insulation	lf	1.50	7,170	12
7.3e	HDPE Tees 8" x 8" x 8", installed & buried	ea	310.00	20	7
7.3f	HDPE Tees 6" x 6" x 6", installed & buried	ea	250.00	22	6
7.4	Valves & Appurtenances				
7.4a	Buried butterfly isolation valves: 10"	ea	2000.00	1	2
7.4b	Buried butterfly isolation valves: 8"	ea	1600.00	15	24
7.4c	LANDTEC GEM-500 LFG analyzer	ls	6395.00	1	6
7.5	Condensate Piping	lf	5.00	3,020	15
7.6	Condensate Pump Stations	ea	50,000	2	100
7.7	Condensate Storage Tank Allowance	ea	25,000	1	25
Total					734
8.0	PERIMETER LF GAS COLLECTION SYSTEM [same as #4a]				
8.1	Vault, Gauges, Fittings and Other Costs	well	4,250	26	111
8.2	Screen, Casing and Other Well Footage Costs	lf	196.00	572	112
8.3	Header Pipe: HDPE				
8.3a	10" HDPE Header Pipe, buried	lf	27.60	3,210	89
8.3b	6" HDPE Header Pipe, buried	lf	18.50	260	5
8.3c	"Blueboard" thermal insulation	lf	1.50	3,470	5
8.3d	HDPE Tees 10" x 10" x 6", installed & buried	ea	430.00	26	11
8.4	Valves & Appurtenances	ea	2000.00	3	6
Total					338
9.0	LF GAS TREATMENT PLANT [same as #4a]				
9.1	Access Roads	sy	5.56	4,222	23
9.2	Electricity Service	lf	14.00	1,600	22
9.3	Water Service	lf	5.00	1,600	8
9.4	Internal & Perim. Coll. System Blowers & Motors	ls	60,000	1	60
9.5	Enclosed Flare and Appurtenances	ea	179,400	1	179
9.6	Foundation: 18" Structural Slab	cy	350.00	111	39
9.7	Photocatalytic Oxidation and Appurtenances	ls	286,000	0	0
9.8	Fence 8' Chain Link	lf	15.00	400	6
Total					338
10.0	GW DEPRESSION SYSTEM: COLLECTION [same as #4a]				
10.1	Buried Piping	lf	8.00	0	0
10.2	Pump Electrical	lf	4.00	0	0
10.3	Pump Station	ls	75,000	0	0
10.4	Shallow Drain Piping & Installation	lf	40.00	0	0
Total					0
11.0	LEACHATE COLLECTION SYSTEM [same as #4a]				
11.1	Buried Piping	lf	5.00	2,100	11
11.2	Pump Electrical	lf	4.00	2,100	8
11.3	Pump Station	ls	50,000	1	50
11.4	Shallow Drain Piping & Installation	lf	40.00	750	30
Total					99

**Breakdown of Alternative #4b (Current) Costs
Rose Hill Regional Landfill**

DETAILED COST TABLE: ALTERNATIVE #		4b Current	SENSITIVITY:		BASE
ITEM	UNIT	UNIT COST (\$ / unit)	QUAN- TITY	COST (\$1,000's)	
12.0	50 GPM WATER TREATMENT PLANT [same as #4a]				
12.1	Not Used				
12.2	Not Used				
12.3	Not Used				
12.4	Equipment	ls	613,500	0	0
12.5	Instrumentation	ls	58,300	0	0
12.6	Foundation: 18" Structural Slab	cy	350.00	0	0
12.7	Structure: 20' Pre-engineered Building	sf	50.00	0	0
12.8	Discharge Line	lf	8.00	0	0
12.9	Groundwater Injection Wells	ea	9,000	0	0
12.10	Fence 8' Chain Link	lf	15.00	0	0
Total					0
13.0	5 GPM WATER TREATMENT PLANT [same as #4a]				
13.1	Not Used				
13.2	Not Used				
13.3	Not Used				
13.4	Equipment	ls	213,500	1	214
13.5	Instrumentation	ls	20,289	1	20
13.6	Foundation: 18" Structural Slab	cy	350.00	200	70
13.7	Structure: 20' Pre-engineered Building	sf	50.00	3,600	180
13.8	Discharge Line	lf	5.00	500	3
13.9	Groundwater Injection Wells	ea	9,000	2	18
13.10	Fence 8' Chain Link	lf	15.00	150	2
Total					507
14.0	ENVIRONMENTAL MONITORING: CAPITAL COST [same as #4a]				
14.1	Piezometer Installation	lf	50	125	6
14.2	Soil Gas Probe Construction	ea	2,500	35	88
Total					94
15.0	DECONTAMINATION AREA - TREATMENT PLANT AREA [same as #4a]				
15.1	Decon Station Allowance	ls	50,000	1	50
Total					50
16.0	INSTITUTIONAL CONTROLS [same as #4a]				
16.1	GW Access Restrictions: Legal Fees	lot	8,000	11	88
16.2	Not Used				
16.3	Not Used				
16.4	LFG Control Contingency	house	9,808	0	0
Total					88
TOTAL DIRECT CAPITAL COST					8,930
REMEDIAL DESIGN ALLOWANCE @ 6%					536
CONTINGENCY @ 20%					1,893
TOTAL CAPITAL COSTS					11,359

