

J.5 Implementation Plan

J.5.1 Project Implementation Bodies

ALMA will be the government body in charge of the implementation of the following 4 projects:

- a. Improvement of Collection System**
- b. Construction of the ANPLS**
- c. Improvement of Los Cocos Workshop**
- d. Public Promotion**

J.5.2 Implementation Schedule

The proposed implementation schedule of the 4 projects is shown in Figure 10.5.2a.

J.5.3 Financial Plan

a. Financial Sources for Investment

Table J.5.3a Financial Sources for Investment

unit: mill.C\$

	1998	1999	2000	Total
Total Investment	95.89	103.77	75.42	275.08
Foreign Aid	85.19	93.07	-	178.26
Loan	-	-	75.42	75.42
Municipality	10.70	10.70	-	21.40

b. Objects of Foreign Aid

The objects of foreign aid are listed below. However, foreign aid is also assumed to cover the cost for the procurement of equipment required by 2000 when the new collection system starts and the foreign portion of the construction cost.

Equipment: Collection vehicles for Area B, large generation sources and street sweeping
Equipment for landfill works
Equipment for workshop
Equipment for public promotion

Construction Construction of the ANPLS
Construction of workshop

c. Objects of Loan

It was assumed that the procurement cost for the equipment to be replaced in 2000 and additional equipment required to cope with increase in waste volume will be covered by a loan because the municipality will not be able to afford the tremendous amount of money required.

The provision from private companies will not be taken into account because these companies are very small in scale at present. Therefore, the following loan conditions were assumed.

Loan condition:	Repayment period	10 years
	Interest	8 % per year

d. Objects of ALMA

The municipality of Managua will procure the remaining number of equipment. It will also supply the budget equivalent to the local portion of the costs for the construction of the ANPLS and Los Cocos workshop.

Projects	1996	1997	1998	1999	2000
1. Collection Improvement					
1.1 Procurement of Equipment					
(1) Preparation					
(2) Detailed design			—		
(3) Tender			—		
(4) Manufacturing of equipment			—	—	
(5) Delivery of equipment				—	
(6) Operation				—	
Investment total			32.03	35.17	47.13
2. Construction of ANPLS					
2.1 Disposal Site Construction					
(1) Preparation					
(2) Land acquisition					
(3) Detailed design			—		
(4) Tender			—		
(5) Construction			—	—	
(6) Operation					—
Sub-total			61.39	61.39	
2.2 Procurement of Equipment					
(1) Preparation			—		
(2) Detailed design			—		
(3) Tender			—		
(4) Manufacturing of equipment			—	—	
(5) Delivery of equipment				—	
(6) Operation				—	
Sub-total				25.79	
Investment cost total			61.39	87.18	

Figure J.5.3a(1) Implementation Schedule

unit: mill.C\$

Projects	1996	1997	1998	1999	2000
3. Improvement of Los Cocos Workshop					
3.1 Construction of Building					
(1) Preparation					
(2) Detailed design			—		
(3) Tender			—		
(4) Construction				—	
(5) Operation					
Sub-total			4.42	4.42	
3.2 Procurement of Equipment					
(1) Preparation					
(2) Detailed design			—		
(3) Tender			—		
(4) Manufacturing of equipment				—	
(5) Installation of equipment					—
(6) Operation					—
Sub-total				2.66	
Total			4.42	7.08	
4. Promotion of Public Participation					
4.1 Procurement of Equipment					
(1) Preparation					
(2) Detailed design			—		
(3) Tender			—		
(4) Manufacturing of equipment			—		
(5) Delivery of equipment				—	
(6) Operation					—
Total			0.68		

Figure J.5.3a(2) Implementation Schedule

unit: mill.C\$

ANNEX K

INVESTIGATION OF FINANCIAL CAPABILITY

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ANNEX K INVESTIGATION OF FINANCIAL CAPABILITY

K.1 Financial Study on the Master Plan and Feasibility Study

K.1.1 Work Flow of Financial Study

The work flow of the financial study is shown in Fig.K.1.1a.

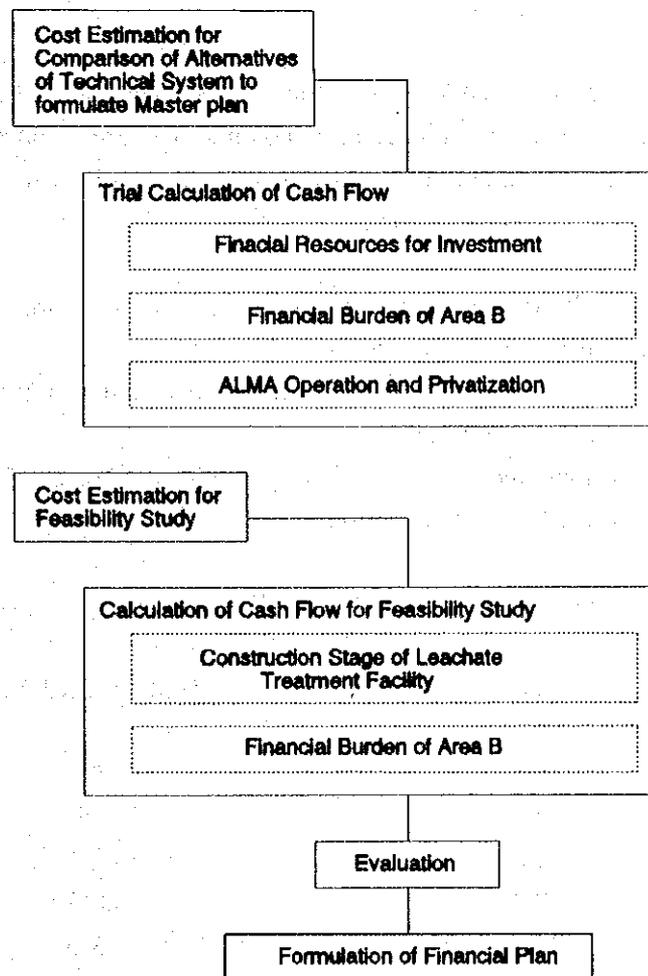


Fig.K.1.1a Work Flow of Financial Study

K.1.2 Pre-conditions and Major Assumptions

The key assumptions used in this study are as follows;

a. Economic Data

It is very difficult to forecast the future economy of Nicaragua because the country is presently changing its economic structure to a market economy. Further, even the use of trend figures of economic variables to describe future scenarios is too risky because for a long period of time the country has been under a controlled regime and civil war.

The formulation of the SWM Master Plan necessitates forecasting future economic figures to estimate waste volume and economic capability, factors relevant to the estimation of the required SWM cost. Therefore, the following assumptions on the future GDP and GRDP were made:

- The actual GDP growth rate will increase to more than 3.5% as the population increase rate exceeds 3%.
- The positive changes in the economy of Nicaragua in 1994 will bring about a 2% to 3% growth rate.
- The development plans for Nicaragua will aim for a 5% economic growth rate in the 1994 - 1995 period.

Based on the above assumptions, the GDP growth rate forecast is as follows:

Year	GDP (growth/year)
1995	3.5%
1996	4.0%
1997	4.5%
1998-2000	5.0%
2001-2005	4.5%
2006-2010	4.0%

In 1992, Managua made up 50% of the GDP, a contribution estimated to increase to 55% by the year 2000. This figure will be adopted until the year 2010 in this Study.

The estimated increase is attributable to the belief that urbanization will attract

migrants from rural areas and encourage the convergence of tertiary industries in Managua City.

Based on the above reasons, the main GDP and GRDP figures per annum were calculated as shown in Table K.1.2a.

Table K.1.2a Master Plan Framework

	Unit	1995	2000	2005	2010
GDP	mill.US\$	1,784.8	2,245.4	2,798.2	3,404.5
Share of Managua	%	51.9	55.0	55.0	55.0
GRDP in Managua	mill.US\$	925.9	1,235.0	1,539.0	1,872.5
Population of Managua	thousands	1,127.6	1,452.9	1,733.9	2,069.3
GRDP per capita	US\$	821.1	850.0	887.6	904.9

The budget of the city of Managua and the income of families in the city are assumed to be proportional to the GRDP growth rate.

Table K.1.2b Financial State of Managua Municipality and Family Income

	Unit	1995	2000	2005	2010
Budget of Managua	mill.US\$	27.4	36.5	45.5	55.4
Family Income	US\$/month	368.6	381.6	389.4	406.2

b. Conditions for Cost Estimation

All cost estimates are conducted taking the following into account:

- The prices and foreign exchange rate are based on the January 1995 rate.

$$\text{US\$ } 1.00 = \text{C\$ } 7.1183$$

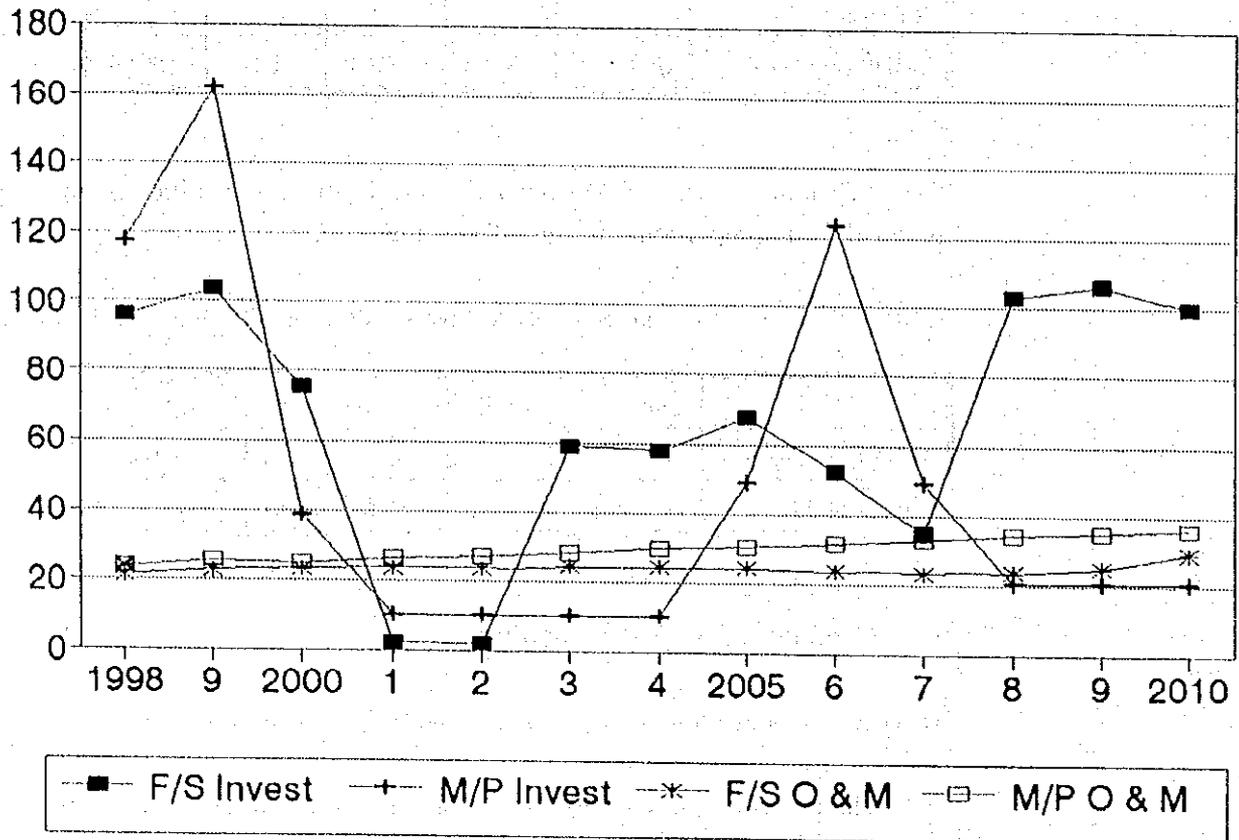
- Inflation is not taken into account.
- Local laborers whose wages are under C\$ 25,000/year are not obliged to pay income tax, but a 12.5% social security charge is deducted from the wage.
- Prices for equipment not available in Nicaragua reflect Japanese price levels. These will be presented in CIF prices in C\$.

Unit prices for earthworks, concrete works, buildings, etc., were based on the information given by the Ministry of Construction, Managua Municipality and private construction companies.

c. Other Assumptions

The investment plan and O & M cost for the Feasibility study is as shown in Fig.K.1.2a.

The depreciation costs were calculated based on the Table K.1.2c.



unit: mill.C\$ - 1994 price rate

Note: F/S: Feasibility Study
M/P: Master Plan
IT/R: Interim Report

Figure K.1.2a Investment Cost and O&M Cost in the F/S & M/P (IT.R)

Table K.1.2c Life Span of Equipments and Facilities

	Life Span(year)	Salvage value(%)
Container	5	0
Truck and Heavy Equipment	7	10
Machinery	15	0
Building and Civil Works	30	0

The loan conditions were assumed as shown in Table K.1.2d.

Table K.1.2d Loan conditions adopted in this Study

Loan conditions	Repayment term	Interest rate	Grace period
long term	15 years	8 %	3 years
middle term	10 years	8 %	3 years
short term	next year	12.5%	-

K.1.3 Criteria of the Feasibility Study

The criteria were made based on the following aspects.

- The Internal Rates of Return (IRR) was set at more than 8.5% in consideration of a loan.
- Since the disposal service is an indispensable public service for SWMS, the rate of revenue and expenditure (R/E) is set at more than 1 when the discount rate is 0%.
- The percentage of the residents are assumed capable of paying was set around 1% of their incomes.
- The financial burden ALMA is assumed capable of for SWMS was set at less than 10% of its total budget (including general accounts and capital accounts).

K.2 Trial Calculation for the Cash Flow of the proposed Technical Alternative

In the progress report II, a trial calculation of financial plan was done in order to determine whether it is possible to carry out a Master Plan and to presume the problems concerning financial plans.

K.2.1 Financial Resources

A study was done regarding initial investment by loans and aids. The cases are set as follows:

- Case 1: Only the local portion of the cost for the construction of the disposal site construction is assumed to be financed by ALMA; the remaining portion is assumed to be financed by loans.
- Case 2: About 80% of the investment is assumed to be financed by grants, while the remaining portion will be financed by ALMA.
- Case 3: About 80% of the investment is assumed to be financed by grant, which only the local portion of the cost for the construction of the disposal site will be financed by ALMA. The remaining portion will be financed by loans.

The results are shown in Fig.K.2.1a and K.2.1b.

Obtaining a loan to finance the initial investment is not a practical approach because it would put the municipality in a debt of C\$ 400 million by 2010 – 90% of the ALMA budget. It is also not practical to divide the initial investment between ALMA and foreign aid as it would require the former to appropriate more than 20% of its budget to SWM.

The Case 3 is most preferable because it will allow ALMA to reserve the amount of waste fee collected for the 2nd and 3rd investment. However, ALMA's contribution to SWM expenses in this case will have to be a little higher than the set amount of criteria.

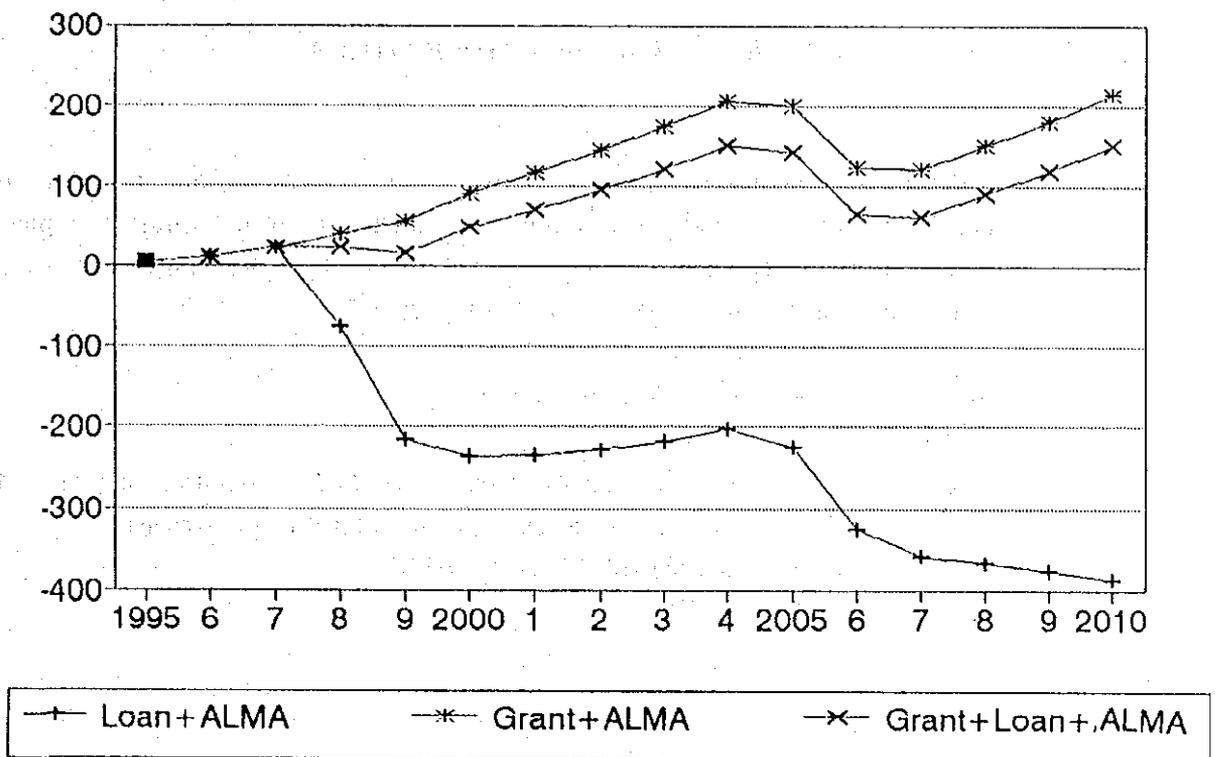
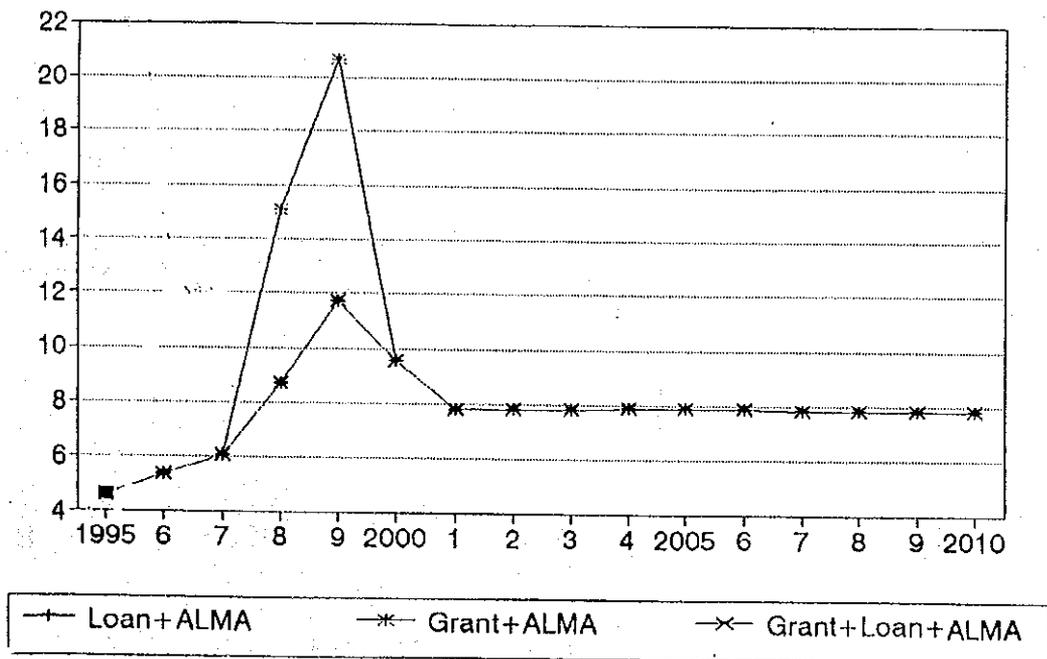


