

8.4.2 Financial Evaluation

8.4.2.1 The Financial Evaluation Method

Depending upon financing alternatives, costs for regional SWM projects will vary as previously explained in the previous section of M/P financial system. Conditions for financing alternatives assumed are listed below.

Table 8-48: Conditions of Respective Financing Alternatives

	Case 1	Case 2	Case 3
Execution body	OPAMSS/COAMSS direct	Public enterprise	Private enterprise
Debt security	0 %	15.5%	15.5%
Interest rate	8.1 %	1.7 %	10.75 %
Corporation tax	0%	25%	25%
Capital	0%	20% of capital investment	
Required achievement	FIRR>8.1%	Profit rate (profit after tax/revenue)>5%	Return on own capital>13.5%

Unit costs per ton handled in respective regional projects based on respective financing alternatives are compared in the table below.

Table 8-49: Unit Costs based on the Respective Financing Conditions

		Case 1	Case 2	Case 3
Transfer station and Transport				
Transfer station #1 and Transport				
Required unit cost (U\$/ton)	inc. VAT (13%)	-	7.3	9.6
	exc. VAT(13%)	7.0	6.5	8.5
Transfer station #2 and Transport				
Required unit cost (U\$/ton)	inc. VAT (13%)	-	6.2	7.8
	exc. VAT(13%)	5.8	5.5	6.9
Landfill (Tonactepeque landfill)				
Required unit cost (U\$/ton)	inc. VAT (13%)	-	18.8	31.0
	exc. VAT(13%)	20.2	16.6	27.4
Selection Plant				
Required unit cost (U\$/ton)	inc. VAT (13%)	-	28.9	41.0
	exc. VAT(13%)	27.2	25.6	36.3
Medical Waste Incineration				
Required unit cost (U\$/ton)	inc. VAT (13%)	-	371.0	530.0
	exc. VAT(13%)	390.0	328.3	469.0

It is important to pay attention that:

- The M/P comprises the “**regional system**” that proposes regional projects for the SWM in AMSS total, and “**individual municipal system**” that are diverse depending upon the respective municipalities’ dimensions.

Therefore in this instance, assuming that the regional projects are implemented as public projects by the OPAMSS/COAMSS direct administration (i.e., using the **unit**

costs of Case-1 in the table above), it is examined herewith whether or not regional projects proposed in the M/P are financially feasible.

The financial evaluation is at first carried out for the AMSS total (i.e., 14 municipalities as a whole) by comparing the total expenditures of “without M/P” and “with M/P” and calculating the financial internal rate of return (FIRR) for “with M/P”.

Then, affordability of respective municipalities for the regional projects is examined with reference to the SWM revenue systems in 14 municipalities.

Table 8-50: Financial Evaluation Method for MP

	Regional System	Individual System
Evaluation period	2001 to 2010	
Evaluation index	Total cost with MP < Total cost without MP (FIRR>8.1%*)	Total balance > 0
Impact indicators		<ul style="list-style-type: none"> • Share of SWM burden to Total Budget in 2010 • Burden on Citizen's income

Note: * London Inter Bank Offered Rate (LIBOR)+1%; Prime rate of BID for El Salvador

8.4.2.2 Financial Evaluation of Regional Management System

a. Conditions for Financial Evaluation

The regional system in the M/P proposes projects of transfer stations (T/S), Tonacatepeque S/L, selection plant (S/P) and medical waste incineration (MWI).

Meanwhile, the M/P also recommends institutional improvement that OPAMSS should create Execution Unit of SWM of OPAMSS (UE-OPAMSS) for supporting all 14 municipalities in database management of weighbridge/revenue/expenditure/users, etc.

In view of the above, revenue and expenditure of the regional projects are assumed as summarized in the table below for “with M/P” and “without M/P”.

Table 8-51: Revenue and Expenditure for Financial Evaluation of Regional Management System

		With MP	Without MP
Revenue		SWM service fee remains the same. Fee collection efficiency remains the same. Revenue of domestic waste fee increases in proportion to the population increase. Revenue of non-domestic waste fee increases in proportion to the GRDP growth rate.	
Expenditure	Regional	Investment expenditures* <ul style="list-style-type: none"> • T/Ss • Tonacatepeque S/L • S/P • MWI O&M costs <ul style="list-style-type: none"> • T/Ss • Tonacatepeque S/L • S/P • MWI • UE-OPAMSS 	—
	Individual	Investment expenditures* Total municipal investment costs for procurement of collection vehicles, containers etc. O&M Sum of O&M costs for other than the costs incurred for participating the regional projects	Investment expenditures* Total municipal investment costs for procurement of collection vehicles, containers etc. for the case of "without MP" O&M Sum of O&M costs for the case of "without MP"

Note: * Investment costs is estimated to be necessary for purchasing vehicles and heavy equipment every 7 years as their service life is estimated as 7 years. Projects periods are estimated that T/Ss be 20 years, S/L be 18 years, S/P be 15 years, and MWI be 15years. Residual book values of projects are appropriated for negative figures of costs in year 2011.

b. Revenue

Revenue till the year 2010 is calculated as shown below, based on the assumptions summarized in the table above. The table below presents the current annual revenue (1999) and future annual revenue calculated for respective phases ending years (2003, 2006 and 2010).

Table 8-52: Revenue Plan for Financial Evaluation of Regional Management System

Unit : 1,000 colones

	1999	2003	2006	2010
San Salvador	96,839	114,418	126,390	140,272
Mejicanos	7,152	10,071	10,732	11,455
Delgado	3,906	5,654	6,055	6,505
Cuscatancingo	2,100	2,462	2,718	3,043
Ayutuxtepeque	1,321	1,967	2,211	2,523
San Marcos	2,394	3,075	3,317	3,604
Nueva San Salvador	16,110	20,870	23,553	27,112
Antiguo Cuscatlan	3,191	3,930	4,552	5,435
Soyapango	13,194	17,673	18,781	20,446
Ilopango	5,357	7,994	8,685	9,529
San Martin	1,553	1,994	2,309	2,742
Apopa	3,981	6,097	6,775	7,650
Nejapa	250	286	309	332
Tonacatapeque	276	325	359	401
Total	157,624	196,816	216,746	241,049

c. Expenditure

In order to calculate expenditures of respective municipalities for the cases of “with M/P” and “without M/P”, the table below shows user municipalities of respective “with M/P” projects, and relevant conditions assumed for the case of “without M/P”.

Table 8-53: Estimate Condition

	With Master Plan						Without Master Plan				
	Transport			Final Disposal			Transport	Final Disposal			
	T/S 1	T/S 2	Direct	MIDES/ Nejapa	New Espiga	Tonacat apeqque	Direct	MIDES/ Nejapa	New Espiga	S/L	
San Salvador	X	X		X			X	X			
Mejicanos		X		X			X	X			
Delgado			X	X			X	X			
Cuscatancingo		X			X		X		X		
Ayutuxtepeque			X	X			X	X			
San Marcos		X		X			X	X			
Nueva San Salvador	X			X			X	X			
Antiguo Cuscatlan	X				X		X		X		
Soyapango		X		X			X	X			
Ilopango		X		X			X	X			
San Martin			X			X	X			X	
Apopa			X	X			X	X			
Nejapa			X	X			X	X			
Tonacatapeque			X			X	X			X	

Expenditures calculated for both cases of “with M/P” and “without M/P”, based on the conditions given above, are summarized in the table below.

