

CHAPTER 4 TECHNICAL ALTERNATIVES

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4.1 Planning Concept

(1) Technical Alternatives

The technical system for the solid waste management plan is made up of a series of sub-systems: storage and discharge, collection and haulage, and treatment and disposal. The solid waste management plan for Metro Manila will focus on the improvement of these subsystems. Because these subsystems are significantly affected by the location of the final disposal site, the technical alternatives should conform with the final disposal site location. Therefore, the solid waste management plan for Metro Manila will be formulated based on this premise.

(2) Final Disposal Site Concept

The first field studies were carried out from February until July 1997 to determine areas suitable for the construction of final disposal sites. The study proposes the construction of two final disposal sites: ① Pintong Bocaue on the left bank of the Marikina River, east of Metro Manila, and ② a part of Manila Bay, which shall be reclaimed. The development of the left bank of the Marikina River is suggested as a component of the "Marikina Environmental Forest Conservation Project"

However, significant changes have occurred since the first field survey, with regard to issues relevant to the use of the final disposal site. A conflict between MMDA and the Carmona City administration has arisen from negotiations for the use of the Carmona final disposal site, which might impel MMDA to close the site as early as March, 1998. However, these changes will not affect the long-term plans of the project. Accordingly, the study of alternatives for the basic plan will focus on the two proposed sites aforementioned.

4.1.1 Premise

The following are conditions in the formulation of technical alternatives:

(1) Forecast Future Waste Amount

The forecast waste stream for Metro Manila in year 2010 is shown in Figure 3.4.3 of Chapter 3.

(2) Targeted Collection Coverage

The collection coverage of each LGU that is necessary to achieve the target collection coverage of 80% in 2005 and 90% in 2010 for the whole of Metro Manila is shown in Table 4.1.1.

Table 4.1.1 Targeted Collection Coverage (%)

LGUs	1997	2000	2005	2010
Manila	63	63	70	85
Quezon	83	84	90	95
Caloocan	37	38	50	70
Navotas	40	40	50	70
Valenzuela	78	78	80	90
Malabon	63	63	75	90
Marikina	51	51	60	85
Pasig	96	96	100	100
Pateros	70	71	80	90
San Juan	72	72	80	90
Taguig	57	57	65	85
Makati	98	98	100	100
Pasay	96	97	100	100
Muntinlupa	94	95	100	100
Mandaluyong	97	98	100	100
Parañaque	68	68	75	85
Las Piñas	87	88	90	95
Weighted Average	73	73	80	90

(3) Final Disposal Sites

The two areas that have been proposed for the development of disposal sites in 2010 are Pintong Bocaue in the Marikina watershed, and a sea landfill site. An extensive improvement of the operation of the present final disposal site by sanitary landfill is recommended. Sanitary landfill level 4, which is considered as the highest landfill operation level and has leachate collection and treatment facilities, will be adopted.

(4) Privatization of Collection and Haulage Services

Except for Las Piñas, Marikina and Pateros, the collection and haulage of the wastes of the 14 LGUs in Metro Manila are currently consigned in part or in whole to private companies. On the whole, private companies carry out 86% of the said services. The alternatives in the Master Plan were adopted assuming private companies are to conduct the entire waste collection and haulage services. The operation expenses will be calculated assuming these services are directly under the supervision of the LGUs. The initial investment for the purchase of equipment will be considered as depreciation cost and apportioned to every equipment and facilities. The sum shall then be considered as the contract cost.

4.1.2 Examination of Technical Alternatives

- (1) SWM Components: The technical system is made up of the following sub-systems:
- Discharge and storage
 - Collection and haulage
 - Intermediate treatment
 - Final disposal
- (2) Optimum Technical System Selection Method: As mentioned in (1), the technical system is made up of a combination of subsystems. The table below outlines the current condition of each subsystem and the respective areas to be improved.

Table 4.1.2 Basic Concept of Alternatives Formulation

Subsystems	Current Condition	Recommended Improvement
Discharge & Storage	Insufficient type of containers in generation sources	Provide containers in squatter area and large generation sources Introduce source separation
Collection & Haulage	One (1) transfer station	Adopt container collection system for areas that are inaccessible and for large generation sources Establish 4 transfer stations
Intermediate Treatment	None	Introduce recycling system, introduce composting and install incinerator
Final Disposal	Controlled tipping, without cover soil and leachate treatment	Establish genuine sanitary landfill with cover soil, leachate treatment, etc.

An ideal solid waste management system should incorporate all the items recommended in the table above. However, the optimum system to be adopted for Metro Manila should extensively consider the city's economic, social and environmental conditions. Using the present system as a base, the alternatives to be adopted will consist of systems proposing the gradual improvement of services.

4.2 Technical Alternatives

The SWM technical system is made up of several sub-systems, namely discharge and storage, collection and haulage, intermediate treatment, and final disposal. This plan entails the improvement of the current solid waste management system in Metro Manila, in phases. Six technical alternatives (A to F) which represent different levels of improvement of the existing system were reviewed. Considering that the location of final disposal sites significantly influences the planning of these systems, two cases will be conceptualized for technical alternatives: case 1 in consideration of both inland and sea landfill, and case 2 for inland landfill alone. In total, 12 technical alternatives will be examined.

- A1, A2: Continuation of present waste management system
- B1, B2: Introduction of a transfer station for effective waste haulage
- C1, C2: Introduction of a compost plant for waste volume reduction, targeting 50% of market wastes for composting
- D1, D2: Construction of a recycling center for waste volume reduction and introduction of separate collection
- E1, E2: Incineration of 30% of the waste disposal volume for waste volume reduction
- F1, F2: Incineration of total waste disposal volume for waste volume reduction

Thus, Alternative F stands for a more advanced option, while Alternative A, a less improved option.

Table 4.2.1 Technical Alternatives

Technical Alternatives		A	B	C	D	E	F
		A1:2sites A2:Inland	B1: 2 sites B2: Inland	C1: 2 sites C2: Inland	D1: 2 sites D2: Inland	E1: 2 sites E2: Inland	F1: 2 sites F2: Inland
Discharge/Collection		Combined	Combined	Combined	Separate	Separate	Separate
Collection/Haulage (Transfer St)		- *1)	x	x	x	x	- *1)
Intermediate Treatment	Recycling Center	-	-	-	x	x	x
	Compost Plant*2)	-	-	x	x	x	x
	Incinerator	-	-	-	-	x*3)	x
Final Disposal (Sanitary Landfill)		Level 4	Level 4	Level 4	Level 4	Level 4	Level 4

Note: *1): Las Piñas T.S

*2): Market waste

*3): 30% of disposal amount

Level 1: controlled tipping

Level 2: sanitary landfill with a dike and daily cover soil

Level 3: sanitary landfill with leachate circulation

Level 4: sanitary landfill with leachate treatment

4.2.1 Outline of the Alternatives

An explanation of each alternative is given below:

Alternative A1: Continuation of the Present System (inland and sea landfills)

This alternative proposes the continuation of the present system (combined collection and without intermediate treatment), and the realization of sanitary landfills.

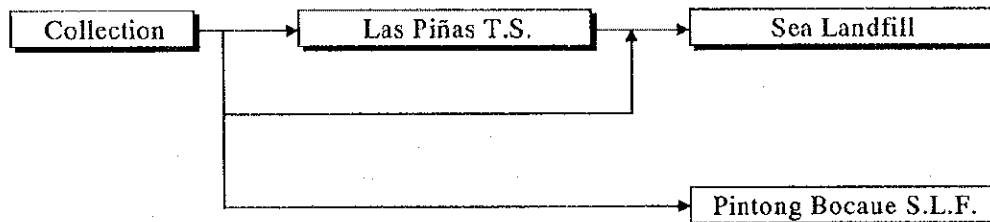


Figure 4.2.1 Flow of Alternative A1

Table 4.2.2 Configuration of Alternative A1

System	Type of Waste	Contents of System
Collection System	MSW	Compactor (15 cum) : 21% of collection waste Dump Truck (10 cum) : 79% of collection waste
Transfer System	MSW	Tractor Head Container (40 cum)
Transfer Station	MSW	Las Piñas 1,200 ton/day
Landfill	MSW	Pintong Bocaue, Sea Landfill (Level 4)

*MSW : Municipal Solid Waste

Alternative A2: Current System (inland landfill)

As in Alternative A1, this alternative recommends the continuation of the present system (combined collection, no intermediate treatment).

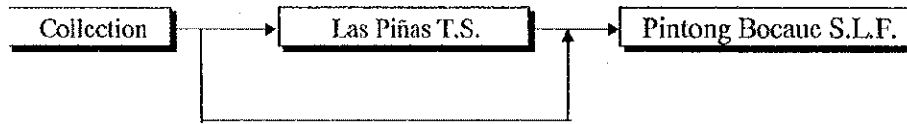


Figure 4.2.2 Flow of Alternative A2

Table 4.2.3 Configuration of Alternative A2

System	Type of Waste	Contents of System
Collection System	MSW	Compactor (15 cum) : 21% of collection waste Dump Truck (10 cum) : 79% of collection waste
Transfer System	MSW	Tractor Head Container (40 cum)
Transfer Station	MSW	Las Piñas : 1,200 ton/day
Landfill	MSW	Pintong Bocaue (Level 4)

MSW : Municipal Solid Waste

Alternative B1: Introduction of a Transfer Station (inland and sea landfills)

This alternative proposes the construction or improvement of the following transfer stations for efficient waste haulage services:

- Las Piñas transfer station : improvement
- Manila transfer station : construction
- Marikina transfer station : construction
- Fort Bonifacio transfer station : construction

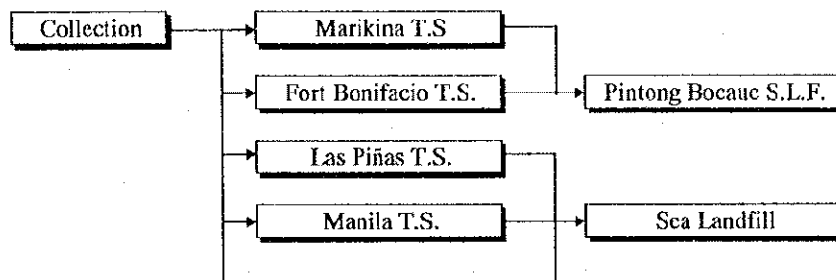


Figure 4.2.3 Flow of Alternative B1

Table 4.2.4 Configuration of Alternative B1

System	Type of Waste	Contents of System
Collection System	Household Waste	Compactor (15 cum)
		Compactor (8 cum)
		Container (1 cum)
	Commercial Waste	Compactor (15 cum)
	Institutional Waste	Compactor (15 cum)
	Market Waste	Roll-on Roll-off Truck
Street Sweeping W. River Cleansing W.		Container (8 cum)
		Dump Truck (10 cum)
Transfer System	MSW	Tractor Head
		Container (40 cum)
Transfer Station	MSW	Las Piñas : 1,200 ton/day
		Marikina : 3,500 ton/day
		Fort Bonifacio : 2,200 ton/day
		Manila : 1,800 ton/day
Landfill	MSW	Pintong Bocaue, Sea Landfill (Level 4)

Alternative B2: Introduction of a Transfer Station (inland landfill)

This alternative basically recommends the same collection and haulage and intermediate treatment systems stated in alternative B1.

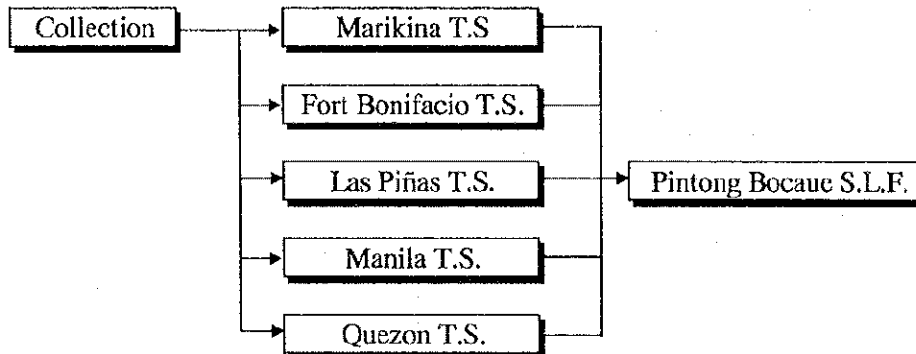


Figure 4.2.4 Flow of Alternative B2

Table 4.2.5 Configuration of Alternative B2

System	Type of Waste	Contents of System
Collection System	Household Waste	Compactor (15 cum)
		Compactor (8 cum)
		Container (1 cum)
	Commercial Waste	Compactor (15 cum)
	Institutional Waste	Compactor (15 cum)
	Market Waste	Roll-on Roll-off Truck
Transfer System	MSW	Tractor Head
		Container (40 cum)
Transfer Station	MSW	Las Piñas : 1,200 ton/day
		Marikina : 3,500 ton/day
		Fort Bonifacio : 2,200 ton/day
		Quezon : 3,500 ton/day
		Manila : 1,800 ton/day
Landfill	MSW	Pintong Bocaue (Level 4)

Alternative C1: Introduction of Composting (inland and sea landfills)

This alternative proposes the introduction of composting as an intermediate treatment. In addition to alternative B, this alternative proposes the establishment of a compost plant in the final disposal site, mainly for market wastes that are mostly organic in composition. Considering the absence of this technology in Metro Manila at present, this alternative assumes that 50% of the market waste will be composted.

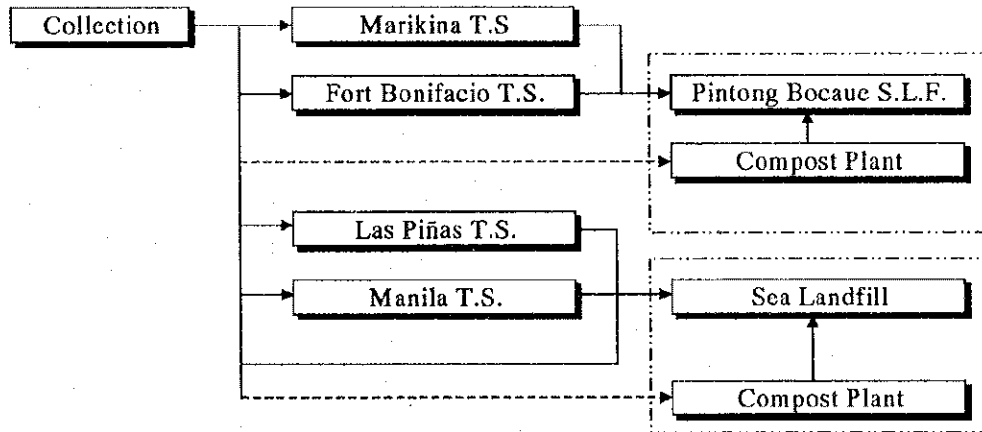


Figure 4.2.5 Flow of Alternative C1

Table 4.2.6 Configuration of Alternative C1

System	Type of Waste	Contents of System
Collection System	Household Waste	Compactor (15 cum) Compactor (8 cum) Container (1 cum)
	Commercial Waste	Compactor (15 cum)
	Institutional Waste	Compactor (15 cum)
	Market Waste	Roll-on Roll-off Truck Container (8 cum)
	Street Sweeping W.	Dump Truck (10 cum)
	River Cleansing W.	Dump Truck (10 cum)
Transfer System	MSW	Tractor Head Container (40 cum)
Transfer Station	MSW	Las Piñas : 1,100 ton/day
		Marikina : 3,300 ton/day
		Fort Bonifacio : 2,100 ton/day
		Manila : 1,600 ton/day
Compost Plant	50% of Market Waste	Pintong Bocau : 200 ton/day
		Sea Landfill : 160 ton/day
Landfill	MSW	Pintong Bocau, Sea Landfill (Level 4)

Alternative C2: Introduction of Composting (inland landfill)

Basically recommends the same collection and haulage system specified in alternative C1.