**Breakdown of Alternative #4b (Current) Costs
Rose Hill Regional Landfill**

DETAILED COST TABLE: ALTERNATIVE #		4b Current	SENSITIVITY:		BASE
ITEM	UNIT	UNIT COST (\$ / unit)	QUAN- TITY		COST (\$1,000's)
ANNUAL COSTS:			Annual	Duration	Net Present
17.0 ENVIRONMENTAL MONITORING: ANNUAL [some reductions]			Quantity	Req'd (yrs)	Value (1)
17.1 Five Year Review	ea	25,000	0.20	30	85
17.2 Cap Inspection and Reporting	ea	1300	4	30	89
17.3 Groundwater Monitoring	sample	1,740	43	30	1,278
17.4 SW/Sediment Monitoring	sample	2,710	22	30	1,015
17.5 Ambient Air Monitoring	sample	1,690	8	15	147
17.6 Soil Gas Monitoring	sample	83	93	15	84
TOTAL					2,698
18.0 LANDFILL GAS COLLECTION AND TREATMENT [same as #4a]					
18.1 O&M Labor:					
18.1a Operator @ 1/2 shift/wk	hr	49	1,040	15	555
18.1b Overtime @ 10%	hr	65	104	15	74
18.1c Supervisory @ 10%	hr	75	104	15	85
18.1d Administrative Costs	ls	4,000	1	15	44
18.2 Equipment Repair/Replacement	ls	56,476	1	15	615
18.3 Electricity Usage Internal System Blower	kWhr	0.07	36,291	15	28
18.4 Elec. Usage Perimeter System Blower	kWhr	0.07	108,872	15	83
18.5 Condensate Transportation: Internal System	gal	0.35	5,059	15	19
18.6 Condensate Transportation: Perimeter System	gal	0.35	53,348	15	201
18.7 Condensate Disposal: Internal System	gal	1.44	5,059	15	79
18.8 Condensate Disposal: Perimeter System	gal	1.44	53,348	15	837
18.9 Auxiliary Fuel Usage	cf	0.02	774,034	15	168
18.10 Photocatalytic Oxidation O&M	ls	27,816	0	0	0
TOTAL					2,787
19.0 GW/LEACHATE COLLECTION & TREATMENT: 50 GPM [same as #4a]					
19.1 O&M Labor:					
19.1a Operator @ 1/2 shift/wk	hr	49	0	0	0
19.1b Overtime @ 10%	hr	65	0	0	0
19.1c Supervisory @ 10%	hr	75	0	0	0
19.1d Administrative Costs	ls	4,000	0	0	0
19.2 Feed Chemicals	1,000 gal	2.00	0	0	0
19.3 Equipment Repair/Replacement	ls	42,276	0	0	0
19.4 Electricity Usage: Collection	kWhr	0.07	0	0	0
19.5 Electricity Usage: Treatment	1,000 gal	1.65	0	0	0
19.6 Diposal of Residuals	1,000 gal	1.01	0	0	0
TOTAL					0
20.0 LEACHATE COLLECTION & TREATMENT: 5 GPM [length of operation lowered to 1 year]					
20.1 O&M Labor:					
20.1a Operator @ 1/2 shift/wk	hr	49	1,040	1	48
20.1b Overtime @ 10%	hr	65	104	1	6
20.1c Supervisory @ 10%	hr	75	104	1	7
20.1d Administrative Costs	ls	4,000	1	1	4
20.2 Feed Chemicals	1,000 gal	0.70	2,628	1	2
20.3 Equipment Repair/Replacement	ls	14,967	1	1	14
20.4 Electricity Usage: Collection	kWhr	0.07	7,258	1	0
20.5 Electricity Usage: Treatment	1,000 gal	0.55	2,628	1	1
20.6 Diposal of Residuals	1,000 gal	0.35	2,628	1	1
Total					83