Table 8-54: Expenditure for Cases of “With M/P” and “Without M/P”

Unit : million colones

			Phase I	Phase II	Phase III	Salvaged value	Total
With MP	Regional	Investment	67.1	49.2	16.2	-76.1	56.4
		O&M	2.1	29.1	54.1	0	85.3
	Individual	Investment	104.9	10.5	116.2	-92.8	138.8
		O&M	508.9	525.8	742.0	0	1,776.7
	Total			683.0	614.6	928.5	-168.9
Without MP	Investment		146.6	8.4	163.9	-121.2	197.7
	O&M		522.9	586.0	846.2	0	1,955.1
	Total			669.5	594.2	1,010.1	-121.2

It shows that the total expenditure of “with M/P” case becomes less than the expenditure of “without M/P”.

d. Financial Analysis

Financial analysis is attempted for the revenues and expenditures in respective years till 2010 of “with M/P” case. It gives the financial internal rate of return about 7%. The result of the financial analysis herewith suggests that concrete measures of expenditure reduction and/or revenue increase should be enforced in order to realize the sustainable municipal SWM with respect to financial viewpoint. The practical measures for financial improvement such as follows are required:

- **revenue increase:** such as fee collection efficiency improvement, application of specific duty system (fee rate proportional to waste amount) for the large commercial/institutions waste.
- **expenditure reduction:** such as lowering the prices of payment to MIDES; lowering the CAESS/DELSUR commission rate; and

8.4.2.3 Financial Evaluation of Individual Management System

a. Conditions for Financial Evaluation of Individual Management System

In order to carry out the individual municipalities’ financial evaluation, costs for utilizing the regional projects should be internalized as individual municipal expenditure respectively. Accordingly, financial evaluation of individual municipalities is carried out with the conditions summarized below.

Table 8-55: Costs for Utilizing Regional Projects for Respective Municipalities

		Unit Costs	Remarks
Transfer Station	TS 1 (350 t/d)	US\$ 7.0/ton	In proportion to deposited amount (from year 2004)
	TS 2 (900 t/d)	US\$ 5.8/ton	Ditto above (from year 2005)
Intermediate treatment	S/P	US\$ 27.2/ton	In proportion to amount of recyclable materials deposited (from year 2008)
Landfill	MIDES Nejapa	US\$ 20.43/ton (US\$ 18/ton + VAT)	In proportion to amount deposited (from year 2001)
	Tonacatepeque	US\$ 20.4/ton (inc.VAT)	Ditto above (from year 2005)
	New Espiga	US\$ 20.4/ton (inc.VAT)	Ditto above (from year 2004)
Medical waste treatment	MIDES Nejapa	US\$ 200/ton+VAT	These costs are not reflected for municipal expenditures.
	Incinerator	US\$ 390/ton	

In addition to the expenditures estimated based on the above unit rates, an indirect expenditure for operating the Execution Unit of OPAMSS is estimated to be about US\$ 80,000/year in total and is proportionally distributed for respective municipalities as their indirect costs.

b. Base Case for Financial Evaluation

With the same revenue assumptions employed for the financial evaluation of the regional management system as listed below, the total balance (revenue and expenditure) till year 2010 is calculated for respective municipalities and summarized in the table below for the cases of “without M/P” and “with M/P”:

- SWM service fee remains the same.
- Fee collection efficiency remains the same.
- Revenue of domestic waste fee increases in proportion to the population increase.
- Revenue of non-domestic waste fee increases in proportion to the GRDP growth rate.

Table 8-56: Comparison of Total Balance until 2010

Unit: 1,000 colones

	Original balance without MP	Balance improvement with MP
San Salvador	68,047	121,217
Mejicanos	-21,600	-17,179
Delgado	-1,293	355
Cuscatancingo	-28,468	-22,047
Ayutuxtepeque	3,454	3,713
San Marcos	-29,162	-21,931
Nueva San Salvador	42,550	73,368
Antiguo Cuscatlan	-45,131	-37,872
Soyapango	-60,448	-39,668
Ilopango	647	8,750
San Martin	-4,879	-5,962
Apopa	-9,158	-7,241
Nejapa	-5,384	-5,449
Tonacatepeque	-19,823	-19,607

The case of “with M/P” improves total balance till year 2010 of almost all municipalities in AMSS.

As for the San Martin municipality, its total balance turns out worse for the case of “with M/P”. This is mainly due to collection/transport costs increase in the “with M/P” case, since the final disposal site in the M/P is located more distant than the present open dumping site. However, if the scenario of participating the MIDES Nejapa S/L were adopted, as its transport distance to MIDES site becomes far more longer than that of the “with M/P” case, the cost increase for the San Martin becomes much more outstanding.

Therefore, “with M/P” is recommended for the San Martin municipality too.

Table 8-57: Comparison of Total Balance until 2010 in San Martin and Tonacatepeque for the Cases of “With M/P” and “To Participate MIDES S/L”

Unit: 1,000 colones

	With M/P	MIDES Nejapa
San Martin	-5,962	-11,147
Tonacatepeque	-19,607	-23,450

c. Revenue Improvement Measures

In assuming the stepwise revenue improvement by adopting the following measures, the total balance from 2001 to 2010 will be calculated below.

Measure-1: Stepwise Fee Collection Efficiency Improvement: Fee collection efficiency will be gradually raised up to 90% in year 2010 by adopting the joint billing with electricity charges both for cleansing fee and landfill fee (it assumes that joint billing starts at year 2003).

Measure-2: Application of Specific Duty System: A specific duty system (fee rate proportion to waste amount) will be applied for commercial/institutions waste

from year 2002. Assuming that 50% of such waste is from large dischargers, the fee rate for such dischargers is to cover the direct costs of collection/transport services and the landfill tipping fee.

d. Improvement by Measure-1: Fee Collection Efficiency Improvement

The total balance from 2001 to 2010 after adopting the improvement **Measure-1** as explained above is calculated for respective municipalities.

Table 8-58: Total Balance Improvement by Adopting Measures-1 (joint-billing with electricity and fee collection rate increase)

Year	Total Balance	Burden to Municipal Budget		Average SWM fees (cleansing fee + landfill fee)	Burden on Citizen's Income
		2001 - 2010	2001 - 2010	2010	2010
Unit	1,000 colones	%	%	colon/month/ household	%
San Salvador	180,526	0.0	0.0	45.8	0.47
Mejicanos	8,160	0.0	5.0	18.8	0.26
Delgado	9,441	0.0	2.4	11.9	0.22
Cuscatancingo	-18,397	10.2	16.6	8.1	0.17
Ayutuxtepeque	7,392	0.0	0.0	21.5	0.41
San Marcos	-13,400	9.0	14.3	13.4	0.21
Nueva San Salvador	93,594	0.0	0.0	28.5	0.35
Antiguo Cuscatlan	-32,633	11.0	9.9	24.9	0.20
Soyapango	-9,795	1.7	10.9	18.7	0.26
Ilopango	17,869	0.0	5.7	17.6	0.34
San Martin	-2,320	2.5	19.7	9.7	0.33
Apopa	1,606	0.0	9.3	10.4	0.26
Nejapa	-3,665	2.7	6.9	8.5	0.23
Tonacatepeque	-18,076	21.7	37.0	4.1	0.13

e. Further Improvement by Measure-2: Specific Duty System

In adopting the improvement **Measure-2** in addition to the Measure-1, the improved total balance from 2001 to 2010 is calculated for respective municipalities.