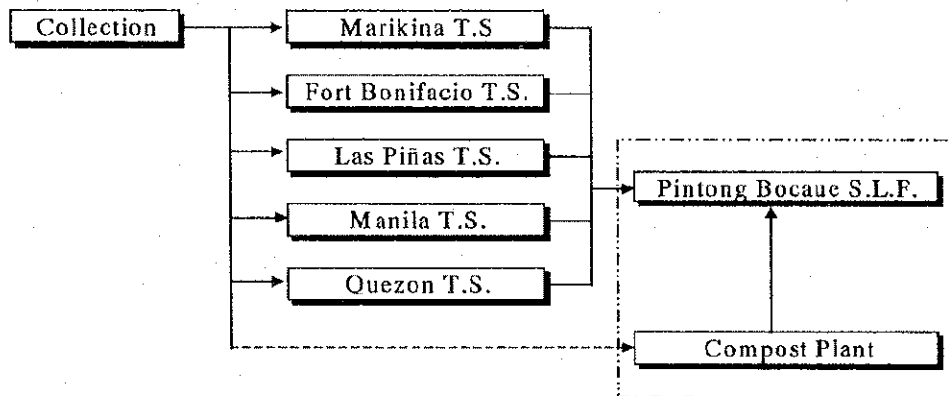


Figure 4.2.6 Flow of Alternative C2

Table 4.2.7 Configuration of Alternative C2

System	Type of Waste	Contents of System
Collection System	Household Waste	Compactor (15 cum)
		Compactor (8 cum)
	Commercial Waste	Container (1 cum)
		Compactor (15 cum)
	Institutional Waste	Compactor (15 cum)
	Market Waste	Roll-on Roll-off Truck
Street Sweeping W. River Cleansing W.	Container (8 cum) Dump Truck (10 cum) Dump Truck (10 cum)	
Transfer System	MSW	Tractor Head Container (40 cum)
Transfer Station	MSW	Las Piñas : 1,100 ton/day
		Marikina : 3,300 ton/day
		Fort Bonifacio : 2,100 ton/day
		Quezon : 3,300 ton/day
		Manila : 1,600 ton/day
Compost Plant	50% of Market Waste	Pintong Bocaue : 360 ton/day
Landfill	MSW	Pintong Bocaue (Level 4)

**Alternative D1: Introduction of Separate Collection and Intermediate Treatment
(composting plant and sorting center)
(inland and sea landfills)**

This alternative recommends waste reduction by introducing composting and recycling as intermediate treatment systems. Separate collection will be introduced simultaneously with the establishment of a sorting center.

The sorting plant will be constructed in the Manila transfer station and in the existing Payatas open dumpsite, and recyclable items will be manually sorted out. The construction of the sorting plant in the Manila transfer station will be considered as an alternative to the incinerator plant currently being promoted by the NHA (National Housing Authority) and R2 Builders (private developer) for construction in the Smokey Mountain area. To construct the sorting plant in the Payatas open dumpsite, the government has to officially acquire the area and conduct necessary waste treatment measures.

The construction of a sorting plant will bring about social benefits such as waste volume reduction and employment, especially for the numerous waste pickers residing in Manila and Payatas.

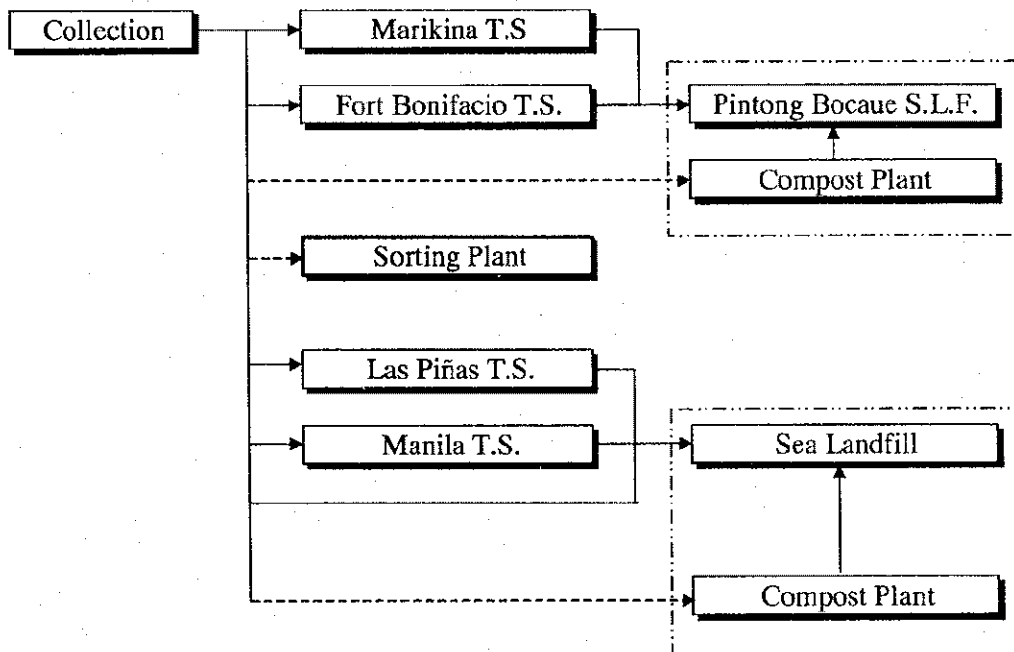


Figure 4.2.7 Flow of Alternative D1

Table 4.2.8 Configuration of Alternative D1

System	Type of Waste	Contents of System
Collection System	Household Waste	Compactor (15 cum) Compactor (8 cum) Container (1 cum)
	Commercial Waste	Compactor (15 cum)
	Institutional Waste	Compactor (15 cum)
	Market Waste	Roll-on Roll-off Truck Container (8 cum)
	Street Sweeping W.	Dump Truck (10 cum)
	River Cleansing W.	Dump Truck (10 cum)
Transfer System	MSW	Tractor Head Container (40 cum)
Transfer Station	MSW	Las Piñas : 1,100 ton/day Marikina : 3,100 ton/day Fort Bonifacio : 2,000 ton/day Manila : 1,600 ton/day
Compost Plant	50% of Market Waste	Pintong Bokaue : 200 ton/day Sea Landfill : 160 ton/day
Sorting Plant	2% of MSW	Manila : 110 ton/day Payatas : 110 ton/day
Landfill	MSW	Pintong Bokaue, Sea Landfill (Level 4)

**Alternative D2: Introduction of Separate Collection and Intermediate Treatment
(composting plant and sorting plant)
(inland landfill)**

This alternative proposes the same system for collection and haulage and intermediate treatment proposed in alternative D1.

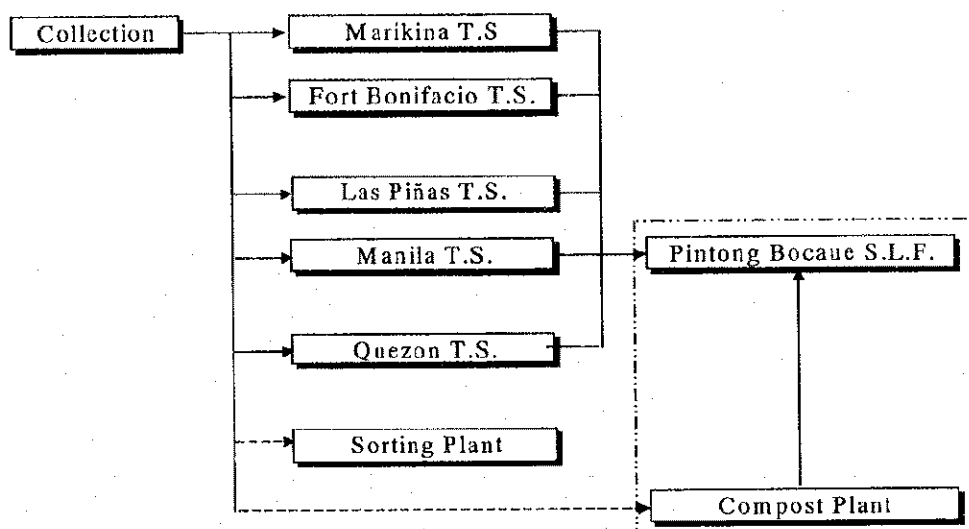


Figure 4.2.8 Flow of Alternative D2

Table 4.2.9 Configuration of Alternative D2

System	Type of Waste	Contents of System
Collection System	Household Waste	Compactor (15 cum)
		Compactor (8 cum)
		Container (1 cum)
	Commercial Waste	Compactor (15 cum)
	Institutional Waste	Compactor (15 cum)
	Market Waste	Roll-on Roll-off Truck
Transfer System	MSW	Tractor Head
		Container (40 cum)
Transfer Station	MSW	Las Piñas : 1,100 ton/day Marikina : 3,100 ton/day Fort Bonifacio : 2,000 ton/day Quezon : 3,200 ton/day Manila : 1,600 ton/day
Compost Plant	50% of Market Waste	Pintong Bocaue : 360 ton/day
Sorting Plant	2% of MSW	Manila : 110 ton/day Quezon : 110 ton/day
Landfill	MSW	Pintong Bocaue (Level 4)

Alternative E1: Introduction of Separate Collection and Intermediate Treatment (composting plant, sorting plant and incineration plant) (inland and sea landfills)

This alternative recommends the use of intermediate treatment facilities such as an incinerator, a sorting plant and composting facilities. The incinerator will be constructed within the sea landfill site. The residue from the incineration will be disposed of in the sea landfill.

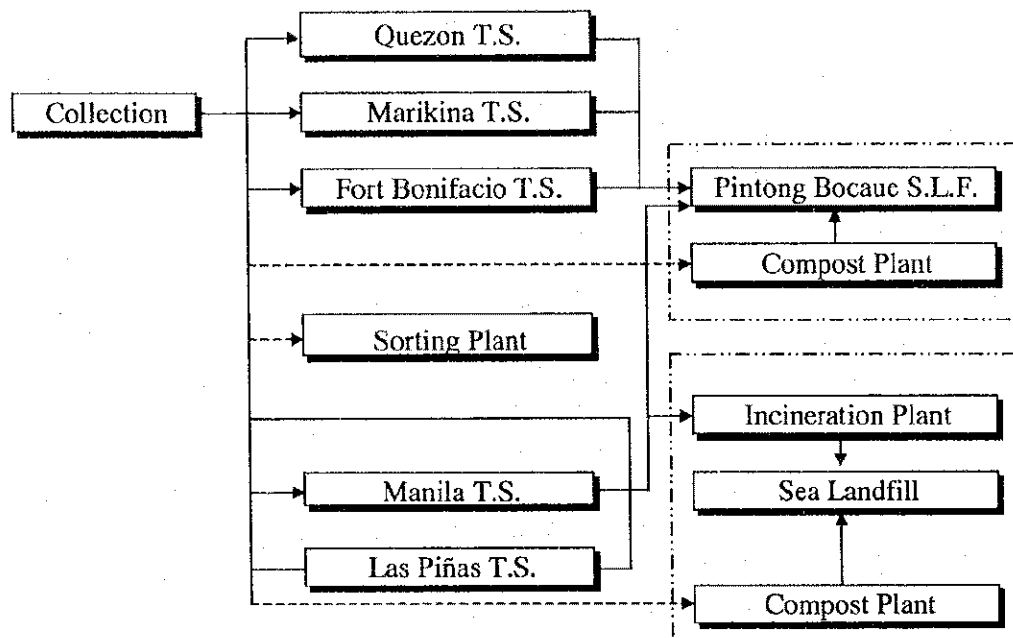


Figure 4.2.9 Flow of Alternative E1

Table 4.2.10 Configuration of Alternative E1

System	Type of Waste	Contents of System
Collection System	Household Waste	Compactor (15 cum)
		Compactor (8 cum)
	Commercial Waste	Container (1 cum)
		Compactor (15 cum)
	Institutional Waste	Compactor (15 cum)
	Market Waste	Roll-on Roll-off Truck
Street Sweeping W. River Cleansing W.	Container (8 cum) Dump Truck (10 cum) Dump Truck (10 cum)	
Transfer System	MSW	Tractor Head Container (40 cum)
	Ash	Dump Truck (10 cum)
Transfer Station	MSW	Las Pinas : 1,100 ton/day
		Marikina : 3,100 ton/day
		Fort Bonifacio : 2,000 ton/day
		Manila : 1,400 ton/day
Compost Plant	50% of Market Waste	Pintong Bocaue : 200 ton/day
		Sea Landfill : 160 ton/day
Sorting Plant	2% of MSW	Manila : 110 ton/day
		Payatas : 110 ton/day
Incineration Plant	MSW	Sea Landfill Site : 3,000 ton/day
Landfill	MSW	Pintong Bocaue, Sea Landfill (Level 4)

**Alternative E2: Introduction of Separate Collection and Intermediate Treatment
(composting plant and sorting plant)
(inland and sea landfills)**

This alternative proposes the same system for collection proposed in alternative E1.

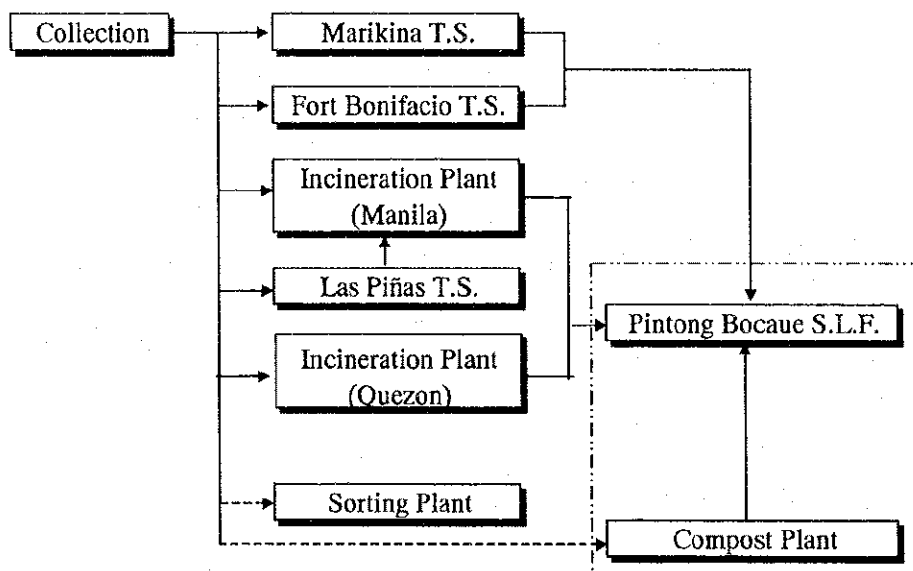


Figure 4.2.10 Flow of Alternative E2

Table 4.2.11 Configuration of Alternative E2

System	Type of Waste	Contents of System
Collection System	Household Waste	Compactor (15 cum)
		Compactor (8 cum)
	Commercial Waste Institutional Waste Market Waste	Container (1 cum)
		Compactor (15 cum)
		Compactor (15 cum)
		Roll-on Roll-off Truck
Street Sweeping W. River Cleansing W.	Container (8 cum)	
	Dump Truck (10 cum)	
	Dump Truck (10 cum)	
Transfer System	MSW	Tractor Head
	Ash	Container (40 cum) Dump Truck (10 cum)
Transfer Station	MSW	Las Piñas : 1,100 ton/day Marikina : 3,100 ton/day Fort Bonifacio : 2,000 ton/day
Compost Plant	50% of Market Waste	Pintong Bocaue : 360 ton/day
Sorting Plant	2% of MSW	Manila : 110 ton/day
		Quezon : 110 ton/day
Incineration Plant	MSW	Quezon : 2,300 ton /day
		Manila : 1,400 ton/day
Landfill	MSW	Pintong Bocaue (Level 4)

Alternative F1: Total Incineration (inland and sea landfills)

This proposes the incineration of all wastes, excluding those for recycling and composting. The systems proposed for collection and haulage and intermediate treatment, except for incineration, are the same in alternative E1, since the incinerator also functions as a transfer station.

