

12.1.3 Design of a Medical Disposal Site

a. Preliminary design

a.1 Outline of the Medical Disposal Site

The outline of the alternative plan is the same as the master plan. The outline of the preliminary design for the proposed medical disposal site is shown in the table below.

Table 12-3: Outline of the Medical Disposal Site in Sofulu

Items	Description
Land Area	Total Area : 3ha
Landfill Volume	Capacity : 48,000m ³
	Disposal Period : 2002-2009

a.2 Capacity of Medical Disposal Site and Disposal Period

The capacity and the economic life of the final disposal site in this alternative plan shall be the same as the master plan project. The medical waste amount generated and the final disposal amount are shown in the following table.

Table 12-4: Final Disposal Amount

Item	unit	formula	2,002	2003	2004	2005	2006	2007	2008	2009
Waste discharge amount	ton/day	a	5.2	5.5	5.8	6.2	6.5	6.8	7.2	7.6
	ton/year	b=ax365	1,898	2,008	2,117	2,263	2,373	2,482	2,628	2,774
Waste + Cover soil	m ³ /year	c=bx1.5/0.7	4,881	5,163	5,444	5,819	6,102	6,382	6,758	7,133
Total	m ³	c	4,881	10,044	15,488	21,307	27,409	33,791	40,549	47,682

a.3 The Impermeable Strata of the Medical Waste Landfill

The structures of the top cover, the bottom, and the slope structure are as follows:

- Top cover : same as the master plan proposal.
- Bottom :impermeable clay layer ($K = 10^{-8}$ to 10^{-9} m/sec) should act as a liner.
- Slope :impermeable layer will be mortar +HDPE. The cross sectional gradient will be: cutting slope 1:1; and filling slope 1:3.

The landfill's impermeable strata of the top cover, the bottom, and the slope are shown in the following figures.