Table 8-59: Total Balance Improvement by Adopting Measures-2 (specific duty on large dischargers)

Year	Total Balance	Burden to Municipal Budget		Average SWM fees (cleansing fee + landfill fee)	Burden on Citizen's Income
		2001 – 2010	2010	2010	2010
Unit	1,000 colones	%	%	colon/month/ household	%
Delgado	14,375	0.0	0.4	11.9	0.22
Cuscatancingo	-15,195	8.4	15.1	8.1	0.17
Ayutuxtepeque	8,732	0.0	0.0	21.5	0.41
San Marcos	-10,192	6.9	12.2	13.4	0.21
Nueva San Salvador	100,813	0.0	0.0	28.5	0.35
Antiguo Cuscatlan	-24,457	9.3	8.1	24.9	0.20
Soyapango	8,886	0.0	7.5	18.7	0.26
San Martin	503	0.0	11.1	9.7	0.33
Apopa	6,347	0.0	6.6	10.4	0.26
Nejapa	-3,416	2.5	6.8	8.5	0.23
Tonacatepeque	-16,474	19.8	34.6	4.1	0.13

Note: The tariff of non-domestic waste has already changed to reflect the waste weight in San Salvador, Nueva San Salvador, and Soyapango.

f. Additional Measure of Raising SWM Fees

Even after adopting both **Measure-1** and **Measure-2**, 5 municipalities of Cuscatancingo, San Marcos, Antiguo Cuscatlan, Nejapa and Tonacatepeque cannot have the total balance (2001 to 2010) positive.

Therefore, revenue improvement by raising the SWM fee is examined herewith for those 5 municipalities.

f.1 Minimum Increase of Fees

The minimum fee increase necessary to make the total balance just a little positive is calculated herewith, assuming that the fee increase will be made in year 2006.

It turns out: 88% increase (or make fee about 1.9 times of the present rate) for Cuscatancingo; 82% increase (or 1.8 times) for San Marcos; 90% increase (or 1.9 times) for Antiguo Cuscatlan; 127% increase (or 2.3 times) for Nejapa; and 552% increase (or 6.5 times) for Tonacatepeque.

The table below shows the calculation summary with impact indicators.

Table 8-60: Price Increase Rate and Total Balance until Year 2010

Year	Increase rate of Cleansing tax	Total Balance (a little positive)		Burden to Municipal Budget	Average SWM fees (cleansing fee + landfill fee)	Burden on Citizen's Income
		2001 – 2010	2001 – 2010			
Unit	%	1,000 colones	%	%	colon/month/household	%
Cuscatancingo	88 %	101	0.0	0.0	15.3	0.33
San Marcos	82 %	38	0.0	0.0	18.9	0.29
Antiguo Cuscatlan	90 %	289	0.0	0.0	47.2	0.38
Nejapa	127 %	7	0.0	3.2	19.4	0.52
Tonacatepeque	552 %	20	0.0	0.0	26.9	0.82

f.2 Burden on Citizen's Income

As the consequence of the above examination, increased fees will account for **0.29% to 0.82%** burden on income for respective 5 municipalities' citizen.

The proportion of citizen's burden for SWM fees varies depending on the economic situation of respective countries or cities. As a general reference, an example⁷ of middle income countries with GDP per capita of about US\$1,950 is given in the table below.

Table 8-61: Representative Costs of Municipal SWM in Middle Income Countries and Percentage on Citizen's Income

SWM cost components	Percentage on Citizen's Income (%)
Collection	0.5 to 1.1
Public cleansing	0.1 to 0.2
Disposal	0.05 to 0.2
Transfer	0.1 to 0.2
Total	0.75 to 1.7

The above table shows a range of **0.75% to 1.7%** as the burden on citizen's income.

Comparing the two tables above, the heaviest citizen's burden among the 5 municipalities that is the one of Tonacatepeque municipality being about **0.82%** is in this range. Accordingly, it will be judged that the fee increase rate examined above will be affordable for the citizens of the 5 municipalities.

Meanwhile, it is strongly anticipated that, if the fee is suddenly raised to 6.5 times of present one, citizen's rejection will be obviously extreme. Therefore, it is necessary to adopt stepwise fee increase.

⁷ Conceptual Issues and Experiences in Developing Countries, December 1991, Sandora Cointreau-Levine.

g. In Cases of Other Financing Conditions

The sections above have attempted financial analysis based on the financing condition of Case-1. If the actual financing condition changes, the total balance and share of SWM burden to municipal budget for respective municipalities also changes. Hence just as a reference, the tables below show total balance and share of SWM burden to municipal budget for respective cases of financing conditions.

Table 8-62: Total Balance in Cases of Other Financing Conditions

Unit : 1,000 colones

Year	Case 1	Case 2 (inc. VAT)	Case 3 (inc. VAT)
	2001 – 2010	2001 – 2010	2001 – 2010
San Salvador	180,526	177,016	159,783
Mejicanos	8,160	7,507	4,878
Delgado	14,375	14,374	14,366
Cuscatancingo	-15,195	-14,269	-23,899
Ayutuxtepeque	8,732	8,732	8,729
San Marcos	-10,192	-10,466	-11,556
Nueva San Salvador	100,813	100,179	95,323
Antiguo Cuscatlan	-27,457	-24,817	-41,931
Soyapango	8,886	7,703	2,939
Ilopango	17,869	17,491	15,979
San Martin	503	1,321	-4,924
Apopa	6,347	6,345	6,332
Nejapa	-3,416	-3,416	-3,417
Tonacatepeque	-16,474	-15,688	-26,406

Note: Total balance improved after adopting Measure-1 and Measure-2 is compared for respective 3 cases of financing conditions.

Table 8-63: Share of SWM Burden to Municipal Budget in Cases of Other Financing Conditions

Unit : (%)

Year	Case 1		Case 2 (inc. VAT)		Case 3 (inc. VAT)	
	Share of SWM burden to Municipal Budget		Share of SWM burden to Municipal Budget		Share of SWM burden to Municipal Budget	
	2001 – 2010	2010	2001 – 2010	2010	2001 – 2010	2010
San Salvador	0	0	0	0	0	0.3
Mejicanos	0	5	0	5.4	0	7.2
Delgado	0	0.4	0	0.4	0	0.5
Cuscatancingo	8.4	15.1	7.9	14.5	13.2	20.6
Ayutuxtepeque	0	0	0	0	0	0
San Marcos	6.9	12.2	7.1	12.5	7.8	13.6
Nueva San Salvador	0	0	0	0	0	0
Antiguo Cuscatlan	9.3	8.1	8.4	7.1	14.2	13.6
Soyapango	0	7.5	0	7.8	0	9.1
Ilopango	0	5.7	0	6	0	7.2
San Martin	0	11.1	0	14.7	5.3	24.2
Apopa	0	6.6	0	6.8	0	6.8
Nejapa	2.5	6.8	2.5	6.8	2.5	6.8
Tonacatepeque	19.8	34.6	18.9	33.4	31.7	36.5

Note: Share of SWM burden to municipal budget after adopting Measure-1 and Measure-2 is compared for respective 3 cases of financing conditions.