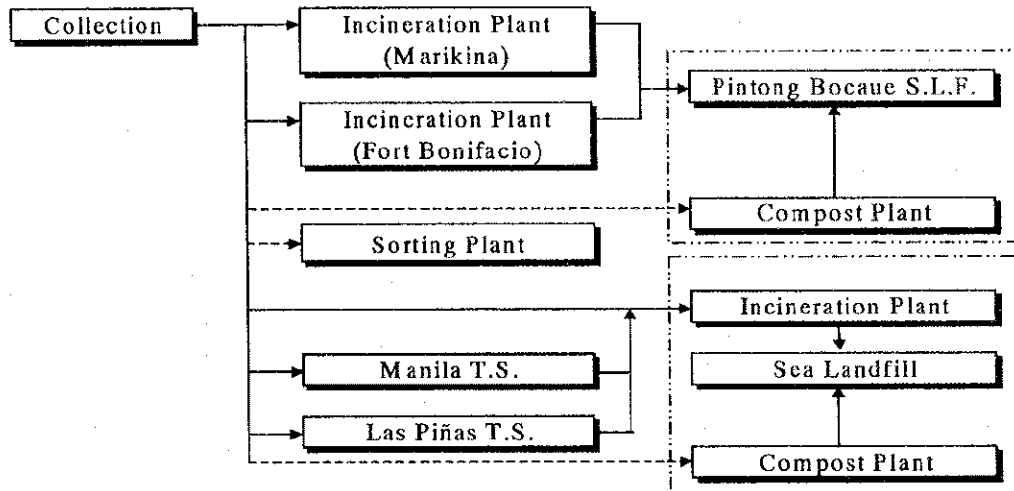


Figure 4.2.11 Flow of Alternative F1

Table 4.2.12 Configuration of Alternative F1

System	Type of Waste	Contents of System
Collection System	Household Waste	Compactor (15 cum)
		Compactor (8 cum)
		Container (1 cum)
	Commercial Waste	Compactor (15 cum)
	Institutional Waste	Compactor (15 cum)
Market Waste	Roll-on Roll-off Truck	
Street Sweeping W. River Cleansing W.	Dump Truck (10 cum)	
	Dump Truck (10 cum)	
Transfer System	MSW	Tractor Head
	Ash	Container (40 cum) Dump Truck (10 cum)
Transfer Station	MSW	Las Pinas : 1,100 ton/day
		Manila : 1,400/ton/day
Compost Plant	50% of Market Waste	Pintong Bocaue : 200 ton/day
		Sea Landfill : 160 ton/day
Sorting Plant	2% of MSW	Manila : 110 ton/day
		Payatas : 110 ton/day
Incineration Plant	MSW	Sea Landfill Site : 4,100 ton /day
		Marikina : 2,700 ton/day
		Fort Bonifacio : 1,700 ton/day
Landfill	MSW	Pintong Bocaue, Sea Landfill (Level 4)

Alternative F2: Total Incineration (inland landfill)

With the exclusion of wastes for recycling and composting, all wastes will be incinerated and the residues will be disposed of in the inland landfill. The system for collection and haulage and intermediate treatment is similar to what is proposed in alternative F1 (since the incinerator also functions as a transfer station).

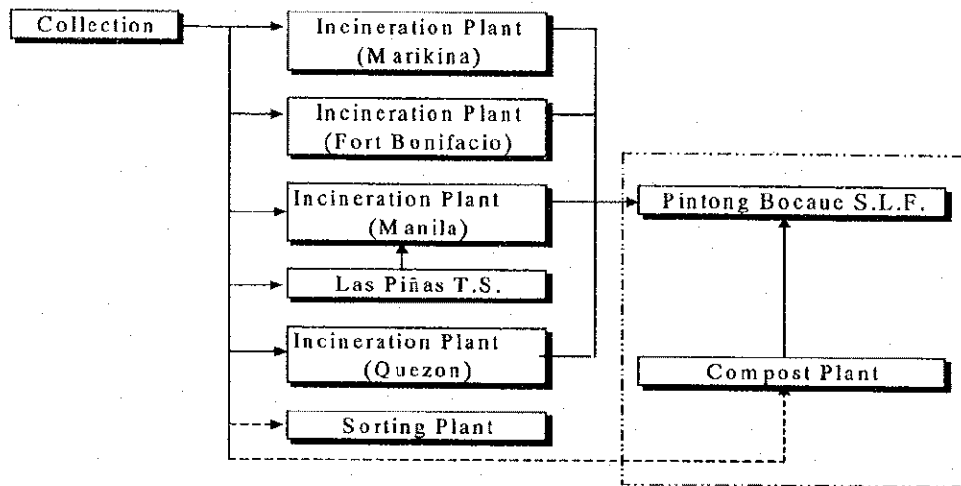


Figure 4.2.12 Flow of Alternative F2

Table 4.2.13 Configuration of Alternative F2

System	Type of Waste	Contents of System
Collection System	Household Waste	Compactor (15 cum)
		Compactor (8 cum)
		Container (1 cum)
	Commercial Waste	Compactor (15 cum)
	Institutional Waste	Compactor (15 cum)
	Market Waste	Roll-on Roll-off Truck
Street Sweeping W.	River Cleansing W.	Container (8 cum)
		Dump Truck (10 cum)
Transfer System	MSW	Dump Truck (10 cum)
	Ash	Tractor Head Container (40 cum) Dump Truck (10 cum)
Transfer station	MSW	Las Piñas : 1,100 ton/day
Compost Plant	50% of Market Waste	Pintong Bocaue : 360 ton/day
Sorting Plant	2% of MSW	Manila : 110 ton/day
		Payatas : 110 ton/day
Incineration Plant	MSW	Marikina : 2,700 ton/day
		Fort Bonifacio : 1,700 ton/day
		Quezon : 2,300 ton/day
		Manila : 1,400 ton/day

4.2.2 Conceptual Design and Cost Estimation

(1) Forecast of Future Waste Collection Amount

The estimated volume of waste is shown in Table 4.2.14.

Table 4.2.14 Estimated Volume of Future Waste Collection

(Unit: ton)

Year	Generation Amount	Self Disposal Amount	Recycling Amount at Generation Sources	Discharge Amount	Collection Amount	Non-Collection Amount	Amount of Recycling	Amount of Composting	Disposal		Total
									Municipal Solid Waste	Industrial Solid Waste	
1997	5,345	341	200	4,804	3,496	1,308	127	0	3,440	460	3,900
2000	6,545	399	248	5,898	4,288	1,610	148	0	4,216	558	4,774
2005	8,286	463	524	7,299	5,844	1,455	117	14	5,405	700	6,105
2010	10,312	467	567	9,278	8,332	946	206	206	5,301	864	6,165

Source: worked out by the JICA Study Team

(2) Conditions for Determining Required Number of Facilities and Equipment

(a) Collection and haulage

- Specific gravity of waste

Table 4.2.15 Specific Gravity of Waste

Type of Waste	Apparent Specific Gravity	Remarks
Household waste	0.18	
Commercial waste	0.15	0.23*44%+0.09*56%
Market waste	0.34	
Institutional waste	0.07	
Street sweeping waste	0.21	
River waste	0.23	
Weighted Average	0.20	
Ash	0.10	

*0.23: Apparent Specific Gravity of restaurant waste

0.09: Apparent Specific Gravity of other shop wastes

- Waste compaction ratio and collection vehicle loading capacity

Table 4.2.16 Design Conditions of Collection Equipment

Vehicle Type	Compaction Ratio	Loading Capacity (m ³)
Compactor(8m ³)	2.0	8m ³
Compactor(15m ³)	2.0	15m ³
Communal Container	1.0	1m ³
Roll-on Roll-off	1.3	8m ³
Dump truck(10m ³)	1.3	10m ³
Transfer vehicles	1.6	40m ³

- Small compactor trucks (8m³) will be used for collection in residential

areas where roads are narrow. The waste amount to be collected by 15m³ and 8m³ compactor trucks shall be 80% and 20%, respectively, of the total waste amount generated in the area covered.

- A 10m³ dump truck will be used for recycling services.
- The waste types for recycling are household waste, commercial waste (shops, restaurants, hotels) and office waste.
- 50% of market wastes will be composted. Market waste will be collected using a roll-on roll-off truck with container (8 cu m) and directly transported to the compost plant within the final disposal site.
- The container collection system will be implemented in the squatter area and is assumed to collect 35% of the total residential waste generation amount.

(b) Waste haulage to transfer station

- Waste will be transported to the transfer station on a 40m³ trailer truck
- The transfer equipment will have compacting functions.

(c) Intermediate treatment facilities: The intermediate treatment facilities to be established are shown in the Table 4.2.17 with their corresponding capacities.

Table 4.2.17 Design Capacities of the Facilities (ton/day)

Intermediate Facilities	Case	A	B	C	D	E	F	
TS	Las Piñas	1	1,200	1,200	1,100	1,100	1,100	
		2	1,200	1,200	1,100	1,100	1,100	
	Marikina	1	-	3,500	3,300	3,100	3,100	-
		2	-	3,500	3,300	3,100	3,100	-
	Fort Bonifacio	1	-	2,200	2,100	2,000	2,000	-
		2	-	2,200	2,100	2,000	2,000	-
	Quezon	1	-	-	-	-	-	-
		2	-	3,500	3,300	3,200	-	-
	Manila	1	-	1,800	1,600	1,600	1,400	1,400
		2	-	1,800	1,600	1,600	-	-
C/P	Pintong Bocaue	1	-	-	200	200	200	
		2	-	-	360	360	360	
	Sea Landfill site	1	-	-	160	160	160	
		2	-	-	-	-	-	
R/C	Manila	1	-	-	-	110	110	
		2	-	-	-	110	110	
	Payatas	1	-	-	-	110	110	
		2	-	-	-	-	-	
Quezon	1	-	-	-	-	-		
	2	-	-	-	110	110		
I/P	Marikina	1	-	-	-	-	2,700	
		2	-	-	-	-	2,700	
	Fort Bonifacio	1	-	-	-	-	1,700	
		2	-	-	-	-	1,700	
	Quezon	1	-	-	-	-	-	
		2	-	-	-	-	2,300	
	Manila	1	-	-	-	-	-	
		2	-	-	-	-	1,400	
Sea Landfill site	1	-	-	-	-	3,000		
	2	-	-	-	-	4,100		

Legend:

- T/S: Transfer Station
R/C: Recycle Center
C/P: Compost Plant
I/P: Incineration Plant

4.2.3 Evaluation

The selection of an optimum technical system will depend on the following evaluations:

- Technical evaluation
- Environmental evaluation
- Financial and economic evaluation
- Social evaluation
- Overall evaluation

(1) Technical Evaluation

- (a) *Improvement of haulage efficiency:* The improvement of haulage efficiency is very important to the present solid waste management system of Metro Manila. And to do so would require taking traffic conditions into consideration. Based on this, alternative A is not suitable as it proposes the continuation of the present collection and haulage system.
- (b) *Introduction of recycling facilities:* NGOs are mainly responsible for recycling activities in Metro Manila. These activities are slowly increasing in importance. Simultaneous with the increase in recycling activities and in consideration of the difficulties in acquiring a disposal site, waste volume reduction measures should be incorporated into the future waste management plan. Accordingly, the introduction of intermediate treatment facilities, such as composting plants and recycling centers, are important for waste volume reduction and to relieve pressures on disposal sites.
- (c) *Multiple final disposal sites:* A final disposal site is important to solid waste management, and the smooth acquisition of a site significantly affects the operation of waste management services. Metro Manila is currently faced with problems concerning final disposal sites. Even the acquisition of a site outside of the metropolis is expected to encounter many difficulties. As much as possible, the disposal site should be within the metropolis, and measures to prevent conceivable risks should be taken. Accordingly, the development of a sea landfill in Manila Bay should be considered as a significant part of future waste management services. However, in view of the enormous embankment costs the sea landfill development would incur, large-scale waste volume reduction should be considered. Accordingly, the introduction of an incinerator should be fully examined.

Table 4.2.18 Technical Evaluation of Alternatives

	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2
Improvement of Haulage Efficiency	0	0	1	1	1	1	1	1	1	1	1	1
Promote Resource-Recovery, Waste Volume Reduction	0	0	0	0	0.5	0.5	1	1	1	1	1	1
Multiple Disposal Sites	1	0	1	0	1	0	1	0	1	0	1	0
Total	1	0	2	1	2.5	1.5	3	2	3	2	3	2

0: no change in current conditions 0.5: effective 1: very effective

(2) Economic and Financial Evaluation

(a) Cost Estimate

Budgetary Demand of Technical Alternatives

Table 4.2.19 shows the budgetary demands for twelve (12) technical alternatives including the operation and maintenance costs during the Master Plan period up to 2010. Each cost of Case 1 (proposed combination of inland and seashore landfill as final disposal system) is relatively high compared with Case 2 of inland landfill except E1 and E2.

Table 4.2.19 Cost Estimates of Technical Alternatives
(Unit: million Pesos)

	Total cost	1998-2000	2001-2005	2006-2010
A1	63,800	2,900	53,000	7,900
A2	37,500	2,800	18,400	16,300
B1	68,600	2,900	58,200	7,500
B2	43,000	2,800	25,500	14,700
C1	71,200	2,900	60,700	7,600
C2	45,400	2,800	27,700	14,900
D1	71,900	2,900	61,000	8,000
D2	46,300	2,800	28,100	15,400
E1	77,500	4,200	42,100	31,200
E2	77,900	2,900	51,900	23,100
F1	121,500	3,100	90,400	28,000
F2	102,400	3,000	71,400	28,000

Assumptions

In the cost estimate and the economic and financial evaluation of the twelve (12) alternatives, the following assumptions have been made:

- *Project Cost* is estimated based on market prices in August 1997 and *Inflation* is not taken into account.
- *Project Life* is assumed to be up to 2015 because all the alternatives are designed to meet the demand in 2015, considering the sustainability of the project beyond the target year 2010.
- *Life Period* of every facility is estimated to be fifteen (15) years after the commencement of operation on the average and *Salvage Value* is calculated to be a negative cost in 2015 by straight line method.
- *Foreign Exchange Rate* as of the end of February 1998 is used during the whole project life as follows:

US\$ 1.00 = Peso 40.06, Peso 1.00 = Japanese Yen 3.2074

(b) *Economic evaluation:* For economic evaluation, the overall expenses which will incur were calculated to determine the disposal cost per ton of waste.

- *Discharge and storage, collection and haulage systems*

- The current system proposed for continuation in alternative A is uneconomical and defective in terms of haulage.
- Inland landfill is going to incur slightly higher haulage costs than sea landfill operation.
- The introduction of incineration near the waste collection site would incur less haulage costs.

- *Intermediate treatment system*

- The waste volume reducing effects of recycling and composting are hardly visible.
- Waste volume reduction through incineration can widely curtail final disposal costs.
- If 30% of the waste is incinerated, SWM service costs would be broken down into 30% collection/haulage, 30% intermediate treatment and 40% final disposal. If all wastes are incinerated, the ratio would be 14:67:19.