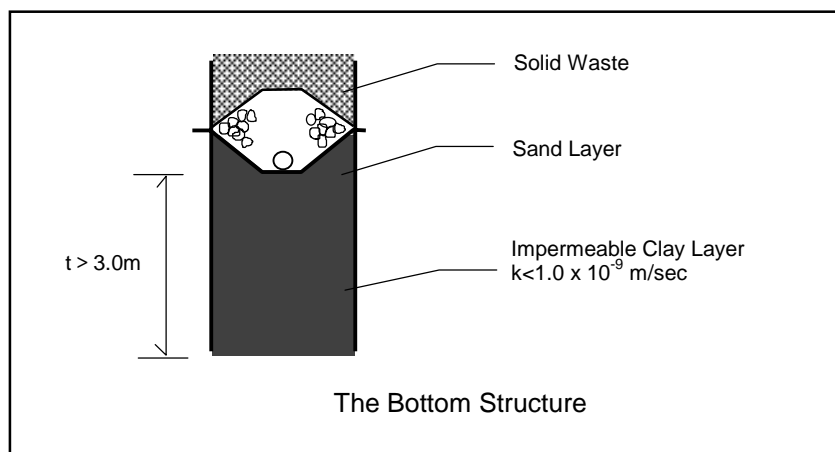
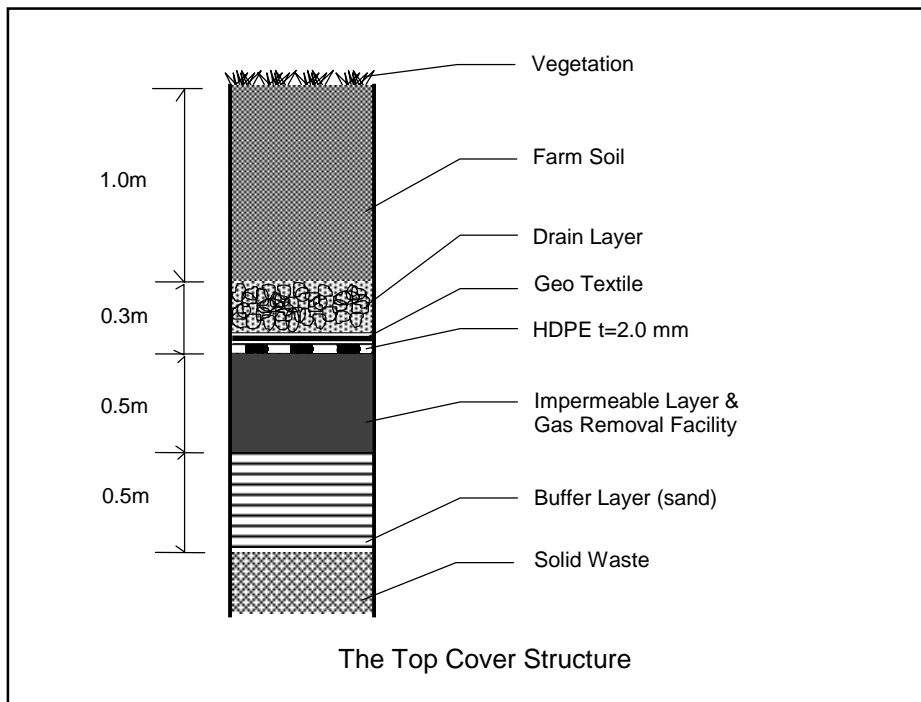
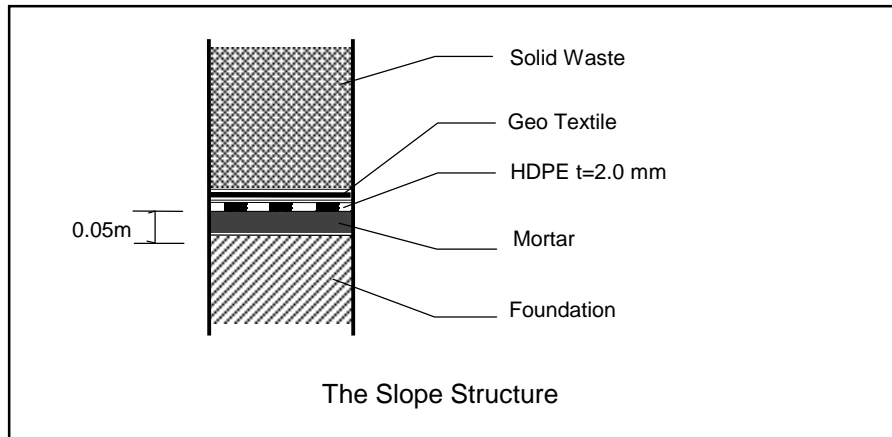


Figure 12-5: Diagrams of the Landfill's Impermeable Strata (Slope, Top Cover, and Bottom)

A typical cross section of slope of medical disposal site is shown in the following figure.

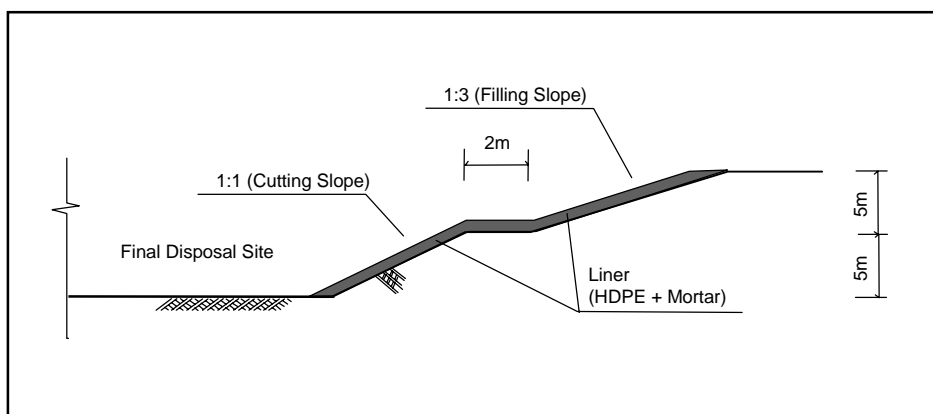


Figure 12-6: Typical Section of Slope with a Liner (HDPE+Mortar)

b. Leachate Control Facility

The leachate control facility will be the same as the master plan proposal.

12.1.4 Cost Estimation

a. Final Disposal Site

The alternative plan and the master plan's disposal site construction costs are compared and tabulated as follows.