8.4.3 Economic Evaluation

Generally, urban environment improvement projects are likely to improve only a part of urban environment components, such as urban structure, solid waste management, water supply and sewerage that are complicatedly related each other. This Study deals with a part of the urban environment, i.e., solid waste management. It is difficult to quantify benefits caused by implementation of M/P in view of characteristic of the urban environment. In case of conducting quantitative analysis of the benefits by force, results would be arbitrarily, in other words, the results would largely be different depending on persons who conduct the analysis. However, from qualitative viewpoint of "Environment Improvement," everybody can consent to the direction toward improvement, even though individual views are different. Therefore, the Study avoided the quantitative analysis that has above mentioned difficulties, then, only applied the qualitative analysis. The results of the qualitative analysis are shown below.

8.4.3.1 Improvement of Collection/Transport Efficiency

By implementing the project of transfer stations and trailer transport (T/S&T), efficiency of collection and transport activities will be improved. It will reduce the total number of waste collection vehicles, and total fuel consumption in the collection/transport system in AMSS. Hence its economic benefit is evident, and will also contribute for an environmental benefit of lessening global warming.

8.4.3.2 Expansion of Service Coverage

Cleansing service coverage will be expanded by realizing measures recommended in the M/P (e.g., container collection, micro-enterprises, etc.). Consequently, sanitary urban or semi-urban conditions in AMSS will be extended and it will offer health benefits for citizens.

8.4.3.3 Improvement of Local and Regional Environment

In executing appropriate final disposal at such as the New ESPIGA S/L and the Tonacatepeque S/L, local environment near these S/Ls and the total regional environment of AMSS will be improved. It turns out benefits of the national economy.

8.4.3.4 Promotion of Recycling

Recycling activities will be promoted and activated by introducing: separate collection system; environmental campaign and programs; selection plant etc. This consequently will enable the resource conservation, its rational use, and protection of natural environment.

8.4.3.5 Plans for Competitive Services

This M/P emphasizes institutional measures to consolidate competitive services in SWM by facilitating private sector participation, appropriate contract administration etc. under competition principles. As its results, SWM services will have to become efficient, dynamic and cost-effective. It will in due course turn out benefits of the national economy.

8.4.4 Institutional Evaluation

a. Institutional Evaluation of the M/P in Line with Objectives

Institutionalization of the different components of the M/P must be analyzed and assessed according to the seeking of objectives and goals by the M/P:

- **Promote the citizens' well-being and public health**, including the welfare of the workers related with SWM activities.
- **Implement sustainable and thus cost-effective SWM** from the technological, institutional, administrative and financial optimization and improvements.
- **Contribute to environmental conservation**, through proposals aimed at reducing the generation of SW; reuse and recycling of SW recovered, and operation of the diverse SWM components (collection, transfer, haulage, treatment, final disposal) without polluting the environment.

Table 8-64 summarizes this institutional evaluation in accordance with objectives and components. It is confirmed that the institutional proposals by the M/P are aimed at complying with the objectives and goals of such M/P.

Table 8-64: Institutional Evaluation of M/P in line with Objectives and Components

Component	Population well-being	SWM sustainability	Environmental conservation
Separation at the source	<ul style="list-style-type: none"> Allows the reduction of SW with community participation Sanitary in-house management 	<ul style="list-style-type: none"> Costs are neither borne by municipalities nor users Community participation ensures sustainability 	<ul style="list-style-type: none"> Material recovery Reduction of the amount of SW that reach S/L
Collection service	<ul style="list-style-type: none"> Increase service coverage to 100% Prevents proliferation of vectors Education program for sanitary management of SW 	<ul style="list-style-type: none"> With the inclusion of EMAUSS the collection service in San Salvador becomes optimized and sustainable Likewise, with the institutional strengthening of the collection service of the remaining 13 municipalities 	<ul style="list-style-type: none"> Effective supervision by EMAUSS and cleansing service of the 13 municipalities Degradation of the environment and public roads is prevented
Separate collection	<ul style="list-style-type: none"> Citizen participation for the recovery of SW is institutionalized In-house sanitary management of SW Raising of sanitary/environmental culture 	<ul style="list-style-type: none"> Possibility to cut costs and ease sustainability with formal participation by former scavengers Reduction of SW to be deposited at S/L(s) 	<ul style="list-style-type: none"> Recovery of recyclable material Reduce generation of SW Foster the recycling industry
Cleansing of public roads	<ul style="list-style-type: none"> Prevent proliferation of noxious fauna Cleaner public roads through supervision and control 	<ul style="list-style-type: none"> Institutionalization and greater formal participation by SW-SRC and micro-enterprises Increase of employment 	<ul style="list-style-type: none"> Effective supervision of cleansing that protects the environment
T/S and haulage	<ul style="list-style-type: none"> Sanitary SWM Prevent proliferation of vectors 	<ul style="list-style-type: none"> Cost reduction Greater private participation Increase of employment 	<ul style="list-style-type: none"> Prevent separation of SW during haulage Effective institutionalization of supervision and control
S/L(s)	<ul style="list-style-type: none"> Prevent proliferation of vectors Supervision for the operation of S/L(s) becomes institutionalized 	<ul style="list-style-type: none"> Formal supervision and control of S/L(s) by OPAMSS and EMAUSS becomes institutionalized By reviewing costs it is confirmed that the S/L is the least expensive final disposal method of SW 	<ul style="list-style-type: none"> Effective supervision that prevents the pollution of aquifers, burning of SW, furious odors, and at the same time protects landscape
Management of hazardous medical SW	<ul style="list-style-type: none"> The staff's health who handle these SW is protected, as well as the population's 	<ul style="list-style-type: none"> Responsibility by MSPAS for the supervision and control of these SW is outlined Responsibility of managing these wastes is by the generators is defined (MSPAS, ISSS and private health establishments) Greater participation by private sector 	<ul style="list-style-type: none"> Transport that does not affect the environment Treatment and final disposal authorized and controlled by MSPAS and MARN

b. Evaluation of Institutional Proposals of the M/P

The adoption and implementation of institutional proposals of the M/P is also recommendable and appropriate when assessed under the following strategic methods:

1) Regional SWM System for AMSS

Recommendation by the M/P to establish a regional SWM system for AMSS and with the active participation by the existing institutions with some organizational modifications is a viable and realistic proposal, which can be implemented without major resistance or restrictions.

2) Institutionalization Timing

The timing proposed in the M/P for the institutionalization of the components follows the downstream of SWM, but respecting such components as Nejapa S/L that is already institutionalized.