**Breakdown of Alternative #4b (Current) Costs
Rose Hill Regional Landfill**

DETAILED COST TABLE: ALTERNATIVE #		4b Current	SENSITIVITY:		BASE
ITEM	UNIT	UNIT COST (\$ / unit)	QUAN- TITY	COST (\$1,000's)	
21.0	INSTITUTIONAL CONTROLS: ANNUAL COSTS [same as #4a]				
21.1	Groundwater Access Restrictions (Not Used)				
21.2	Not Used				
21.3	Not Used				
21.4	LFG Control Contingency (Annual Inspections)	house	500	0	0
Total					0
TOTAL PRESENT COST					5,568
CONTINGENCY @ 20%					1,114
TOTAL ANNUAL COSTS (Present Value in \$1,000's)					6,682
TOTAL COST (in \$1,000's)					18,041

Notes:

1) Net Present Value costs were calculated using the following formula:

$$\text{NPV} = \frac{\text{A}_0}{(\$1,000's)}$$

$$= \frac{1 - (1 + i_{INF})^N / (1 + i_{DF})^N}{(i_{DF} - i_{INF})}$$

where:

A₀ = (Unit cost) · (Annual quantity)
N = duration of annual cost (years)

i_{DF} = discount factor or rate
i_{INF} = inflation rate

**Unit Cost Development Backup for Alternative #4b (Current)
Rose Hill Regional Landfill**

Note that the only items included are those which could potentially change based on assumptions made.
See FS for those items not included.

UNIT COST DEVELOPMENT	UNIT COST	UNIT	Comparison of total costs for some items
ITEM	(\$ / unit)		
CAPPING: SOLID WASTE AREA			
<p>Previously, a rough assumption was made to increase all capping material quantities by 10% due to waste placement of BWA residuals on the SWA. As this is only FS level estimating, that assumption is reasonable. The FS level estimation of materials takes the flat area and multiplies by the depth of material being used, but in reality, more material is needed due to the area being above ground by 10 to 15 feet. The following brief analysis checks to see if there will be a significant cost difference due to the current knowledge that more solid waste would need to be placed on the SWA if the BWA is landfill mined.</p>			
Under previous scenario,			
SWA volume w/ cover soils =	880,000 cy		
SWA volume w/o cover soils =	703,000 cy		
BWA volume w/ cover soils =	130,000 cy		
BWA volume w/o cover soils =	114,000 cy		
Scrap metal volume =	37,500 cy		
Reclaimed soil for backfill (40%) =	45,600 cy		
Residue for SWA placement =	30,900 cy		
Current BWA volume estimate (based on GZA report; M&E has not confirmed calculation),			
BWA volume w/ cover soils =	227,000 cy		
BWA volume w/o cover soils =	190,000 cy		
(May not account for areas where backhoe did not reach bottom of waste)			
Assume no reclaimable soil for backfill in BWA; no scrap metal for recycling			
Scrap metal volume =	0 cy		
Reclaimed soil for backfill =	0 cy		
Residue for SWA placement =	190,000 cy		
To look at the height increase at the SWA, we will review the current size versus height relationship:			
Area =	997,524 sf		
Height = 10 to 15 ft above grade	Use	12 ft	
Vol. above grade (assuming no side slope)		443,344 cy	
Lower by 10% to account for some slope		399,010 cy	
Approximate volume per ft of height =		33,251 cy / ft	
The original estimate of residual placement			
could be assumed to increase the height by:	0.9 ft	8%	
The new estimate of residual placement			
could be assumed to increase the height by:	5.7 ft	48%	
<p>In both cases, this is probably the minimum the height would be increased since the residual waste volumes are in-place (bank) values. Expansion will occur upon excavation. Note also that the cap will increase both scenarios by approximately 2 feet.</p>			
<p>Although the height increases in both cases at different percentages, the assumption of 10% more materials is probably adequate in either case due to the FS level of estimation.</p>			
<p>No change from original 4b estimate.</p>			

Unit Cost Development Backup for Alternative #4b (Current)
Rose Hill Regional Landfill

Note that the only items included are those which could potentially change based on assumptions made.
 See FS for those items not included.