Figure K.2.1a Comparison of Reserves and/or Total Debt According to Financial Resources of Investment



Share (%) is calculated from ALMA budget distribution divided by ALMA total budget.

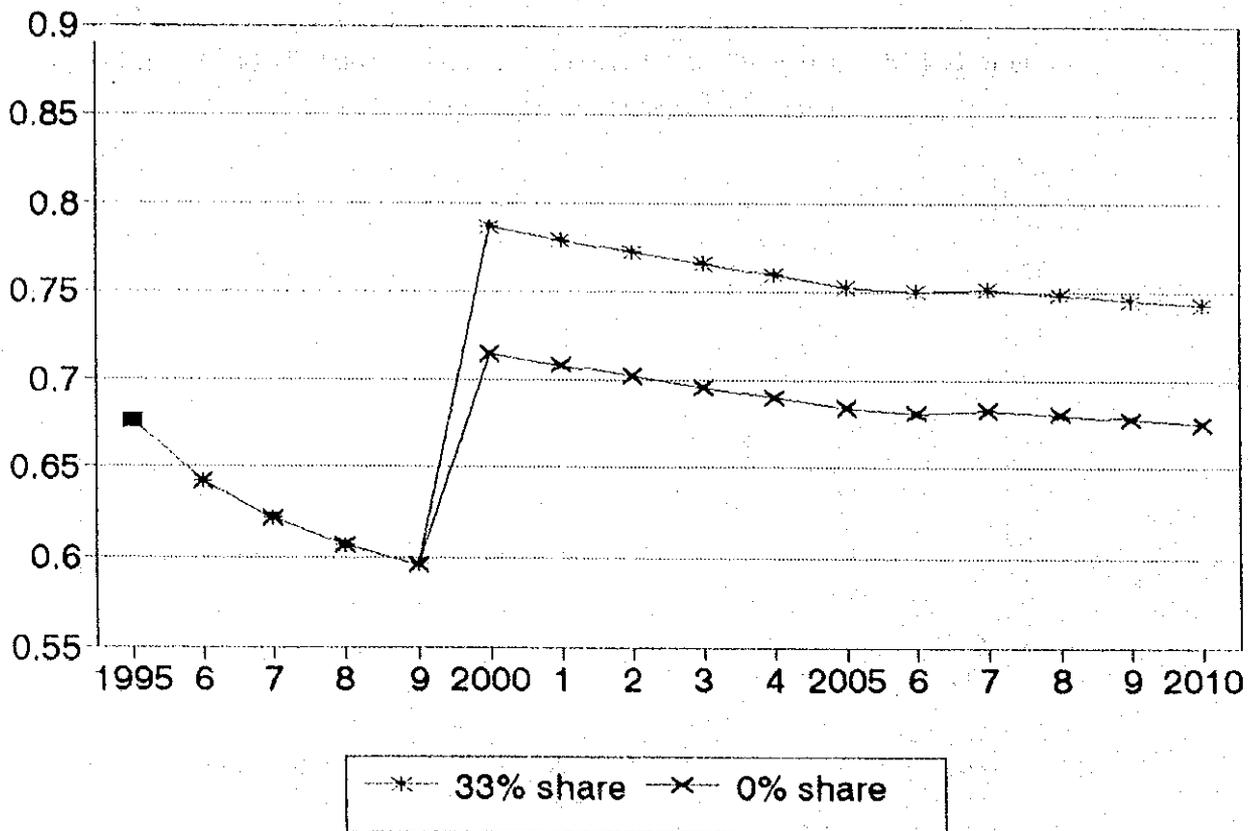
Figure K.2.1b Comparison of Share of SWM in Budget According to Financial Resources of Investment

K.2.2 Financial Burden for the Collection Area B Services

It is difficult to impose waste collection fees on the residents of area B because of their poor economic conditions. A study was carried out to determine how much of the service expenses in this area can be covered by collection area A, large generation sources, and ALMA (Refer to Figure K.2.2a).

Two assumptions were made in the study:

- Case 1: ALMA, the residents of Area A and large generation sources will shoulder the entire cost, each paying a third of the expenses.
- Case 2: All costs will be subsidized by ALMA.



unit: %

Figure K.2.2a Comparison of Residential Burden According to Financial Burden for the Collection Area B Services

K.2.3 ALMA Operation and Privatization

Nicaragua has been promoting the privatization of municipal services, a trend which further increases the financial share of the residents due to the requirements present legislations impose.

The additional costs brought about by privatization are assumed as follows:

- more taxes (VAT, Income tax and Profit tax)
- license fee payments
- Banks interest rates

According to the "Beneficiary Pay Principle", the tipping fee for landfill will be added to the above costs.

This study assumed the following cases:

- Case 1: Collection and disposal services will be executed by ALMA (no privatization)
- Case 2: 50% and 100% of collection area A will be privatized in 2000 and 2010, respectively, under the condition that the concessionaires purchase the collection vehicles of their owns and pay tipping fees according to collection and haulage volume.
- Case 3: 50% and 100% of collection area A will be privatized in 2000 and 2010, respectively, under the condition that concessionaires rent ALMA's collection and haulage vehicles and pay tipping fees according to collection volume.
- Case 4: 50% and 100% of collection area A will be privatized in 2000 and 2010, respectively, under the condition that concessionaires rent ALMA's collection and haulage vehicles and pay tipping fees which will be discounted until 2000.

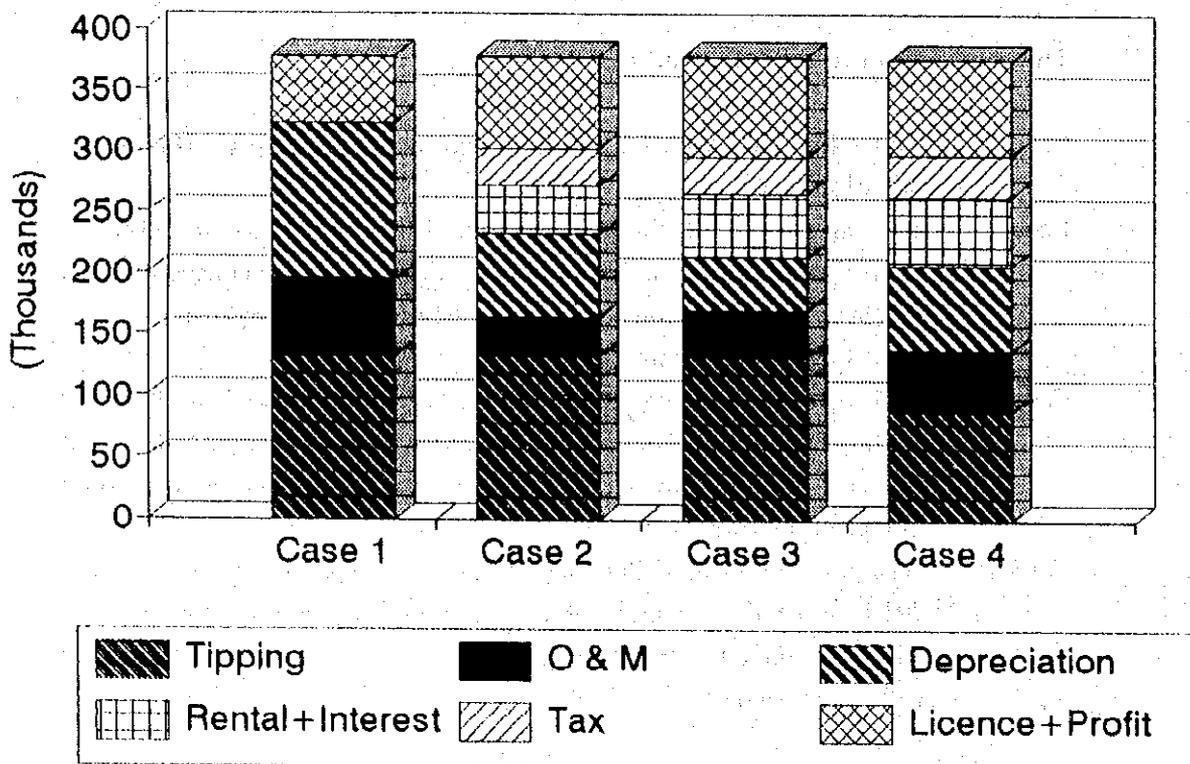
The amount that can be curtailed (O&M cost and vehicle procurement cost) if either case 2, 3 or 4 is implemented, in contrast to the total cost that would be required for case 1, are calculated as follows:

- Case 2: 60%
- Case 3: 50%
- Case 4: 25%

The breakdown of the costs are shown in Fig.K.2.3a. It seems to be very difficult to reduce these costs to more than 50%, therefore a subsidy for the tipping fee is

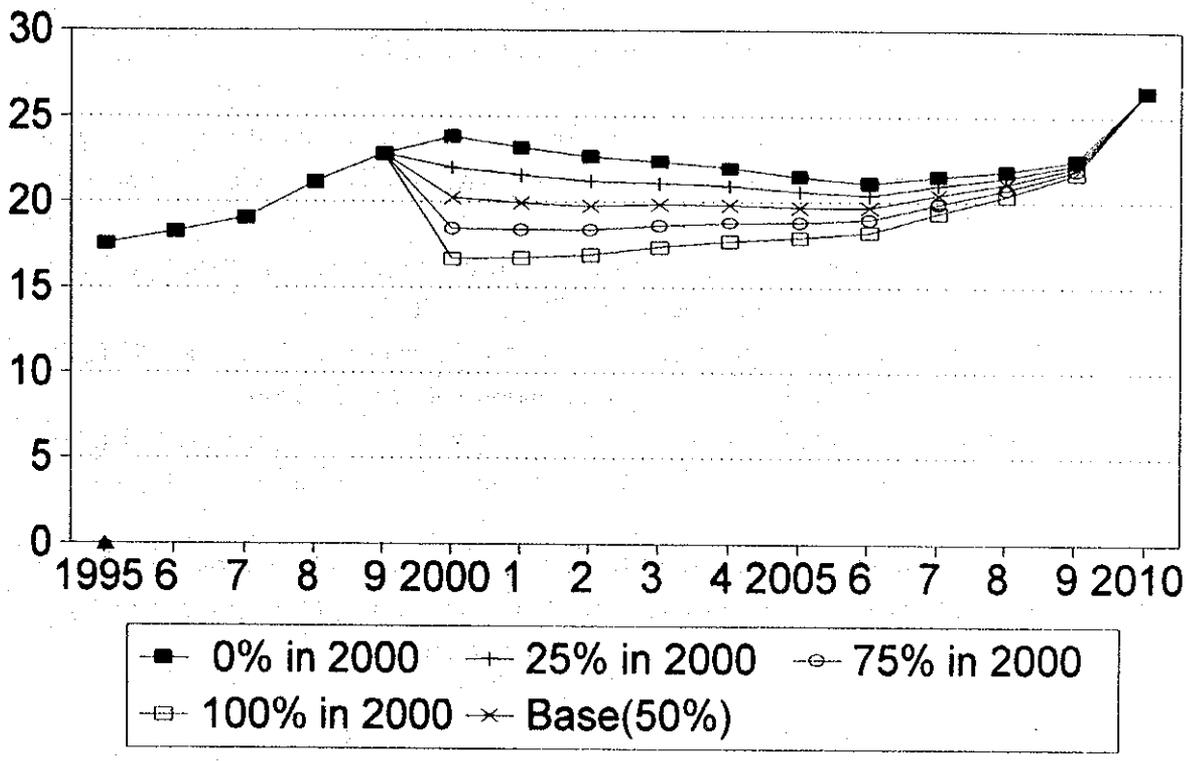
proposed in the Master Plan.

In order to reduce the burden of ALMA, the privatization of the entire area (100%) in 2000 is preferable as shown in Figure K.2.3b. There are, however, no private concessionaires presently capable of operating SWM services in Nicaragua. The establishment of these private concessionaires in a few years is also doubtful, therefore, 50% privatization in 2000 is proposed in the Master Plan.



unit: mill. C\$

Figure K.2.3a Comparison of Cost According to ALMA Operation and Privatization Cases



unit: mill.C\$ - 1994 price rate

Figure K.2.3b ALMA's SWM Costs by Privatization target in 2000

K.3 Cash Flow for the Feasibility Study

K.3.1 Construction Stages of Leachate Treatment Facilities

In order to reduce the investment cost in Phase I, the construction stages of leachate treatment facilities were examined based on the following assumptions:

Case 1: A leachate treatment facility will be constructed in Phase I (1998 and 1999) and the operation will start in 2000.

Case 2: A leachate treatment facility will be constructed in Phase II (2003, 2004 and 2005) and the operation will start in 2006.

Case 3: A leachate treatment facility will be constructed in Phase III (2008, 2009 and 2010) and the operation will partly start in 2010.

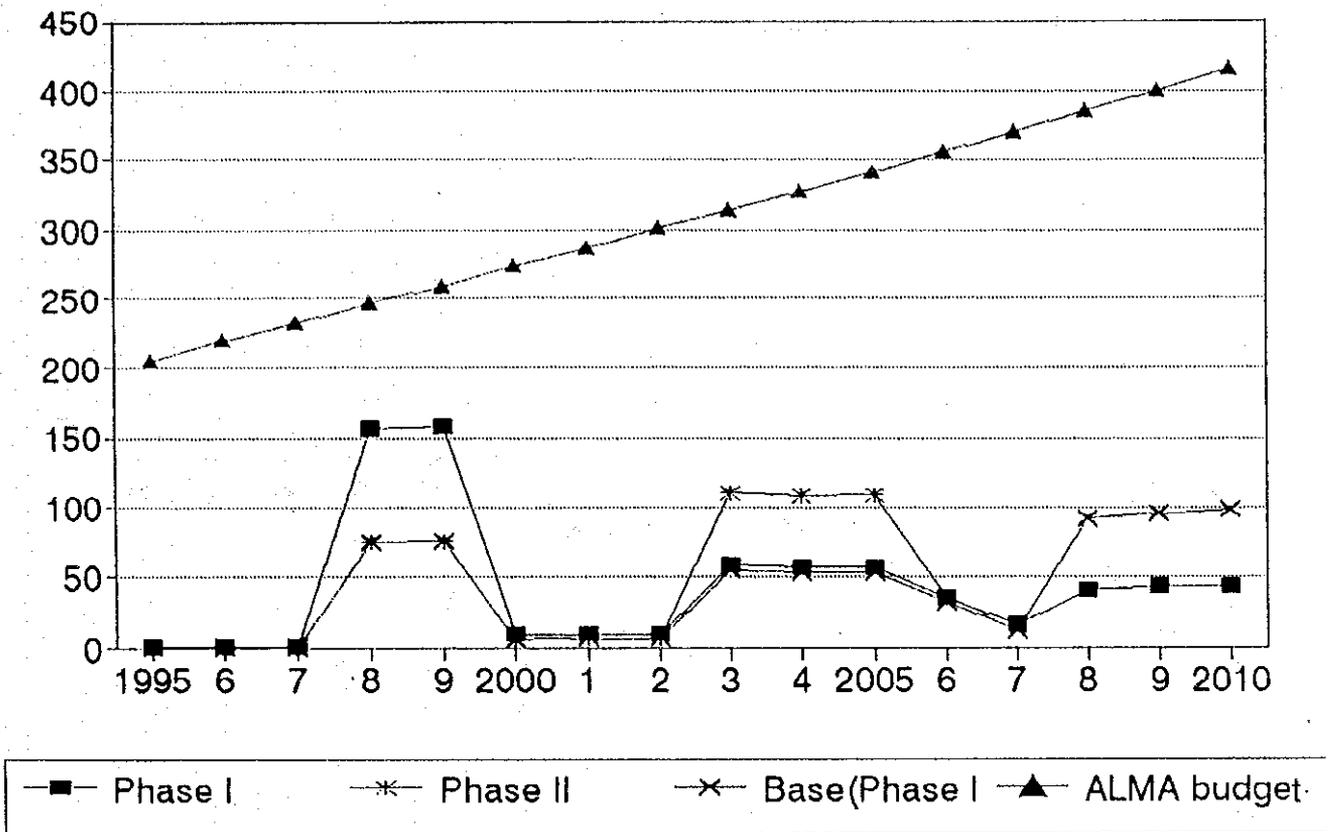
The total investment cost and O&M cost for landfill operation are shown in Figure K.3.1a. If the construction expenses will be financed by ALMA alone, the amount that it will cover in ALMA's budget is as follows:

Case 1: 66% in 1998

Case 2: 35% in 2003

Case 3: 24% in 2008

It is not practical to appropriate 66% or 35% of ALMA's budget if foreign aid or loan can be obtained, especially because ALMA also needs to finance other projects in Phase I necessary to improve SWM in Managua.



unit: mill.C\$ - 1994 price rate

Figure K.3.1a Comparison of Costs by Construction Stage of Leachate Treatment Facility

K.3.2 Financial Burden of Area B

The study on the financial capability of residents in Area A considered the gradual reduction of the subsidy for tipping fees to establish an independent fund reserve for the sustainable operation of SWM services, and for privatization.