Table 12-5: Comparison of Disposal Site Construction Costs

Item	M/P US\$ 1,000	A/P US\$ 1,000
Control Facilities and Approach road	721	721
Phase 2 MSW Landfill Site	5,315	4,008
Sub Total	6,036	4,729
Miscellaneous 10%	604	473
Direct Cost	6,640	5,201
General expenses/overhead 30%	1,992	1,560
Total construction cost	8,632	6,762
Physical contingency 10%	863	676
VAT 15%	1,295	1,014
Total cost	10,789	8,452
Phase 3 MSW Landfill Site	7,651	3,132
Miscellaneous 10%	765	313
Direct Cost	8,417	3,445
General expenses/overhead 30%	2,525	1,034
Total construction cost	10,942	4,479
Physical contingency 10%	1,094	448
VAT 15%	1,641	672
Total cost	13,677	5,598
General cost	24,466	14,050

Note: A/P = Alternative Plan

b. Medical Disposal Site

The construction costs for the alternative plan and for the master plan's medical waste disposal site are compared and tabulated as follows.

Table 12-6: Comparison of Medical Disposal Site Construction Costs

Item	M/P US\$ 1,000	A/P US\$ 1,000
Control Facilities and Approach road	544	275
Miscellaneous 10%	54	28
Direct Cost	598	303
General expenses/overhead 30%	180	91
Total construction cost	778	394
Physical contingency 10%	78	39
VAT 15%	117	59
Total Cost	972	492

12.2 Cimsa Disposal Site

12.2.1 Overall Alternative Plan

During the meeting on the Draft Final Report (DF/R), the Turkish counterpart requested the examination of an alternative plan to reduce the project costs of the priority projects. Although the laws concerning disposal sites do not acknowledge the contents of the alternative plan, the following alternative plans will reduce project costs, and from a view of environmental protection the problems will be negligible, and therefore the team recommends them.

Municipal Solid Waste Disposal Site:

If the impermeable structure of the slope is constructed according to the law i.e., "clay layer + HDPE" the slope's gradient would have to be reduced, thus increasing the area of the impermeable structure. The impermeable layer of the slope shall be changed from the legally stipulated "clay layer + HDPE" to "mortar + HDPE".

The adoption of this measure would reduce the construction costs of the medical waste landfill site by 26.2%.

Medical Waste Disposal Site:

There is over 3m of impermeable strata that lies 2 to 8 m from the surface of the landfill's top soil. The bottom of the disposal site shall be an impermeable structure without an HDPE liner. If the impermeable structure of the slope is constructed according to the law i.e., "clay layer + HDPE" the slope's gradient would have to be reduced, thus increasing the area of the impermeable structure. The impermeable layer of the slope shall be changed from the legally stipulated "clay layer + HDPE" to "mortar + HDPE".

The adoption of this measure would reduce the construction costs of the medical waste landfill site by 51.7%.

Further, the C/P's comments on the DF/R included a regional medical waste incineration plant; the following is an outline from the main report.

- Because no land has been secured for the incineration plant, the transregional medical waste incineration plant for Adana and Icel will be located part way between the two provinces.
- Specifically, a rough estimate of the costs for construction, operation, and management costs, and the advantages and disadvantages of the plant are presented.

The overall alternative plan is shown in the following figure.