UNIT COST DEVELOPMENT	UNIT COST	UNIT	Comparison
ITEM	(\$ / unit)		of total costs for some items
[Increase all capping material quantities by 10% for Alternatives #4b & #5b due to waste placement from Bulky Waste Area]			
2.1 Vegetation			
Air seeding with mulch & fertilizer	\$0.35	/ sy	
[Basis: Danbury, CT Landfill, 1997]			
Quantity: Size of disposal area		110,836 sy	
2.2 Topsoil: 6"			
Spread conditioned topsoil 6" deep, 300 Hp dozer			
Total Bare Cost	\$3.50	/ sy	
[Basis: Danbury, CT Landfill, 1997]			
Quantity: Size of disposal area		110,836 sy	
2.3 Cover Layer: 18"			
Select granular fill borrow cost	[M&E estimate, 1997]	\$12.00	/ cy
Compaction, 18" with roller, 4 passes			
Backfilling 300' haul, sand & gravel			
Quantity: Size of disposal area x depth		55,418 cy	
2.4 Drainage Layer: Composite			
Drainage composite; hydr. conductivity = 10 cm/s		\$3.60	/ sy
[Carmo Environmental Systems, Inc., 1997]			
Quantity: Size of disposal area		110,836 sy	
2.5 Geomembrane			
60 mil LLDPE installed		\$0.43	/ sf
[Polyflex, Lou Jacobsen]			
Quantity: Size of disposal area		997,524 sf	
2.6 Low Permeability Layer: 12"			
Silt/Sand; hydr. conductivity = 1×10^{-4} cm/s		\$8.00	/ cy
[M&E Estimate, 1997]			
Quantity: Size of disposal area		36,945 cy	
2.7 Protective Layer: 6"			
Select granular fill borrow cost	[M&E estimate, 1997]	\$12.00	/ cy
Compaction, 6" with roller			
Backfilling 300' haul, sand & gravel			
Quantity: Size of disposal area x depth		18,473 cy	
2.8 Emergent Wetlands Replacement (1993 dollars)			
Assume similar to reference		\$50,000	/ acre
[Figure 1, King and Bohlen, 1994]			
Quantity: Emergent Wetland on Figures, GIS measured		0.1 acres	
GRADING & SITE PREP.: BULKY WASTE AREA			
No change from original 4b estimate.			

Unit Cost Development Backup for Alternative #4b (Current)
Rose Hill Regional Landfill

Note that the only items included are those which could potentially change based on assumptions made.
 See FS for those items not included.

UNIT COST DEVELOPMENT	UNIT COST (\$ / unit)	UNIT	Comparison of total costs for some items
ITEM			
3.1 Clearing & Grubbing See 1.1 Quantity: Use acreage of disposal area; Table 2-13	\$335	/ acre 7.4 acres	
3.2 Silt Fencing See 1.2 Quantity: Approximate perimeter of disposal area, measured from figures	\$2.00	/ ft 2,200 ft	
3.3 Drainage Ditches (None for LF Mining Alternatives) See 1.3 Quantity: Measured from figures	\$0.36	/ ft 1,100 ft	
3.4 Detention Basins (None basin for LF Mining Alternatives) Detention Basin #3 Excavation: Backhoe, hydraulic, crawler mtd., 1 cy capacity; 75 cy/hr [M&E estimate, 1997] Quantity: Basin volume in Appendix B Basin #3 484 cy Add 50% capacity	\$4.00	/ cy	
3.5 Fence: 8' Chain Link See 1.5 Quantity: Approximate, measured from figures	\$15.00	/ ft 2,600 ft	
CAPPING: BULKY WASTE AREA			
No change from original 4b estimate.			
4.1 Vegetation See 2.1 Quantity: Size of disposal area	\$0.35	/ sy 35,816 sy	
4.2 Topsoil: 6" See 2.2 Quantity: Size of disposal area	\$3.50	/ sy 35,816 sy	
4.3 Cover Layer: 18" See 2.3 Quantity: Size of disposal area x depth	\$12.00	/ cy 17,908 cy	
4.4 Drainage Layer: Composite See 2.4 Quantity: Size of disposal area	\$3.60	/ sy 35,816 sy	
4.5 Geomembrane See 2.5 Quantity: Size of disposal area	\$0.43	/ sf 322,344 sf	
4.6 Low Permeability Layer: 12" See 2.6 Quantity: Size of disposal area	\$8.00	/ cy 11,939 cy	