The assumptions made in the study were:

- Case 1: One third of the expenses for Area B will be subsidized by ALMA, while the remaining expenses will be shared by the residents of Area A and large generation sources from 2000 to 2010.
- Case 2: After 2005, half of the expenses will be subsidized by ALMA, while the remaining expenses will be shared by the residents of Area A and large generation sources.

The results are shown in Fig.K.3.2a.

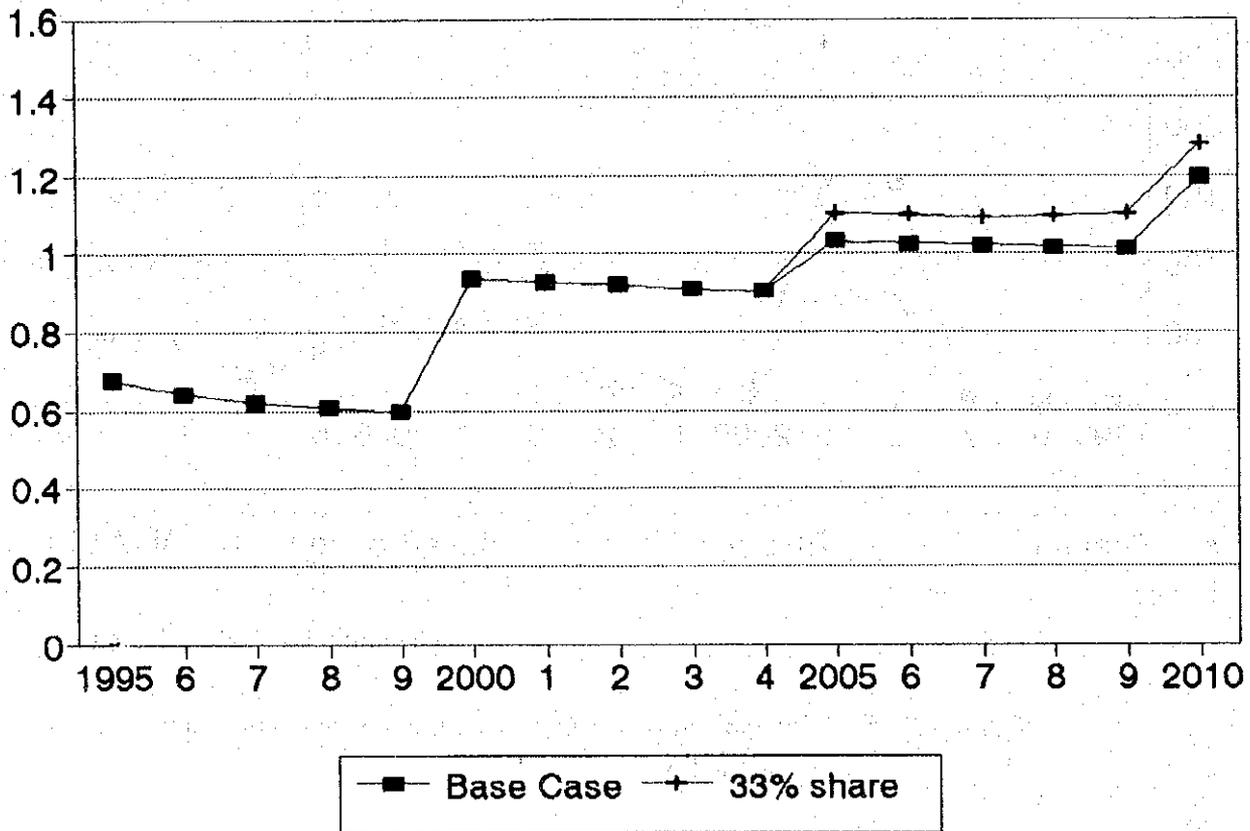


Figure K.3.2a Comparison of Residential Burden

K.3.3 Financial Evaluation

The method used to calculate the cash flow of the projects whereupon an F/S will be carried out is outlined below:

Table K.3.3a Estimation Method of Cash Flow

Items	Sources	Execution Body	Revenue	Expenditure
Collection & Haulage	Collection Area A	ALMA	-Waste Fee	-Investment and O&M of Vehicles
		Private	-License Fee -Rental Fee -Tipping Fee (Partially)	-Investment and maintenance cost of Vehicles
	Collection Area B	ALMA	-Waste Fee (partially)	-Investment and O&M of Vehicles
	Large Generation Sources	ALMA	-Waste Fee	-Investment and O&M of Vehicles
	Street Sweeping	ALMA	-(Property Tax)	-Investment and O&M of Vehicles
Final Disposal		ALMA	-Tipping Fee	-Investment and O&M of Facilities, Vehicles and Equipment

a. Evaluation of the Project for the Improvement of the Collection and Public Area Cleansing System

In order to establish an independent fund reserve for the sustainable operation of SWM services, waste collection fees will be imposed on the residents of Area B, according to the "Beneficiary Pay Principle", although it is very difficult to collect the fees. The remaining amount required for the operation of SWM services in Area B will be shared by ALMA, the residents of Area A, and large generation sources.

When the initial investment for the improvement of collection services in Area B is not counted as revenue, the rate of revenue and expenditure (R/E) only amounts to 0.80, even if the discount rate is 0%. When the initial investment costs is counted as revenue, under the assumption of grants, the internal rate of return (FIRR) becomes 9.8% as shown in Table K.3.3b, which concludes this project is feasible.

Table K.3.3b ALMA's Revenue & Expenditure for the Collection System Improvement Project (1998 - 2000)

unit: mill.C\$

	Revenue					Expenditure			Discount rate 9.8 %	
	Residents of Area B	Residents of Area A	Large generation source	Subsidy from ALMA	Sub-total	Invest- ment	O & M cost	Sub-total	Revenue	Expen- diture
1998	0.0			15.8	15.8	15.8	2.2	18.0	15.8	18.0
1999	0.1			19.0	19.1	19.0	2.3	21.4	17.4	19.5
2000	0.5	3.0	3.0	3.0	9.4	0.0	3.6	3.6	7.8	3.0
2001	0.6	3.1	3.1	3.1	9.8	1.7	3.8	5.5	7.4	4.2
2002	0.7	3.2	3.2	3.2	10.2	1.6	4.0	5.7	7.0	3.9
2003	0.8	3.3	3.3	3.3	10.7	6.6	4.3	10.9	6.7	6.8
2004	1.0	3.4	3.4	3.4	11.2	6.5	4.6	11.2	6.4	6.4
2005	1.7	2.6	2.6	2.6	9.4	14.7	4.8	19.5	4.9	10.1
2006	1.9	2.7	2.7	2.7	9.9	15.0	5.0	20.0	4.7	9.5
2007	2.1	2.7	2.7	2.7	10.1	8.0	4.5	12.4	4.4	5.4
2008	2.7	3.0	3.0	3.0	11.9	15.2	5.4	20.7	4.7	8.1
2009	3.4	3.5	3.5	3.5	14.0	17.4	6.4	23.9	5.0	8.5
2010	5.1	3.7	3.7	3.7	16.2	12.2	7.5	19.7	5.3	6.4
2011					0.0	(41.4)		(41.4)	0.0	(12.3)
Total	20.7	34.1	34.1	68.9	157.8	92.5	58.5	151.0	97.5	97.5

R/E 1.0000623

Financial plan for Area B service is shown in Table K.3.3c.

Table K.3.3c Financial Plan for Area B

unit: C\$ 1,000 in 1994

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
a. Profit and Loss State													
Revenue													
Fee	41	118	4,941	5,058	5,159	5,285	5,392	4,895	5,094	5,179	6,086	7,126	8,815
Private Concessions	0	0	1,478	1,688	1,902	2,139	2,379	1,944	2,145	2,266	2,737	3,353	3,703
ALMA	0	0	2,956	3,068	3,169	3,290	3,398	5,185	5,362	5,332	6,083	7,060	7,407
Subtotal	41	118	9,376	9,814	10,230	10,714	11,168	12,025	12,601	12,777	14,906	17,540	19,925
Expenditure													
O & M cost	2,177	2,349	3,602	3,820	4,042	4,295	4,646	4,797	4,951	4,486	5,441	6,420	7,489
Depreciation	0	0	5,774	5,994	6,188	6,419	6,522	7,227	7,650	8,291	9,465	11,119	12,436
Interest	0	267	579	0	0	0	0	0	0	714	761	1,579	2,567
Subtotal	2,177	2,616	9,955	9,814	10,230	10,714	11,168	12,025	12,601	13,491	15,667	19,119	22,492
Balance	(2,136)	(2,499)	(579)	0	0	0	0	0	0	(714)	(761)	(1,579)	(2,567)
b. Cash Flow													
Balance+Dep.	(2,136)	(2,499)	5,195	5,994	6,188	6,419	6,522	7,227	7,650	7,577	8,703	9,540	9,870
Money demand													
Investment	15,774	19,029	0	1,716	1,649	6,631	6,530	14,710	15,033	7,957	15,245	17,441	12,181
Loan repayment	0	2,136	4,635	0	0	0	0	0	0	5,711	6,091	12,632	20,533
Subtotal	15,774	21,165	4,635	1,716	1,649	6,631	6,530	14,710	15,033	13,668	21,336	30,073	32,713
Money supply													
Loan	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreign aid	15,774	19,029	0	0	0	0	0	0	0	0	0	0	0
Reserved Fund	0	0	0	1,716	1,649	6,631	6,530	14,710	15,033	7,957	15,245	17,441	12,181
ALMA	0	0	0	0	0	0	0	0	0	0	0	0	0
Short loan	2,136	4,635	0	0	0	0	0	0	5,711	6,091	12,632	20,533	22,844
Subtotal	17,911	23,664	0	1,716	1,649	6,631	6,530	14,710	20,744	14,048	27,878	37,973	35,024
Surplus	0	0	560	4,278	4,538	(212)	(8)	(7,483)	(1,673)	0	0	0	0
Reserved fund	0	0	560	4,837	9,376	9,164	9,156	1,673	0	0	0	0	0
Total debt	2,136	4,635	0	0	0	0	0	0	5,711	6,091	12,632	20,533	22,844

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
c. Balance Sheet													
Assets													
Current Assets	0	0	560	4,837	9,376	9,164	9,156	1,673	0	0	0	0	0
Fixed Assets	15,774	34,803	29,029	24,751	20,213	20,425	20,433	27,916	35,300	34,966	40,746	47,067	46,811
Other Capitalized Assets	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	15,774	34,803	29,589	29,589	29,589	29,589	29,589	29,589	35,300	34,966	40,746	47,067	46,811
Liabilities													
Current Liabilities	2,136	4,635	0	0	0	0	0	0	5,711	6,091	12,632	20,533	22,844
Long-term Debt	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	2,136	4,635	0	0	0	0	0	0	5,711	6,091	12,632	20,533	22,844
Net Worth													
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreign Aid	15,774	34,803	34,803	34,803	34,803	34,803	34,803	34,803	34,803	34,803	34,803	34,803	34,803
ALMA	0	0	0	0	0	0	0	0	0	0	0	0	0
Retained Earning	(2,136)	(4,635)	(5,214)	(5,928)	(6,690)	(8,269)	(10,835)						
Total	13,638	30,168	29,589	28,875	28,114	26,534	23,968						

b. Evaluation of the ANPLS Construction Project

It is quite difficult to say whether the construction of the new landfill site is feasible because the financial evaluations of the operation until 2010 indicated an FIRR of 1.5%, as shown in Table K.3.3d, assuming that all of the initial investment is financed by loans. If the foreign portion of the initial investment costs is counted as revenue assuming it will be subsidized through grants, the FIRR rises up to 29.6% because the tipping fee is set to cover the full costs including the depreciation costs of Phase I. As shown in Table K.3.3c.

However, evaluations carried out from 1998 to 2016, when the Acahualinca newly proposed disposal site becomes fully utilized, indicate an R/E of 0.83 even if the discount rate is 0% (see Table K.3.3f), because the construction of a leachate treatment facility is considered. A feasibility study should be carried out again should a waste treatment plant is to be constructed.

Table K.3.3d ALMA's Expenditure & Revenue of ANPLS Construction Project (1998 - 2010)

unit: mill.C\$

	Revenue				Expenditure			Discount rate 1.5 %	
	Area A	Commer- cial	ALMA	Sub-total	Invest- ment	O & M cost	Sub-total	Revenue	Expen- diture
1998	0.0	0.2	0.0	0.2	71.6		71.6	0.2	71.6
1999	0.0	0.3	0.0	0.3	77.0		77.0	0.3	75.8
2000	7.0	11.3	10.4	28.7	0.0	6.0	6.0	27.8	5.8
2001	7.4	11.8	11.1	30.2	0.0	6.1	6.1	28.9	5.9
2002	7.8	12.3	11.8	31.9	0.0	6.3	6.3	30.1	5.9
2003	8.3	12.9	12.5	33.7	48.6	6.6	55.3	31.3	51.3
2004	8.8	13.5	13.2	35.5	46.6	6.8	53.4	32.5	48.8
2005	16.4	14.1	7.0	37.5	46.6	7.0	53.5	33.8	48.2
2006	17.4	14.6	7.4	39.4	25.8	7.1	32.9	35.0	29.2
2007	18.4	15.2	7.9	41.5	5.2	7.9	13.0	36.3	11.4
2008	19.5	17.0	8.3	44.8	83.8	8.1	92.0	38.6	79.3
2009	20.6	19.0	8.8	48.4	86.8	8.7	95.6	41.1	81.1
2010	35.3	23.8	0.0	59.1	85.9	12.3	98.2	49.4	82.1
2011					(256.6)		(256.6)		(211.4)
Total	166.9	165.9	98.5	431.3	321.3	82.9	404.2	385.3	385.1

R/E

1.0005262

Table K.3.3e ALMA's Expenditure & Revenue for the ANPLS Construction Project (1998 - 2010)

unit: mill.C\$

	Revenue				Expenditure			Discount rate 29.6 %	
	Area A	Commer- cial	ALMA	Sub-total	Invest- ment	O & M cost	Sub-total	Revenue	Expen- diture
1998	0.0	0.2	57.3	57.5	71.6		71.6	57.5	71.6
1999	0.0	0.3	61.6	61.8	77.0		77.0	47.7	59.4
2000	7.0	11.3	10.4	28.7	0.0	6.0	6.0	17.1	3.6
2001	7.4	11.8	11.1	30.2	0.0	6.1	6.1	13.9	2.8
2002	7.8	12.3	11.8	31.9	0.0	6.3	6.3	11.3	2.2
2003	8.3	12.9	12.5	33.7	48.6	6.6	55.3	9.2	15.1
2004	8.8	13.5	13.2	35.5	46.6	6.8	53.4	7.5	11.3
2005	16.4	14.1	7.0	37.5	46.6	7.0	53.5	6.1	8.7
2006	17.4	14.6	7.4	39.4	25.8	7.1	32.9	5.0	4.1
2007	18.4	15.2	7.9	41.5	5.2	7.9	13.0	4.0	1.3
2008	19.5	17.0	8.3	44.8	83.8	8.1	92.0	3.4	6.9
2009	20.6	19.0	8.8	48.4	86.8	8.7	95.6	2.8	5.5
2010	35.3	23.8	0.0	59.1	85.9	12.3	98.2	2.6	4.4
2011					(256.6)		(256.6)		(8.8)
Total	166.9	165.9	217.4	550.1	321.3	82.9	404.2	188.1	188.1

R/E

1.0001003

Table K.3.3f ALMA's Expenditure & Revenue for the ANPLS Construction Project (1998 - 2016)

unit: mill.C\$

	Revenue				Expenditure			Discount rate 0%	
	Area A	Commer- cial	ALMA	Sub-total	Invest- ment	O & M cost	Sub-total	Reve- nue	Expen- diture
1998	0.0	0.2	57.3	57.5	71.6		71.6	57.5	71.6
1999	0.0	0.3	61.6	61.8	77.0		77.0	61.8	77.0
2000	7.0	11.3	10.4	28.7	0.0	6.0	6.0	28.7	6.0
2001	7.4	11.8	11.1	30.2	0.0	6.1	6.1	30.2	6.1
2002	7.8	12.3	11.8	31.9	0.0	6.3	6.3	31.9	6.3
2003	8.3	12.9	12.5	33.7	48.6	6.6	55.3	33.7	55.3
2004	8.8	13.5	13.2	35.5	46.6	6.8	53.4	35.5	53.4
2005	16.4	14.1	7.0	37.5	46.6	7.0	53.5	37.5	53.5
2006	17.4	14.6	7.4	39.4	25.8	7.1	32.9	39.4	32.9
2007	18.4	15.2	7.9	41.5	5.2	7.9	13.0	41.5	13.0
2008	19.5	17.0	8.3	44.8	83.8	8.1	92.0	44.8	92.0
2009	20.6	19.0	8.8	48.4	86.8	8.7	95.6	48.4	95.6
2010	35.3	23.8	0.0	59.1	85.9	12.3	98.2	59.1	98.2
2011	35.3	23.8	0.0	59.1	32.1	12.3	44.4	59.1	44.4
2012	35.3	23.8	0.0	59.1	57.9	12.3	70.2	59.1	70.2
2013	35.3	23.8	0.0	59.1	5.2	12.3	17.5	59.1	17.5
2014	35.3	23.8	0.0	59.1	0.0	12.3	12.3	59.1	12.3
2015	35.3	23.8	0.0	59.1	3.0	12.3	15.3	59.1	15.3
2016	35.3	23.8	0.0	59.1	3.0	12.3	15.3	59.1	15.3
2017					(2.6)		(2.6)	0.0	(2.6)
Total	166.9	165.9	217.4	550.1	577.9	82.9	660.8	550.1	660.8

R/E 0.8325044

Financial plan for ANPLS is shown in Table K.3.3g.