- *Final disposal system*

- Case 1, which includes the development of both inland and sea landfills, shall incur more expenses than Case 2, which only proposes inland landfill development.
- The introduction of an incinerator would incur less disposal expenses.
- The introduction of an incinerator would markedly reduce expenses for the operation of a sea landfill.

The above evaluation results indicate that adopting alternatives D2, C2, and B2 would be economically advantageous. But because either alternative only proposes the development of an inland landfill, the construction of multiple final disposal sites is recommended as a risk prevention measure. Of the alternatives proposing the development of 2 disposal sites (inland and sea landfills), alternative E1 is recommended as it is the most economical.

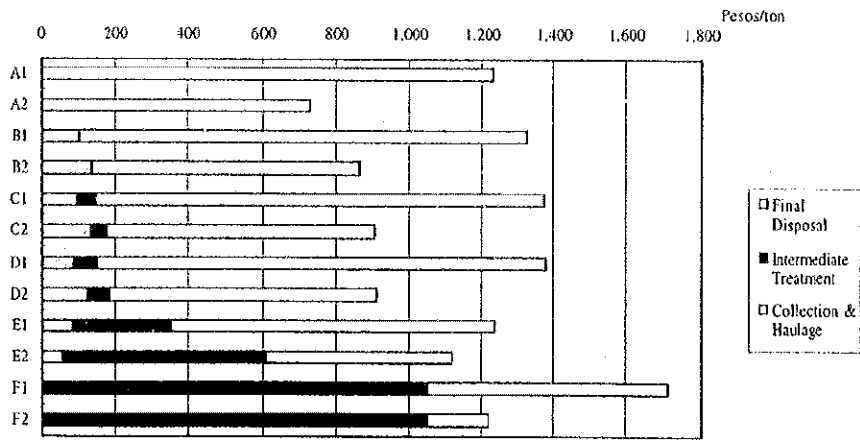


Figure: 4.2.13 Comparison of Unit Investment Cost

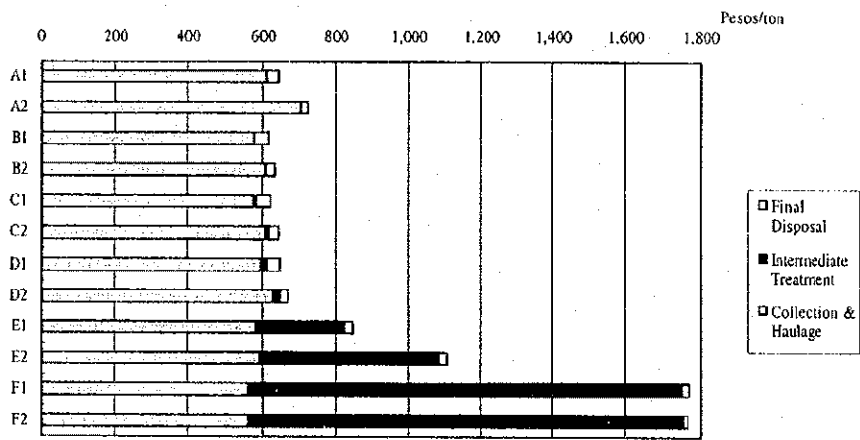


Figure: 4.2.14 Comparison of Unit O & M Cost

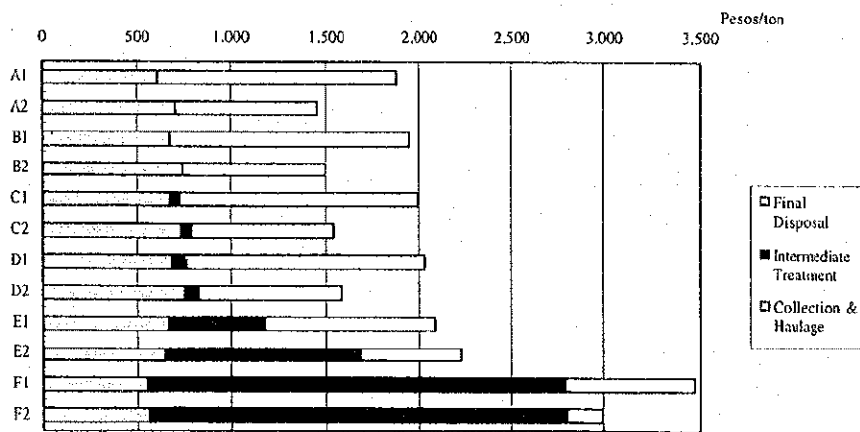


Figure: 4.2.15 Comparison of Unit Total Cost

Note: Unit cost is calculated taking into account of the investment cost until 2010 and O & M cost until 2015. The salvage costs of the facility is considered as a negative cost in 2015.

- (c) *Financial evaluation:* This section explores the twelve (12) alternatives from the financial point of view.

1) Potential Budget of SWM Costs

The financial viability of twelve (12) alternatives were compared and evaluated considering the potential budget of SWM in MMDA and LGUs. The Financial Internal Rate of Return (FIRR) were calculated under the following assumptions:

- the future population and GRDP of Metro Manila are estimated based on the socioeconomic framework (Base Case) described in sections 3.3 of Chapter 3;
- presently, in Metro Manila, the budget revenues of 17 LGUs are estimated to be approximately 2.5 % of the GRDP, of which about 10 % is allocated to SWM on the average, while MMDA receives 0.2 % of the GRDP as budget revenue and allocates 40 % to SWM. For the future prospect of budgets of MMDA and LGUs, it is estimated that the revenues will correspondingly increase and keep the same share of GRDP in Metro Manila;
- MMDA and LGUs will appropriate their expenditure to SWM under the present budget structure and system, namely, 0.3 % of the GRDP of Metro Manila has been estimated to be allocated to the SWM; and
- all the alternatives are designed as to be utilized in the middle of 2002 and meet the demand in 2015 after five years from the target year of 2010. In the evaluation, therefore, 0.3 % of the GRDP of Metro Manila during the period from the middle of 2002 to 2015 are regarded as the potential budgets for the implementation of technical alternatives.
- additionally, the financial sensitivity of each alternative has been examined resulting from the change of Peso value against US Dollar, as the portion of foreign currency is relatively high for the investment of the SWM and the value of Peso has been seriously fluctuating since July 1997.

2) Financial Evaluation

Under the assumptions described above, the financial capability of MMDA and LGUs to implement twelve (12) alternatives were evaluated. Firstly, 0.35 % of GRDP in Metro Manila were estimated to be the potential burden. Secondly, an additional 0.1 % of GRDP, namely 0.4 % of GRDP, was estimated to be allocated to SWM. Finally the financial sensitivity was examined in case of the appreciation of Peso by 20 % and the depreciation of Peso by 20 %

against US Dollar. The results of evaluation are presented by using the Financial Internal Rate of Return (FIRR) in Table 4.2.20.

Table 4.2.20 FIRR of Twelve Technical Alternatives

1) Appropriation of 0.3 % of GRDP to SWM						
- Case 1: Combination of inland and sea landfill	A1	B1	C1	D1	E1	F1
Base (US\$1.00=Peso40.06)	-	-	-	-	-	-
Appreciation of Peso by 20%	-	-	-	-	-	-
Depreciation of Peso by 20%	-	-	-	-	-	-
- Case 2: Inland landfill	A2	B2	C2	D2	E2	F2
Base (US\$1.00=Peso40.06)	8.3%	4.9%	3.5%	2.8%	-	-
Appreciation of Peso by 20%	11.9%	7.8%	6.2%	5.7%	-	-
Depreciation of Peso by 20%	4.8%	2.1%	1.0%	0.2%	-	-
2) Appropriation of 0.4 % of GRDP to SWM						
- Case 1: Combination of inland and sea landfill	A1	B1	C1	D1	E1	F1
Base (US\$1.00=Peso40.06)	4.0%	3.0%	2.5%	2.2%	2.0%	-
Appreciation of Peso by 20%	5.7%	4.6%	4.0%	3.8%	4.3%	-
Depreciation of Peso by 20%	2.5%	1.6%	1.1%	0.8%	0.0%	-
- Case 2: Inland landfill	A2	B2	C2	D2	E2	F2
Base (US\$1.00=Peso40.06)	20.6%	15.0%	13.3%	12.7%	0.6%	-
Appreciation of Peso by 20%	23.8%	18.1%	16.1%	15.7%	3.2%	-
Depreciation of Peso by 20%	17.5%	12.3%	10.8%	10.1%	-	-

From the financial point of view, alternative A2 and B2, showing 8.3% and 4.9% of FIRR, respectively, will be viable under the present amount of budget allocation to SWM, if the MMDA and LGUs will efficiently manage the expenditures of SWM. C2 and D2 show the minimum return; 3.5% and 2.8% respectively, to implement under the present appropriation of budget to SWM. In order to implement alternatives A1, B1, C1, D1 and E1, however, an additional allocation of the SWM expenditure, amounting to at the least 0.1 % of GRDP of Metro Manila, by MMDA, LGUs, the central government and/or communities is required.

It is noted that the FIRR of alternative E1 is almost same as that of alternative D1, i.e. as the waste amount of final disposal will decrease through incinerating, the cost for the sea landfill will accordingly decrease, and this decreased cost will offset the increased cost for intermediate treatment resulting from the investment of incineration plants, when incineration plants will be designed on an appropriate scale. Alternatives F1 and F2 will hardly be expected to be implemented during the period up to the target year of 2010.

The portion of foreign currencies of twelve alternatives varies from 40% to 60%. The alternatives which have the larger share of foreign portion severely affected by the fluctuation of Peso value against US\$. For example the FIRR of E1 is estimated to be higher than that of D1 on the contrary of base case, when Peso will be appreciated by 20 %.

(3) Environmental Evaluation

The technical alternatives are evaluated for optimum technical system from the viewpoint of environmental consideration. The evaluation criteria are the following 23 environmental items in three environmental components:

- (a) Social environment: resettlement, economic activity, traffic/public facilities, split of communities, cultural property, water rights/communal rights, public health conditions, waste, hazards (risks)
- (b) Natural environment: topography/geology, soil erosion, groundwater, hydrological condition, coastal zones, fauna/flora, meteorological condition, landscape
- (c) Pollution: air pollution, water pollution, soil contamination, noise/vibration, land subsidence, offensive odor

The evaluation for each environmental item is carried out by point system, as follows:

- Significant positive impact : 3
- Moderately positive impact : 2
- Negligible positive impact : 1
- Fair : 0
- Negligible negative impact : -1
- Moderately negative impact : -2
- Significant negative impact : -3

The environmental components and final environmental evaluation are weighed based on the impacts of resettlement, sea reclamation, and air pollution by emission from incinerator. The grade of evaluation is as follows:

- A : suitable for priority project among technical alternatives
- B : relatively suitable for priority project among technical alternatives
- C : fair
- D : relatively not suitable for priority project among technical alternatives
- E : not suitable for priority project among technical alternatives

The results of environmental evaluation are shown in Table 4.2.21 – 4.2.23. Technical alternatives C2 and D2 are recommended as suitable for priority project among all the other alternatives, from the viewpoint of environmental consideration. Technical alternatives A2, B2, and E1 are relatively suitable to technical system among technical alternatives.

Table 4.2.21 Total Environmental Evaluation for 12 Technical Alternatives

Alternatives	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2
Social Env.	E	E	E	D	D	C	C	C	A	B	B	B
Natural Env.	C	A	C	A	C	A	C	A	C	C	E	C
Pollution	C	A	B	A	B	A	B	A	C	C	E	D
Total Points	D	B	D	B	C	A	C	A	B	C	D	C

The following countermeasures are recommended for alternatives from the environmental viewpoint:

(a) Impact by Resettlement

In the case of inland landfill site, problems brought about by resettlement might occur. Resettlement may cause the transfer of rights of occupancy and land ownership. It might also cause loss of livelihood, social and cultural inadaptability to the new resettlement area, friction between the original residents and resettlers over social and economic burdens, and the deterioration of living standard after resettlement due to the poor compensation system in the status of illegal occupants.

Therefore, if inland alternative is selected for optimum technical system, some countermeasures are required. They include: (i) selection of resettlement site, (ii) consideration of the wishes of inhabitants, (iii) adequate information dissemination and dialogue, (iv) proper management of living and economic condition in the resettlement site, and (v) establishment of compensation and job training and guidance system.

(b) Impact by Reclamation of the Sea

In the case of sea landfill site, the construction and operation of landfill sites might cause the obstruction of fishing rights and water rights. Effects on coastal topography and vegetation by erosion and sedimentation, and water pollution may also occur.

Therefore, if sea landfill alternative is selected for the priority project, some countermeasures are required. They include: (i) provision of new common land, (ii) meetings with the inhabitants and provision of necessary information, (iii) sufficient compensation, (iv) examination of location of landfill site and the project content, (v) protection against soil erosion, and (vi) proper configuration of land reclamation to alleviate the effect on current.

(c) Impact to Air Quality by Emission from Incinerator

The emission of gas from smoke stacks of incineration plants can cause air pollution, which is hazardous to health, i.e. it may cause asthma due to high level of toxicity. Especially, careful attention should be paid to facilities that need clean air, such as hospitals.

Therefore, if the alternative with incinerator is selected for the priority project, some countermeasures are required. They include: (i) the examination of location, (ii) capacity, stack height, etc., (iii) the planning in consideration of land use around the area, and (iv) careful construction planning and management.

Table 4.2.22 Environmental Evaluation for Technical Alternatives (1)

Environmental Items	Existing Condition	A1	A2	B1	B2	C1	C2	
Resettlement	None	0 Resettlement for 1 inland landfill site	-3 Same as A1	-3 Same as A1	-3 Same as A1	-3 Same as A1	-3 Same as A1	-3
Economic Activity	None	0 None	0 None	0 None	0 None	0 Employment promotion by 2 compost plants	0 Employment promotion by 1 compost plant	1
Traffic and Public Facility	Traffic congestion by lack of transfer station	-2 Improvement of traffic congestion by 1 transfer station	1 Same as A1	1 Improvement of traffic congestion by 4 transfer stations	2 Improvement of traffic congestion by 5 transfer stations	2 Same as B1	2 Same as B2	2
Split of Communities	None	0 None	0 None	0 None	0 None	0 None	0 None	0
Cultural Property	None	0 None	0 None	0 None	0 None	0 None	0 None	0
Water Rights/ Rights of Common	None	0 Impacts to rights of common/ fishing rights by 1 inland landfill site/ sea landfill	-3 Impacts to rights of common by 1 inland landfill site	-2 Same as A1	-3 Same as A2	-2 Same as A1	-3 Same as A2	-2
Public Health Condition	Impacts to public health condition by inadequate solid waste management	-3 Impacts to public health condition by 1 inland landfill site	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1
Waste	None	0 None	0 None	0 None	0 None	0 None	0 None	0
Hazards (Risk)	None	0 None	0 None	0 None	0 None	0 None	0 None	0
		E	D	E	F	D	D	C
Natural Environment	Topography and Geology	None	0 Impact to topography and geology by 1 inland landfill site	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1
	Soil Erosion	None	0 Soil erosion by 1 inland landfill site	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1
	Groundwater	Impact to groundwater by inadequate solid waste management	-3 Impact to groundwater by 1 inland landfill site	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1
	Hydrological Situation	Impact to rivers by inadequate solid waste management	-2 Impact to rivers by 1 inland landfill site	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1
	Coastal Zone	Impact to coastal zone by illegal dumping	-2 Impact to coastal zone by sea landfill site	-1 None	0 Same as A1	-1 None	0 Same as A1	-1 None
	Fauna and Flora	Impact to fauna/ flora by inadequate solid waste management	-2 Impact to fauna/ flora by 1 inland landfill site/ sea landfill site	-2 Impact to fauna/ flora by 1 inland landfill site	-1 Same as A1	-2 Same as A2	-1 Same as A1	-2 Same as A2
	Meteorology	None	0 Impact to meteorology by 1 inland landfill site	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1
	Landscape	Impact to landscape by inadequate solid waste management	-2 Impact to landscape by sea landfill site	-1 None	0 Same as A1	-1 None	0 Same as A1	-1 None
		E	C	A	C	A	C	A
Pollution	Air Pollution	Air pollution by occasional fire	-2 None	0 None	0 None	0 None	0 None	0
	Water Pollution	Water pollution by inadequate solid waste management	-2 Water pollution by 1 inland landfill site/ sea landfill site	-2 Water pollution by 1 inland landfill site	-1 Same as A1	-2 Same as A2	-1 Same as A1	-2 Same as A2
	Soil Contamination	Soil contamination by inadequate solid waste management	-2 Soil contamination by 1 inland landfill site	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1
	Noise and Vibration	Noise/ vibration by inadequate solid waste management	-2 Noise/ vibration by 1 inland landfill site/ sea landfill site	-2 Noise/ vibration by 1 inland landfill site	-1 Same as A1	-2 Same as A2	-1 Same as A1	-2 Same as A2
	Land Subsidence	None	0 Land subsidence by 1 inland landfill site	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1
	Offensive Odor	Offensive odor by inadequate solid waste management	-2 Offensive odor by 1 inland landfill site/ sea landfill site	-1 Offensive odor by 1 inland landfill site	-1 Same as A1	-1 Same as A2	-1 Same as A1	-1 Same as A2
Final Evaluation		D	C	A	B	A	B	A
		E	D	B	D	B	C	A

