Planning-Level Cost Estimates for Landfill Options

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This memorandum provides background for planning-level cost estimates of two landfill options: 1) transfer waste from East Hawai`i to the West Hawai`i Sanitary Landfill (WHSL) and 2) expanding the South Hilo Sanitary Landfill (SHSL) in two phases, with the first phase consisting of a 7-acre lateral expansion of the existing landfill, and the second phase consisting of expanding the landfill into quarries adjacent to the SHSL site. It is intended to outline the rationale and assumptions for each option and assist the County in decision making about long-term disposal options.

The cost estimates are shown on a per-ton basis for managing the waste currently disposed of at the County's SHSL. An analysis of the County's budget resulted in an estimated per-ton cost of landfilling at the SHSL of $57.64 per ton in 2007-08. The estimated per-ton disposal cost of each landfill option follows, with a high-low cost range shown for the new landfill development options.

	Per-ton Cost (2009$)	
Landfill Options	**Low**	**High**
Transfer waste from East Hawai`i to the WHSL	$82	
7-acre lateral expansion of SHSL	$82	$94
Expand SHSL into Quarries	$69	$73

1. Transfer Waste from East Hawai`i to the WHSL

As shown in Exhibit 1, the estimated cost of transferring waste from East Hawai`i for disposal at the WHSL is $82 per ton.

EXHIBIT 1
Cost Summary – Transfer Waste from East Hawai`i to the WHSL

Cost Element	2009 Dollars per ton
Transfer Station Operations	$11.00
Transportation	$24.00
Landfill Cost	$47.00
Total	$82.00

For comparison, Table 3.2 of the 2004 Sort Station EIS[1] estimated the per-ton cost of transfer, transport, and disposal at $7.21, $18.83 and $34.83, respectively, for a per-ton total of $58.86. Escalating those costs from 2003 to 2008 using Engineering News Record's Construction Cost Index, would increase that estimate by 29 percent to $75.93 per ton, or about 7 percent less than the estimate shown in Exhibit 1.

Planning-level operating costs for a transfer operation at the SHSL Sort Station are presented in Exhibit 2. These costs include an estimate of the labor (FTEs) and equipment necessary to operate the station.

The estimated cost of transporting waste from the Sort Station to the WHSL is shown in Exhibit 3. These estimates are based on a trucking cost model used by CH2M HILL on recent similar projects, with input parameters adjusted to reflect specific conditions that apply in Hawai`i County. The estimate also includes an adjustment to account for the assumption that waste would be hauled directly from the Pahoa Recycling and Transfer Station to the WHSL instead of to the SHSL for transfer; this cost adjustment is based on the County's 2007-08 actual per-mile trucking cost. Exhibit 4 presents the assumptions used to estimate the number of tractor trailers needed for the trucking operation.

The estimated variable per-ton cost for landfilling at the WHSL is calculated based on actual 2007-08 costs as shown in Exhibit 5. It was assumed that no additional County staff would be needed at the WHSL to accommodate the increase in waste from East Hawai`i. Should additional workers be required, the unit costs would be higher than shown.

Other cost considerations relevant to this option that are not included in these cost estimates include:

- No costs have been included for environmental review, transportation improvements or mitigation. Depending on the transportation route selected from the Sort Station to the WHSL, and the number and types of permits and studies required, it's possible that additional costs would be incurred to address these considerations.
- Landfilling waste from East Hawai`i at the WHSL will shorten the life of that landfill. Long-term disposal forecasts (that take into account population and employment growth and the effect of planned diversion programs) are that the WHSL has an additional 38 years of capacity remaining[2]. If waste from East Hawai`i is added starting in 2013-14 (the time when the SHSL is likely to close if it is not expanded), the WHSL's capacity would be exhausted in 27 years, or 11 years sooner.

[1] County of Hawai`i. 2004. *Final Environmental Impact Statement*, *Construction and Operation of the East Hawai`i Regional Sort Station.*

[2] The County is currently investigating options to extend the years of remaining capacity at the WSHL. These options would be evaluated as part of the WHSL master plan proposed for implementation as part of this ISWMP Update.