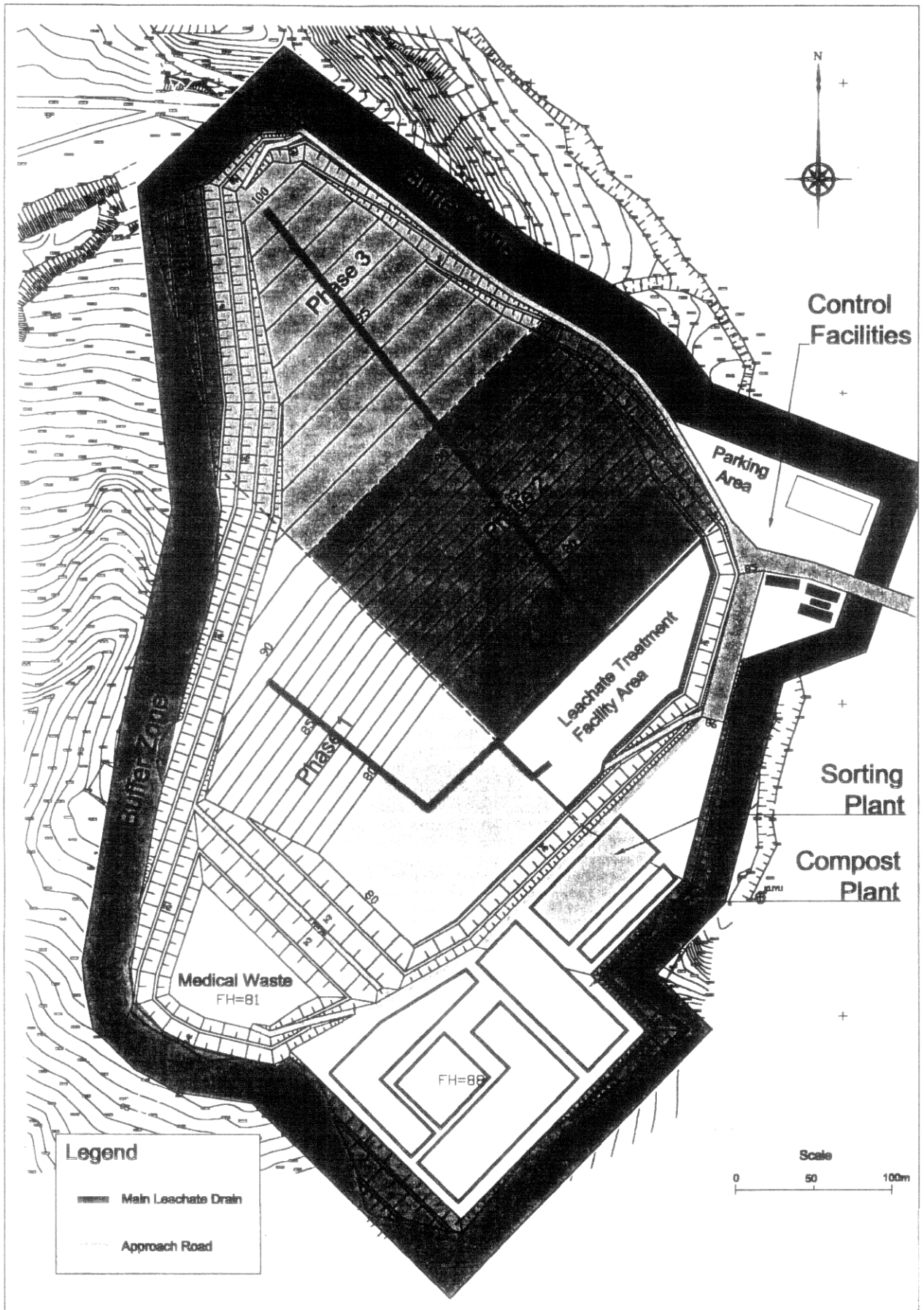


Figure 12-7: Overall Alternative Plan

12.2.2 Design of a Final Disposal Site

a. Preliminary Design

a.1 Outline of the Sofulu Disposal Site

Outline of the CIMSA Disposal site is shown on the table below.

Table 12-1: Outline of the CIMSA Disposal Site

Items	Description
Land Area and Proposed Land Use	<u>Total Area</u> :24ha
	Phase1:Landfill Area :5ha
	Phase2:Landfill Area :4ha
	Phase3:Landfill Area :4ha
	Plant :Area :3ha
	Medical waste Landfill Are :2ha Buffer zone :Area :6ha
Landfill Volume	<u>Phase</u> <u>Capacity</u> <u>Disposal Period</u>
	Phase 463,000m ³ 2002-2003
	Phase2 397,000m ³ 2004-2004
	Phase3 297,000m ³ 2005-2005
Road	Approach road(Asphalt paved) :width15.0m,lenght170m
	Access road(Asphalt paved) : width4.0m,lenght490m
	Operation road
Control facilities and approach road	Entrance area(Asphalt paved) :1,000m ²
	Site office :300m ²
	Weighbridge : 2sets
	Tire washing pit : 1set
	Gate : 1set
	Power supply :1set
	water supply :1set
	Weighbridge and washing area(conc. paved) :1,000m ²
	Parking for heavy vehicle(gravel) :1,000m ²
Leachate control facility	Leachate collection pipe 100mm:2,255m
	Main leachate drain 200mm:650m
	Leachate treatment facility:1set
	Impermeable structure :Bottom Impermeable Clay layer :Slope HDPE+Mortar
Drain for runoff water	Open concrete drain :725m
	Pipe drain for rain fall :650m
Environmental protection facilities	Fence :2,040m
	Buffer zone :2,040m
	Gas removal facility(Vertical) :780m
	Gas removal facility(Horizon) :2,255m
	Monitoring borehole :3set