3) Organizational Changes

To ensure sustainability, optimization and supervision of cleansing in AMSS the M/P proposes the following organizational changes that are deemed as appropriate and necessary:

- Establish the SWM Execution Unit of OPAMSS.
- Set up and create the San Salvador Municipal Public Company of Urban Cleansing (EMAUSS).
- Strengthen and modernize the offices of public cleansing of the remaining 13 municipalities in AMSS, without including San Salvador municipality.
- Strengthen the Solid Waste Unit of the Department of Environmental Health of MSPAS for the supervision and control of hazardous medical SW generated at health establishments in AMSS.

4) Metropolitan Planning

The M/P recommends that T/S, S/L, haulage from T/S to S/L, the recovery of recyclable items and intermediate treatment have a metropolitan approach due to technical, operative, institutional, environmental, financial and cost-related reasons. Likewise, regarding the national policies for the management of hazardous medical SW, it is pertinent that MSPAS plans, sets up, supervises and controls such management in AMSS with a regional criterion along with all health establishments of MSPAS, ISSS and private ones that are operating in the area.

5) Participation by Private Sector

- The M/P proposes that participation by private sector be fostered in the construction, operation, maintenance and financing of the diverse SWM components in AMSS by means of contracts and concessions with solid waste service-rendering enterprises (SW-SRE), small enterprises, microenterprises and cooperatives.
- The M/P also promotes participation by private industries for the recovery and recycling of SW.
- Also, the M/P proposes incentives for the private sector to be in charge exclusively of compost processing and commercialization of organic waste from markets and parks in AMSS.

- Furthermore, the M/P fosters competitiveness among contractors and/or concessionaires, insists upon the regulation of the service quality being rendered and requires supervision of SW-SRE.

6) Contracts and Concessions

Participation by private sector in SWM entails bids, contracting out and concessions. Therefore, the M/P recommends and proposes guidelines to allow a full analysis, regulation and control of such legal compromises and formalities.

A relevant achievement of the present Study is the breakdown of the US\$18/ton price paid by the municipalities for the MIDES project. This breakdown of the S/L fee of Nejapa and other elements of MIDES project were particularly requested and proposed by JICA Study Team, and it is pleasant to know that such request was attained.

7) Supervision and Control

The M/P emphasizes that supervision and control of contracts and concessions be in charge of EMAUSS and the SWM Execution Unit of OPAMSS. The latter will allow municipalities with scarce financial resources to have a highly qualified supervision and control at a low cost, both for MIDES contract as well as for other metropolitan SWM contracts in which the municipalities take part.

Besides, it is also recommended that the cleansing departments of the remaining 13 municipalities institutionalize and strengthen their supervising and control of collection and sweeping contracts/concessions within their jurisdiction, be it lump sum or unit price ones.

Additionally, the M/P highlights the setting up of the SWM Execution Unit of OPAMSS and EMAUSS as entities that supervise and control currently executed metropolitan contracts such as MIDES, which will operate several years more. Since such MIDES contract is a unit price one with a minimum compulsory amount to be delivered at the S/L, it is urgent that supervision and control be organized and institutionalized in the way proposed by the M/P.

8.4.5 Social Evaluation

Social evaluation of the M/P is based on the criteria that follows, and summarized in Table 8-65.

a. Improvement of Public Health

Health benefits are pursued through the following institutional proposals in the M/P:

- Public education program aimed at raising sanitary management of SW upon population.
- Separation of SW at the source and separate collection of recyclable items sought through in-house sanitary management, which prevents the proliferation of vectors at the source and improves the sanitary collection process.
- Total collection coverage to solve the issue of lack of service in low-income marginal areas.
- Construction of T/S(s) and optimization of collection and street sweeping

services, which leads to the improvement of occupational health of public cleansing workers

- Separation at the source, separate collection, storage and sanitary trading of recyclable items that improves occupational health of former scavengers.
- Final disposal through sanitary landfills in the municipalities of Antiguo Cuscatlan, Cuscatancingo, San Martin and Tonacatepeque, which will improve public health in such municipalities.

b. Population's Well-being

The technological, operative and institutional proposals of the M/P for the separation of SW at the source, collection optimizing, construction of T/S(s) and sanitary landfills and institutionalization of a regional system for SWM will bring about the following benefits:

- Population will become aware of urban and environmental aspects through the public education program, and they will acknowledge their role as generators of solid wastes.
- Cleaner public roads and areas and protection of the landscape and natural sites.
- Regulation and control of dust and noise in T/S(s) and S/L(s) to prevent damages upon population nearby.

c. Employment and Working Conditions

- Separate collection of recyclable items, the construction of T/S(s), the sanitary landfills for Antiguo Cuscatlan, Cuscatancingo, San Martin and Tonacatepeque and haulage from T/S(s) to S/L(s) will constitute new sources of employment.
- The greater recyclable material coming from the separation at the generation source, the greater employment required for the haulage, storage, trading and processing of such recovered wastes.
- Progressive formalization of former scavengers and other workers will bring about benefits to a considerable informal sector.

d. Citizen Participation and Sustainability

- The educational program for the population and gradual separation of SW at the source will benefit citizens' participation, thus allowing a close relation with municipal authorities.
- Besides, the educational program will also promote the culture of payment for cleansing services, which in turn will make such services sustainable.
- Finally, the strict and transparent supervision and control of contracts will protect the population's interests, and people's confidence towards municipalities will also rise

Table 8-65: Summary of Social Evaluation of the M/P

Components	Public health	Environmental well-being	Employment	Sustainability
Separation at the source	<ul style="list-style-type: none"> In-house sanitary management 	<ul style="list-style-type: none"> Reduction, reuse and recycling of SW Raise environmental education 	<ul style="list-style-type: none"> Employment is not affected 	<ul style="list-style-type: none"> Permanent participation by community
Separate collection	<ul style="list-style-type: none"> Sanitary management improves Delivery is arranged 	<ul style="list-style-type: none"> Prevents "scavenging" during collection 	<ul style="list-style-type: none"> Employment increases Former scavengers are formalized 	<ul style="list-style-type: none"> Trading of recyclable items is eased
Collection in low-income marginal areas	<ul style="list-style-type: none"> Sanitary improvement in low-income marginal areas Prevents proliferation of vectors 	<ul style="list-style-type: none"> Environmental conditions improved 100% collection coverage is achieved 	<ul style="list-style-type: none"> Employment increases Former scavengers are formalized 	<ul style="list-style-type: none"> Participation by community itself Culture of payment is promoted
Separation and processing of recyclable SW	<ul style="list-style-type: none"> Sanitary management of SW Prevents proliferation of noxious fauna 	<ul style="list-style-type: none"> Environmental education is raised Reduction of SW reaching S/L 	<ul style="list-style-type: none"> Employment increases Former scavengers are formalized 	<ul style="list-style-type: none"> Recycling increases Greater participation by private sector
Optimization of SWM within municipalities	<ul style="list-style-type: none"> Sanitary management benefits population and workers Risk of accidents decrease 	<ul style="list-style-type: none"> More orderly and safer process Optimized collection Environmental education is raised 	<ul style="list-style-type: none"> Employment in private sector increases Training of workers 	<ul style="list-style-type: none"> Greater citizen participation ensures sustainability Fluent correlation between municipality/ community
T/S(s) & haulage	<ul style="list-style-type: none"> Occupational health improves Sanitary management of the process 	<ul style="list-style-type: none"> Reduce traffic jams Orderly, clean and efficient process 	<ul style="list-style-type: none"> Possible increase of employment Labor conditions improve 	<ul style="list-style-type: none"> Greater participation by private sector Image of collection service improves
Final disposal	<ul style="list-style-type: none"> Sanitary management of SW in Nejapa S/L and new S/L proposed 	<ul style="list-style-type: none"> Prevent aquifer pollution due to leachate Burning of wastes is prevented Landscape is protected 	<ul style="list-style-type: none"> Employment increases Former scavengers are formalized 	<ul style="list-style-type: none"> Greater participation by private sector Image of collection service increases
Management of hazardous medical SW	<ul style="list-style-type: none"> Public health improves Workers' health is protected 	<ul style="list-style-type: none"> Risks due to contamination by hazardous SW is avoided 	<ul style="list-style-type: none"> Possible increase of employment Staff is trained and occupational health is protected 	<ul style="list-style-type: none"> Greater participation by private sector MSPAS responsibility upon hazardous medical SW is confirmed