Table K.3.3g Financial Plan for ANPLS

unit: mill.C\$ in 1994

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
a. Profit and Loss Statement													
Revenue													
Fee	0	0	14,765	15,112	15,459	15,790	16,102	18,153	18,088	17,956	18,962	19,994	23,815
Private concessions	0	0	3,475	4,058	4,703	5,409	6,180	12,303	13,892	15,637	17,532	19,583	35,294
ALMA	0	0	10,426	11,068	11,757	12,482	13,243	7,030	7,442	7,884	8,348	8,834	0
Subtotal	0	0	28,666	30,237	31,918	33,681	35,525	37,486	39,422	41,477	44,842	48,411	59,108
Expenditure													
O & M cost	0	0	5,990	6,120	6,250	6,640	6,790	6,950	7,100	7,890	8,140	8,710	12,320
Depreciation	0	0	28,262	28,262	28,262	28,546	28,546	28,546	31,936	32,648	32,648	33,075	33,075
Interest	0	0	0	0	0	0	0	0	0	0	0	0	5,290
Subtotal	0	0	34,252	34,382	34,512	35,186	35,336	35,496	39,036	40,538	40,788	41,785	50,685
Balance	0	0	(5,585)	(4,144)	(2,593)	(1,505)	189	1,990	385	939	4,054	6,626	8,423
b. Cash Flow													
Balances+Dep.	0	0	22,676	24,117	25,668	27,041	28,735	30,536	32,322	33,587	36,702	39,701	41,498
Money demand													
Investment	71,619	76,959	0	0	0	48,636	46,591	46,591	25,793	5,154	83,835	86,844	85,880
Loan repayment	0	1	1	0	0	0	0	0	0	0	0	0	42,323
Subtotal	71,619	76,960	1	0	0	48,636	46,591	46,591	25,793	5,154	83,835	86,844	128,203
Money supply													
Loan	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreign aid	61,356	66,697	0	0	0	0	0	0	0	0	0	0	0
Reserved Fund	0	0	0	0	0	46,591	46,591	46,591	0	0	83,835	83,835	83,835
ALMA	10,262	10,262	0	0	0	2	0	0	26	5	0	3	2
Short loan	1	1	0	0	0	0	0	0	0	0	0	42,323	86,702
Subtotal	71,619	76,960	0	0	0	46,593	46,591	46,591	26	5	83,835	126,161	170,540
Surplus	0	0	22,675	24,117	25,668	(21,593)	(17,856)	(16,055)	6,554	28,439	(47,133)	(4,818)	0
Reserved fund	0	0	22,675	46,792	72,461	50,868	33,012	16,957	23,512	51,951	4,818	0	0
Total debt	1	1	0	0	0	0	0	0	0	0	0	42,323	86,702

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
c. Balance Sheet													
Assets													
Current Assets	0	0	22,675	46,792	72,461	50,868	33,012	16,957	23,512	51,951	4,818	0	0
Fixed Assets	71,619	148,578	120,316	92,055	63,793	83,883	101,928	119,973	113,829	86,335	137,522	191,291	244,096
Other Capitalized Assets	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	71,619	148,578	142,992	138,847	136,254	134,751	134,940	136,930	137,341	138,286	142,340	191,291	244,096
Liabilities													
Current Liabilities	1	1	0	0	0	0	0	0	0	0	0	42,323	86,702
Long-term Debt	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1	1	0	42,323	86,702								
Net Worth													
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreign Aid	61,356	128,053	128,053	128,053	128,053	128,053	128,053	128,053	128,053	128,053	128,053	128,053	128,053
ALMA	10,262	20,524	20,524	20,524	20,524	20,526	20,526	20,526	20,552	20,557	20,557	20,560	20,562
Retained Earning	0	0	(5,585)	(9,730)	(12,323)	(13,828)	(13,639)	(11,649)	(11,264)	(10,324)	(6,270)	356	8,779
Total	71,618	148,577	142,992	138,847	136,254	134,751	134,940	136,930	137,341	138,286	142,340	148,969	157,394

c. Evaluation of the Project for the Improvement of Los Cocos Workshop

The R/E by 2010 is calculated at 0.82 even if the discount rate is 0% (see Table K.3.3h) if the initial investment is counted as revenue and subsidized through grant aid. However, as stated in the economic evaluation, the workshop should be improved to smoothly operate cleansing services in Managua. Therefore, this project is considered feasible if evaluated with the collection services improvement project.

Table K.3.3h ALMA's Revenue & Expenditure for the Improvement of the Los Cocos Workshop (1998 - 2000)

unit: mill.C\$

	Revenue			Expenditure			Discount rate 0 %	
	from ALMA	from P.C.	Sub-total	Investment	O & M cost	Sub-total	Revenue	Expenditure
1998	4.8	0.0	4.8	5.2		5.2	4.8	5.2
1999	5.8	0.0	5.8	6.3	0.0	6.3	5.8	6.3
2000	0.0	1.2	1.2	0.0	1.0	1.0	1.2	1.0
2001	0.0	1.2	1.2	0.0	1.0	1.0	1.2	1.0
2002	0.0	1.2	1.2	0.0	1.0	1.0	1.2	1.0
2003	0.0	1.2	1.2	0.0	1.0	1.0	1.2	1.0
2004	0.0	1.2	1.2	0.0	1.0	1.0	1.2	1.0
2005	0.0	1.2	1.2	0.0	1.0	1.0	1.2	1.0
2006	0.0	1.2	1.2	0.5	1.0	1.6	1.2	1.6
2007	0.0	0.0	0.0	0.0	1.0	1.0	0.0	1.0
2008	0.0	0.0	0.0	0.0	1.0	1.0	0.0	1.0
2009	0.0	0.0	0.0	0.0	1.0	1.0	0.0	1.0
2010	0.0	0.0	0.0	0.0	1.0	1.0	0.0	1.0
2011				(0.2)		(0.2)	0.0	(0.2)
Total	10.6	8.4	19.1	11.9	11.2	23.1	19.1	23.1

R/E 0.824433

Note: P.C.: Private Companies

Financial plan for Los Cocos workshop is shown in Table K.3.3i.

d. Evaluation of the Project for the Promotion of Public Awareness, Cooperation and Participation

This project cannot be financially evaluated because it does not have any direct revenues. Nevertheless, the implementation of this project is considered feasible when evaluated along with the collection service improvement project.

Financial plan for promotion of public education is shown in Table K.3.3j.

Table K.3.3i Financial Plan for Los Cocos workshop

unit: C\$ 1,000 in 1994

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
a. Profit and Loss Statement													
Revenue													
Fee	0	0	0	0	0	0	0	0	0	0	0	0	0
Private Concessions	0	0	1,205	1,205	1,205	1,205	1,205	1,205	1,205	0	0	0	0
ALMA	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	1,205	1,205	1,205	1,205	1,205	1,205	1,205	0	0	0	0
Expenditure													
O & M cost	0	0	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020
Depreciation	0	220	510	510	510	510	510	510	510	510	510	510	510
Interest	0	0	0	0	0	0	0	0	0	0	33	165	313
Subtotal	0	220	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,563	1,695	1,843
Balance	0	(220)	(325)	(325)	(325)	(325)	(325)	(325)	(325)	(1,530)	(1,563)	(1,695)	(1,843)
b. Cash Flow													
Balance+Dep.	0	0	185	185	185	185	185	185	185	(1,020)	(1,053)	(1,185)	(1,333)
Money demand													
Investment	5,216	6,287	0	0	0	0	0	0	540	0	0	0	0
Loan repayment	0	0	0	0	0	0	0	0	0	0	268	1,321	2,506
Subtotal	5,216	6,287	0	0	0	0	0	0	540	0	268	1,321	2,506
Money supply													
Loan	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreign aid	4,774	5,845	0	0	0	0	0	0	0	0	0	0	0

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Reserved Fund	0	0	0	0	0	0	0	0	540	0	0	0	0
ALMA	442	442	0	0	0	0	0	0	0	0	0	0	0
Short loan	0	0	0	0	0	0	0	0	0	268	1,321	2,506	3,840
Subtotal	5,216	6,287	0	0	0	0	0	0	540	268	1,321	2,506	3,840
Surplus	0	0	185	185	185	185	185	185	(356)	(752)	0	0	0
Reserved fund	0	0	185	369	554	739	923	1,108	752	0	0	0	0
Total debt	0	0	0	0	0	0	0	0	0	268	1,321	2,506	3,840
c.Balance Sheet													
Assets													
Current Assets	0	0	185	369	554	739	923	1,108	752	0	0	0	0
Fixed Assets	5,216	11,283	10,773	10,263	9,753	9,243	8,733	8,223	8,253	7,743	7,233	6,723	6,213
Other Capitalized Assets	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	5,216	11,283	10,958	10,632	10,307	9,982	9,656	9,331	9,006	7,743	7,233	6,723	6,213
Liabilities													
Current Liabilities	0	0	0	0	0	0	0	0	0	268	1,321	2,506	3,840
Long-term Debt	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	268	1,321	2,506	3,840
Net Worth													
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreign Aid	4,774	10,619	10,619	10,619	10,619	10,619	10,619	10,619	10,619	10,619	10,619	10,619	10,619
ALMA	442	884	884	884	884	884	884	884	884	884	884	884	884
Retained Earning	0	(220)	(545)	(871)	(1,196)	(1,521)	(1,847)	(2,172)	(2,497)	(4,027)	(5,591)	(7,286)	(9,129)
Total	5,216	11,283	10,958	10,632	10,307	9,982	9,656	9,331	9,006	7,476	5,912	4,217	2,374

Table K.3.3j Financial Plan for Promotion of Public Education

unit: C\$ 1,000 in 1994

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
a. Profit and Loss Statement													
Revenue													
Fee	0	0	0	0	0	0	0	0	0	0	0	0	0
Private Concessions	0	0	0	0	0	0	0	0	0	0	0	0	0
ALMA	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0
Expenditure													
O & M cost	335	670	670	690	690	690	710	710	710	740	740	740	740
Depreciation	0	0	80	80	80	80	80	80	80	80	80	80	80
Interest	0	42	131	231	360	491	639	826	1,086	1,310	1,580	1,870	2,196
Subtotal	335	712	881	1,001	1,130	1,261	1,429	1,616	1,876	2,130	2,400	2,690	3,016
Balance	(335)	(712)	(881)	(1,001)	(1,130)	(1,261)	(1,429)	(1,616)	(1,876)	(2,130)	(2,400)	(2,690)	(3,016)
b. Cash Flow													
Balance+Dep.	(335)	(712)	(801)	(921)	(1,050)	(1,181)	(1,349)	(1,536)	(1,796)	(2,050)	(2,320)	(2,610)	(2,936)
Money demand													
Investment	680	0	0	110	0	0	150	540	0	110	0	0	150
Loan repayment	0	335	1,047	1,848	2,879	3,929	5,110	6,608	8,684	10,480	12,640	14,960	17,570
Subtotal	680	335	1,047	1,958	2,879	3,929	5,260	7,148	8,684	10,590	12,640	14,960	17,720
Money supply													
Loan	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreign aid	680	0	0	0	0	0	0	0	0	0	0	0	0
Reserved Fund	0	0	0	110	0	0	150	540	0	110	0	0	150
ALMA	0	0	0	0	0	0	0	0	0	0	0	0	0
Short loan	335	1,047	1,848	2,879	3,929	5,110	6,608	8,684	10,480	12,640	14,960	17,570	20,656
Subtotal	1,015	1,047	1,848	2,989	3,929	5,110	6,758	9,224	10,480	12,750	14,960	17,570	20,806
Surplus	0	0	0	0	0	0	0	0	0	0	0	0	0
Reserved fund	0	0	0	0	0	0	0	0	0	0	0	0	0
Total debt	335	1,047	1,848	2,879	3,929	5,110	6,608	8,684	10,480	12,640	14,960	17,570	20,656

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
c.Balance Sheet													
Assets													
Current Assets	0	0	0	0	0	0	0	0	0	0	0	0	0
Fixed Assets	680	680	600	630	550	470	540	1,000	920	950	870	790	860
Other Capitalized Assets	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	680	680	600	630	550	470	540	1,000	920	950	870	790	860
Liabilities													
Current Liabilities	335	1,047	1,848	2,879	3,929	5,110	6,608	8,684	10,480	12,640	14,960	17,570	20,656
Long-term Debt	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	335	1,047	1,848	2,879	3,929	5,110	6,608	8,684	10,480	12,640	14,960	17,570	20,656
Net Worth													
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreign Aid	680	680	680	680	680	680	680	680	680	680	680	680	680
ALMA	0	0	0	0	0	0	0	0	0	0	0	0	0
Retained Earning	(335)	(1,047)	(1,928)	(2,929)	(4,059)	(5,320)	(6,748)	(8,364)	(10,240)	(12,370)	(14,770)	(17,460)	(20,476)
Total	345	(367)	(1,248)	(2,249)	(3,379)	(4,640)	(6,068)	(7,684)	(9,560)	(11,690)	(14,090)	(16,780)	(19,796)

e. Overall Financial Evaluation

The results of IRR are summarized in Table K.3.3k, and concluded the necessity of the four projects to SWM services.

Table K.3.3k Summary of EIRR and FIRR

Projects	EIRR	FIRR
1.Collection Improvement	24.1 %	9.0 %
2.Construction of ANPLS	-	29.6 %
3.Improvement of Los Cocos	12.5 %	-
4.Promotion of Public Education	34.0 %	-

ea. Overall Evaluation of the 3 Proposed Projects

The improvement of collection services and the workshop, and the implementation of activities to promote public participation and cooperation are considered feasible in Area B as the EIRR is calculated at 9.0% the initial investment is counted as revenue, assuming it will be financed by grant aid as shown in Table K.3.3l.

Table K.3.3l Revenue & Expenditure for the Collection System Improvement Project including Workshop Improvement and Promotion of Public Cooperation (1998 – 2000)

unit: mill.C\$

	Revenue						Expenditure			Discount rate 9.0 %	
	Residents of Area B	Residents of Area A	Large Generation Sources	Subsidy from ALMA	Work shop	Sub-total	Investment	O & M cost	Sub-total	Revenue	Expenditure
1998	0.0			17.7		17.7	17.7	3.9	21.5	17.7	21.5
1999	0.1			20.8		20.9	20.8	4.1	24.9	19.2	22.8
2000	0.5	3.0	3.0	3.0	1.2	10.6	0.0	5.3	5.3	8.9	4.5
2001	0.6	3.1	3.1	3.1	1.2	11.0	1.7	5.5	7.2	8.5	5.6
2002	0.7	3.2	3.2	3.2	1.2	11.4	1.8	5.8	7.6	8.1	5.4
2003	0.8	3.3	3.3	3.3	1.2	11.9	7.2	6.0	13.2	7.7	8.6
2004	1.0	3.4	3.4	3.4	1.2	12.4	7.1	6.4	13.4	7.4	8.0
2005	1.7	2.6	2.6	5.2	1.2	13.2	14.8	6.6	21.4	7.2	11.7
2006	1.9	2.7	2.7	5.4	1.2	13.8	15.0	6.7	21.7	6.9	10.9
2007	2.1	2.7	2.7	5.3	0.0	12.8	8.0	6.2	14.2	5.9	6.5
2008	2.7	3.0	3.0	6.1	0.0	14.9	15.4	7.2	22.6	6.3	9.5
2009	3.4	3.5	3.5	7.1	0.0	17.5	17.4	6.4	23.9	6.8	9.2
2010	5.1	3.7	3.7	7.4	0.0	19.9	12.2	7.5	19.7	7.1	7.0
2011						0.0	(41.5)		(41.5)	0.0	(13.5)
Total	20.7	34.1	34.1	90.8	8.4	188.2	97.6	77.6	175.1	117.8	117.8

R/E 1.000067

that the services of concessionaires are to be 30% more efficient in 2010 than the municipality's, and that they will be granted tipping fee discounts, 60% and 30%, for the periods 2000 – 2004 and 2005 – 2009, respectively (refer to Table K.3.3m). This project is considered feasible therefore.