a.2 Final Disposal Site

a.2.1 Capacity of Final Disposal Site and Disposal Period

The capacity and economic life of the alternative plan's final disposal site is the same as the master plan. The volume of municipal solid waste from Mersin Greater Municipality is shown in the table below.

Table 12-2: Final Disposal Amount in CIMSA

Item	unit	formula	2002	2003	2004	2005
Final Waste Disposal Amount	ton/day	a	440	473	503	593
	ton/year	b=ax365	160,799	172,780	183,736	196,729
Waste +Cover soil	m ³ /year	c=bx1.2/0.8	241,199	259,170	275,604	295,094
Total	m ³ /year	d	241,199	500,369	775,973	1,071,067

a.2.2 The Landfill’s Impermeable Strata of the Final Disposal Site

According to the SWM regulation, a liner must be laid at the bottom and the slope of the final disposal site to prevent leachate from seeping into the existing ground.

The structure of the bottom and the slope are as follows;

- Bottom: impermeable clay layer ($K = 10^{-8}$ to 10^{-9} m/sec) should act as a liner.
- Slope: the slope shall have an impermeable mortar + HDPE structure. The slope’s gradient shall be: cutting slope 1:1, and filling slope 1:3.

The structure of the bottom and the slope and a typical cross section of slope with a liner are shown in the following figure.