8.4.6 Environmental Evaluation

Environmental benefits of the M/P comprise such as:

- Sanitary conditions of waste discharge areas through the improved discharge and storage manners (container use, citizen participation, etc.);
- Separate discharge and collection of recyclable materials for resources conservation;
- Improvement of urban environment by SWM services expansion; and
- Groundwater and soil pollution prevention by facilitating sanitary landfills.

8.4.6.1 Discharge and Storage

Currently, a number of discharge areas have unhygienic conditions such that wastes are scattered. The M/P proposed plans to improve those conditions by such as appropriate assignment of containers, examination of corresponding collection frequencies, public participation etc.

On the other hand, gradual introduction of separate discharge and collection is also proposed for recovering recyclable materials.

In so doing, it is deemed that M/P contributes environmental improvement in the contexts of enlarging hygienic conditions and resource conservation in AMSS.

8.4.6.2 Collection

Most collection routes in AMSS other than those in San Salvador municipality have usually been decided based on the empirical judgement of collection vehicle drivers. Those practices may sometimes solve local intricacies, however, they generally result in the lesser productivity in total than what could normally be achievable by technical objective assessment measures of route planning.

In order to resolve this issue, the Study conducted pilot projects of route improvement and produced the Manual for Collection Route Improvement (see Annex R). Collection works efficiency will be surely improved, if this manual is actually utilized in the route improvement practices by respective municipal officers patiently.

This collection efficiency improvement will contribute reduction of no-service areas in AMSS, accordingly deterioration of the urban environment related with municipal SWM will be lessened.

8.4.6.3 Final Disposal

The environmental legislation published June 2000 requires that the final disposal site for municipal wastes should be sanitary landfills.

Immediate compliance with this regulation will impose considerable financial burdens on municipalities. However, the M/P proposed solutions to meet the regulation's requirement and to implement sustainable SWM for 14 municipalities. Solutions are such as: fee collection efficiency improvement, administrative improvements, etc.

As a consequence, in maintaining the sustainable municipal SWM, environmental deterioration of soil/groundwater contamination by municipal waste disposal will be mitigated.

8.4.7 Overall Evaluation

In this section, the viability of the M/P for the SWM in the AMSS has been assessed from the point of technical, financial, economical, institutional, social and environmental views.

Technically, it was judged that the M/P be appropriate and its goals be attainable, taking into account of the current technical level of SWM in AMSS and availability of foreign technological inputs.

Financially, it was verified that the total expenditure (2001 to 2010) of “with M/P” is lesser than that of “without M/P”, namely M/P will reduce about 96million colones financial burden of 14 municipalities. However, in order to attain the sustainable SWM that the M/P aims, it is necessary for all 14 municipalities to improve SWM fee collection efficiency and to apply specific duty system for large waste dischargers. And in addition several municipalities are required to raise the SWM fee rates, which are considered to be affordable for respective municipal citizens.

Economically, the M/P is evaluated from the viewpoint of national economy benefits, which confirmed the necessity of implementing the M/P and its benefits.

The M/P proposed institutional building that improves the functioning of present institutions and it is judged to be enforceable and beneficial to a great length.

In view of social aspects, the M/P is deemed to be socially acceptable and enforceable.

Environmentally, it is appreciated that the implementation of M/P projects mitigates the environmental contamination and deterioration. At the same time it promotes resources conservation.

Accordingly it is concluded that the execution of the M/P is judged to be viable and appropriate for SWM in the AMSS.

8.4.8 Phased Implementation Plan

8.4.8.1 Regional System

The proposed implementation plan of the Master Plan for Regional System is shown in below table.

Table 8-66: Phased Implementation Plan for Regional System

		Phase I			Phase II			Phase III			
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Transfer system	TS 1 (350 t/d)	FS, EIA	B/D, D/D	Con.	OP	OP	OP	OP	OP	OP	OP
	TS 2 (900 t/d)	FS	EIA, B/D	D/D, Con.	Con.	OP	OP	OP	OP	OP	OP
Intermediate treatment	S/P					FS, EIA	B/D, D/D	Con.	OP	OP	OP
	Incineration									Begin examine	
Landfill	MIDES Nejapa	OP	OP	OP	OP	OP	OP	OP	OP	OP	OP
	Toacatepeque	FS, EIA	B/D, D/D	Con.	Con.	OP	OP	OP	OP	OP	OP
	New Espiga	Con.	Con.	OP	OP	OP	OP	OP	OP	OP	OP
Medical waste treatment	MIDES/Nejapa	OP	OP	OP	OP	OP	OP	OP	OP	OP	OP
	Incinerator	FS, EIA	B/D, D/D	Con.	OP	OP	OP	OP	OP	OP	OP

Note: FS: feasibility study B/D: basic design EIA : environmental impact assessment
D/D : detailed design Con.: construction OP: operation

8.4.8.2 Individual Management System

The proposed implementation plan of the Master Plan for Regional System is shown in below tables.

Table 8-67: Implementation Plan for Individual System (1)

		Phase I			Phase II			Phase III					
		Step	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
SS	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											
MJ	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											

Table 8-68: Implementation Plan for Individual System (2)

			Phase I			Phase II			Phase III			
		Step	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
CD	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
	Final disposal	III										
		II										
		I										
CT	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
	Final disposal	III										
		II										
		I										
AY	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
	Final disposal	III										
		II										
		I										
SM	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
	Final disposal	III										
		II										
		I										

Table 8-69: Implementation Plan for Individual System (3)

		Phase I			Phase II			Phase III					
		Step	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
ST	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											
AC	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											
SY	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											
IL	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											

Table 8-70: Implementation Plan for Individual System (4)

		Phase I			Phase II			Phase III					
		Step	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
SMT	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											
	AP	Discharge/ Storage	III										
			II										
			I										
Collection		III											
		II											
		I											
Haulage		III											
		II											
		I											
Final disposal		III											
		II											
		I											
NJ	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											
TN	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											

8.5 Alternatives of the Regional System of Municipal SWM

The system shown in Figure 8-18 is proposed in the M/P as the regional management system. With taking into account the status quo of municipal SWM in AMSS such as technical level and political situation, the regional system proposed by the M/P has become the optimum and most reasonable.