**Unit Cost Development Backup for Alternative #4b (Current)
Rose Hill Regional Landfill**

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UNIT COST DEVELOPMENT	UNIT COST	UNIT	Comparison of total costs for some items
ITEM	(\$ / unit)		
4.7 Gas Vent Layer: Composite See 2.4	\$3.60	/ sy	
Quantity: Size of disposal area x depth		35,816 sy	
4.8 Passive Gas Vents Vent Installation See 7.2	\$196	/ ft	
Quantity: 10 penetrating cap at 10' deep; Table 4-3		100 ft	
LANDFILL MINING			
Note that the costs used are not conservative. Refer to FS Appendix A for TM on LF mining. Costs were taken from current LF mining operations.			
Also note that scrap metal cost recovery in Final FS was erroneously summed as a cost rather than a reduction.			
5.1 Waste Removal and Segregation [Appendix A]	\$9	/ cy	
Old Quantity: Estimated Bulky Waste Area Vol		114,000 cy	\$1,026,000
New Quantity: Estimated Bulky Waste Area Vol (minimum)		190,000 cy	\$1,710,000
5.2 Scrap Metal Transport [Appendix A]	\$5	/ cy	
Old Quantity: Estimated Volume; Appendix A		37,500 cy	\$187,500
New Quantity: None found		0 cy	\$0
5.3 Transport Non-recyclables to Solid Waste Area [Appendix A]	\$1.50	/ cy	
Old Quantity: Estimated Volume; Appendix A		30,900 cy	\$46,350
New Quantity: See SWA capping information above		190,000 cy	\$285,000
5.4 Backfill With Reclaimed Soil [Appendix A]	\$2.15	/ cy	
Old Quantity: Estimated Volume; Appendix A		45,600 cy	\$98,040
New Quantity: See SWA capping information above		0 cy	\$0
5.5 Backfill With Clean Fill Fill consisting of common earth [M&E estimate, 1997] (Most of the fill is below grade)	\$11.00	/ cy	
Old Quantity: Assumed Volume; Appendix A		50,000 cy	\$550,000
New Quantity: Assumed Volume, not overly conservative		150,000 cy	\$1,650,000
5.6 Vegetation See 2.1	\$0.35	/ sy	
Old Quantity: Size of disposal area		35,816 sy	\$12,536
New Quantity: Size of disposal area		35,816 sy	\$12,536

**Unit Cost Development Backup for Alternative #4b (Current)
Rose Hill Regional Landfill**

Note that the only items included are those which could potentially change based on assumptions made.
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UNIT COST DEVELOPMENT			UNIT COST	UNIT	Comparison of total costs for some items
ITEM			(\$ / unit)		
5.7	Miscellaneous Allowances				
	[Appendix A]				
	Hazardous Waste Disposal	\$10,000		ls	
	Dewatering System	\$50,000		ls	
	Health & Safety Training, Equipment	\$37,000		ls	
	Total	\$97,000		ls	
			\$97,000	/ ls	
	Old Quantity: One lump sum			1 ls	\$97,000
	HW disposal and H&S training remain the same. Old dewatering assumption was for 3 extraction wells and 3 injection wells to lower water table in a small area. New dewatering should probably assume twice that, but without more time, we will leave it the same and note that the dewatering cost increase has not been included.				
	New Quantity: One lump sum			1 ls	\$97,000
5.8	Scrap Metal Revenue				
	[Appendix A]				
	Old Quantity: Appendix A; 37,500 cy metal x 800 lb/cy	30,000,000 lb		\$0.02 / lb	(\$600,000)
	New Quantity: None	0 lb			\$0
5.9	Supervision & Monitoring Labor				
	[Appendix A; assumption]				
	Old Quantity: Appendix A; 114,000 cy @ 1,000 cy/day	114 days		\$300 / day	\$34,200
	New Quantity: Appendix A; 190,000 cy @ 1,000 cy/day	190 days			\$57,000
INTERNAL LF GAS COLLECTION SYSTEM					
The only capital cost changes in this section will be in the increased length of the well pipe due to increased waste placement. Additional piping and fittings would be necessary for the time that the wellheads are above the area by 5 to 10 ft.					
Costs associated with any waste placement difficulties due to there being 36 wells (about 1 every 100 ft) are not included.					
7.1	Vault, Gauges, Fittings and Other Costs				
	Cost Per Well:				
	Precast Concrete Vault & Hatch Door Installed	\$3,625 per well		[M&E estimate, 1997]	
	LANDTEC 2" Accu-Flo 200 Vertical Wellhead	\$325 per well		[Landfill Control Technologies]	
	Well Head Installation	\$300 per well		[M&E estimate, 1997]	
	Total Cost	\$4,250 per well			
			\$4,250	/ well	
	Quantity: Number of wells; Section 3.1.8.3			36 wells	

Unit Cost Development Backup for Alternative #4b (Current)
Rose Hill Regional Landfill