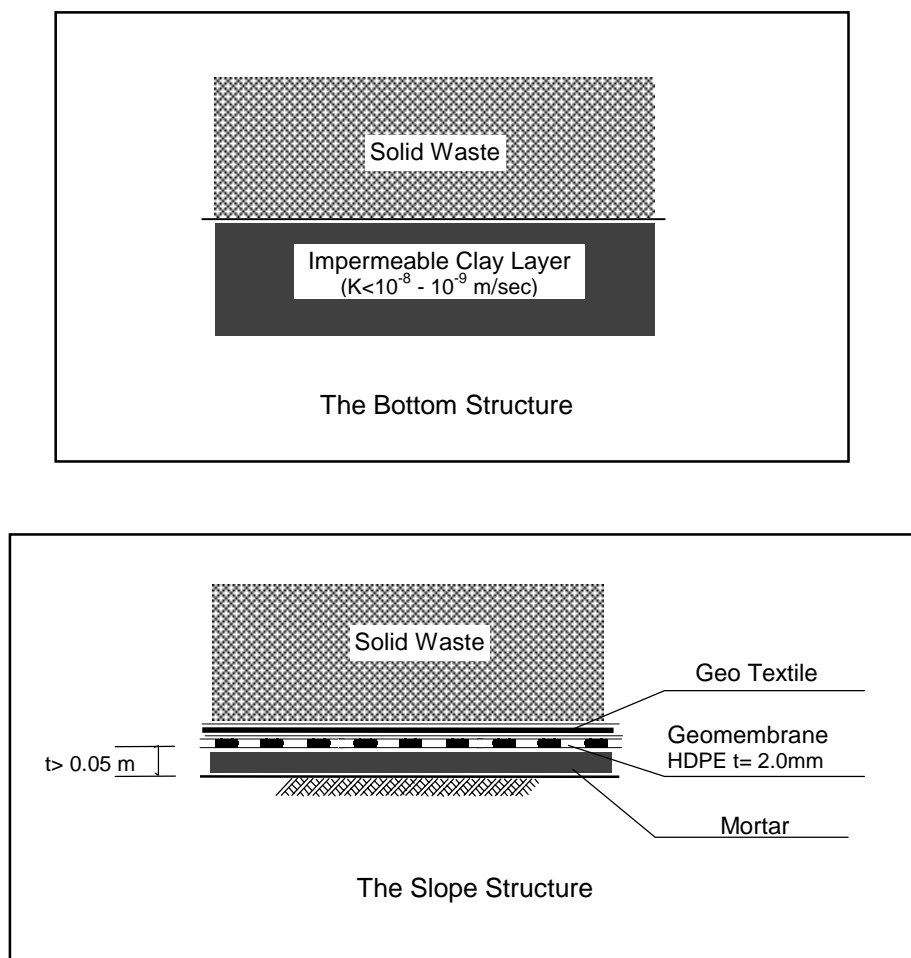


Figure 12-8: Diagrams of the Landfill’s Impermeable Strata

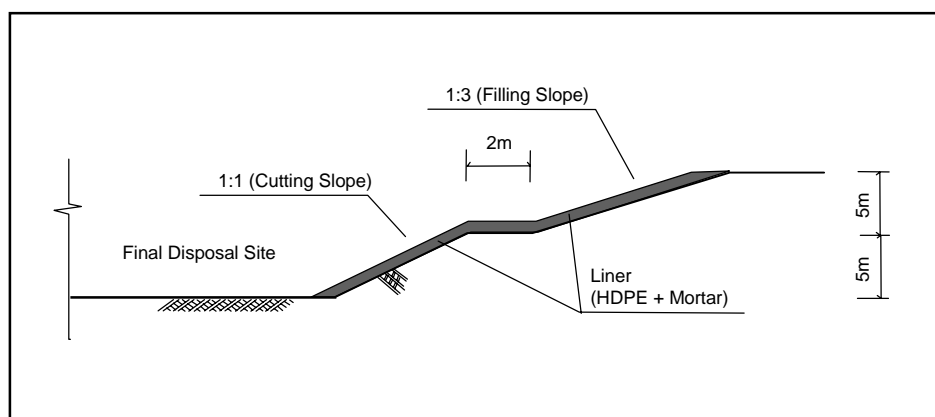


Figure 12-9: Typical Section of Slope with a Liner (HDPE+Mortar)

b. Control Facilities and Approach Road

The control facilities and the approach road shall be the same as the master plan.

c. Leachate Control Facility

The leachate control facilities shall be the same as the master plan.

12.2.3 Design of a Medical Disposal Site

a. Preliminary design

a.1 Outline of the Medical Disposal Site

The outline of the alternative plan is the same as the master plan. The outline of the preliminary design for the proposed medical disposal site is shown in the table below.

Table 12-3: Outline of the Medical Disposal Site in CIMSA

Items	Description
Land Area	Total Area : 2ha
Landfill Volume	Capacity : 57,5000m ³
	Disposal Period : 2002-2020

a.2 Capacity of Medical Disposal Site and Disposal Period

The capacity and the economic life of the final disposal site in this alternative plan shall be the same as the master plan project. Medical waste amount generated and final disposal amount are shown in the following table.

Table 12-4: Final Disposal Amount

Item	unit	formula	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Waste discharge amount	ton/day	a	1.9	2.0	2.1	2.2	2.3	2.5	2.6	2.7	2.9	3.1	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8
	ton/year	b=ax365	694	730	767	803	840	913	949	986	1,059	1,132	1,168	1,241	1,314	1,387	1,460	1,533	1,606	1,679	1,752
Waste + Cover soil	m ³ /year	c=bx1.5/0.7	1785	1,877	1,972	2,065	2,160	2,348	2,440	2,535	2,723	2,911	3,003	3,191	3,379	3,567	3,754	3,942	4,130	4,317	4,505
Total	m ³	c	1785	3,662	5,634	7,699	9,859	12,207	14,647	17,182	19,905	22,816	25,819	29,010	32,389	35,956	39,710	43,652	47,782	52,099	56,694

a.3 The Landfill's Impermeable Strata of Medical Disposal Site

The top cover, bottom and slope structure are as follows;

- Top cover : same as the master plan proposal
- Bottom :impermeable clay layer ($K = 10^{-8}$ to 10^{-9} m/sec) should be kept as the liner.
- Slope :the cross sectional impermeable layer will be mortar + HDPE. The cross sectional gradient will be: cutting slope 1:1, and filling slope 1:3.