Evaluation for environmental item:

3; very good impact, 2; good impact, 1; a little good impact, 0; no impact, -1; a little significant impact, -2; a significant impact, -3; serious impact

Evaluation for environmental category and final evaluation

A; suitable for priority project among technical alternatives, B; relatively suitable for priority project among technical alternatives, C; fair,

D; relatively not suitable for priority project among technical alternatives, E; not suitable for priority project among technical alternatives

Table 4.2.23 Environmental Evaluation for Technical Alternatives (2)

Environmental Items	D1	D2	E1	E2	F1	F2						
Social	Resettlement	Same as A1	-3 Same as A1	-3 Same as A1	-3 Same as A1	-3 Same as A1	-3 Same as A1	-3				
	Economic Activity	Employment promotion by 2 compost plants/ 1 sorting plant	3	Employment promotion by 1 compost plant/ 1 sorting plant	2 Same as D1	3 Same as D2	2 Same as D1	3 Same as D2	2			
	Traffic and Public Facility	Same as B1	2 Same as B2	Improvement of traffic congestion by 5 transfer stations/ 1 incineration plant	2	Improvement of traffic congestion by 3 transfer stations/ 2 incineration plant	3	Improvement of traffic congestion by 2 transfer stations/ 3 incineration plant	2	Improvement of traffic congestion by 1 transfer stations/ 4 incineration plant	2	
	Split of Communities	None	0 None	0 None	0 None	0 None	0 None	0 None	0			
	Cultural Property	None	0 None	0 None	0 None	0 None	0 None	0 None	0			
	Water Rights/ Rights of Common	Same as A1	-3 Same as A2	-2 Same as A1	-3 Same as A2	-2 Same as A1	-3 Same as A2	-2				
	Public Health Condition	Same as A1	-1 Same as A1	-1	Impacts to public health by 1 inland landfill site/ 1 incineration plant	-1	Impacts to public health by 1 inland landfill site/ 2 incineration plants	-2	Impacts to public health by 1 inland landfill site/ 3 incineration plants	-3	Impacts to public health by 1 inland landfill site/ 4 incineration plants	-3
	Waste	None	0 None	0	Waste reduction by 1 incineration plant	3	Waste reduction by 2 incineration plants	3	Waste reduction by 3 incineration plants	3	Waste reduction by 4 incineration plants	3
Hazards (Risk)	None	0 None	0 None	0 None	0 None	0 None	0 None	0				
		C	C	A	B	B	B	B				
Natural Environment	Topography and Geology	Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1				
	Soil Erosion	Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1				
	Groundwater	Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1				
	Hydrological Situation	Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1				
	Coastal Zone	Same as A1	-1 None	0 Same as A1	-1 None	0 Same as A1	-1 None	0				
	Fauna and Flora	Same as A1	-2 Same as A2	-1 Same as A1	-2 Same as A2	-1 Same as A1	-2 Same as A2	-1				
	Meteorology	Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1				
	Landscape	Same as A1	-1 None	0	Impact to landscape by sea landfill site/ 1 incineration plant	-1	Impact to landscape by 2 incineration plants	-2	Impact to landscape by sea landfill site/ 3 incineration plants	-3	Impact to landscape by 4 incineration plants	-3
		C	A	C	C	F	C					
Pollution	Air Pollution	None	0 None	0	Air pollution by 1 incineration plant	-1	Air pollution by 2 incineration plants	-2	Air pollution by 3 incineration plants	-3	Air pollution by 4 incineration plants	-3
	Water Pollution	Same as A1	-2 Same as A2	-1 Same as A1	-2 Same as A2	-1 Same as A1	-2 Same as A2	-1				
	Soil Contamination	Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1				
	Noise and Vibration	Same as A1	-2 Same as A2	-1 Same as A1	-2 Same as A2	-1 Same as A1	-2 Same as A2	-1				
	Land Subsidence	Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1 Same as A1	-1				
	Offensive Odor	Same as A1	-1 Same as A2	-1	Offensive odor by 1 inland landfill site/ sea landfill site/ 1 incineration plant	-1	Offensive odor by 1 inland landfill site/ 2 incineration plants	-2	Offensive odor by 1 inland landfill site/ sea landfill site/ 3 incineration plants	-3	Offensive odor by 1 inland landfill site/ 4 incineration plants	-3
Final Evaluation		B	A	C	C	B	D					
		C	A	B	C	D	C					

Evaluation for environmental item:

3: very good impact, 2: good impact, 1: a little good impact, 0: no impact, -1: a little significant impact, -2: a significant impact, -3: serious impact

Evaluation for environmental category and final evaluation

A: suitable for priority project among technical alternatives, B: relatively suitable for priority project among technical alternatives, C: fair, D: relatively not suitable for priority project among technical alternatives, E: not suitable for priority project among technical alternatives

(4) Social Evaluation

The most difficult but important part in the establishment of a solid waste management system in Metro Manila is the acquisition of a final disposal site. This is attributed to the fact that the defective operation of the present disposal sites has adversely affected the surrounding environment to a large extent, thereby losing the people's trust and cultivating the "NIMBY" syndrome.

Accordingly, because a lot of difficulties are predicted to arise from the development of an inland landfill disposal site, the alternative proposing the development of a sea landfill is a desirable means to offset the garbage crisis.

Waste reduction through composting and recycling is widely receiving support, not only in Metro Manila but from around the world with campaigns like "zero waste campaign" and "effective use of resources." On the other hand, as the intermediate treatment method most effective in waste volume reduction, incineration is vehemently opposed by NGOs as it destroys limited natural resources.

However, for a completely urbanized metropolis that holds 10 million people, there is no other recourse but to develop an inland landfill disposal site outside of the metropolis. Furthermore, in order to easily gain the consensus of residents in areas surrounding the proposed disposal site, the adoption of measures for considerable waste volume reduction is necessary.

(5) Overall evaluation

From the technical standpoint, alternatives D1, E1 and F1, which propose the improvement of haulage efficiency, introduction of intermediate treatment facilities for waste volume reduction, and the establishment of multiple disposal sites, are recommended.

From economic and financial standpoints, the operation of alternatives A2, and B2 is deemed feasible as they propose the development of an inland landfill, with the exclusion of an incinerator, using the present SWM budget. Excluding alternatives F1 and F2, which proposes the incineration of the total waste amount, all other alternatives are deemed feasible with the adoption of reasonable budgetary measures.

From the environmental point of view, alternatives C2, D2, A2, B2, and E1 are evaluated to have the least impact on the environment.

On the other hand, alternatives promoting the "polluter pays principle" (PPP) are considered advantageous from the social vantage point. The most important factor in solid waste management planning is the acquisition of a final disposal site. However, if the PPP concept is applied, case 1 is recommended as it proposes the development of a disposal site within the metropolitan area.

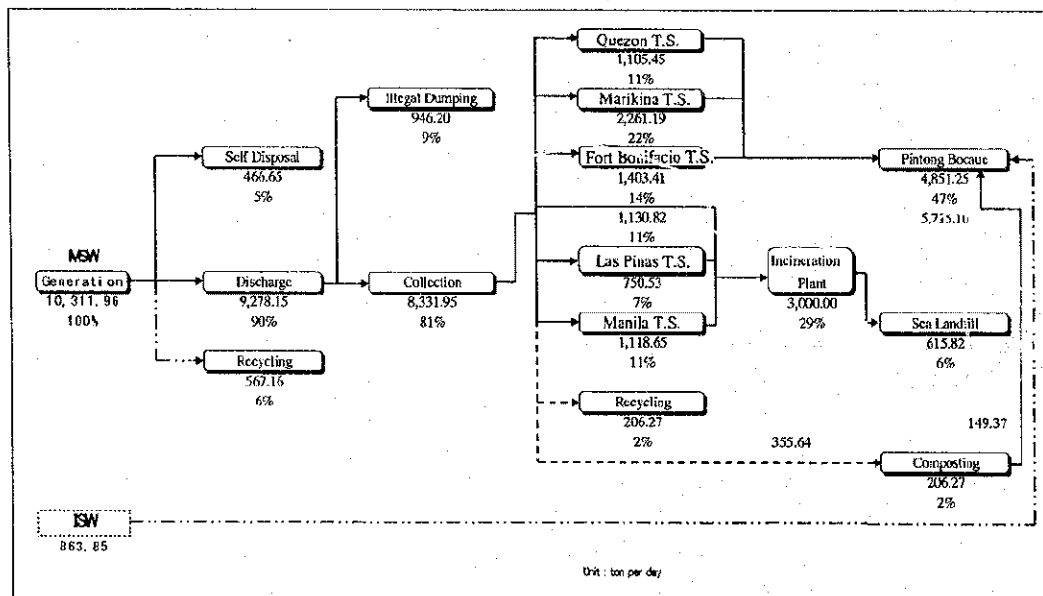
Sea landfill development is the only development possible within the metropolitan area. But because it necessitates an enormous capital investment, it is not financially feasible. However, as long as the possibility of a sea landfill development exists, the discharge of the total waste amount in a disposal site outside of the metropolitan area would be strongly opposed by the affected residents. Under these circumstances, a plan proposing the disposal of part of the waste in a sea landfill within the metropolitan area and the rest in a disposal site outside the metropolitan area would be more realistic. If the development of an inland landfill outside of the metropolitan area is planned, the cooperation of waste dischargers in the maximum reduction of waste volume is extremely important in gaining the understanding of the residents of areas surrounding the planned disposal site.

Accordingly, the results of the overall evaluation, which also took social considerations into account, support the selection of alternative E1. From economic and financial standpoints, however, the implementation of alternative E1 would incur higher running costs and require the reconsideration of present budget appropriation policies. This alternative is also highly recommended from technical and environmental standpoints.

4.3 Selected Technical System

4.3.1 Waste Flow

Waste flow in 2010 of proposed technical system selected from 12 alternatives in the preceding section is shown below:



Source: worked out by the JICA Study Team

Figure 4.3.1 Waste Flow for Selected Technical System in 2010

However, the proposed location of the incinerator plant should be reviewed according to additional surveys to be conducted before the detailed study. Furthermore, the results of the Metro Manila Urban Transportation Integration Study (MMUTIS) should be considered. The reason is not only that the construction method, period and cost may change drastically depending on the ground condition of the seabed, but also that the infrastructure in this area is not sufficient.

4.3.2 Discharge and Storage

(1) Type of Discharge Containers

- (a) *Household waste:* Residents of Metro Manila currently use various waste storage materials, e.g. plastic bags, rice sacks, various plastic or metal dustbins, dustbins from reusable tires, cartons, drum cans. A particular waste discharge container will not be specified for future use, but the use of plastic bags is recommended due to the following reasons:

- Plastic bags are handy and disposable
- Plastic bags prevent the leakage of fluid from waste
- Plastic bags are easy to collect and haul

Collection in squatter areas is not possible due to spatial restrictions. As a consequence, residents discharge waste into rivers and creeks, thereby deteriorating sanitary and aesthetic conditions in Metro Manila. To counter these illegal dumping activities, the installation of small discharge containers (1m³) at points accessible to collection vehicles was proposed. Accordingly, detailed investigations of the collection system most suitable to the area will be made through the implementation of pilot projects, to verify the following points:

- Justification of the necessity of the proposed collection system (study the necessity for primary collection in wider areas)
- Verification of residents' willingness to cooperate
- Verification of the possibility of conducting activities by community
- Verification of the LGU cooperation system
- Verification of the implementation and impacts of sanitary education programs

A model representing the discharge system proposed for squatter areas is shown in Figure 4.3.2.

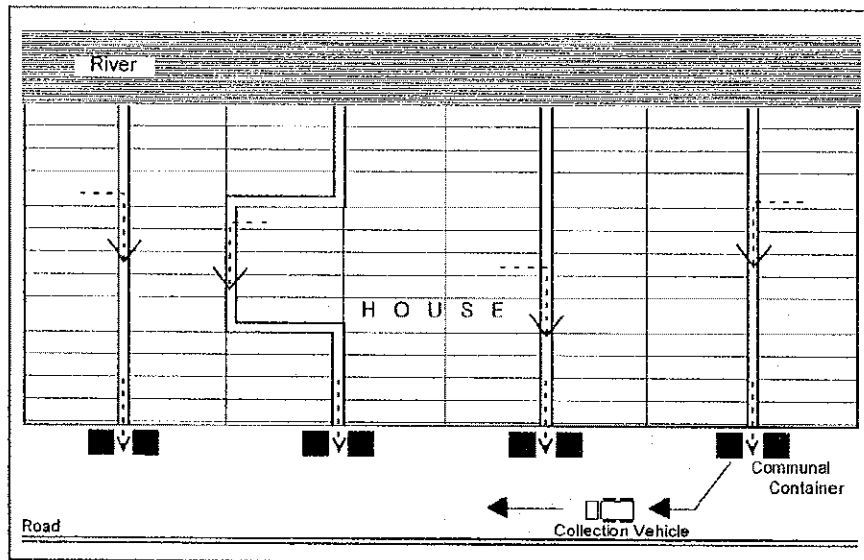


Figure 4.3.2 Discharge and Collection System in Squatter Area

- (b) *Commercial waste:* Large malls and shopping centers currently use containers for waste discharge. Shops along main thoroughfares mainly use plastic bags for waste discharge. Because these discharge methods are effective in improving collection efficiency and sanitary conditions, this practice should be continued.
- (c) *Institutional waste:* Some offices use containers for waste discharge, while some mainly use plastic bags. Because these discharge methods are effective in improving collection efficiency and sanitary conditions, this practice should be continued.
- (d) *Market waste:* Of the markets in Metro Manila, only a few use waste discharge containers. The majority discharge waste in discharge yards or waste dumping grounds within market areas. To improve collection efficiency in large waste generation sources such as markets, and to improve the sanitary conditions in discharge points vicinities, the installation of large containers should be adopted.
- (e) *Street sweeping waste:* Street sweeping wastes are currently collected using plastic bags and are piled on road sides. The continuation of this collection system is encouraged.
- (f) *River cleansing waste:* The present collection system - collection of river waste by boat, non-utilization of designated discharge containers, and straining of waste moisture in a certain area - should also be continued.