Table K.3.3m Revenue and Expenditure of Private Concessions (2000 – 2010)
unit: mill.C\$

	Revenue		Expenditure						Discount rate 7.7 %	
	Residents of Area B	Sub-total	Investment	O & M cost	Tipping Fee	Rental Fee	License Fee & Tax	Sub-total	Revenue	Expenditure
2000	16.9	16.9	24.1	2.4	3.5	4.6	5.0	39.6	16.9	39.6
2001	19.3	19.3	3.6	2.9	4.1	5.2	5.4	21.1	19.2	21.0
2002	21.9	21.9	3.6	3.4	4.7	5.7	5.8	23.2	21.6	22.9
2003	24.7	24.7	3.6	4.0	5.4	6.2	6.2	25.4	24.1	24.8
2004	27.6	27.6	3.6	4.5	6.2	6.7	6.7	27.6	26.8	26.8
2005	35.2	35.2	3.6	5.0	12.3	7.2	6.5	34.7	33.9	33.4
2006	38.9	38.9	3.6	5.6	13.9	7.7	6.9	37.7	37.2	36.0
2007	42.7	42.7	27.7	7.3	15.6	0.0	8.2	58.9	40.5	55.8
2008	46.7	46.7	7.2	7.8	17.5	0.0	8.7	41.3	43.9	38.9
2009	50.9	50.9	7.2	8.4	19.6	0.0	9.7	44.9	47.5	41.9
2010	65.1	65.1	7.2	8.9	35.3	0.0	10.6	62.1	60.3	57.5
2011			(28.9)					(28.9)	0.0	(26.5)
Total	390.1	390.1	66.2	60.2	138.1	43.3	79.7	387.5	371.9	371.8

R/E

1.00010038

ec. Area A Financial Capability

Area A is assessed to be financially capable of paying the imposed collection fees, which will also partly subsidize the services for Area B. The collection fee will only amount to 1% of the area A residents' income in 2004, and 1.2% in 2010 when the landfill site is upgraded to level 4 and installed with a leachate treatment facility (refer to Figure K.3.3a).

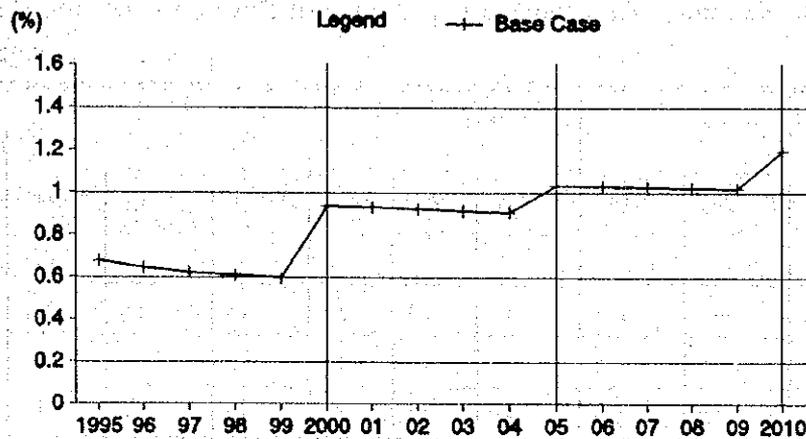


Figure K.3.3a Share of Waste Fee in Residential Income unit: %

ed. Municipal Financial Capability

Figure K.3.3b shows the decrease in SWM expenses from 2000 to 2010. The share of SWM in ALMA's budget will be gradually reduced from 6.3% in 2000 to 3.2% in 2010. The reduction will gradually minimize the financial weight enforced by the services on the municipal budget. Conclusively, the municipality is capable of financially keeping up with its share in MSWM expenses (refer to Figure K.3.3c).

If most of the initial investment is to be covered by grant aid, the waste collection fees will later provide the municipality with internal reserves which will enable it to independently finance the 2nd and 3rd investments. On the other hand, loans will not provide the municipality with any reserve because the waste collection fees will be used for repayment, which would then force the municipality to make another loan for the 2nd and 3rd investments, employing the same manner of repayment, and consequently becoming heavily indebted to banks for a sum of C\$ 300 million (refer to Figure K.3.3d).

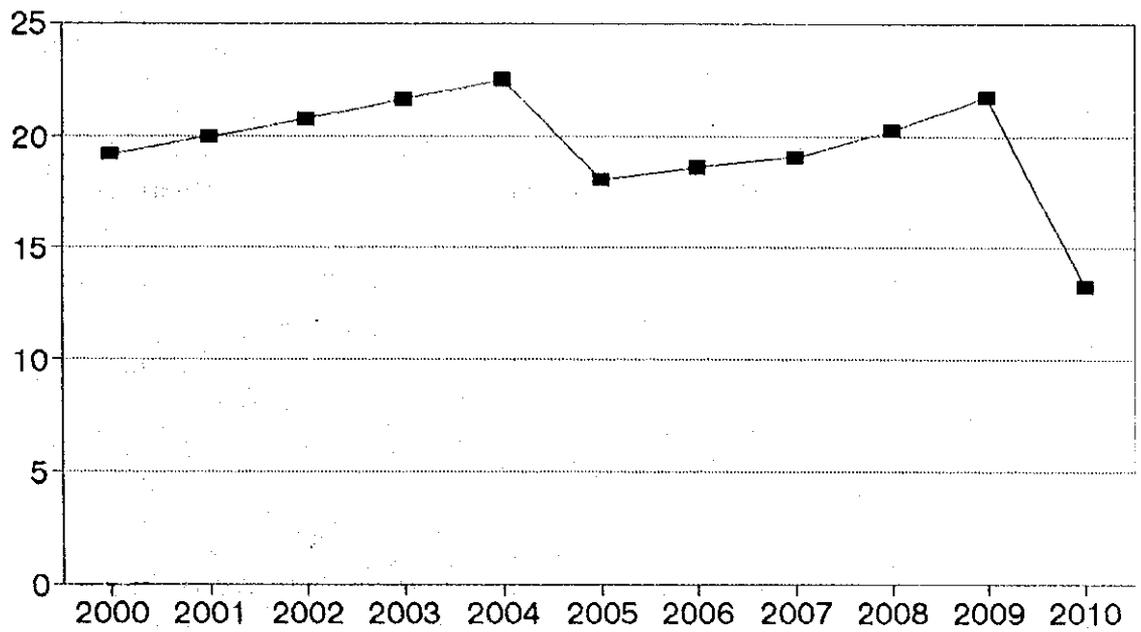


Figure K.3.3b Amount of SWM in Budget unit: mill.C\$ – 1994 price

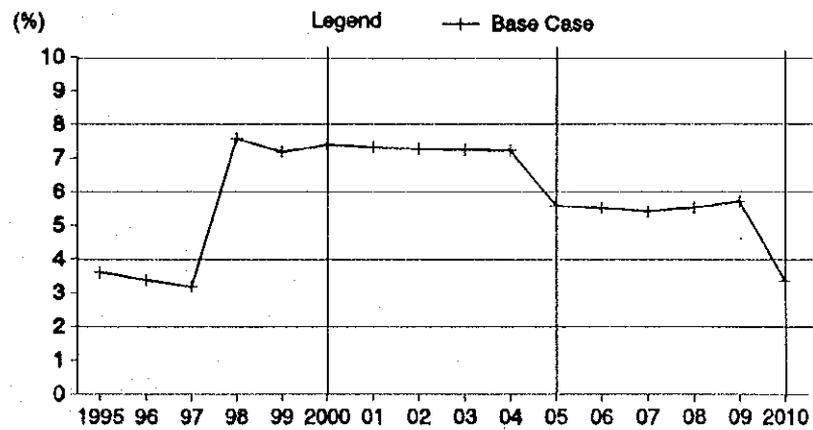


Figure K.3.3c Share of SWM in Municipal Budget unit: %

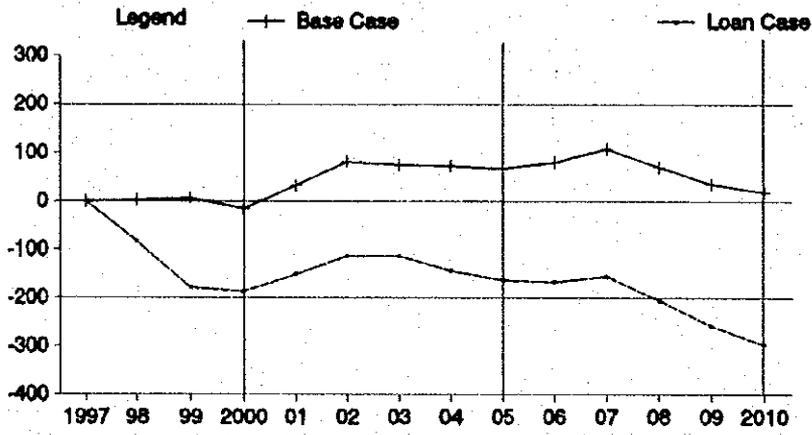


Figure K.3.3d Reserved Fund / Total Debt (mill. x 10² C\$)

K.4 Financial Plan - Conclusion of Financial Study

K.4.1 Basic Concept

The financial plan employed to attain the targets of the MSWM Master Plan was examined according to the process shown in Fig.K.4.1a.

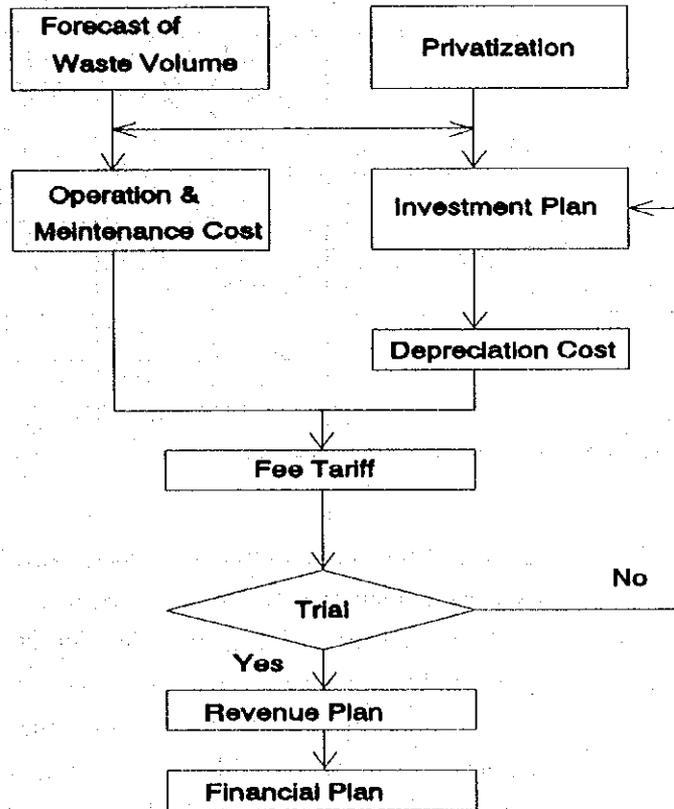


Figure K.4.1a Financial Planning Process

Expenditure for MSWM mainly refer to operation and maintenance cost (O&M cost) and investment cost, while costs to calculate profit or loss refer to O&M cost and depreciation cost.

O&M costs depend on the kind of facility and equipment introduced, which in turn rely on the amount and schedule of investment. The depreciation costs are calculated from the investment cost and the life span of facilities and equipment assumed in Table K.1.2c.

K.4.2 Expenditure Plan

a. O&M Cost

- O&M cost for 1995, 2000 and 2010 were summarized below based on the conditions of cost estimation mentioned in K.1.2.

Table K.4.2a O&M Cost of MSWM

	Total Cost (million C\$)			Unit Cost (C\$/ton)		
	1995	2000	2010	1995	2000	2010
(1) Collection and Public Cleansing	16.61	19.30	28.11	-	-	-
Collection	9.59	14.04	22.85	56.2	50.7	43.2
Public Area Cleansing	7.02	5.26	5.26	1074.5	679.8	679.8
(2) Final Disposal	0.68	5.99	12.32	2.7	15.8	18.1
(3) Workshop	0.27	1.02	1.02	1.6	3.7	1.9
(4) Promotion	0.00	0.67	0.74	0.0	2.4	1.4
Total	17.57	26.98	42.19	102.9	97.4	79.8

- The annual operation and maintenance cost, which refer to the fuel and lubricant expenses, maintenance fee and personnel expenses, was calculated considering the partial privatization of collection services.
- The operation and maintenance cost of collection services under private concession is assumed to be 30% cheaper than the Municipality's in 2010.
- 50 % and 100% of the waste collection services in collection area A are assumed to be privatized in 2000 and 2010, respectively.

The yearly O&M costs are shown in Table K.4.2b.

Table K.4.2b O&M Cost (ALMA) by Priority Project (1995 - 2010)

unit: mill. CS in 1994 price

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
(1) Collection and Public Cleansing	16.884	17.548	17.288	19.670	21.215	15.730	15.850	15.900	16.020	16.110	15.590	15.180	13.550	14.140	14.670	15.380
Collection	9.862	10.526	11.266	12.648	14.193	10.470	10.590	10.640	10.760	10.850	10.330	9.920	8.290	8.880	9.410	10.120
Public Cleansing	7.022	7.022	7.022	7.022	7.022	5.260	5.260	5.260	5.260	5.260	5.260	5.260	5.260	5.260	5.260	5.260
(2) Final Disposal	0.684	0.724	0.769	0.845	0.929	5.990	6.120	6.250	6.640	6.790	6.950	7.100	7.890	8.140	8.710	12.3
(3) Workshop	0.000	0.000	0.000	0.000	0.000	1.020	1.020	1.020	1.020	1.020	1.020	1.020	1.020	1.020	1.020	1.020
(4) Promotion	0.000	0.000	0.000	0.670	0.670	0.670	0.690	0.690	0.690	0.710	0.710	0.710	0.740	0.740	0.740	0.740
Total	17.568	18.272	19.057	21.186	22.815	23.410	23.680	23.860	24.370	24.630	24.270	24.010	23.200	24.040	25.140	29.460

b. Investment Plan and resources

- It is assumed that the investment for collection services from 1998 to 2000 can be financed by foreign aid and soft loans to cope with the whole collection volume in 2000. After 2001, the Municipality will purchase collection vehicles in accordance with the yearly increase in waste amount. Private companies will also purchase collection vehicles for efficient collection and haulage services – the collection activities of private companies are assumed to be 30% more efficient than that of the municipality in 2010.
- The assumed investment for the disposal site is going to be divided among the following 3 stages:
 - 1998–1999 Initial earthworks necessary to set up the sanitary landfill and earthworks for a disposal area that can accommodate about half of the Master Plan waste volume.
 - 2003–2005 The earthworks for a disposal area that will accommodate the other half of the Master Plan waste amount.
 - 2008–2010 Construction of a section III in ANPLS which is capable of holding 2.1 mill. cubic meter of waste for three years after 2010. Also leachate treatment facilities will be installed upgrade the sanitary landfill to the target level which is level 4.
- It is assumed that the initial purchase cost from 1998 to 2000 of collection vehicles for the expansion of collection services in Collection Area B will be financed through foreign subsidies. The replacement of vehicles (27 compactors) granted before this study will be financed by loans. After 2001, the Municipality of Managua and the concessionaires will finance the cost for the repair of collection vehicles and the purchase of new ones.
- The construction cost of the sanitary landfill in the first phase will be divided between the foreign counterpart and the Municipality of Managua. The share of the foreign counterpart is assumed to be 80%, including the cost for the purchase of heavy equipment.
- Loans will be made under the following conditions to finance the purchase cost of collection vehicles for Area A and commercial areas.

Repayment terms - 10 years with a 3 year grace period
Interest - 8 % per year

- The Municipality of Managua will finance the purchase of equipment for street cleansing and the maintenance of parks and green areas.

The yearly investment costs are shown in Table K.4.2c.

c. Depreciation cost

- The calculation of the depreciation costs of equipment and facilities was made by dividing the investments by the life span defined in Table K.1.2c.

The yearly depreciation costs are shown in Table K.4.2d.

d. Expenditure Plan

O&M, depreciation and investment cost are summarized in Table K.4.4a.