EXHIBIT 2
Transfer Station Operating Cost

				Notes
Typical Annual Tonnage	80,000			
TS Operating hours				
per year	3,801			10.5 hours per day
per week	73			
Days per year	362			
tons per day	221			Annual tons / 362
Peak hour tons	44			Conceptual "rule of thumb" - 20 percent in peak hour
Peak hour trailers	2			Assumes 18 tons per trailer
Blended Labor rate				
Site attendants	$49,885			2008-09 cost times 36 percent benefits (percent estimated from actuals)
Equipment operator	$62,206			2008-09 cost times 36 percent benefits (percent estimated from actuals)
Staffing				CH2M HILL Estimates
Trailer Shuttle	1	$62,206	$62,206	
Dozer	1	$62,206	$62,206	
Site attendant at main building	2	$49,885	$99,770	
Scale attendant	1	$62,206	$62,206	
Extra FTE for illness/vacation	0.4		$22,030	
Total Staff	5.4		$308,419	
Multiplier for >40 hours per wk	1.8			
Total FTEs	10.0		$563,606	
Annual staffing			$563,606	
Non-labor percent			60 percent	CH2M HILL estimate for this type of facility
Non-labor cost			$338,163	Equipment replacement and operations, fuel, insurance, utilities, general site maintenance
Total			$900,000	
$/ton disposed			$11.25	Total / tons per year
Staff per operating hour			5.5	Avg number of staff on-site at one time

EXHIBIT 3

Trucking Cost Estimate

Operating Assumptions	
Origin Location	SHSL
Destination	WHSL
Miles (one way)	77.5
Average Miles per Hour	40
Workdays per Week	7
Annual Workdays	362
Monthly Tons through the T/S	6,682
Annual Trips	4,455
Average Tons per Trip	18
Compacted / Uncompacted Loads	Uncompacted
Average Loading Time	20
Average Unloading Time	20
Average Roundtrip Time	3.88
Total Time per Trip	4.54
Loads per day	12
Labor Assumptions	
Non-driving percent	0 percent
Driver hours per day	56
Hostler hours per day	0
Total hours per day	56
Driver Annual Wage	$45,740
Loaded Driver Percentage	36 percent
Fuel Cost	
Fuel MPG	5.0
Diesel Cost per Gallon	$4.00
Repair & Maintenance	
Truck Cost per Mile	$0.30
Trailer Cost per Mile	$0.22

Equipment Cost	
Tractor (truck) Make and Model	County Actuals
Number of Tractors in the Fleet	7.0
Annual Lease	$24,000
Total Tractor Cost	$168,000
Trailer Make and Model	Tri-axle Trailer
Number of Trailers in the Fleet	14
Annual Lease	$11,000
Total Trailer Financed Cost	$154,000
Total Tractor and Trailer Lease	$322,000
Required Tractor Quantity	7.0
Required Trailer Quantity	14
Licenses & Taxes	
State Highway Use Tax	n.a.
State	Hawai`i
Rate per mile	n.a.
State An. Registration (per truck)	n.a.
Federal Hwy Use Tax (per truck)	$550
Insurance (per truck per year)	$1,000
Annual Insurance	$7,000
Operational Assumptions	
SG&A Overhead Percentage (SG&A is Sales / Mgmt / Admin / Dispatch)	0 percent
Profit Margin Percentage	0 percent
Interest Rate	5.00 percent

	Annual Cost per Truck	**Annual Trucking Costs**	**Cost per Ton**	**Cost per Mile**
Truck	$24,000	$168,000	$2.10	$0.49
Trailer	$11,000	$154,000	$1.92	$0.45
Labor		$605,060	$7.55	$1.75
Fuel		$552,374	$6.89	$1.60
R&M		$359,043	$4.48	$1.04
Insurance		$14,000	$0.17	$0.04
License & Fees		$0	$0.00	$0.00
G&A		$0	$0.00	$0.00
Profit		$0	$0.00	$0.00
Total		$1,852,478	$23.10	$5.37
Direct haul from Pahoa TS to WHSL		$106,000		
Total tons			81,487	
Total per ton cost			$24.03	

EXHIBIT 4
Estimated Number of Tractors Needed to Haul to WHSL

Origin Location	SHSL
Destination	WHSL
Miles (one way)	77.5
Average speed (miles per hour)	40
Workdays per week	7
Annual workdays	362
Monthly tons throughput	6,682
Average tons per trip	18
Compacted / Uncompacted Loads	Uncompacted
Average loading time (mins.)	20
Average unloading time (mins.)	20
Average roundtrip driving time	3.9
Total time per trip (hrs.)	4.54
Hrs per day of tractor operations	10
Trips per truck/day	2.20
Spare	1.0
No. of tractors needed per shift	6.6

EXHIBIT 5
Estimated Variable Landfilling Cost at the WHSL

	$ per ton
Contract costs	$42.97
Contract escalation	$0.97
Fuel	$1.59
Parts	$1.73
Total variable cost	$47.26

2. SHSL Expansion

The cost of expanding the South Hilo Sanitary Landfill is less certain than the cost of transporting waste to the WHSL. Thus discussion of this option is based upon certain assumptions regarding feasibility, and the cost estimates as presented have some degree of uncertainty. Additional analysis would be needed to further refine the cost estimates and confirm the feasibility of this option.