The landfill's impermeable strata of the top cover, the bottom, and the slope are shown in the following figures.

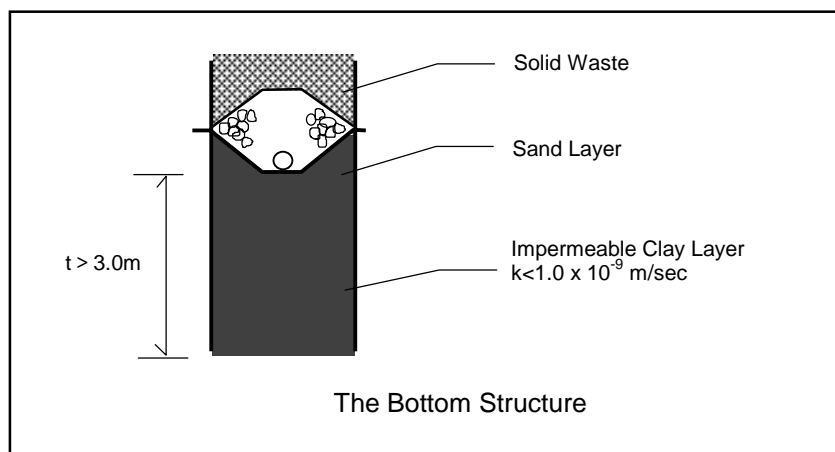
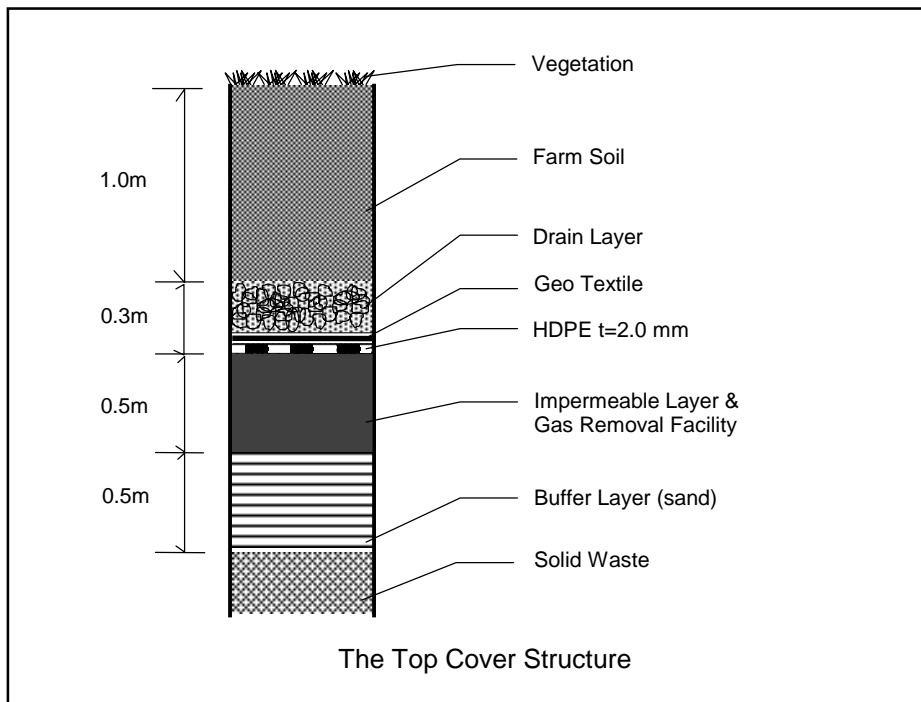
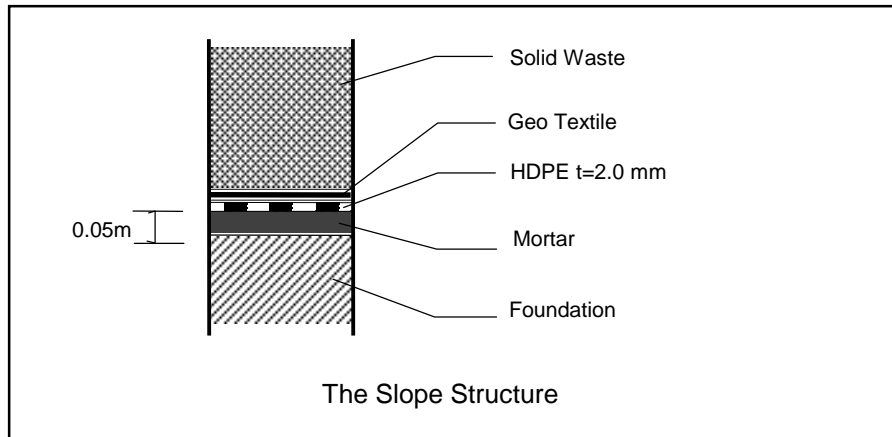