Note that the only items included are those which could potentially change based on assumptions made.
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UNIT COST DEVELOPMENT			UNIT COST (\$ / unit)	UNIT	Comparison of total costs for some items
ITEM					
7.2 Screen, Casing and Other Well Footage Costs					
[Source: Final Report Evaluation of LFG Migration Barrier Systems, M&E, 1993]					
	11" O.D. boring for 4" well	\$110 per foot	[ENVEST]		
	Assume 2/3 of well depth is screened, 1/3 is unscreened				
	4" PVC, Schedule 40 well screen	\$25 per foot	[ENVEST]		
	x 2/3 =	\$17 per foot			
	4" PVC, Schedule 40 well casing	\$22 per foot	[ENVEST]		
	x 1/3 =	\$7 per foot			
	Well Filter Pack	\$44 per foot	[ENVEST]		
	x 2/3 =	\$29 per foot			
	Total Direct Cost	\$163 per foot			
	Add 20% Overhead & Profit	\$196 per foot		\$196 / ft	
	Old Quantity: Number of wells x assumed depth of 25 ft	900 ft			\$176,400
	New Quantity: Number of wells x assumed depth of 30 ft	1,080 ft			\$211,680
7.3 Header Pipe: HDPE					
Refer to the attached sketches for basis of quantities.					
7.3a	10" HDPE Header Pipe, buried	[M&E estimate, 1997]		\$27.60 / ft	\$13,800
	Quantity:	500 ft			
7.3b	8" HDPE Header Pipe, buried	[M&E estimate, 1997]		\$23.60 / ft	\$89,208
	Quantity:	3,780 ft			
7.3c	6" HDPE Header Pipe, buried	[M&E estimate, 1997]		\$18.50 / ft	\$53,465
	Quantity: 23 wells w/10' connectors (230'), 3 wells w/120' connectors (360'), 6 branch sections (2,300')	2,890 ft			
7.3d	"Blueboard" thermal insulation				
	1" thick by 3' wide	[M&E estimate, 1997]		\$1.50 / ft	\$10,755
	Quantity: Add 7.3a through 7.3c	7,170 ft			
7.3e	HDPE Tees 8" x 8" x 8", installed & buried	[M&E estimate, 1997]		\$310 / ea	\$6,200
	Quantity:	20 total			
7.3f	HDPE Tees 6" x 6" x 6", installed & buried	[M&E estimate, 1997]		\$250 / ea	\$5,500
	Quantity:	22 total			
					Old: \$178,928
					New: Assume 10% increase for temporary work above waste
					\$196,821
					This is assumed to account for increases in items below as well, but is probably low.
7.4 Valves & Appurtenances					
Refer to back-up attachments for 7.3					
7.4a	Buried butterfly isolation valves: 10"				
	Header pipeline, 10"	[M&E estimate, 1997]		\$2,000 / ea	
	Quantity:	1 total			
7.4b	Buried butterfly isolation valves: 8"				
	Header pipeline, 8"	[M&E estimate, 1997]		\$1,600 / ea	
	Quantity:	15 total			
7.4c	LANDTEC GEM-500 LFG analyzer	[Landfill Technologies, 1997 - attached]		\$6,395 / ls	
	Quantity:	1 ls			

Unit Cost Development Backup for Alternative #4b (Current)
Rose Hill Regional Landfill

Note that the only items included are those which could potentially change based on assumptions made.
 See FS for those items not included.

UNIT COST DEVELOPMENT		UNIT COST	UNIT	Comparison of total costs for some items
ITEM		(\$ / unit)		
7.5	Condensate Piping			
	Assume 1" HDPE Line	\$5.00	/ ft	
	[M&E estimate, 1997]			
	Quantity: Refer to backup for 7.3: Alts #3a to 4b		3,020 ft	
	Alts #5a & 5b (GW piping used for some)		1,470 ft	
7.6	Condensate Pump Stations			
	[M&E estimate, 1997]	\$50,000	/ ea	
	Quantity: Refer to backup for 7.3: Alts #3a to 4b		2 ea	
	Alts #5a & 5b		1 ea	
7.7	Condensate Storage Tank Allowance			
	[M&E estimate, 1997]	\$25,000	/ ea	
	Quantity: One required		1 ea	
ENVIRONMENTAL MONITORING: ANNUAL				
17.1	Five Year Review			
	[Assumed]	\$25,000	/ ea	
	Annual Quantity: Once every 5 years		0.20 ea	
17.2	Cap Inspection and Reporting			
	Assumed labor per quarterly event	\$2,500	/ ea	
	6 hrs @ \$60/hr			
	24 hrs @ \$85/hr			
	Misc. Exp. @ \$100			
	Annual Quantity: Quarterly		4 ea	
	New: Assume hours cut in half - no maintenance of BWA	\$1,300	/ ea	
17.3	Groundwater Monitoring - Sample Collection and Analyses			
	[9/16/96 calculation attached]	\$1,740	/ sample	
	Annual Quantity: [9/16/96 calc.] - All Alts. but 4b & 5b		51 samples	
	Alternatives #4b & #5b include a few more locations:			
	Year 1: 46 locations, 4 times per year		184 samples	
	Years 2-30: 24 locations, 2 times per year		1,392 samples	
	QA/QC @ 10% of total:		158 samples	
			<u>1,734</u>	
	Annual Quantity: Over 30 years		58 samples	
	New: Assume eight fewer monitoring locations (MW-03-01,-02,-03, MW-12-01,-02 and 3 extraction wells after year 5			
	Year 1: 46 locations, 4 times per year		184 samples	
	Years 2-5: 24 locations, 2 times per year		192 samples	
	Years 6-30: 16 locations, 2 times per year		800 samples	
	QA/QC @ 10% of total:		118 samples	
			<u>1,294</u>	
			43 samples	