Table K.4.2c Investment Cost by Priority Project (1998 - 2010)

unit: mill. C\$

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
(1) Collection and Public Cleansing	18.382	20.522	75.423	6.442	6.455	15.742	16.957	26.269	32.770	62.637	31.300	31.701	29.743
Collection													
ALMA	15.774	19.029	75.423	1.990	2.003	10.177	11.392	18.096	24.598	29.247	19.056	19.458	14.161
Private Companies	0.000	0.000	0.000	4.452	4.452	5.565	5.565	5.565	6.678	33.391	12.243	12.243	15.582
Sub-total	15.774	19.029	75.423	6.442	6.455	15.742	16.957	23.661	31.277	62.637	31.300	31.701	29.743
Public Cleansing													
Vehicle etc.	2.608	1.493	0.000	0.000	0.000	0.000	0.000	2.608	1.493	0.000	0.000	0.000	0.000
(2) Final Disposal													
Construction	71.618	51.166	0.000	0.000	0.000	46.591	46.591	46.591	0.000	0.000	83.835	83.835	83.835
Heavy Equipment etc.	0.000	25.793	0.000	0.000	0.000	2.045	0.000	0.000	25.793	5.154	0.000	3.009	2.045
Sub-total	71.618	76.959	0.000	0.000	0.000	48.636	46.591	46.591	25.793	5.154	83.835	86.844	85.880
(3) Workshop													
Construction	5.216	3.624	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vehicle etc.	0.000	2.663	0.000	0.000	0.000	0.000	0.000	0.000	0.540	0.000	0.000	0.000	0.000
Sub-total	5.216	6.288	0.000	0.000	0.000	0.000	0.000	0.000	0.540	0.000	0.000	0.000	0.000
(4) Promotion	0.680	0.000	0.000	0.110	0.000	0.000	0.150	0.540	0.000	0.110	0.000	0.000	0.150
Total	95.896	103.769	75.423	6.552	6.455	64.378	63.698	73.400	59.103	67.901	115.135	118.545	115.773
ALMA	95.896	103.769	75.423	2.100	2.003	58.813	58.133	67.835	52.425	34.510	102.892	106.302	100.191

Table K.4.2d Depreciation Cost (ALMA) (1995 - 2010)

unit: mill. \$

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
(1) Collection and Public Cleansing	0.000	0.000	0.000	3.915	7.687	17.297	17.582	17.938	18.294	18.792	18.365	18.222	15.589	17.012	18.578	20.500
Collection	0.000	0.000	0.000	3.559	7.118	16.728	17.013	17.369	17.725	18.223	17.796	17.653	15.020	16.443	18.009	19.931
Public Cleansing	0.000	0.000	0.000	0.356	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569
(2) Final Disposal	0.000	0.000	0.000	0.712	1.780	28.262	28.262	28.262	28.546	28.546	28.546	31.936	32.648	32.648	33.075	33.075
(3) Workshop	0.000	0.000	0.000	0.000	0.220	0.510	0.510	0.510	0.510	0.510	0.510	0.510	0.510	0.510	0.510	0.510
(4) Promotion				0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Total	0.000	0.000	0.000	4.707	9.767	46.149	46.434	46.790	47.430	47.929	47.501	50.749	48.827	50.251	52.244	54.166

K.4.3 Revenue Plan

a. Revenue Sources

In order to secure an independent fund reserve for the sustainable operation of the cleansing services proposed in the Master Plan for the year 2010, the following should be considered:

- Establishment of a "Beneficiary Pay Principle"
- Imposition of fees in accordance with the economic standing of the residents
- Appropriate allocation of funds from the general budget of the Municipality.

The revenue sources and money flow system of fee collection are show in Fig.K.4.3a.

Area B, a basically impoverished area, will also be required to pay waste collection fees, albeit partially, in accordance with the Beneficiary Pay Principle. The remaining cleansing expenses will be covered by the Municipality, Area A and Large Generation Sources(cross subsidy).

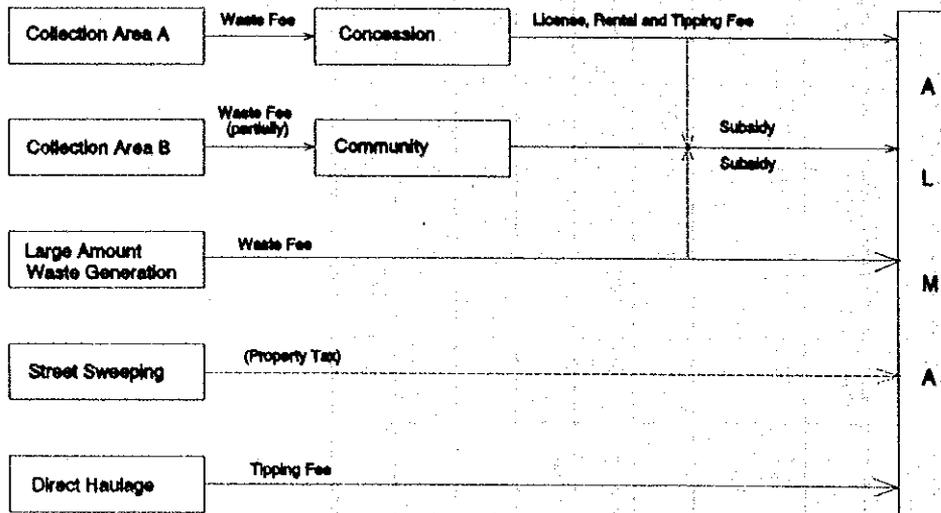


Figure K.4.3a Revenue Sources and Money Flow System of Fee Collection

b. Fee Tariff

The fee tariff will be determined by the following steps:

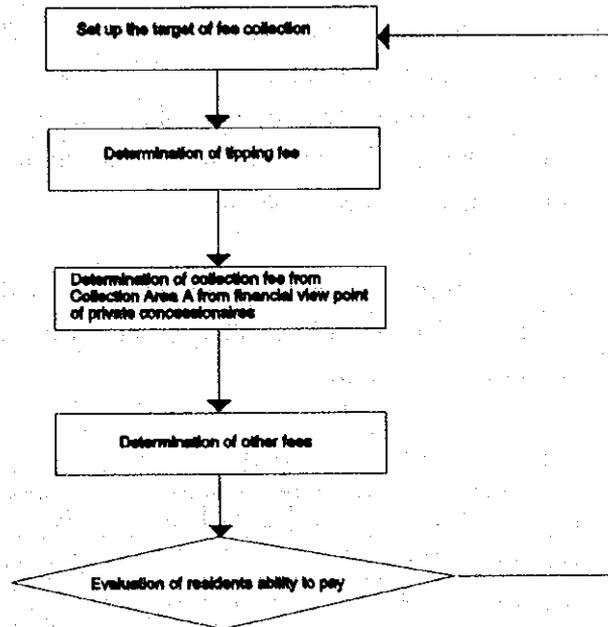


Figure K.4.3b Determination Flow of Fee Tariff

The first step: Set up the target collection fee

- The collection rate will be drastically increased from 10 – 95% within four or five years. The target collection rate in 2000 and 2010 is set at 95%.

The second step: Determination of tipping fees

- Tipping fees will be imposed to cover the whole costs from 2000 to 2006 to maintain the sanitary landfill; the costs include the operation and maintenance costs, depreciation costs and management costs. Loan interests will be taken into account after 2007.

The third step: Determination of collection fee

- In this trial calculation, the total cost from 2001 to 2010 is taken into account, including the operation costs, tipping fees, rental fees of vehicles, license fee, loan interests (12.5 % in real term) and taxes. Although the services offered by private companies are efficient, they are more expensive

than the services offered by the Municipality.

The fourth step: Determination of other fees

- The fees imposed on Collection Area B will be equal to the amount to be imposed during the collection experiment. After 2000, the fee will be increased to cover the O&M costs of waste collection services.
- A unit cost will be established for fee collection in commercial areas and companies, in consideration of the future fee collection system which will be based on the discharged waste volume.

The fee tariff estimated from the above mentioned trial calculation was shown in Table K.4.3a. And fee collection ratio established and used as a basic assumption for calculation is shown in K.4.3b.

Table K.4.3a Fee Tariff (1995 - 2010)

Description		1995	2000	2005	2010	1995	2000	2005	2010
Waste Fee *	Collection Area A (C\$/month/meter)				(C\$/month/household)				
	Residential (A)	3.00	6.57	7.56	8.92	64.3	140.8	161.9	191.1
	Residential (B)	2.00	4.38	5.04	5.94	23.8	52.1	59.9	70.7
	Traditional	1.00	2.19	2.52	2.97	10.0	21.9	25.2	29.7
	Popular	0.75	1.64	1.89	2.23	7.5	16.4	18.9	22.3
	Collection Area B (C\$/month/household)								
	Bell Collection	2.00	4.38	6.50	8.00				
	Container Collection	1.00	2.19	3.25	4.00				
	Commercial & Companies (C\$/ton)								
	Collection	175.1	612.2	655.1	741.3				
Tipping Fee	Direct Haul	2.7	99.2	99.2	112.3				

* : Waste fee includes the tipping fee

Table K.4.3b Fee Collection Ratio by Collection Area

unit: %

	1994	2000	2010
Collection Area A			
- Residential (A)	52	95	95
- Residential (B)	55	95	95
- Traditional	10	95	95
- Popular	10	95	95
Collection Area B			
- Bell Collection	0	50	95
- Container Collection	0	50	95
Commercial & Companies	100	100	100

c. Revenue Plan

Revenue plan examined based on the fee tariff is shown in Table K.4.3c.

Table K.4.3c Revenue Plan(1995 - 2010)

unit: C\$ 1,000

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Waste Fee	8,021	12,499	14,704	16,988	19,315	37,853	38,636	37,004	36,709	36,323	39,626	38,864	37,972	37,326	36,613	40,965
Collection Area A	5,129	5,219	9,717	11,711	13,706	17,191	16,128	14,920	13,566	12,065	11,982	9,920	7,692	5,295	2,732	0
Residential A	1,421	1,702	1,983	2,263	2,544	3,093	2,902	2,684	2,441	2,171	2,156	1,785	1,384	953	492	0
Residential B	2,385	2,821	3,256	3,692	4,128	4,997	4,688	4,337	3,943	3,507	3,483	2,884	2,236	1,539	794	0
Traditional	418	696	973	1,251	1,529	1,978	1,856	1,717	1,561	1,388	1,379	1,141	885	609	314	0
Popular	1,505	2,505	3,505	4,505	5,505	7,123	6,682	6,182	5,621	4,999	4,964	4,110	3,187	2,194	1,132	0
Collection Area B	0	0	0	41	118	507	609	721	843	974	1,654	1,877	2,114	2,740	3,420	5,112
Commercial and Companies	2,293	4,877	4,986	5,236	5,492	20,155	21,898	21,363	22,301	23,285	25,991	27,065	28,167	29,290	30,461	35,852
Commercial (Restaurant)	841	1,752	1,828	1,918	2,014	7,396	7,732	8,089	8,447	8,827	9,875	10,281	10,688	11,118	11,572	13,611
Commercial (Others)	13	26	26	26	26	89	89	89	89	89	96	96	96	96	96	108
Institutional	77	160	166	173	179	648	670	693	715	737	789	813	837	861	885	1,028
Hospital	208	435	454	479	505	1,855	2,793	1,408	1,452	1,520	1,698	1,793	1,889	1,985	2,080	2,462
Industrial	294	614	639	671	703	2,592	2,704	2,816	2,950	3,084	3,443	3,586	3,730	3,873	4,017	4,735
Market	860	1,790	1,873	1,969	2,065	7,575	7,910	8,268	8,648	9,028	10,090	10,496	10,927	11,357	11,811	13,908
Private Concessions	0	0	0	0	0	11,594	12,879	14,220	15,646	17,128	23,132	25,250	19,611	22,003	24,670	40,990
Tipping fee	0	0	0	0	0	3,475	4,058	4,703	5,409	6,180	12,303	13,892	15,637	17,532	19,583	35,294
Rental fee	0	0	0	0	0	4,647	5,161	5,676	6,191	6,706	7,221	7,735	0	0	0	0
License fee	0	0	0	0	0	3,472	3,660	3,841	4,046	4,243	3,608	3,622	3,974	4,471	5,087	5,697
Direct Haulage	21	44	45	140	177	8,022	8,379	8,760	9,153	9,566	9,995	10,394	10,809	12,457	14,225	18,235
ALMA Budget	7,022	7,022	7,022	7,022	7,022	8,786	8,898	8,999	9,120	9,227	11,015	11,191	11,161	11,912	12,899	13,236
Public Cleansing	7,022	7,022	7,022	7,022	7,022	5,829	5,829	5,829	5,829	5,829	5,829	5,829	5,829	5,829	5,829	5,829
Collection Area B	0	0	0	0	0	2,956	3,068	3,169	3,290	3,398	5,185	5,362	5,332	6,083	7,060	7,407
Sub-total	15,064	19,564	21,771	24,150	26,513	66,255	68,792	68,982	70,628	72,246	83,767	85,699	79,553	83,698	88,397	113,427
Subsidy for Disposal	0	0	0	0	0	104,263	110,675	117,565	124,824	132,432	70,302	74,420	78,844	83,452	88,342	0
Total	15,064	19,564	21,771	24,150	26,513	76,681	79,860	80,738	83,110	85,489	90,797	93,141	87,437	92,046	97,231	113,427

K.4.4 Financial Plan and Recommendation

a. Financial Plan

The financial plan was based from the expenditure and revenue plan, and is shown in Table K.4.4a.

b. Recommendation

It would be difficult for ALMA to recover the entire cost to be spent on the priority projects with waste fee, tipping fee and revenue from private concession. But it is necessary to make an effort to establish a fee system and collect fees in order to continue MSWM.

The investment costs should be subsidized by the central government or with donations from bilateral and multilateral agencies. ALMA must therefore strive to acquire such sources to successfully implement the projects.

Table K.4.4a Financial Plan (1995 - 2010)

unit: mill.C\$

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Expenditure																
O & M	17.57	18.27	19.06	21.19	22.81	23.41	23.68	23.86	24.37	24.63	24.27	24.01	23.20	24.04	25.14	29.46
Investment	0.00	0.00	0.00	95.90	103.77	75.42	2.10	2.00	58.81	58.13	67.83	52.43	34.51	102.89	106.30	100.19
Sub-total	17.57	18.27	19.06	117.08	126.58	98.83	25.78	25.86	83.18	82.76	92.10	76.44	57.71	126.93	131.44	129.65
Cost																
O & M	17.57	18.27	19.06	21.19	22.81	23.41	23.68	23.86	24.37	24.63	24.27	24.01	23.20	24.04	25.14	29.46
Depreciation	0.00	0.00	0.00	4.71	9.77	46.15	46.43	46.79	47.43	47.93	47.50	50.75	48.83	50.25	52.24	54.17
Interest etc.	0.00	0.31	0.00	0.00	0.00	0.00	6.03	6.03	6.03	5.17	4.31	3.45	2.59	1.72	0.86	0.00
Sub-total	17.57	18.59	19.06	25.89	32.58	69.56	76.15	76.68	77.83	77.73	76.08	78.21	74.61	76.01	78.25	83.63
Revenue																
Waste Fee	8.04	12.54	14.75	17.13	19.49	45.87	47.02	45.76	45.86	45.89	49.62	49.26	48.78	49.78	50.84	59.20
Private Concession	0.00	0.00	0.00	0.00	0.00	11.59	12.88	14.22	15.65	17.13	23.13	25.25	19.61	22.00	24.67	40.99
ALMA General Budget	7.02	7.02	7.02	7.02	7.02	19.21	19.97	20.76	21.60	22.47	18.04	18.63	19.05	20.26	21.72	13.24
Sub-total	15.06	19.56	21.77	24.15	26.51	76.68	79.86	80.74	83.11	85.49	90.80	93.14	87.44	92.05	97.23	113.43
Balance	-2.50	0.98	2.71	-1.74	-6.07	7.12	3.71	4.05	5.28	7.76	14.72	14.93	12.82	16.03	18.99	29.80
Investment																
Foreign Aid	0.00	0.00	0.00	85.19	93.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan	0.00	0.00	0.00	0.00	0.00	75.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALMA Capital Budget	0.00	0.00	0.00	10.70	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reserved Fund	0.00	0.00	0.00	0.00	0.00	0.00	2.10	2.00	58.81	58.13	67.83	52.43	34.51	102.89	106.30	100.19
Sub-total	0.00	0.00	0.00	95.90	103.77	75.42	2.10	2.00	58.81	58.13	67.83	52.43	34.51	102.89	106.30	100.19

K.5 Economic Evaluation of Priority Projects

K.5.1 Method

The method used to calculate the Economic Internal Rate of Return (EIRR) of the projects is outlined below:

Table K.5.1a Items of benefits and Costs for Economic Evaluation by Priority Project

Project	Improvement of Collection Services	Final Disposal Site	Workshop Improvement	Promotion of Public Co-operation
Benefits (B)	<ul style="list-style-type: none"> - Curtails cost for the removal of illegally dumped waste - willingness to pay of Area B - improved living environment, improved public health and sanitation, attracts tourists, higher land market value 	<ul style="list-style-type: none"> - better sanitary environment, improved public health and sanitation, ground water preservation, prevent waste scattering 	<ul style="list-style-type: none"> - Saves in investment and O&M cost - Helps increase the efficiency of collection services in Area A 	<ul style="list-style-type: none"> - Saves costs in street sweeping* - Increase in willingness to pay in Area B - Saves costs for drain cleansing, and removal of illegally dumped waste
Cost (C)	Investment, O&M costs	Investment, O&M costs	Investment, O&M costs	formulation of pamphlets and vidcos, personnel costs, transportation costs, material costs

Note: * These were analyzed quantitatively. The major reason the quantitative evaluation was not carried out for the disposal site is that it is very difficult to separate the effects of contamination of Managua Lake from other causes such as sewage and industrial liquid waste.

Table K.5.1b Conversion Factor from Financial Cost to Economic Cost

Item	Conversion factor	Assumption
Import goods		
collection vehicles	85%	Custom duty 5%, domestic taxes 10%
video set	80%	Custom duty 10%, domestic taxes 10%
spare parts	90%	Custom duty 0%, domestic taxes 10%
light heavy oil	90%	Custom duty 1%, domestic taxes 0%
Labor unskilled	60%	Income level of semi-unemployed people
Equipment ownership cost	90%	Heavy equipment (imported goods) 60%, Heavy oil 25%, Personnel expenses (skilled) 15% (weighing average)

Note: Average Shadow Exchange Rate (SER) was estimated 1.06 in 1991, 1.05 in 1992 respectively despite the data available. SER was disregarded in the Study, because only almost 1.0 was calculated in 1994.