In this section, alternatives, which would possibly appear in case that some preconditions of the proposed system are changed, are examined aside from the M/P in order to contribute to the realization of appropriate municipal SWM in the Study Area in the future.

8.5.1 Present System and Proposed System

As Figure 8-17 shows, the present system consists of:

- one sanitary landfill
- one controlled dumping site
- two open dumping sites

Only MIDES/Nejapa S/L meets the final disposal standard of MARN having taken effect in June 2000. The 10 municipalities are disposing of their waste into it.

Direct transport to those final disposal sites is done by collection vehicles although the distances from the municipalities are various.

Hence, the M/P proposes the regional management system based on the following 2 principles:

- to implement landfilling all the waste of 14 municipalities that meets the recently published environmental regulation, and
- to install transfer stations, to transport waste by tractor-trailers in stead of the distant direct transport of several municipalities, in order to raise the efficiency of collection/transport activities and to prolong service life of the collection vehicles.

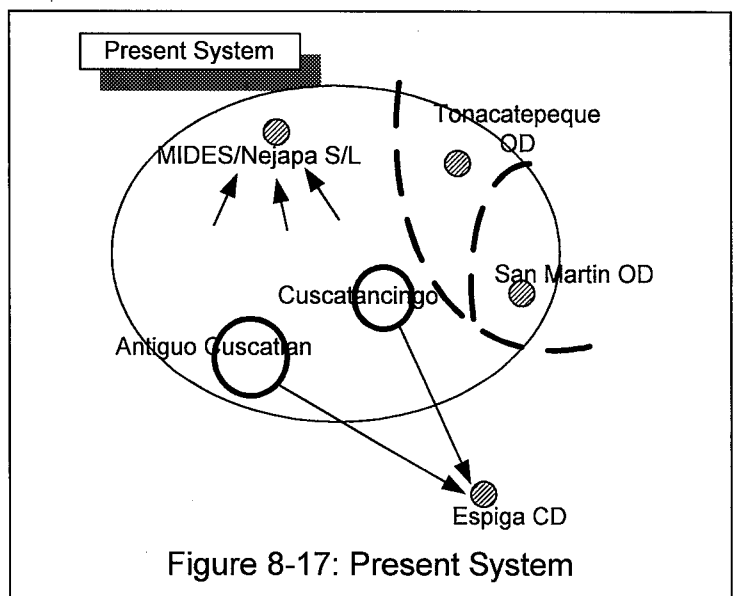


Figure 8-17: Present System

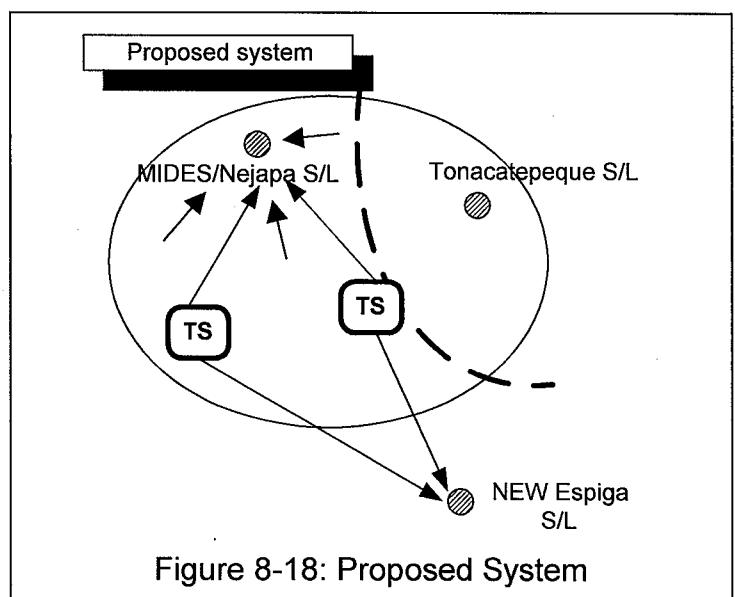
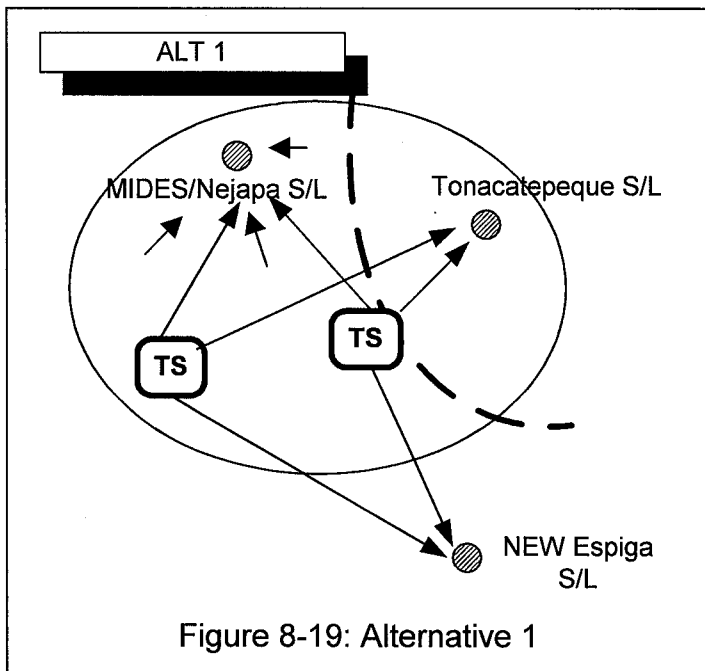


Figure 8-18: Proposed System

8.5.2 Brief Outline of Alternatives

In complying with the above 2 principles of the M/P proposal, the following 4 alternatives could also become viable, if the circumstances change in the near future. Or, one of the following 4 alternatives can be carried out for a certain period of time due to for example, temporal closure of a landfill due to accident.

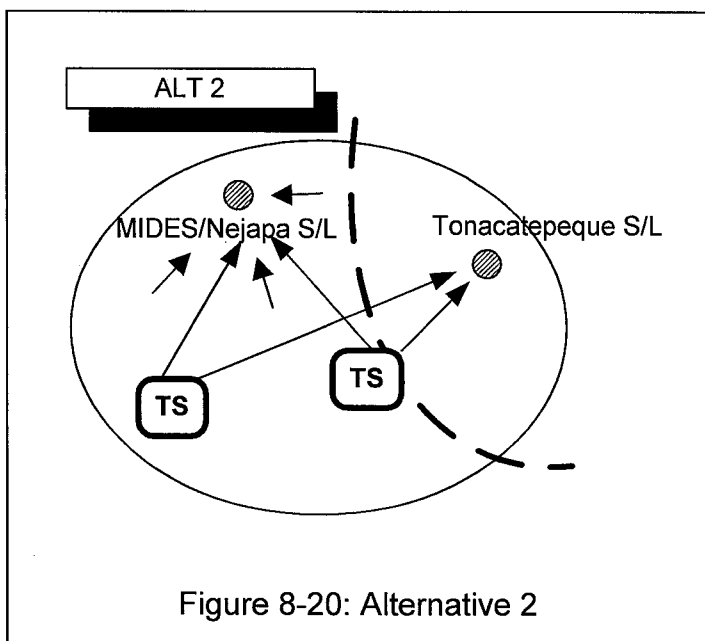
a. ALT 1



In this alternative, not only Tonacatepeque and San Martin but also other municipalities dispose of their waste in Tonacatepeque S/L. This alternative assures all the municipalities of sanitary landfilling even in the case that MIDES Nejapa S/L becomes not usable temporarily by any reason. Transport costs will vary depending on changed distances from respective municipalities or from the transfer stations. The disposal fee of Tonacatepeque S/L would be cheaper than that of MIDES Nejapa S/L, since US\$18.8/ton (inc. VAT) is estimated in case that a public company constructs and operates it