**Unit Cost Development Backup for Alternative #4b (Current)
Rose Hill Regional Landfill**

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UNIT COST DEVELOPMENT		UNIT COST	UNIT	Comparison of total costs for some items
ITEM		(\$ / unit)		
17.4	SW/Sediment Monitoring [9/16/96 calculation attached]	\$2,710	/ sample	
	Annual Quantity: [9/16/96 calculation attached]		22 samples	
	No reduction in SW/Sed monitoring since it is not specific to BWA			
17.5	Ambient Air Monitoring [9/16/96 calculation attached]	\$1,690	/ sample	
	Annual Quantity: [9/16/96 calculation attached]		10 samples	
	New: Reduce number of samples by 2 for BWA		8 samples	
17.6	Soil Gas Monitoring [9/16/96 calculation attached]	\$83	/ sample	
	Annual Quantity: [9/16/96 calculation attached]		94 samples	
	New: Reduce number of samples by 1 for BWA		93 samples	
LANDFILL GAS COLLECTION AND TREATMENT				
By adding the BWA solid waste to the SWA, landfill gas generation will be increased in the area (which may assist in reducing auxiliary fuel costs, but may also increase length of time of operation) depending on the design. Assume no changes at this time.				
18.1	O&M Labor			
	[Source: PSG, Inc.]			
18.1a	Operator @ 1/2 shift/wk	\$49	/ hr	
	Annual Quantity:		1,040 hrs	
18.1b	Overtime @ 10%	\$65	/ hr	
	Annual Quantity:		104 hrs	
18.1c	Supervisory @ 10%	\$75	/ hr	
	Annual Quantity:		104 hrs	
18.1d	Administrative Costs	\$4,000	/ ls	
	Annual Quantity: One lump sum		1 ls	
18.2	Equipment Repair/Replacement [9/16/96 calculation attached]	\$56,476	/ ls	
	Annual Quantity: One lump sum per year		1 ls	
18.3	Electricity Usage Internal System Blower Assume \$0.07 / kWhr & 5 Hp	\$0.07	/ kWhr	
	Annual Quantity: 5 Hp x 0.7457 kW/HP @ 90% efficiency x 24 hrs/day x 365 days/yr		36,291 kWhr	
18.4	Electricity Usage Perimeter System Blower Assume \$0.07 / kWhr & 15 Hp	\$0.07	/ kWhr	
	Annual Quantity: 15 Hp x 0.7457 kW/HP @ 90% efficiency x 24 hrs/day x 365 days/yr		108,872 kWhr	

Unit Cost Development Backup for Alternative #4b (Current)
Rose Hill Regional Landfill

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 See FS for those items not included.