Figure 12-10: Diagrams of the Landfill's Impermeable Strata (Slope, Top Cover and Bottom)

A typical cross section of slope of medical disposal site is shown on the following figure.

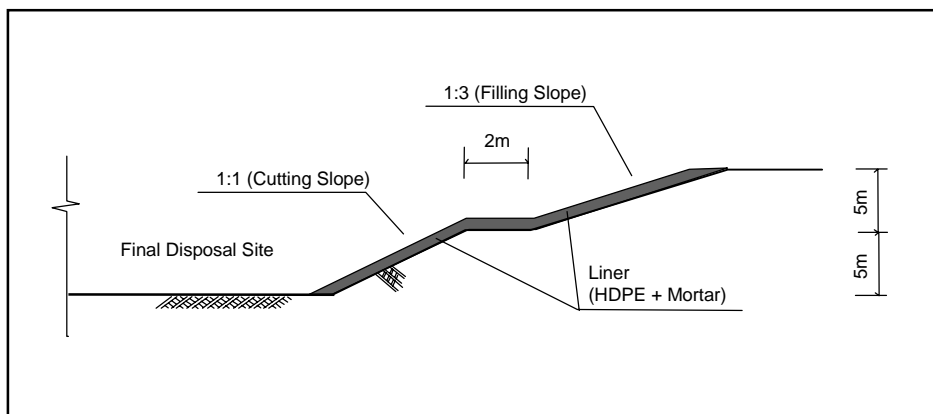


Figure 12-11: Typical Section of Slope with a Liner (HDPE+Mortar)

b. Leachate Control Facility

The leachate control facility will be the same as the master plan proposal.

12.2.4 Cost Estimation

a. Final Disposal Site

The alternative plan and the master plan's disposal site construction costs are compared and tabulated as follows.

Table 12-5: Comparison of Disposal Site

Item	M/P US\$ 1,000	A/P US\$ 1,000
Control Facilities and Approach road	441	441
Phase 1 & Phase 2MSW Landfill Site	2,460	1,928
Sub Total	2,900	2,368
Miscellaneous 10%	290	237
Direct Cost	3,190	2,605
General expenses/overhead 30%	957	782
Total construction cost	4,148	3,387
Physical contingency 10%	415	339
VAT 15%	622	508
Total cost	5,185	4,233
Phase 3 MSW Landfill Site	1,010	517
Miscellaneous 10%	101	52
Direct Cost	1,111	569
General expenses/overhead 30%	333	171
Total construction cost	1,445	740
Physical contingency 10%	144	74
VAT 15%	217	111
Total cost	1,805	924
General cost	6,990	5,157

Note: A/P = Alternative Plan

b. Medical Disposal Site

The construction costs for the alternative plan and for the master plan's medical waste disposal site are compared and tabulated as follows.

Table 12-6: Comparison of Medical Disposal Site Construction Costs

Item	M/P US\$ 1,000	A/P US\$ 1,000
Control Facilities and Approach road	1,045	505
Miscellaneous 10%	105	51
Direct Cost	1,150	556
General expenses/overhead 30%	345	167
Total construction cost	1,495	722
Physical contingency 10%	150	72
VAT 15%	224	108
Total cost	1,868	902