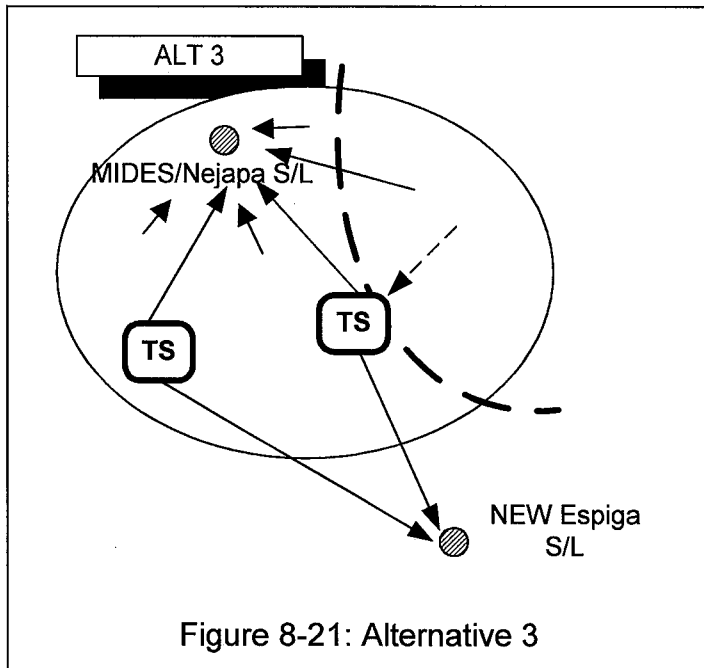
by having a loan of a low interest rate. However, the service life of the Tonacatepeque S/L will be shortened as it is not planned for the waste amount of several municipalities in AMSS.

b. ALT 2



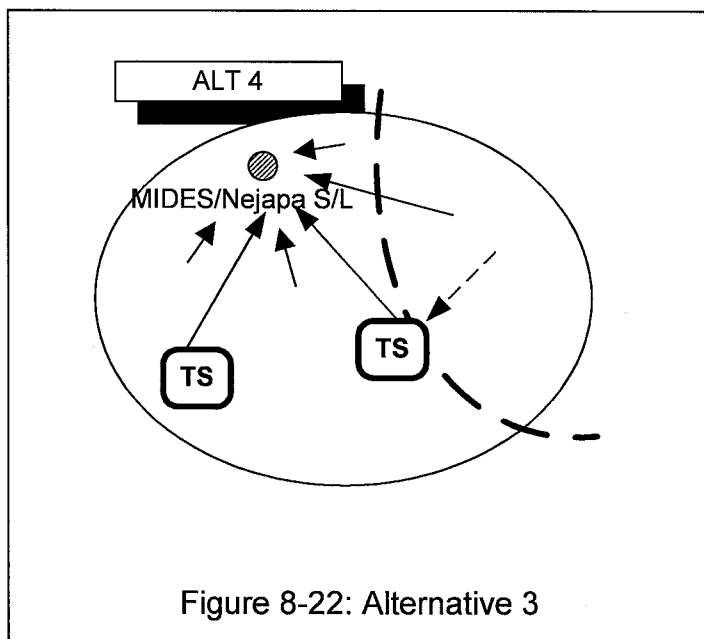
This alternative is basically the same as ALT1, but does not use New ESPIGA S/L. Transport cost born by each municipality will be changed depending on distances from respective municipalities or from the transfer stations. The issues of disposal fee and the service life of Tonacatepeque S/L have the same discussions as ALT1.

c. ALT 3



This alternative does not construct Tonacatepeque S/L, and increases financial cost burden of Tonacatepeque and San Martin municipalities than the regional system proposed by the M/P.

d. ALT 4



This alternative proposes that the all of 14 municipalities use MIDES Nejapa S/L. Changes in total transport costs for 12 municipalities would be insignificant. Meanwhile, costs increase for Tonacatepeque and San Martin municipalities will be considerable due to longer transport distance and higher tipping fee. It is, however, expected that this alternative may add more benefits of "economies of scale" in the final disposal management.

8.5.3 Comparison of Alternatives

Comparison of each alternative is shown in the following table.

Table 8-71: Comparison of Alternatives

ALT	Transport distance	Landfill service life	Safety of system	Precondition
1	The transport distance from the west T/S to Tonacatepeque S/L will be lengthened.	The service life of Tonacatepeque S/L will become shorter than planned in the M/P.	High safety level is assured as there are three (3) disposal sites same as in the M/P.	Revision and improvement of MIDES contract (e.g., to change the minimum guarantee quantity). New agreement between Tonacatepeque S/L and its new participants
2	In altering the destination to Nejapa S/L, there are no significant changes in distance from 2 T/Ss. Altering the destination to Tonacatepeque S/L will increase the transport distance from the west T/S.	The service life of Tonacatepeque S/L will become shorter than planned in the M/P.	Safety level decreases compared with the M/P. But there would be least problem, as two (2) disposal sites are available.	Revision and improvement of MIDES contract (e.g., price down, to change the minimum guarantee quantity). New agreement between the two (2) municipalities (CT&AC) and MIDES S/L or Tonacatepeque S/L
3	Transport distances from Tonacatepeque and San Martin will be lengthened.	Not particular	Safety level decreases compared with the M/P. But there would be least problem, as two (2) disposal sites are available.	Revision and improvement of MIDES contract (e.g., price down, to change the minimum guarantee quantity). New agreement between the two (2) municipalities (TN&SMT) and MIDES S/L or New ESPIGA S/L
4	Transport distances from Tonacatepeque and San Martin will be lengthened.	Not particular	Safety of final disposal system decreases, as only one (1) disposal site is available.	Revision and improvement of MIDES contract (e.g., price down, to change the minimum guarantee quantity). New agreement between the four (4) municipalities (CT, AC, TN and SMT) and MIDES S/L

8.5.4 Conclusion

As a conclusion, in order to make any of the above four alternatives viable and enforceable, it is necessary to obtain a mechanism that allows the benefits/costs born or reduced by the alternatives (e.g., mainly by "economies of scale") be fairly distributed among the participating municipalities. Hence, in order to make the costs distribution among users clear, it is required that each service (T/S&T or landfilling) should be fairly paid respectively only by those who utilize the respective service in proportion to the amount handled.