Expansion of the SHSL could potentially be accomplished in two separate phases: first, a 7-acre lateral expansion to the northwest; and second, a larger-scale expansion into rock quarries located adjacent to the southeast perimeter of the site. A discussion of the two possible expansion areas follows.

Seven-Acre Lateral Expansion to the Northwest

It is assumed that the initial expansion would occur on a 7-acre vacant land parcel which borders the SHSL to the northwest. It was initially assumed that expansion into this area

would also allow the County to increase the elevation of a portion of the existing landfill, and an initial estimate of the capacity that would be added by this expansion is just less than 2 million cubic yards[3]. At 2007-08 fill rates (about 250,000 cubic yards per year), this would have provided about 8 years of added capacity. However, the County recently received an unfavorable opinion from the Federal Aviation Administration that would limit the extent to which the SHSL could be expanded vertically. Thus, it is now anticipated that the lined expansion on this parcel would provide only an additional 4 years of capacity.

State and federal regulations (Hawai'i Administrative Rules [HAR], Title 11, Chapter 58.1 and 40 CFR 258.48) require that all new landfills be constructed with a waste containment system consisting of a bottom liner with leachate collection and recovery system. The liner system would consist of two layers of heavy duty plastic geomembrane, placed above and below a geosynthetic clay liner. The bottom of the new landfill cell would also have an engineered drainage layer. In addition, an expansion of the County's existing groundwater monitoring program would probably be required.

Estimated Capital Cost

The estimated construction cost for the 7-acre lined cell is $3.2 million[4]. To this estimate must be added the cost of a leachate collection and treatment system, a landfill gas collection system, and added groundwater monitoring. In regions with high annual precipitation rates higher volumes of leachate are produced and must be managed. In response, Hawai`i County should consider taking steps to actively reduce the volume of leachate generated in the lined expansion by maintaining a system of plastic membranes and tarps to cover the waste. When the waste is covered by membranes or tarps, infiltration of precipitation can be mitigated and runoff can be managed as storm water.

Even with the use of membrane and tarp covers, leachate will be generated that requires treatment. Leachate that collects on the landfill liner would be pumped out of the cell, and then treated prior to discharge. Treatment options include treatment at the local wastewater treatment plant (WWTP) near the Hilo Airport, and treatment using constructed wetlands. Treating leachate at the WWTP would be costly because it would involve either constructing a lengthy pipeline or trucking leachate to the WWTP. Further, the County wastewater division prefers that other options be considered for leachate treatment: thus, the County investigated the feasibility of wetlands treatment. An initial feasibility evaluation indicated that wetlands treatment could effectively treat the leachate[5]. Additional assessment has been completed since the initial evaluation, resulting in a range of cost estimates for the use of constructed wetlands for leachate treatment. Estimated costs for leachate treatment using constructed wetlands for leachate treatment for four scenarios are presented in Exhibit 6.

[3] "South Hilo Sanitary Landfill Proposed Expansion Feasibility and Capital Cost Estimate". 2008. SWT Engineers.

[4] ibid. plus 10 percent engineering and 8 percent permitting.

[5] CH2M HILL. 2008. *South Hilo Sanitary Landfill Leachate Quality Improvement Using Treatment Wetlands – High Level Sizing and Cost Opinion*. Technical Memorandum to SWT Engineering.

EXHIBIT 6
Estimated Capital Cost of Constructed Wetland Leachate Treatment at SHSL

					Surface Flow Wetland		Vertical Subsurface Flow Wetland	
Scenario	Cover Scenario	Fill Plan	Design Flows	Equaliz-ation Tank (gallons)	Wetland Size (acres)	Capital Cost	Wetland Size (acres)	Capital Cost
1	Aggressive: 60 percent cover	Three 15-foot lifts	Avg annual - 5.5 gpm	60,000	1.2	$1,610,000	0.2	$1,801,000
2	Moderate: 35 percent cover	Three 15-foot lifts	Avg annual - 8.9 gpm	60,000	1.5	$1,983,000	0.3	$1,956,000
3	No cover	One 15-foot lift	Avg annual - 13.5 gpm	60,000	2.3	$2,261,000	0.6	$2,398,000
4	No cover	One 15-foot lift	Peak monthly - 82 gpm	300,000	10	$6,677,000	1.8	$4,847,000

Source: CH2M HILL, 2009.