K.5.2 Evaluation of the Project for the Improvement of the Collection and Public Area Cleansing System

a. Quantitative Evaluation

- i. The most important factor resulting from the improvement of collection services in Area B is environmental improvement.
- ii. Economic evaluation is extremely quantitatively difficult to carry out.
- iii. The curtailment of collection cost for illegally dumped waste will be considered as a quantitative effect of the collection system improvement project. Accordingly, the reduction of the amount of waste illegally dumped along streets, at parks and rivers will be considered as a benefit.

One fourth of the present unit cost for street cleansing services is used to determine the unit benefit for the collection of illegally dumped waste. Conversion factor from financial cost to economic cost is assumed to be 78%.

$$5.2 \text{ million C\$} / \{16.5 \text{ tons/day} \times 365 \text{ days}\} / 4 = 216 \text{ C\$/ton}$$

$$216 \text{ C\$/ton} \times 0.78 = 168 \text{ C\$/ton}$$

- iv. The economic internal rate of return (EIRR), that is if the investment cost and O & M cost for collection services in Area B is regarded as expenses, which is 24.1% as shown Table K.5.2a, proves the feasibility of the project in the area. The investment cost for the year 2011 is determined by deducting the remaining value of the services from the estimated cost.

b. Qualitative Evaluation

The following items are the subjects for qualitative evaluation:

- i. Improvement of Public Health and Sanitation

Eliminate waste heaping practices and prevent the generation of dengue fever.

- ii. Promotion of residential participation

residents to clean their area more and to participate in cleansing activities.

iii. **Attracts Tourists**

The cleanliness of the area will lure and encourage tourists.

iv. **Higher Land Market Value**

Migration from Area B to A is possible with improved infrastructure conditions.

K.5.3 Evaluation of the ANPLS Construction Project

a. **Qualitative Evaluation**

Sanitary landfill level 3 should be at least carried out to protect the environmental conditions of Managua lake. This landfill level introduces the use of a leachate circulation system.

The use of a sheet lining for leachate circulation will mean additional expenses to the estimated construction cost. Nevertheless, the following situations are expected to result from its use:

- Counter-act the contamination of Managua Lake
- Improved public health and sanitation
- Groundwater preservation

The following effects are expected from daily waste covering activities and the construction of a buffer zone:

- Prevent waste scattering
- Sanitation of the disposal site and surrounding environment

The operation of collection services using independent fund reserves would inevitably raise the tipping fee. Operations, for example, the prevention of illegal dumping, should be smoothly carried out in accordance with the law.

K.5.4 Evaluation Project for the Improvement of Los Cocos Workshop

a. Quantitative Evaluation

The improvement of the workshop will lengthen the life span and improve the operation rate of collection vehicles. It will also realize the curtailment of costs planned through privatization. Simultaneously, the improvement of the workshop will ensure fixed collection services and help fulfil the objectives of the collection services improvement project.

Quantitative evaluation was carried out by calculating the profits from the curtailment of investment and O&M costs as a result of effective privatization. The calculation did not expect benefits in 2000 because only the degree of improvement can be attained in collection efficiency. However, the benefits in 2010 will amount to C\$ 7.5 million due to increased collection efficiency and 30% cost reduction in operation and purchase of collection vehicles.

This project is considered to be feasible based on an FIRR of 12.5%, as shown in Table K.5.4a.

b. Qualitative Evaluation

The improvement of the workshop is expected to raise the efficiency of the vehicles of ALMA for collection and street sweeping services.

Moreover, the provision of a fixed collection will further motivate the residents to pay for the services.

K.5.5 Evaluation of the Project for the Promotion of Public Awareness, Cooperation and Participation

a. Quantitative Evaluation

A program promoting resident participation and cooperation will not only raise the efficiency of collection services in Area B but reduce the amount of waste illegally dumped along streets, at parks and canals, and consequently curtail cleansing expenses. By reducing the amount of waste discharge, this program will also bring about cheaper waste collection and disposal costs.

Quantitative evaluation was carried out by considering the curtailed street sweeping costs as benefits.

- **Curtailed Street Sweeping Cost**

Only 0.8% of the present unit cost for street cleansing services is used to determine the cost for the collection of illegally dumped waste.

Conversion factor from financial cost to economic cost is assumed to be 0.78.

$$5.2 \text{ million C\$} / \{16.5 \text{ tons/day} \times 365 \text{ days}\} \times 0.008 = 6.9 \text{ C\$/ton}$$

$$6.9 \text{ C\$/ton} \times 0.78 = 5.4 \text{ C\$/ton}$$

An R/E rate of more than 1, calculated in the collection service improvement project, will be used to determine cost reduction that is supposed to result from this project.

The comparison of the above benefits and costs for the formulation of promotional pamphlets and videos, including personnel, transportation and material costs, indicates an EIRR of 34.0%, thereby proving the feasibility of this project.

If only 0.2% of the present unit cost for street cleansing services is assumed as a benefit, the rate of benefit and cost will be less than 1 and, EIRR -60.7%. However, if 1% of the present cost is adopted, the EIRR becomes 106.4%, because the costs for public cooperation activities is very small compared to the cleansing cost.

b. Qualitative Evaluation

- **Increased Willingness to Pay**

The discrepancy between the amount residents are willing to pay and the amount listed in the collection fee table indicated in the Pilot Project is considered as the rate of increase in the residents willingness to pay.

Public participation and cooperation in other areas aside from Area B are expected to bring about the following results:

- Promote recycling activities
- Attract tourists

Table K.5.5a Cost & Benefit of Collection System Improvement Project (1998 - 2010)

unit: mill.C\$

	Waste Volume to be collected from Area B(ton/year)	Number of Households in Area B paying waste fees (1,000)	Benefits		Cost		Discount rate (24.1%)		
			Cost saved from waste removal activities	Sub-total	Investment	O & M cost	Sub-total	Benefits	Cost
1998	90.0	2.4	5.5	5.5	12.6	1.9	14.5	5.5	14.5
1999	126.1	7.0	7.7	7.7	15.2	2.1	17.3	6.2	13.9
2000	167.6	13.8	10.2	10.2	0.0	3.2	3.2	6.7	2.1
2001	177.9	16.6	10.9	10.9	1.4	3.4	4.7	5.7	2.5
2002	189.0	19.6	11.5	11.5	1.3	3.6	4.9	4.9	2.1
2003	200.6	22.9	12.3	12.3	5.3	3.8	9.1	4.2	3.1
2004	212.9	26.5	13.0	13.0	5.2	4.1	9.3	3.6	2.5
2005	226.0	30.3	13.8	13.8	11.8	4.2	15.9	3.0	3.5
2006	239.2	34.4	14.6	14.6	12.0	4.3	16.3	2.6	2.9
2007	253.4	38.7	15.5	15.5	6.4	4.0	10.4	2.2	1.5
2008	306.7	50.2	18.7	18.7	12.2	4.8	17.0	2.2	2.0
2009	365.2	62.6	22.3	22.3	0.0	5.7	5.7	2.1	0.5
2010	429.8	76.1	26.3	26.3	0.0	6.6	6.6	2.0	0.5
2011			0.0	0.0	(14.8)		(14.8)	0.0	(0.9)
Total	2,984.4	401.0	182.4	182.4	68.6	51.5	120.1	50.7	50.7

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Table K.5.5b Cost & Benefit of Los Cocos Workshop Improvement Project (1998 - 2010)

unit: mill.CS

	Benefits			Cost			Discount rate	
	Cost saved		Sub-total	Investment	O & M cost	Sub-total	12.5 %	
	Investment	O & M					Benefits	Cost
1998	0.0	0.0	0.0	4.2		4.2		4.2
1999	0.0	0.0	0.0	5.2	0.0	5.2	0.0	4.6
2000	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.8
2001	1.8	0.2	2.1	0.0	1.0	1.0	1.4	0.7
2002	1.8	0.5	2.3	0.0	1.0	1.0	1.4	0.6
2003	1.8	0.7	2.5	0.0	1.0	1.0	1.4	0.6
2004	1.8	0.9	2.8	0.0	1.0	1.0	1.4	0.5
2005	1.8	1.2	3.0	0.0	1.0	1.0	1.3	0.4
2006	1.8	1.4	3.2	0.5	1.0	1.5	1.3	0.6
2007	1.8	1.6	3.4	0.0	1.0	1.0	1.2	0.3
2008	3.7	1.9	5.5	0.0	1.0	1.0	1.7	0.3
2009	3.7	2.1	5.7	0.0	1.0	1.0	1.6	0.3
2010	3.7	2.3	6.0	0.0	1.0	1.0	1.5	0.2
2011			0.0	(0.1)		(0.1)	0.0	(0.0)
Total	23.7	12.7	36.5	9.7	10.0	20.7	14.1	14.1

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Table K.5.5c Cost & Benefit of Public Cooperation Promotion Project (1998 - 2010)

unit: mill.C\$

	Waste Volume to be collected from Area B (ton/year)	Number of Households in Area B paying waste fees (1,000)	Benefits		Cost			Discount rate 34.0 %	
			Cost saved from road sweeping services	Sub-total	Investment	O & M cost	Sub-total	Benefits	Cost
1998	90.0	2.4	0.5	0.4	0.6	0.7	1.2	0.5	1.2
1999	126.1	7.0	0.7	0.7	0.0	0.7	0.7	0.5	0.5
2000	167.6	13.8	0.9	0.9	0.0	0.7	0.7	0.5	0.4
2001	177.9	16.6	1.0	1.0	0.1	0.7	0.8	0.4	0.3
2002	189.0	19.6	1.0	1.0	0.0	0.7	0.7	0.3	0.2
2003	200.6	22.9	1.1	1.1	0.0	0.7	0.7	0.2	0.2
2004	212.9	26.5	1.1	1.1	0.1	0.7	0.8	0.2	0.1
2005	226.0	30.3	1.2	1.2	0.2	0.7	0.9	0.2	0.1
2006	239.2	34.4	1.3	1.3	0.0	0.7	0.7	0.1	0.1
2007	253.4	38.7	1.4	1.4	0.1	0.7	0.8	0.1	0.1
2008	306.7	50.2	1.6	1.6	0.0	0.7	0.7	0.1	0.0
2009	365.2	62.6	2.0	2.0	0.0	0.7	0.7	0.1	0.0
2010	429.8	76.1	2.3	2.3	0.2	0.7	0.9	0.1	0.0
2011				0.0	(0.1)		(0.1)	0.0	0.0
Total	2,984.4	401.0	16.0	16.0	1.2	9.0	10.2	3.3	3.3

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ANNEX L

PILOT PROJECTS

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ANNEX L PILOT PROJECTS

Pilot projects will be carried out according to the following objectives:

- to determine the feasibility of the proposed Master Plan
- to establish a more practical plan
- to demonstrate upgraded services and environmental improvement impacts
- to obtain the basic data for the preliminary design of the F/S

Based on the discussion between the Coordinating Committee and the Study Team, the following Pilot Projects were proposed for the second phase of the project:

- Collection Experiment
- Public Education Campaign
- Sanitary Landfill Experiment

L.1 Collection Experiment

L.1.1 Background

a. Present Waste Collection Services

Collection services cover 77.0% of the urban area of Managua City, while non-collection areas make up the remaining 23.0%.

The collection area is divided into Areas A and B according to the system of collection. In Collection Area A, the curb collection system is practiced: compactor trucks (15.3m³) collect the wastes discharged by residents in front of their premises. In contrast to Area A, Area B is predominantly made up of slums and has poor infrastructure, and wastes are discharged in registered illegal dump sites and collected by municipal wheel loaders and dump trucks.

The non-collection area is mainly composed of temporary settlements as in Collection Area B, and wastes are not collected in this area due to lack of suitable equipment.

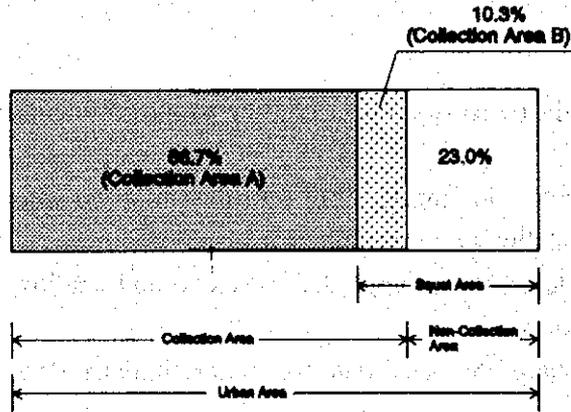


Figure L.1.1a Urban Area Definition in terms of Collection Services

b. Non-collection Area

This area is mostly made up of squat settlements and has very poor infrastructure; electric cables and water pipes are illegally installed to avail with electric and water supply services. Furthermore, road condition is bad and there are no sewage drains.

Residents in this area are forced to live without basic public services, and the absence of waste collection services creates many registered illegal dump sites in various places. The economic means of the residents are very restricted, malnutrition is common especially in infants and access to preventive medicine is hard. In addition, basic knowledge of public health is low in squat areas due to lack of education.

Generally speaking, collection service was never a priority in these areas as there are other matters of prior importance such as legalization of land tenure, improvement of housing facilities, drinking water, electricity, employment, etc..

However, it is advisable to combine the collection project with another equally important one, thereby forming an attractive package.

L.1.2 Objectives

The collection system in the well developed Collection Area A will be modified, but compactor trucks will still be used. Collection services will be expanded in Area B where conditions are not sanitary enough.

The objectives of the collection experiment are to examine the following possibilities:

- establishment of proper collection and haulage system
- establishment of beneficiary-pay principle system
- establishment of monitoring system to prohibit the discharge of waste other than household waste (industrial and construction waste)
- establishment of an environmental cleansing system through community activities
- establishment of roads and drains improvement system carried out by the community with municipality assistance

L.1.3 Outline of Experiment

The outline and procedure of the collection experiment are shown in Figure L.1.3a. The experiment consists of the following three stages:

i Planning Stage:

The following works were carried out prior to the commencement of the experiment:

- review of present situation, i.e. Study Area condition and waste collection system
- formulation of basic plan for experiment, i.e. collection method, collection fee, sanitation methods (improvement of roads and drains)
- selection of candidate areas for experiment

ii Execution Stage

Execution stage involves work for the preparation and implementation of the experiment. The preparation works are outlined below:

- organization of meetings with district coordinators, community leaders and residents
- determination of subject area(s)
- detailed design of experiment
- monitoring of the experiment

iii Evaluation Stage

Overall evaluation and the handing over of works are carried out in this stage, and the following were carried out to evaluate the experiment:

- time and motion survey
- public opinion survey
- observation works
- identification of issues and problems

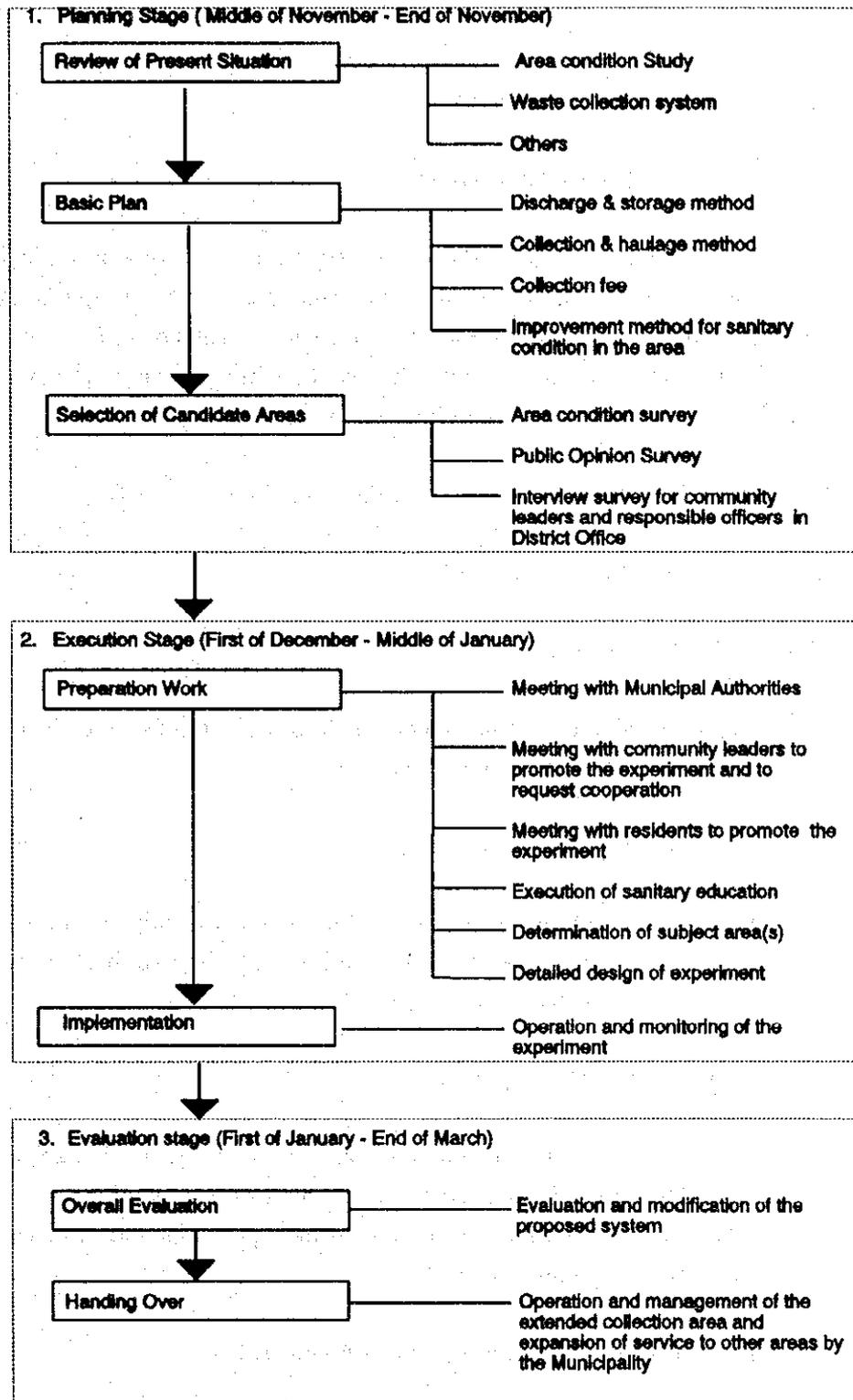


Figure L.1.3a Outline and Procedure of Experiment

L.1.4 Planning Stage

a. Basic Plan of Experiment

aa. Basic Conditions for Planning

There are mainly two area conditions in area B: an area without vehicular access roads and an area with a main road for vehicular access. According to the General Urbanization Plan for Managua, the former is categorized as spontaneous settlements making up about 60% of area B, while the latter is categorized as progressive settlements covering 40% of the area.