Table 4.3.1 Discharge and Storage Container

Type of Waste	Discharge and Storage Container	
	Present System	Proposed System
Household waste	plastic bags, rice sacks, plastic or metal dustbins, dustbins made from reusable tires, cartons, drum cans	various types of dustbins overlain with a plastic bag
Household waste in non-service areas (e.g. squatter areas)	-	installation of containers for communal use
Commercial waste	plastic bags, containers	plastic bags, containers
Institutional waste	plastic bags, containers	plastic bags, containers
Market waste	discharge yards (open heaping), containers	containers
Street sweeping waste	plastic bags	plastic bags
River cleansing waste	open heaping	open heaping

(2) At-Source Separation

Through the recycling activities of NGOs, some recyclable materials are recovered from discharge sources. This amount is estimated for the entire Metro Manila at 200 tons/day, based on the results of WACS. Based on this, it is estimated that each individual discharges 21g of recyclable waste every day. Collection workers were observed to recover 56 tons of recyclable waste during collection, while waste pickers in the disposal site recover 71 tons of recyclable waste. Recycling at the time of collection and in the disposal site will be prohibited in the future in order to efficiently conduct collection services, to ensure the safety and welfare of collection workers and waste pickers, and to maintain sanitary condition.

The extension of guidance in the separate discharge of recyclable materials at discharge sources is recommended for waste volume reduction and environmental conservation. Recycling will be done by NGOs, as in the present, and by communities and barangays with the support of respective LGUs.

(3) Proper Discharge

To maintain sanitary conditions and improve collection efficiency, the production of educational materials, e.g. booklets and pamphlets, should have the items enumerated below to promote proper discharge in schools and in the community:

- Discharge containers
- Discharge time
- Designated discharge areas
- Discharge methods (particularly for large wastes like garden waste, pruning waste)
- Types of recyclable materials and corresponding discharge methods

4.3.3 Collection and Haulage

- (1) The proposed future collection system is outlined in Table 4.3.2.

Table 4.3.2 Collection System

Type of Waste	Discharge Container	Collection System	Collection Equipment
Household waste	plastic bags	curbside or bell collection system	compactor trucks
	containers (1m ³)	container collection system	compactor trucks
Commercial waste	containers or plastic bags	container or curbside collection system	compactor trucks
Institutional waste	containers or plastic bags	container or curbside collection system	compactor trucks
Market waste	containers (8m ³)	container selection system	arm-roll truck
Street sweeping waste	plastic bags	station collection system	dump trucks
River cleansing waste	open heaping	station collection system	dump trucks

- (a) *Household waste:* The present curbside or bell collection system is highly efficient and considered appropriate for residential areas.

The container collection system is recommended for areas inaccessible to collection vehicles, e.g. squatter areas. This system involves the installation of containers in accessible points and their collection by compactor trucks. As previously mentioned, a pilot project will be executed to investigate the discharge and collection methods suitable to squatter areas and the like.

- (b) *Commercial waste:* The container collection system is currently adopted for large malls and shopping centers. On the other hand, shops along main thoroughfares discharge waste using plastic bags, which are then collected under the curb collection system. Because these collection systems are effective in improving collection efficiency and sanitary conditions, their continuation is recommended.
- (c) *Institutional waste:* At present, offices employ either the container or curbside collection system. The continuance of these collection systems is recommended as they are viewed to be effective in improving collection efficiency and sanitary conditions.
- (d) *Market waste:* Of the markets in Metro Manila, only a few use waste discharge containers. The majority discharge waste in discharge yards or waste dumping grounds within market areas.

To improve collection efficiency in large waste generation sources such as markets, and to improve the sanitary conditions in discharge point vicinities, the container collection system is recommended.

- (e) *Street sweeping waste:* Station collection system is recommended for street sweeping wastes. This collection system entails the discharge of wastes in plastic bags on roadsides for collection.

- (f) *River cleansing waste*: Station collection system is recommended for river cleansing waste. This system entails the collection of wastes discharged at a designated point without any specified container.

(2) Collection Method

The separate collection of recyclable materials and other wastes is recommended by extending guidance in the separate discharge of recyclable materials at the discharge source, for waste volume reduction and environmental conservation.

As in the present, a part of segregated recyclable materials will be mainly collected by NGOs. Those left behind will be collected by the respective LGUs' collection fleet.

(3) Collection Time

As much as possible, there should be a fixed collection time for a reliable collection system. Considering the traffic conditions in Metro Manila, this would be extremely difficult to realize though. As a countermeasure, the appropriate location of a transfer station and minimization of haulage distance are proposed as detailed in later sections.

Most local government units adopt day collection for residential areas and night collection for main thoroughfares. With the traffic conditions in Metro Manila, the continuation of these collection methods is deemed inevitable.

(4) Collection Equipment and Number of Units

Table 4.3.3 shows the type and number of collection vehicles in 2010 by generation source.

Table 4.3.3 Collection Vehicles

Type of Waste	Type of Equipment	Quantity
Household Waste	15m ³ compactor trucks	489
	8m ³ compactor trucks	180
	1m ³ containers	15,465
Commercial Waste	15m ³ compactor trucks	131
Institutional Waste	15m ³ compactor trucks	6
Market Waste	arm-roll trucks	85
	8m ³ containers	271
Street Sweeping Waste	dump trucks	9
River Cleansing Waste	dump trucks	2

- (a) *Compactor trucks*: For the effective collection of household, commercial and institutional wastes, the use of compactor trucks is recommended. Aside from large containers (15m³), 8m³ compactor trucks will also be introduced in consideration of areas with narrow roads. Taking the area conditions in Metro Manila into account, 80% of the containers will be 15m³ and 20% 8m³.
- (b) *Communal containers (1m³)*: Communal containers (1m³) will be installed in areas (e.g. squatter areas) inaccessible to collection vehicles. These compactor trucks will be installed with an arm to facilitate the removal and placement of containers.
- (c) *Roll-on roll-off truck*: The use of arm-roll trucks is recommended for the efficient collection of market wastes.
- (d) *Containers (8m³)*: The installation of 8m³ containers in market places is proposed to improve collection efficiency and sanitary conditions.
- (e) *Dump trucks*: Dump trucks are proposed for the collection of street sweeping wastes and river cleansing wastes.

(5) Truck Scale Management System

The collection and haulage service of the present system, which requires collection vehicles to pass through the dispatch office for the submission of trip tickets, is highly inefficient. To improve these services, the installation of a truck scale at transfer stations, incineration plants and sanitary landfill sites is proposed. Sharing the data obtained from this equipment would enable MMDA and the LGUs to systematically operate the services.

(6) Supervision of collection contractors

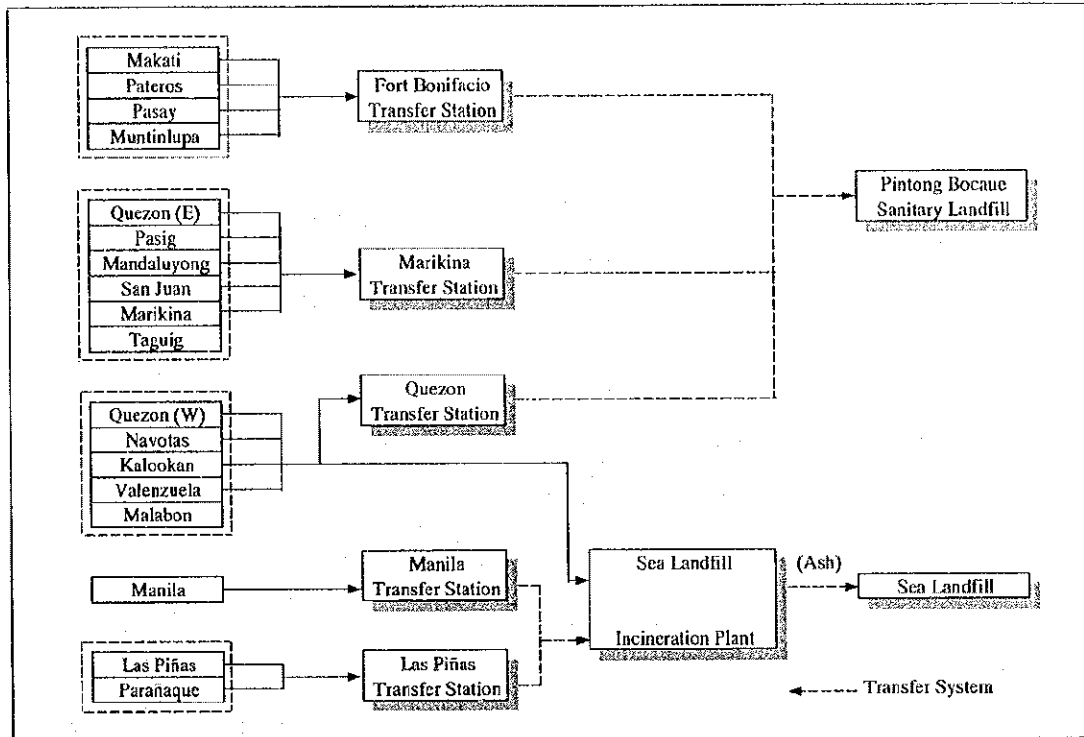
Private companies collect and haul about 86% of the amount of waste generated in Metro Manila. However, these services are not properly supervised by the LGUs. Accordingly, to offer appropriate collection and haulage services to the public, the supervision system of every LGU will be strengthened. Simultaneously, the formulation of a manual, incorporating the items below, for the selection of private companies and the supervision of their services, are proposed.

- Selection of private companies by competitive tendering
- Supervision of and the extension of guidance to private companies
- Security measures and health considerations for collection workers
- Selection of a collection system suited to area conditions and waste type

(7) Haulage system

The transfer system shown in Figure 4.3.3, which involves the initial haulage of wastes by grouped LGUs to the transfer station, is proposed to improve collection efficiency. Wastes taken to the Marikina and Fort Bonifacio transfer stations will be hauled to the Pintong Bocaue sanitary landfill. On the other hand, wastes taken to the Manila transfer station and other LGU wastes that do not pass through any

transfer station will be transported to the sea landfill and incinerated the landfill will be equipped with an incineration plant - with the ash residue disposed therein.



Source: Worked out by the IICA Study Team

Figure 4.3.3 Proposed Transfer System

The conceptual drawing of the transfer station is shown in Figure 4.3.4.

Transfer Station System

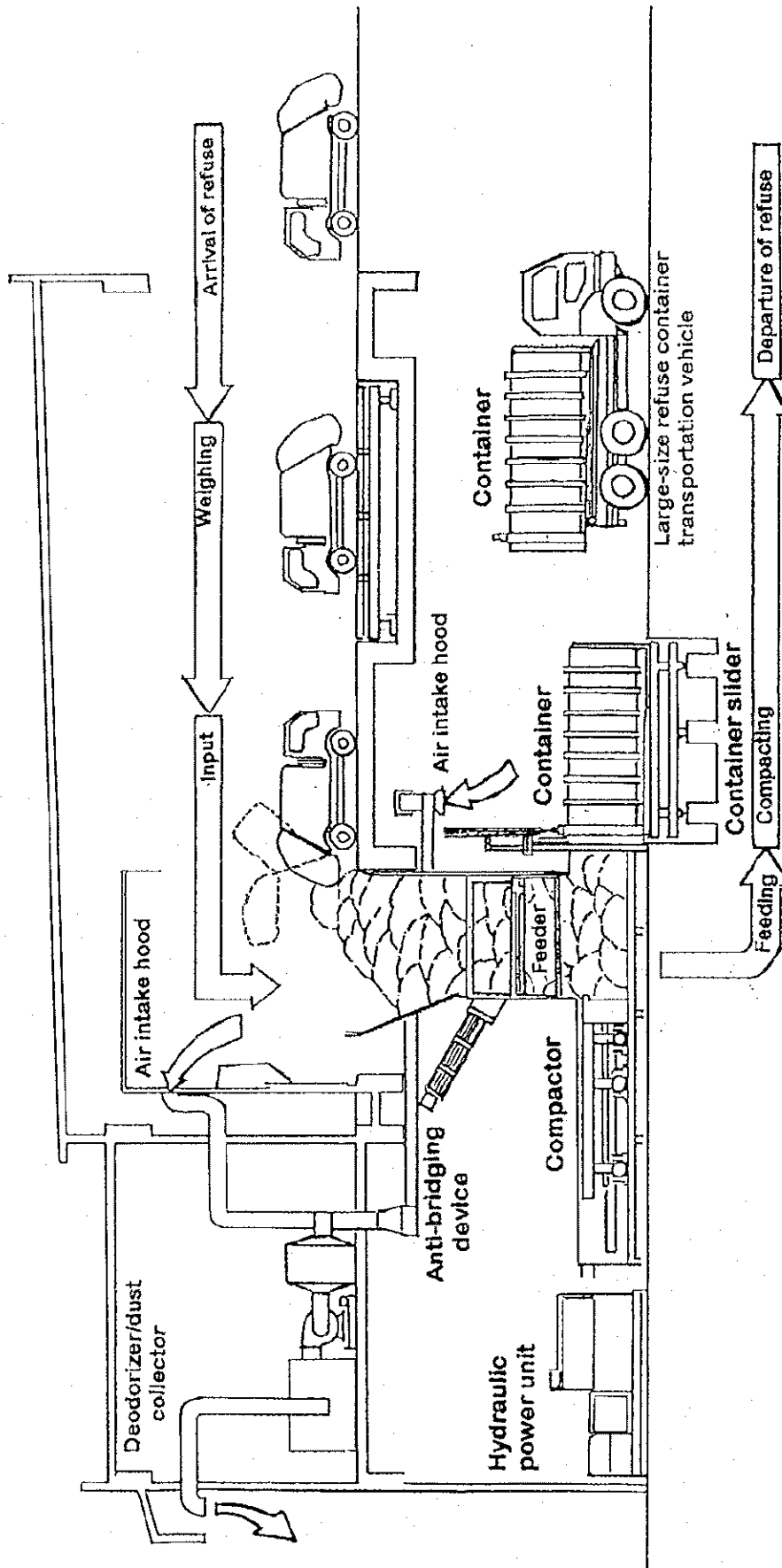


Figure 4.3.4 Concept of Transfer Station

4.3.4 Intermediate Treatment

The adoption of waste volume reduction measures is extremely important to ensure the acquisition and continuous use of final disposal sites for solid waste management services in Metro Manila. Because of the current absence of intermediate treatment facilities, the metropolis is dependent on the recycling activities of NGOs as the only means of waste volume reduction.

This project proposes the introduction of the following intermediate treatment systems for waste volume reduction.

- (1) Composting
 - (a) Average annual amount of waste for treatment in the target year:
360.0 tons/day (30% of which is market waste)
 - (b) Process capacity: 180t/day × 2 units
 - (c) Facility location
 - Inland landfill site
 - Sea landfill site

Because the demand for compost has not been determined at this point, only 50% of market waste will be composted. However, the amount of waste for composting will be set with the compost buyers for the conduct of the F/S, by determining the steady demand for compost.

The concept of the compost plant is shown in Figure 4.3.5

- (2) Recycling
 - (a) Resource-recovery: The total amount of waste recovered by present collection workers and by waste pickers at the final disposal site was calculated to represent the recoverable ratio in 2010.
$$\text{Resource-recovery amount} = 206.3 \text{ t/day}$$
 - (b) Facility scale: 80% of recovered wastes are recyclable. The facility has an 85.8% rate of operation.
$$206.3/0.858/2 = 120 \text{ t/day}$$
$$120 \text{ t/day} \times 2 \text{ units}$$
 - (c) Facility location: Because residues in the sorting plant have to be hauled to the final disposal site, a transfer station will be annexed to the center. This plan excludes the implementation of resource-recovery at the final disposal sites. Accordingly, the collection workers for this facility will consist of waste pickers in present disposal sites, e.g. open dumpsites in the cities of Manila and Quezon. Most of the waste pickers in the Manila disposal site make a living from the resource-recovery of wastes.