As shown in Exhibit 6, at this level of analysis there are a number of uncertainties about the sizing and cost of using constructed wetlands for leachate treatment. Wetland sizing depends on contaminant and hydraulic loading rates. Contaminant loading rates for the short-term expansion into the 7-acre parcel are unknown, but were assumed using a combination of data from "wet" landfills in Oregon and Alaska and existing data from a landfill on Oahu[6]. Based on data from a high-rainfall landfill in Unalaska, Alaska, contaminant loading rates were decreased by 50 percent during peak flows to account for dilution. The contaminant loading used in this analysis is likely to be conservative because actual dilution from rainfall at the SHSL may be higher. Because the exact data for contaminant loading is unknown, it is not certain at this stage whether smaller size wetlands would provide sufficient residence time for treatment.

Hydraulic loading refers to the rate of leachate generation in the landfill liner. Leachate flow rate depends on liner area, climate inputs (e.g., rainfall and evaporation), cover used during operations to divert storm water, and thickness of in-place waste. The design flows for the scenarios shown in Exhibit 6 were estimated using the EPA HELP model[7]. Application of more membrane and tarps to divert storm water has the potential to decrease leachate generation and require a smaller wetland footprint for treatment. The most conservative estimate for wetland sizing and cost is Scenario 4 with no cover to divert storm water, a single 15-foot lift of waste in place over the entire cell, an equalization tank sized to accommodate the 10-year peak daily flow, and wetlands sized to accommodate peak monthly precipitation yielding a high leachate flow rate of 82 gpm. Less conservative

6 County of Hawai`i. 2004. *Final Environmental Impact Statement, Construction and Operation of the East Hawai`i Regional Sort Station.*

7 CH2M HILL. 2008. *Estimate of Leachate Generation Rate for Proposed Lined Lateral Expansion of Hawai`i County's Hilo Landfill.* Technical Memorandum to SWT Engineering.

scenarios assume more cover and the associated diversion of storm water, less generation of leachate, a smaller equalization tank, and smaller wetland sizing and the associated costs.

Wetland sizing also depends on regulatory endpoints and compliance frequency. More stringent regulatory requirements typically require higher residence time in the treatment wetlands and larger size and cost. The wetlands treatment option assumes surface discharge of treated leachate and subsequent infiltration and migration to groundwater. Testing of treated effluent would be conducted to confirm regulatory requirements prior to discharge, and groundwater monitoring would be conducted to confirm that leachate discharge is not negatively impacting the shallow aquifer.

For planning purposes it was assumed that leachate discharged from wetlands would contain lower concentrations of contaminants than are presently discharged in leachate infiltrating the subsurface from the existing unlined landfill. Leachate discharge regulatory criteria assumed for the current sizing are as follows: less than 200 milligrams per liter (mg/L) biological oxygen demand (BOD5), less than 25 mg/L total suspended solids (TSS), and less than 10 mg/L ammonia-nitrogen (NH4-N) and nitrate+nitrite- nitrogen (NOx-N). If actual regulatory endpoints are stricter than this, then required wetland size and cost would increase. Similarly, if monthly average compliance is permitted, then required size and cost would be smaller than if daily compliance is mandated.

Potential additional steps to evaluate regulatory compliance issues, and how they affect wetland size and design would include the following:

- Conduct a more thorough evaluation of contaminant loading for the potential lined expansions of the SHSL.
- Conduct modeling of specific treatment wetland processes to select minimum size treatment area.
- Meet with staff from the State of Hawai`i Department of Health Environmental Management Division, Clean Water Branch to evaluate regulatory requirements and discharge criteria for wetlands leachate treatment.

The lined expansion would require a system to collect and manage landfill gas. The type of system, active or passive, would depend on the landfill gas system selected for the unlined portion of the landfill and a series of other factors. Thus, Exhibit 7 includes a passive control system as a low estimate, and an active control system as a high estimate. The estimate is only for the 7-acre expansion to the northwest of the existing landfill.

Operations and Maintenance Costs

In is anticipated that County staff levels for day-to-day operations would be similar to its current operations. O&M costs expected to increase include costs associated with diverting rainfall from waste, managing leachate, and additional monitoring and regulatory compliance.