UNIT COST DEVELOPMENT	UNIT COST	UNIT	Comparison of total costs for some items
ITEM	(\$ / unit)		
18.5 Condensate Transportation: Internal System [Source: Final Report Evaluation of LFG Migration Barrier Systems, M&E, 1993] 5,000 gal per trip @ \$1,500 per trip (Updated from Jan. 1993 to 1997 costs by ENR indices) Annual Quantity: 77 cfm x 125/million cf (Section 3.1.8.2) 5,059 gal Flow from Appendix E	\$0.35	/ gal	
18.6 Condensate Transportation: Perimeter System See 18.5 Annual Quantity: 812 cfm x 125/million cf (Section 3.1.8.2) 53,348 gal Flow from Appendix E	\$0.35	/ gal	
18.7 Condensate Disposal: Internal System [Source: Final Report Evaluation of LFG Migration Barrier Systems, M&E, 1993] (Updated from Jan. 1993 to 1997 costs by ENR indices) Annual Quantity: See 18.5 5,059 gal	\$1.44	/ gal	
18.8 Condensate Disposal: Perimeter System See 18.7 Annual Quantity: See 18.6 53,348 gal	\$1.44	/ gal	
18.9 Auxiliary Fuel Usage [Appendix E] Annual Quantity: [Appendix E] - Basis 15-year average 774,034 cf	\$0.02	/ cf	
18.10 Photocatalytic Oxidation Operations & Maintenance Includes electricity, bulb & catalyst replacement [Appendix A; Range: \$900 to \$4,500 per month; use \$2,318] Annual Quantity: One lump sum 1 ls	\$27,816	/ ls	
GW/LEACHATE COLLECTION & TREATMENT: 50 GPM			
No change			
19.1 O&M Labor [Source: PSG, Inc.]			
19.1a Operator @ 1/2 shift/wk Annual Quantity: 1,040 hrs	\$49	/ hr	
19.1b Overtime @ 10% Annual Quantity: 104 hrs	\$65	/ hr	
19.1c Supervisory @ 10% Annual Quantity: 104 hrs	\$75	/ hr	
19.1d Administrative Costs Annual Quantity: One lump sum 1 ls	\$4,000	/ ls	
19.2 Feed Chemicals [9/16/96 calculation attached] Annual Quantity: 50 gpm 26,280,000 gal	\$2.00	/ 1,000 gal	
19.3 Equipment Repair/Replacement [9/16/96 calculation attached] Annual Quantity: One lump sum per year 1 ls	\$42,276	/ ls	

Unit Cost Development Backup for Alternative #4b (Current)
Rose Hill Regional Landfill

Note that the only items included are those which could potentially change based on assumptions made.
 See FS for those items not included.

UNIT COST DEVELOPMENT		UNIT COST (\$ / unit)	UNIT	Comparison of total costs for some items
ITEM				
19.4	Electricity Usage: Collection Assume \$0.07 / kWhr	\$0.07	/ kWhr	
	Assume 2 submersible pumps @ 1 Hp each			
	Annual Quantity: 2 x 1 Hp x 0.7457 kW/HP x 24 hrs/day x 365 days/yr @ 90% motor effic.		14,516 kWhr	
19.5	Electricity Usage: Treatment [9/16/96 calculation attached]	\$1.65	/ 1,000 gal	
	Annual Quantity: 50 gpm		26,280,000 gal	
19.6	Disposal of Residuals [9/16/96 calculation attached]	\$1.01	/ 1,000 gal	
	Annual Quantity: 50 gpm		26,280,000 gal	
LEACHATE COLLECTION & TREATMENT: 5 GPM				
20.1	O&M Labor [Source: PSG, Inc.]			
20.1a	Operator @ 1/2 shift/wk Annual Quantity:	\$49	/ hr	
			1,040 hrs	
20.1b	Overtime @ 10% Annual Quantity:	\$65	/ hr	
			104 hrs	
20.1c	Supervisory @ 10% Annual Quantity:	\$75	/ hr	
			104 hrs	
20.1d	Administrative Costs Annual Quantity: One lump sum	\$4,000	/ ls	
			1 ls	
20.2	Feed Chemicals [9/16/96 calculation attached]	\$0.70	/ 1,000 gal	
	Annual Quantity: 5 gpm		2,628,000 gal	
20.3	Equipment Repair/Replacement [9/16/96 calculation attached]	\$14,967	/ ls	
	Annual Quantity: One lump sum per year		1 ls	
20.4	Electricity Usage: Collection Assume \$0.07 / kWhr	\$0.07	/ kWhr	
	Assume 1 submersible pump @ 1 Hp			
	Annual Quantity: 1 x 1 Hp x 0.7457 kW/HP x 24 hrs/day x 365 days/yr @ 90% motor effic.		7,258 kWhr	
20.5	Electricity Usage: Treatment [9/16/96 calculation attached]	\$0.55	/ 1,000 gal	
	Annual Quantity: 5 gpm		2,628,000 gal	
20.6	Disposal of Residuals [9/16/96 calculation attached]	\$0.35	/ 1,000 gal	
	Annual Quantity: 5 gpm		2,628,000 gal	
INSTITUTIONAL CONTROLS: ANNUAL COSTS				
21.1	Groundwater Access Restrictions Not Applicable			
21.2	Not Used			

**Unit Cost Development Backup for Alternative #4b (Current)
Rose Hill Regional Landfill**

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UNIT COST DEVELOPMENT	UNIT	UNIT	Comparison
ITEM	COST (\$ / unit)		of total costs for some items
21.3 Not Used			
21.4 LFG Control Contingency (Annual Inspections) Assumed Maintenance Allowance [1996] Annual Quantity: 4 potential houses		\$500 / house	
		4 houses	