Composting System

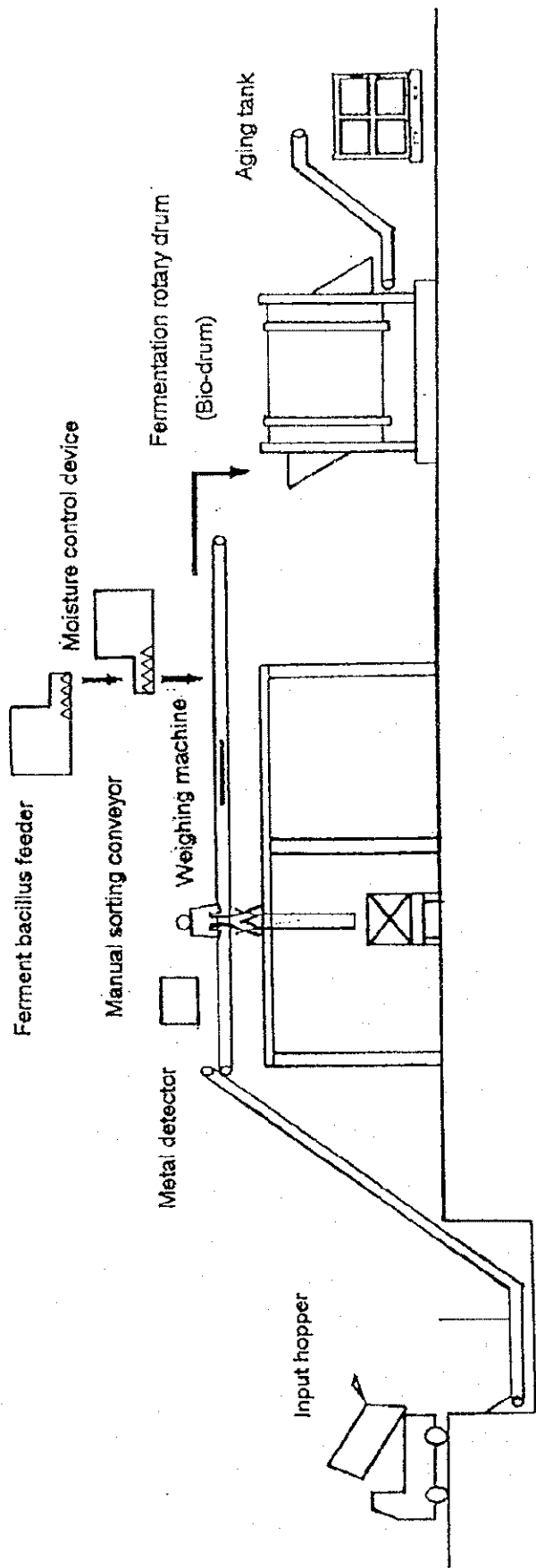


Figure 4.3.5 Concept of Compost Plant

Hand Sorting System

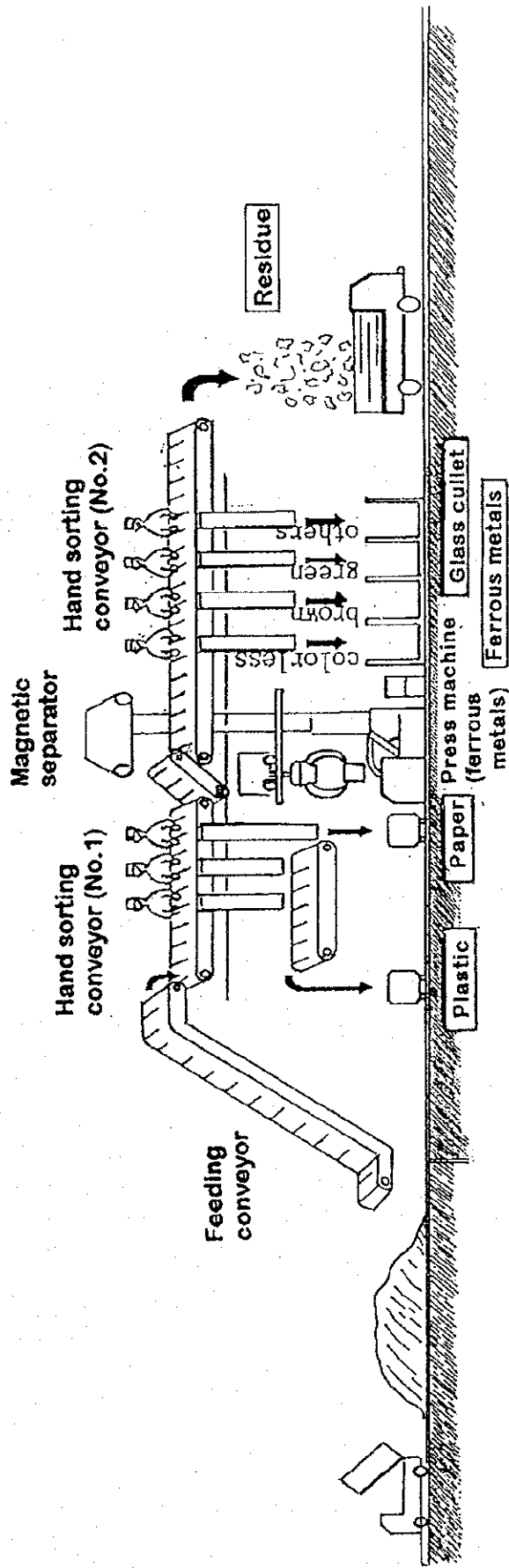


Figure 4.3.6 Concept of Sorting Plant



Figure 4.3.7 Sample of the Recycling Center in Rio de Janeiro

(3) Incineration

- (a) Designed daily average amount for treatment (measured over a one year period): 2,415.31 tons/day
- (b) Process capacity
 - Continuous incineration: 3 lines (6 furnaces)
 - (1,000 tons/day \times 3 lines, 500 tons/day \times 6 furnaces)
- (c) Environmental countermeasures: Gas, offensive odor, vibration noise, etc., that waste treatment facilities generate will be designed within relevant standards stipulated by the Philippine government. In the absence of such standards, Japanese standards will be applied.
- (d) Facility location: Because incineration is proposed for sea landfill, the planned facilities will be established adjacent to the sea landfill site. This basic plan proposes the construction of a large incineration plant. But to improve haulage efficiency and ease traffic conditions, the establishment of medium scale incineration plants in several places should be examined.

A concept for an incineration plant is shown in Figure 4.3.8.

Incineration system

- | | | |
|-----------------------------|------------------------|----------------------------|
| ① Unloading platform | ⑧ Under-grate conveyor | ⑮ Bag filter |
| ② Refuse bunker | ⑨ Ash extractor | ⑯ Induced draft fan |
| ③ Refuse crane control room | ⑩ Ash conveyor | ⑰ Stack |
| ④ Refuse crane | ⑪ Ash crane | ⑱ Steam turbine generator |
| ⑤ Refuse feeding hopper | ⑫ Ash bunker | ⑲ Central control room |
| ⑥ Furnace | ⑬ Ash truck | ⑳ Electric facilities room |
| ⑦ Steam boiler | ⑭ Gas cooler | ㉑ Pump room |

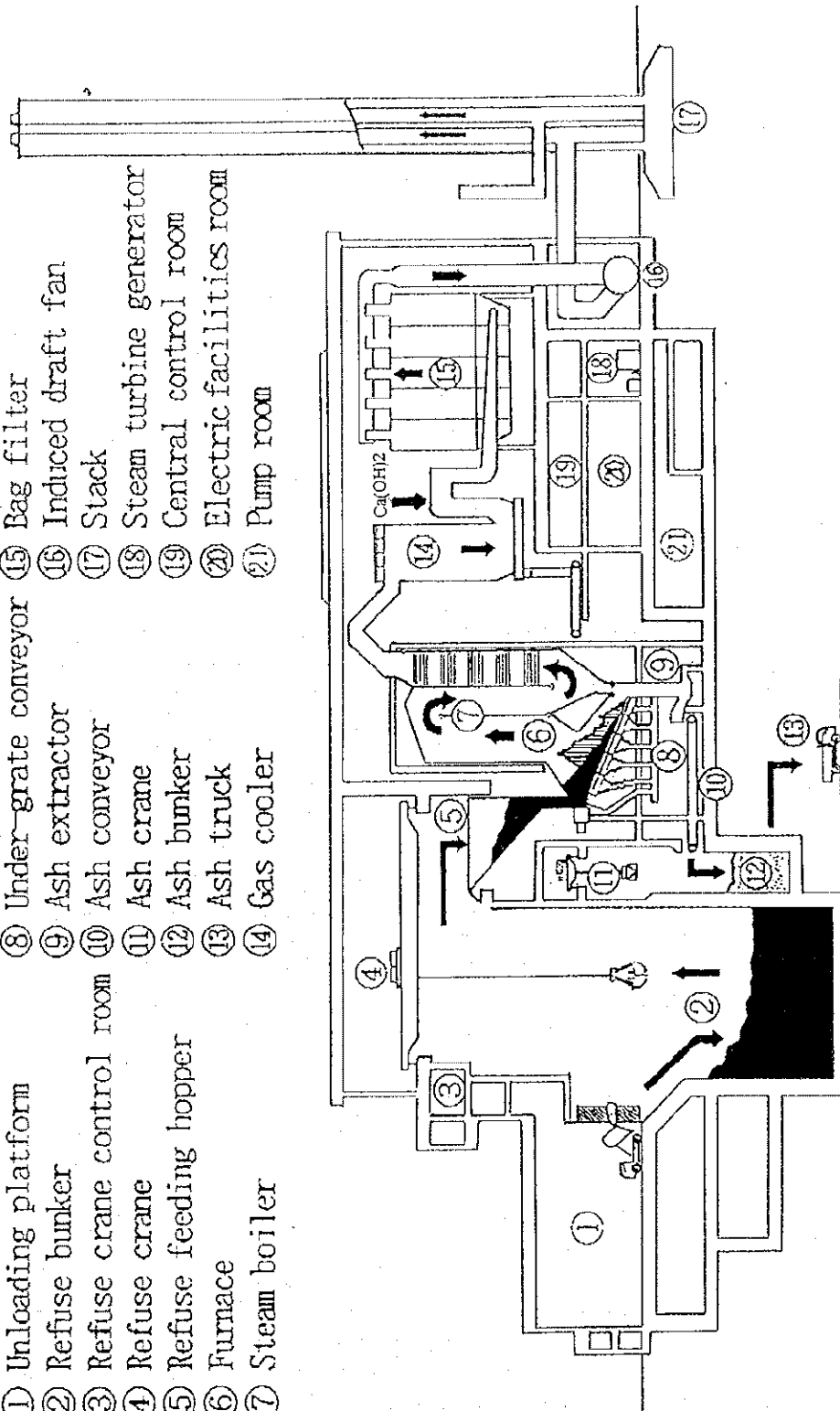


Figure 4.3.8 Concept of an Incineration Plant

4.3.5 Final Disposal

(1) Outline of Final Disposal Site

The final disposal site proposed in this master plan will be constructed with the following facilities:

(a) Storage facility

This is one of the most important final disposal site facility as it ensures the safe storage of wastes. This facility has the following functions:

- Storage of target waste volume for landfilling
- Prevention of destruction and runoff of waste layers
- Prevention of runoff and leakage of leachate
- Safe storage of temporary standing water
- Safe storage of waste during and after landfill operations

(b) Leachate control facility

The leachate control facility prevents pollution of public areas, groundwater contamination, and adverse impacts these factors could inflict on the surrounding environment. This facility also prevents the increase in leachate due to groundwater inflow from surrounding areas.

(c) Stormwater drains

The inflow of a significant or small amount of rainwater from the watershed, to which the landfill belongs to, into the landfill is natural. This amount usually exceeds the leachate volume in the landfill. If this rainwater flows into the landfill site, the leachate treatment facilities will be forced to cope with large amounts of polluted water of irregular volume and quality. To prevent this from occurring, ditches shall be constructed in the surrounding area for the discharge and diversion of rainwater.

(d) Leachate collection and discharge facilities

These facilities speedily transmit rainwater and leachate seepage to the leachate treatment facilities.

(e) Leachate treatment facility

This facility treats leachate collected by the leachate collection and drainage facilities to prevent the contamination of the public water area to which it is later discharged into, and groundwater contamination. Of the numerous leachate treatment methods available, this project shall adopt the method using an oxidization pond.

(f) Gas control facilities

Organic fraction in MSW placed in a landfill undergoes biodegradation and then stabilizes, consequently generating various gases. This decomposition process is classified as anaerobic and aerobic.

Anaerobic decomposition generates methane, nitrogen and ammonia, and in small amounts, sulfides, methyl-sulfides, and methyl-mercaptans. Appropriate control measures should be taken to prevent these gases from causing fires and explosions in the landfill, impeding the settlement and compaction of wastes and cover soil, and damaging surface vegetation factors that adversely affect the environment.

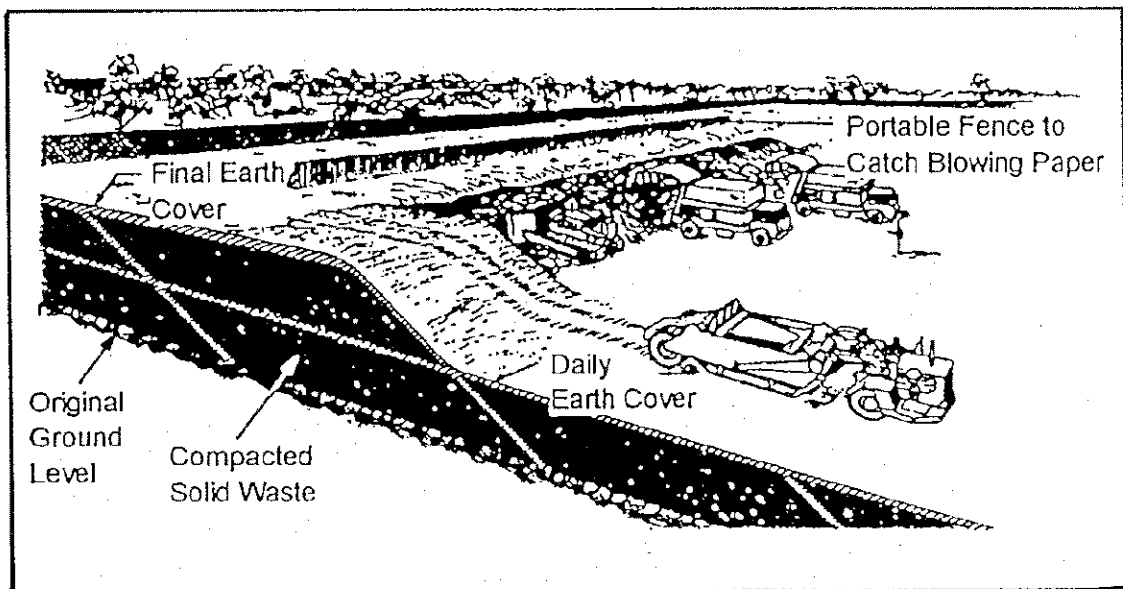


Figure source: Solid waste Management for Economically Developing Countries

Figure 4.3.9 Image of Sanitary Landfill

4.4 Environmental Consideration

The following components of the proposed technical system, were evaluated, considering their possible, and/or potential impacts on social environment, natural environment, and pollution. However, the positive impacts derived from activities for solid waste management improvement, such as waste reduction and improvement of sanitary conditions are not evaluated in this section.