In Scenario 2 of Exhibit 6, it is assumed that capital costs to procure tarping, and labor costs for one extra FTE would be required. In Scenario 4, it is assumed that no extra effort would be made to divert rainfall from waste.

Estimated additional annual costs for pumping leachate, groundwater monitoring, and a weekly walk through of the wetlands treatment system are $100,000 in Scenario 2 and $200,000 for Scenario 4.

EXHIBIT 7
Landfill Gas Cost Estimates

328,000	Tons from 7-acre expansion
0.46	Tons per cubic meter
150,464	Cubic meters from 7-acre expansion
0.00047	SCFM per cubic meter
70.95901	SCFM
Low - Passive System	
$0.31	$ per cubic meter (escalated for Hawai`i with 10 percent engineering)
$47,000	Landfill gas cost for 7-acre expansion
$4,700	Annual O&M (10 percent of capital)
High - Active System	
Collection system	
$0.60	$ per cubic meter (escalated for Hawai`i with 10 percent engineering)
$90,000	Landfill gas collection system cost for 7-acre expansion
Flare system	
$600,000	$ per 1,000 scfm
$123,000	Flare system capital cost for 7-acre expansion
Total Active System	
$213,000	Sum of collection system and flare system costs
$21,000	Annual O&M (10 percent of capital)

Source: CH2M HILL, 2009.

Periodic major maintenance of the wetland treatment system would be required, which could include replacing the equalization tank, reconstruction or cleanout of wetland cells, and/or development of a new infiltration basin. These costs are estimated to occur approximately every 6 years at a cost of $250,000 for Scenario 2 and about $900,000 for Scenario 4.

Finally, it is estimated that three new monitoring wells would be constructed at a cost of $15,000 per well. Based on current County monitoring costs, it is assumed that it would cost an additional $7,500 per well annually, for a total of $22,500 per year in additional groundwater monitoring costs.

Closure and Post-Closure Costs

The SWT report (Table 3) estimates the added closure cost for the 7-acre extension of $1,156,000. Post-closure cost estimates are shown in Exhibit 8: the low estimate assumes passive landfill gas collection, and the high estimate assumes active landfill gas collection. When the extension is closed, it is assumed that any residual leachate would be treated along with leachate from the expansion into the quarries, with the costs included as part of that expansion.

EXHIBIT 8
Post-closure Cost Estimates for 7-Acre Expansion

Item	Qty	Unit	Unit cost	Annual cost Low	Annual cost High
Inspections	7	acre	$260	$2,000	$2,000
Final cover	7	acre	$1,300	$9,000	$9,000
Surface water management	7	acre	$1,300	$9,000	$9,000
Vegetation	7	acre	$390	$3,000	$3,000
Gas management				$5,000	$21,000
Environmental monitoring					
groundwater	3	wells	$7,500	$23,000	$23,000
landfill gas	7	acre	$780	$5,000	$5,000
leachate	7	acre	$260	$2,000	$2,000
stormwater	7	acre	$260	$2,000	$2,000
Inspections	7	acre	$260	$2,000	$2,000
Total				$55,000	$71,000

Source: CH2M HILL, 2009.

Per ton costs of 7-Acre Expansion

A low and high range of per-ton costs for the 7-acre expansion is shown in Exhibit 9. As shown, the costs are expected to range from between $82 and $94 per ton for approximately 4 years of added capacity.

EXHIBIT 9
Per-ton Costs of 7-Acre Expansion (2009$)

	Low	High
Capital Costs (7-acre cell only)		
Expansion - construction	$3,200,160	$3,200,160
Leachate treatment system (wetlands) construction	$1,956,000	$4,847,000
Landfill gas collection	$47,000	$213,000
Groundwater wells	$45,000	$45,000
Closure	$1,156,000	$1,156,000
Total Capital Cost	$6,404,160	$9,461,160
O&M Costs (7-acre cell only)		
Landfill stormwater management	$60,000	$0
Leachate O&M	$100,000	$200,000
Leachate treatment upgrades (annual)	$42,000	$103,000
Added groundwater monitoring	$23,000	$23,000
Annual post closure care[a]	$277,000	$333,000
Total O&M Cost	$502,000	$659,000
Total capacity of expansion (tons)	328,000	328,000
Added per ton costs		
Capital	$19.52	$28.85
O&M	$6.12	$8.04
Total	$25.65	$36.88
Current (2007-08) per ton cost	$56.74	$56.74
Estimated per-ton cost of SH Lateral Expansion	$82.39	$93.62

[a]Assumes all funds are collected up front prior to closure and invested in a fund that is drawn down to zeor over a 30-year period (i.e., a sinking fund).