The basic plan will be made based on the conditions in area B.

ab. Basic Plan for Experiment

aba. Collection System

According to the above mentioned area conditions, the following collection system was prepared for non-collection areas.

- Container collection system:

This system will be implemented in narrow areas without access roads for collection vehicles. The residents shall directly dispose their waste to where the communal containers are located.

- Container collection system:

This system will be implemented in wide areas without access roads for collection vehicles. The community shall employ a primary collector to collect the wastes they put in front of their premises and dispose them into the communal container.

The conceptual design is shown in Figure L.1.4a.

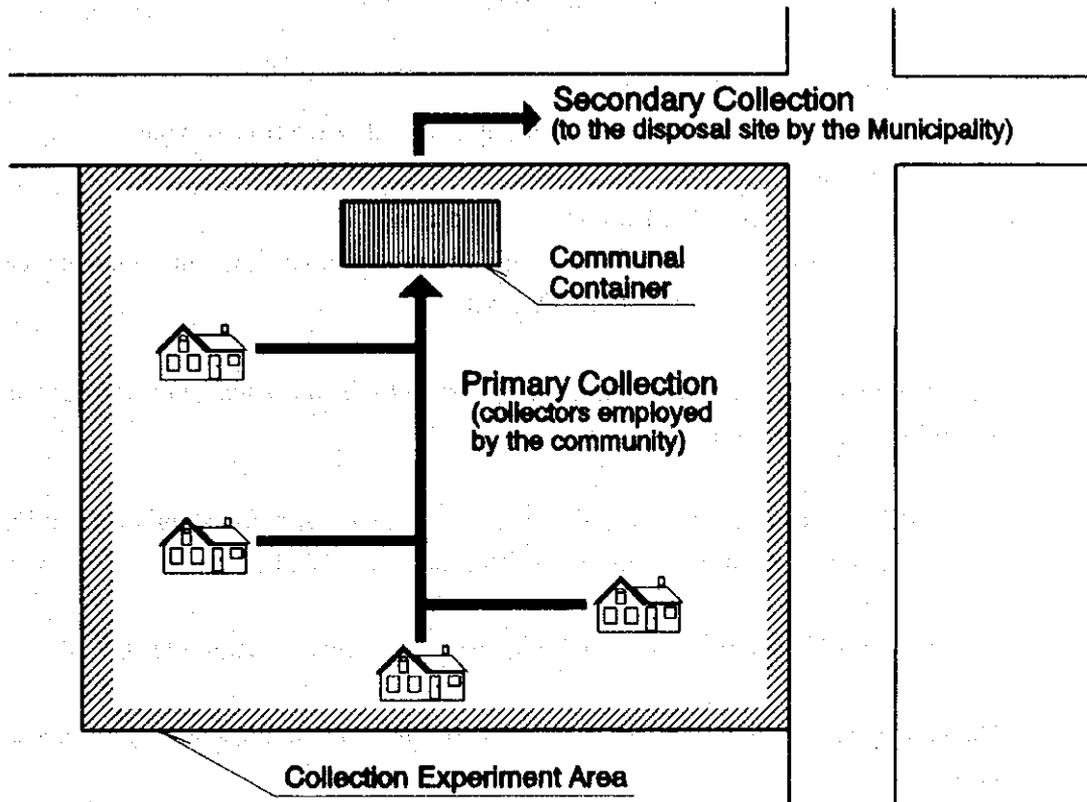


Figure L.1.4a Conceptual Design of the Collection System

- Bell collection system through the use of compactor trucks:

This system will be used in areas with an access road for collection vehicles. The collectors shall call out to the residents to discharge their waste upon the arrival of the collection vehicle at a given collection point.

- Station collection system through the use of compactor trucks:

This system will be used in areas with an access road for collection vehicles. The residents shall bring their waste in plastic bags or sacks to a collection point built by the community.

abb. Waste Fee

Waste fees will be collected from households participating in the experiment based on the beneficiary-pay-principle. The amount to be charged per household is decided at C\$ 3 /month/household based on the following calculation:

$$5.5 / 12 / 834,427 * 6.7 * 1,000,000 = \text{C\$ } 3.7$$

where,

C\$ 5.5 million :1994 budget for household collection service

12 months :one year

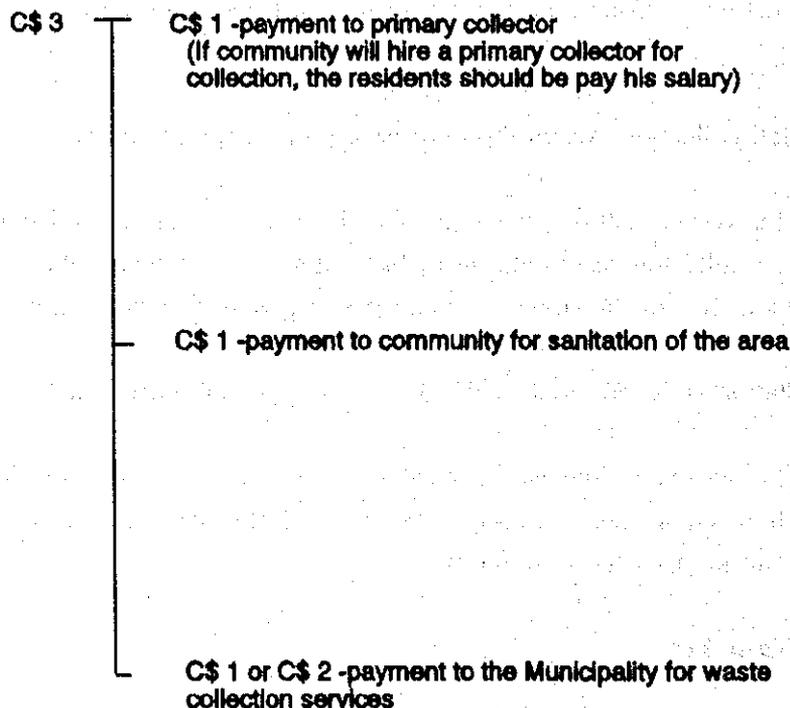
834,427 persons :1994 urban area population

6.7 persons :number of family members household in Managua city
(1,071,868/159,696)

The introduction of a waste collection fee system in the squat area requires the following consideration:

- difficulties in the charging of waste fees because of a low standard of living;
- the need to employ primary collectors due to lack of access roads and wide areas;
- the need to sanitize area condition (improvement of roads and drains).

The C\$ 3 (waste collection fee) to be collected from each household shall be used as follows:



The salary of the primary collector is estimated as follows:

$$500 \times 64 / 160 = \text{C\$ } 200$$

C\$ 500 :average salary of worker

64 :monthly working time of primary collector
(4 hrs/day x 4 days/week x 4 weeks/month)

160 :average monthly working time (8 hrs/day x 20 days/month)

Each household is estimated to pay the following for the payment of the primary collector:

$$\text{C\$ } 200 / 200 \text{ households} = \text{C\$ } 1 / \text{month/household}$$

abc. Sanitation of the area

Sanitary problems in non-collection areas, i.e. squat areas, do not only stem from waste but also from sewage. To sanitize the environment of this area, roads and drains should be repaired or constructed through municipality assisted community activities.

aba. Outline of basic plan

The basic plan is shown in Table L.1.4a.

Table L.1.4a Outline of Basic Plan

Collection System	Container Collection System		Compactor Collection System	
	Direct Discharge	Primary Collector	Bell Collection	Station Collection
1.AREA CONDITION	applied to narrow areas without access roads for collection vehicles	applied to narrow areas without access roads for collection vehicles	applied to areas with main roads for collection vehicles	applied to areas with main roads for collection vehicles
2.STORAGE	Not necessary	Necessary	Necessary	Necessary
3.DISCHARGE				
-Point	Containers	In front of premises	Compactors	Station
-Time	Anytime	Fixed time	Fixed time	Fixed time
-Vessel	Any vessel	Bags, baskets, etc.	Bags, baskets, etc.	Nylon sacks or plastic bags
-Management	Community	Residents	Not necessary	Community
4.COLLECTION (Primary)				
-Management	-	Community	-	-
(Secondary)				
-Management	Municipality	Municipality	Municipality	Municipality
-Frequency	twice or thrice a week depending on the number of households in the area	twice or thrice a week depending on the number of households in the area	thrice a week	thrice a week
-Type of vehicle	Roll-on Roll-off trucks	Roll-on Roll-off trucks	Compactor trucks	Compactor trucks
5.WASTE FEE	C\$ 3 (C\$ 1 for improvement of area condition)	C\$ 3 (C\$ 1 for salary of primary collector and C\$ 1 for improvement of area condition)	C\$ 3 (C\$ 1 for improvement of area condition)	C\$ 3 (C\$ 1 for improvement of area condition)
6.SANITATION OF AREA CONDITION				
-Area cleansing activity	Prior to the experiment, the selected area(s) will be cleaned by the community with the assistance of the Public Cleansing Office.			
-Area improvement activity	Prior to the experiment, the roads and drains in the selected area(s) will be improved by the community with the assistance of the District Coordination Office.			

b. Selection of Candidate Areas

The Nicaraguan counterpart and the Study Team selected five candidate areas for the experiment based on the following points of view:

- Non-collection area
- Area condition
- strong demand for collection services

The selected five candidate areas are listed below and shown in Figure L.1.4d.

- Hialeah (D3)
- César Sandino (D5)
- Carlos Marx (D6)
- Villa Canada (D6)
- Waspan Norte (D6)

The conditions of the candidate areas, results of interviews with residents, community leaders and authorized persons in the District Office are shown in Tables L.1.4b, L.1.4c and L.1.4d, respectively.

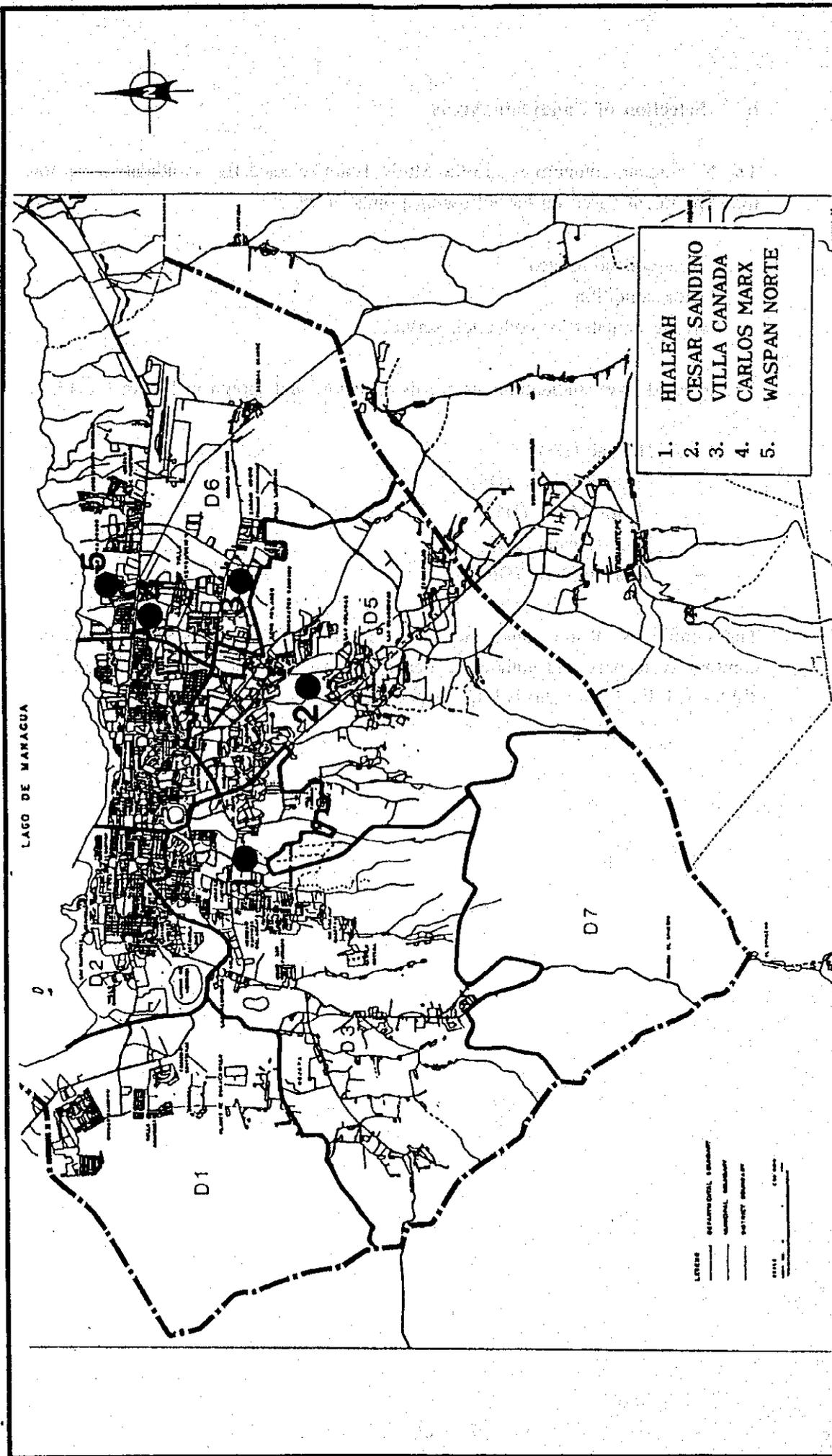


Figure L.1.4b Candidate Areas for Collection Experiment

THE STUDY ON THE IMPROVEMENT OF THE SOLID WASTE
 MANAGEMENT SYSTEM FOR THE CITY OF MANAGUA
 JAPAN INTERNATIONAL COOPERATION AGENCY

Table L.1.4b Area Condition of Candidate Areas

Item	Name of Area	HIALEAH (D3)	CESAR SANDINO (D5)	VILLA CANADA (D6)	CARLOS MARX (D6)	WASPAN NORTE (D6)
1. Population		1,340	2,010	2,850	1,320	1,090
- Number of Families		200	300	425	197	163
- Area (ha)		4.2	4.4	6.7	3.0	9.7
- Population Density (per/ha)		319	457	425	440	112
- Type of Area		Progressive Settlement	Progressive Settlement	Spontaneous Settlement	Spontaneous Settlement	Spontaneous Settlement
2. Road Condition						
- Total Length (km)		1.42	2.17	2.00	3.58	1.50
- Length and % of road (more than 5 m (%))		50	55	60	30	40
- Length and % of paved road (%)		30	0	0	5	0
3. Kind and % of Drain						
- soil (%)		100	100	80	100	80
- concrete (%)		0	0	20	0	20
4. Water Supply (%)		100	100	100 (Illegal connection)	100 (Illegal connection)	100 (Illegal connection)
5. Electricity (%)		100 (Illegal connection)	100 (Illegal connection)	100 (Illegal connection)	100 (Illegal connection)	100 (Illegal connection)
6. Discharge point of waste		Channel, Road side	Road side	Road side & RIDS	Channel, Road side, & RIDS	Channel, Road side
7. Sanitary Condition		Sewage freely flows on roads but each household premises is kept very clean	Sewage freely flowing on roads but each household premises is kept very clean	Sewage freely flows on roads but each household premises is kept very clean	Sewage freely flows on roads but each household premises is kept very clean	Swage flowing on the road but each household premises is kept very clean

Table L.1.4c Results of Interview with Residents by candidate area

(unit: %)

Candidate Areas	HIALEAH (D6)	CESAR SANDINO (D5)	VILLA CANADA (D6)	CARLOS MARX (D6)	WASPAN NORTE (D6)
1. Discharge Method					
1. RIDS	0	50	40	20	0
2. Surrounding area or channel	60	0	30	50	80
3. Combustion / disposal	40	50	30	30	20
4. Others	0	0	0	0	0
2. Percentage of residents who want to receive collection service (reason)	100	100	100	100	100
a. to make the area clean	20	30	10	50	0
b. to prevent generation of flies and bad smell	80	40	60	30	40
c. to prevent diseases	60	40	50	30	60
d. others	0	10	10	0	20
3. Percentage of residents who are able to cooperate by independently carrying their waste to communal containers	100	100	100	90	100
4. Average amount of residents willing to pay (Cordobas/month)	4.3	6.2	2.4	8.0	7.6
5. Percentage of residents who think public cooperation is necessary in order to maintain a beautiful and clean environment	100	100	90	100	100
6. Percentage of residents who think public education or campaign is necessary in order to maintain a beautiful and clean environment	100	100	90	100	100
7. Percentage of residents who participate in the above public education works or campaign	80	90	90	60	90
8. Type of Association					
1. J'COP	10	0	20	40	10
2. Community Activities	-	40	0	10	10
3. Churches	10	20	20	0	0
4. School	0	0	0	10	0
5. Others	80	40	60	40	80

Note; J'COP: Community leader