The estimates assume that all funds for post-closure are collected up front in a sinking fund where the funds collect interest, and are then paid out during the 30-year post-closure period. While the County would probably fund post-closure differently, this approach is conservative. The costs shown are conservative because it is assumed that all costs would be spent at once, whereas the costs of post-closure (and the landfill gas system) would not be spent until the expansion is at capacity. In other words, the County could set aside a smaller sum into an interest-bearing account, and then spend them when needed.

Expansion into the Quarries at the SHSL Site

If constructed, the 7-acre expansion to the northwest of the current SHSL would provide capacity until approximately 2016-17. At that time, the County would need new landfill capacity for residuals from East Hawai`i. Hawai`i County owns several parcels of land currently used for quarry operations southeast of the existing landfill. The 75-acre quarry site is slightly larger than the existing landfill footprint. Preliminary estimates are that development of this quarry site for future landfill operations would provide 47 years of capacity beginning in 2017-18 when the 7-acre expansion is full[8].

This larger expansion area would be constructed and operated using the same assumptions noted above for the 7-acre northwest expansion (i.e., it assumes a liner system, constructed wetlands for leachate treatment, additional groundwater monitoring wells, an active landfill gas management, active stormwater management to minimize leachate production, and final closure and post-closure monitoring).

It is assumed that the landfill would be operated as a series of 7-acre cells. When each cell is at capacity, it would be closed on an interim basis to minimize leachate generation. Thus, it is assumed that the constructed wetlands developed for the 7-acre northwest expansion would be of sufficient size to accommodate leachate generated from the larger expansion to the southeast. It is assumed that the existing groundwater monitoring network would provide adequate coverage in the downgradient direction from the quarry expansion area, and that new monitoring wells would be needed along the east and west perimeter and upgradient edges of the new cells. It is assumed that the landfill would eventually have an active landfill gas management system. Operations are assumed to be similar to what was assumed for Scenario 2 (Exhibit 6) for the 7-acre expansion (i.e., active steps would be taken to minimize leachate generation).

It should be noted that no engineering analysis has yet been conducted for the quarry site. Thus, contingencies of 15 percent for the low estimate and 30 percent for the high estimate have been added to the capital costs to account for unknown conditions that could result in cost increases. In addition, expanding to the southeast into the quarry site would require a successful outcome of the State Land Use Boundary Amendment and County Zoning processes, completion of an Environmental Impact Statement, and resolution of Department of Health permitting issues.

The estimated costs of landfilling in the quarry site are shown in Exhibit 10.

[8] This estimate accounts for growth in population and employment and assumes planned diversion programs in this ISWMP Update are implemented. The life of the landfill would increase if additional diversion programs are implemented in future ISWMP updates.

EXHIBIT 10
Per-ton Costs of Landfilling in Quarry Site (2009$)

Capital Costs	Low	High
Expansion – construction	$34,287,000	$34,287,000
Leachate treatment system expansion	$450,000	$700,000
Landfill gas collection	$11,212,000	$11,212,000
Groundwater wells	$135,000	$135,000
Closure	$12,386,000	$12,386,000
Add contingency (15 percent/30 percent)	$6,825,000	$13,650,000
Total Capital Cost[a]	$65,362,000	$72,580,000
O&M Costs		
Landfill stormwater management	$60,000	$0
Leachate O&M	$100,000	$200,000
Leachate treatment upgrades (annual)	$42,000	$103,000
Added groundwater monitoring[b]	$34,000	$34,000
Annual post closure care[c]	$99,000	$99,000
Total O&M Cost	$335,000	$436,000
Total capacity of expansion (tons)	7,905,700	7,905,700
Added per ton costs		
Capital	$8.27	$11.22
O&M	$4.09	$5.32
Total	$12.35	$16.54
Current (2007-08) per ton cost	$56.74	$56.74
Estimated per-ton cost of SH Lateral Expansion	$69.03	$73.28

[a]Costs would be spent over the life of the facility as new cells are opened; closure costs would be spent once the landfill is at capacity.

[b]Midpoint of annual costs over life of landfill as wells are progressively installed.

[c]Assumes all funds are collected up front prior to closure (sinking fund).