(1) Transfer Stations, Recycling Centers, and Compost Plants

- (a) Social Environment: Traffic volumes will increase around these new sites because they are sizeable traffic generators. On the other hand, construction

workers are required in the construction phase so that this activity can contribute to the economy.

- (b) **Natural Environment:** There will be no serious impacts on natural environment in the construction and O/M phases.
- (c) **Pollution:** In the construction phase, emission gas and noise will be generated by operation of heavy equipment. Since the sites are located in an urbanized area, the construction works should be controlled so as not to worsen the living environment. In the O/M phase, emission gas, noise and odor will be generated from collection vehicles. Therefore, it is recommended to install washing facilities for outgoing trucks.

(2) **Incineration Plan**

- (a) **Social Environment:** The incineration plant will be located at the sea landfill site in Navotas so that social environment problems will not occur, although some social unrest may be anticipated. Haulage of waste to the incineration plant will cause increase of traffic volumes. Therefore, the implementing agency should exert effort to provide appropriate information to the public.
- (b) **Natural Environment:** Landscape and seascape will be changed by construction of the incineration plant. Design of the structure should be considered to harmonize with landscape and seascape.
- (c) **Pollution:** Hazardous emission gas from stack(s) brings air pollution, if no adequate pollution control device is installed with the plant. A detailed environmental impact study should be conducted in the F/S phase. Traveling construction vehicles will also generate emission gas, noise, and odor, so the manner of construction should be considered in order to minimize these pollutants. Collection vehicles should also be well maintained against leakage of leachate.

(3) **Inland Landfill**

- (a) **Social Environment:** Construction of the new landfill site located in Pintong Bocaue requires land acquisition. If there are inhabitants in the site, an adequate resettlement plan should be prepared. The existing land use will change, so that the following should be considered: delineation of boundary; establishment of buffer zone; and planning of the future land use after closing. Construction of the landfill will contribute to the local economy through employment of workers.
- (b) **Natural Environment:** It can be foreseen that construction of the landfill will cause the forest to vanish and other terrestrial and aquatic resources. Cut and fill works will give rise to deterioration of natural landscape and change hydrological conditions.
- (c) **Pollution:** Air pollution and noise in the construction and O/M phases will not be serious in as much as the site is not located in a dense residential area.

In the operation phase, however, inadequate operation and maintenance will lead to water pollution of surface water and groundwater. A well-functioning leachate treatment system should be constructed and maintained.

(4) Sea Landfill

- (a) Social Environment: Construction of the sea landfill will entail occupying a portion of the sea area; therefore, fishery ground may be damaged in the surroundings of the project site. The magnitude of the damage on fishery shall be carefully examined. Boats plying the area will also be obstructed by the existence of the structure. These impacts should be studied. On the other hand, construction of the sea landfill will require workers, thereby contributing to the local economy.
- (b) Natural Environment: Marine life, especially benthos, will be vanished at least in and around the area of the site. Current conditions will be changed by the existence of the structure. Changing of hydrological conditions may cause beach erosion and sedimentation. Therefore, the design of the structure should be considered to minimize the deterioration of the marine environment.
- (c) Pollution: Operation of heavy equipment and traveling collection vehicles will cause air pollution. However, this impact will not be serious due to the diffusion of emission gas by wind. Leaching and scattering of waste into the sea should be strictly controlled.

CHAPTER 5 SOCIAL PARTICIPATION AND RECYCLING

CHAPTER 5 SOCIAL PARTICIPATION AND RECYCLING

5.1 Social Considerations

5.1.1 Rationale

The formulation of a Master Plan on solid waste management for any particular urbanized area must always take into account its social environment. Indeed, it is well known that the citizenry is very much affected by the performance of the solid waste system and, at the same time, it plays a fundamental role in the production of refuse and in the solution of the problems caused by it.

Compared to other public services, solid waste management is the one where the interaction of service-provider vs. service-recipient is more active and permanent. Also, by way of the solid waste system, the economic and social inequities and unbalances of the society become more evident: some discarding their goods as useless, and others counting only on it for their livelihood.

In a large metropolitan area of a developing country such as Metro Manila in the Philippines, the importance of the social environment of the solid waste system specially holds true. The dimension and the characteristics of the overall problem and the scarcity of funds to solve it properly, makes imperative the search for innovative solutions and partnerships with all the stakeholders whenever possible.

In this Master Plan, therefore, the social aspects of the solid waste sector shall be analyzed and addressed in order to guide and to support the technical, the institutional and the economical/financial systems envisaged in the solid waste management plan, especially on the issues that will depend upon the following:

- (a) Participation of the public in the solid waste management activities in general, which means that, its awareness to the problem should be heightened, specially in respect to the public health and environmental implications
- (b) Acceptance of the specific groups potentially affected by the siting of the proposed new solid waste management facilities, specially the transfer stations and sanitary landfills, and the acceptance of the citizenry, as a whole, of the imposition of user charges for solid waste collection, transfer and disposal services
- (c) Development of appropriate systems to extend the collection coverage to the areas where regular access is impaired by the bad condition or lack of roads, trying therefore to redress the present inequities in service provision
- (d) Improvement of the recycling activities being made by the waste pickers, through the promotion of separate collection and through the development of recycling centers, providing for them a more efficient and hygienic way of earning their livelihoods.
- (e) Improvement of the performance of the solid waste formal workers through the enhancement of their working conditions and working capability

A diagram of the above mentioned concept is given below:

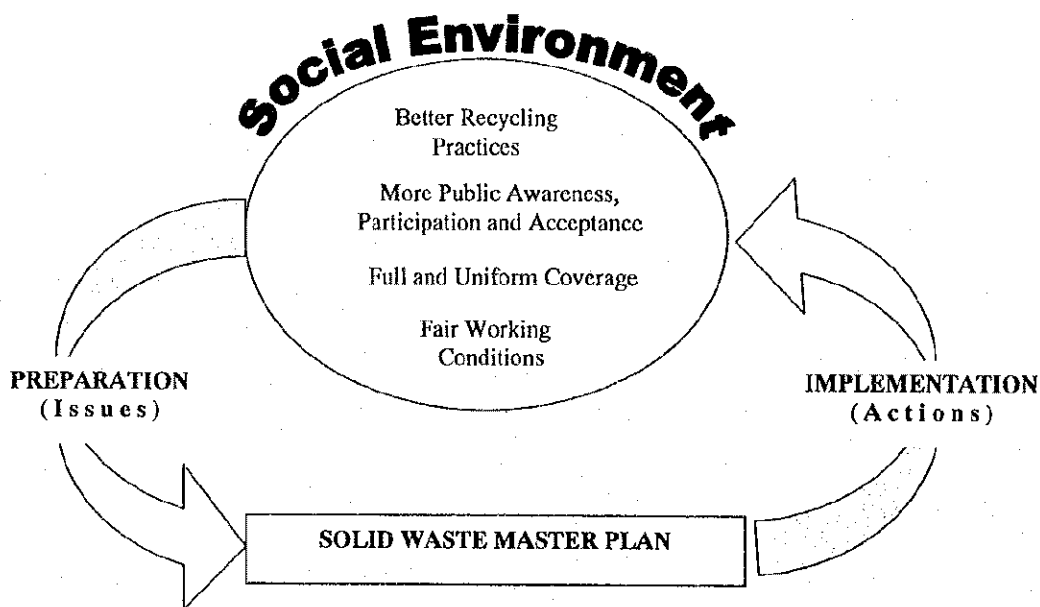


Figure 5.1.1 Social Environment and SWM Scheme

5.1.2 Public Awareness

Successful programs of solid waste management in several cities worldwide show that the formulation and implementation of solid waste management plans rely deeply on the collaboration and participation of the people. This specially holds true for the aspects of curbing littering in public spaces and water bodies, of collaborating in recycling activities, of easing refuse collection tasks, of helping in the controlling and monitoring of the system and of paying directly for the services provided.

In Metro Manila, littering and clandestine dumping in public spaces, vacant lots, rivers and esteros (a channel) is a problem that can be seen in many places, and it has been shown that only the enforcement of the appropriate legislation has not been efficient in curbing it.

Payment directly for the services is accomplished only in the rich subdivisions and, paradoxically, in some very poor neighborhoods where refuse is taken from the houses for a payment.

These situations could be changed through the citizen's understanding of the problems caused by the waste and by the ways that each one can collaborate in dealing with it. Furthermore, on the pro-active side, the public in general shall be induced to collaborate with the collection operations, placing the garbage in appropriate bags or containers at the fixed collection scheduled time in order to ease collection. This effort may be coupled with the separation of refuse into recyclable and non-recyclable in order to boost the collection efficiency of the street pickers

In order to enhance public awareness in Metro Manila, it is therefore recommended that MMDA set up a specific and dedicated section in its organization to deal with public awareness campaigns. This section would assist the LGUs of Metro Manila on regularly producing and disseminating educational and awareness materials on environmental education regarding solid wastes. It should also coordinate the several existing initiatives of CBOs (Community Base Organization), NGOs and barangays on this matter.

The setting up of this activity in MMDA does not conflict with its mandate, which states on sec 3 - "Scope of MMDA Services, MMDA law (R.A.792, on item (c): *Solid waste disposal and management, which includes formulation, and implementation of policies, standards, programs and projects for proper and sanitary waste disposal. It shall likewise include the establishment and operation of sanitary landfill and related facilities and the implementation of other alternative programs intended to reduce, reuse and recycle solid waste.*"

The permanent staff and accompanying qualification suggested to this new section, along with the basic material resources needed for the fulfillment of its tasks is given ahead, being understood that most of the people can be found in the existing ranks of MMDA

Community Mobilization and Environmental Education Section (CMEES)

- (1) Mandate and Activities: CMEES will be responsible for the following main tasks:
 - (a) Preparation and development of environmental education activities: This activity shall be permanent and aimed mainly to schools, public or private, in Metro Manila, and made in connection with the educational system of each LGU.
 - (b) Preparation and development of mobilization campaigns: This activity shall support the need for awareness campaigns, which would include the cleaning of specific areas in strict coordination with the LGUs and the Barangays where the campaign takes place. It is recommended that this effort be accomplished with the partnership of local NGOs, whenever possible.
 - (c) Promotion of other activities, regarding production and dissemination of information through pamphlets, posters, audiovisual kits, etc. More details about this activity are also given in section 5.3.3.
 - (d) Evaluation of the results of activities and campaigns undertaken: Educational and awareness enhancing activities are not made based on a straightforward approach, but rather using techniques and means adapted to and suiting each situation. This means that it is very important that the outcomes of the programs and campaigns are evaluated at the end of each accomplishment, in order to gauge the effectiveness of the work done and to polish the methodologies used.
- (2) Proposed Staff: The proposed new section of MMDA shall require educators, and audio-visual specialists/operators, among other staff members.

This new section of MMDA shall be set up in 1999, which means that it should be budgeted in 1998.

5.1.3 Public Acceptance - Facilities Siting and Users Charge

(1) Facilities Siting

It is very likely that the siting for facilities, mainly sanitary landfills, transfer stations and incinerators, is likely to raise strong opposition from the surrounding communities due to the problems associated to odor, noise, litter, air pollution and traffic congestion that they foresee. Protests against their construction are made directly or through their elected officials, community groups and NGOs.

This situation has been known as the NIMBY (Not In My Back Yard) syndrome, which is omnipresent today worldwide. This syndrome is present also in Manila where the present landfills in Carmona and San Mateo have evolved into less sanitary facilities, raising public opposition, where Payatas and Catmon open dumps show a horrible scenery and where, in the recent past, there was the infamous "smoking mountain".

This bad past record means that a community reaction to the new facilities proposed by this Master Plan will most probably arise in the neighboring communities of the proposed sites selected for the construction of sanitary landfills and transfer stations.

To cope with this problem, it is necessary that the responsible authorities pledge to do the following:

- (a) Involve the community in the early stages of site selection, providing them with the technical, economic and scientific data that support the selection.
- (b) Assure the community that the facility managers will follow, during actual operation, the environmental rules and controls agreed to be met during the planning stage, specially those that are set with the objective of mitigating the impacts which are predicted to happen.
- (c) Offer "improvement compensation packages" to the community so as to compensate the unavoidable negative impacts foreseen. These improvement packages may include the construction of sport playgrounds, improvements in the roads and street lightning, construction of parks and gardens, lowering the property tax, etc. In this case, the NIMBY syndrome is switched to the YIMBY, FAP approach: "Yes in my back yard, for a price".

The following basic steps are therefore recommended for the public involvement-for-acceptance-process:

- Setting up a "community relations ad hoc committee." In this committee, MMDA representatives, LGU officials and community leaders belonging to the selected siting area would convene regularly during the planning and construction phases of the disposal or transfer plant. This Committee would

oversee and guide the process of community involvement, and guarantee its transparency.

- Identification of issues of concern (noise, air pollution, water pollution odors, traffic, etc). This shall be done based on the history of the present disposal sites and through direct interviews with the people and community leaders.
- Identification of needs and desires of the communities neighboring the disposal sites. This step shall be done also through local interviews with community leaders and local government officials, in order to assess the community improvements to be proposed for compensation.
- Getting the consensus (or at least the approval of the majority) for the compensations to be offered to the community, first at the "community relations committee," and later with the community itself.

The process shall lead to a "package compensation deal" that shall be incorporated in the project of the sanitary landfills and transfer stations and accordingly budgeted, being then considered an integral part of the project of the plants and or disposal sites.

A diagram showing the linkages and phases of decision in this process is shown in Figure 5.1.2.

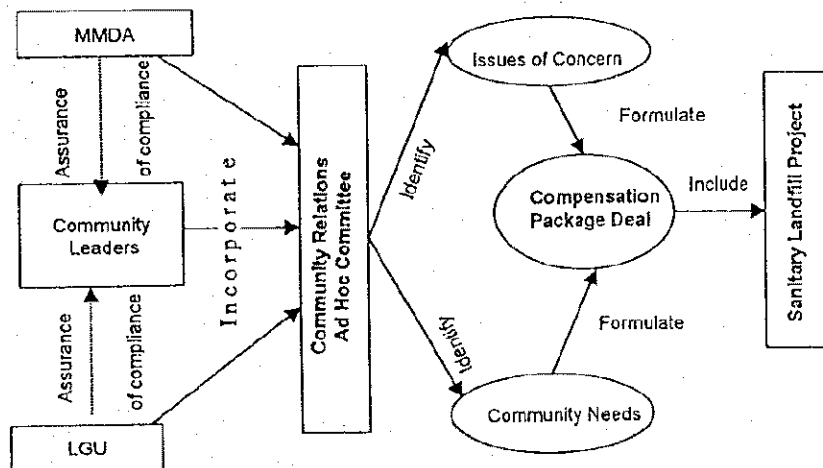


Figure 5.1.2 Public Involvement-for-Acceptance Process

(2) User Charges

Nowadays, most of the LGUs in Metro Manila finance their solid waste management services through the LGU's general funds. This practice lacks accountability to the waste producers, and it is responsible for the chronic deficiency of funds to manage the systems in an appropriate manner, because it has always to compete with other government spending.

The solution for this situation is the imposition of direct user charges, billed directly to the waste producers according to the nature and amount of the waste produced and adjusted to their affordability to pay. The imposition of these charges, however, needs the public acceptance, otherwise it will be very difficult to implement it. Usually, refuse management charges raise strong public opposition, voiced by politicians and the media, necessitating special and careful provisions to gain public acceptance.

It is recommended that the process to impose user charges shall be led by the Presidential Task Force on Solid Waste Management, since there is a need for a very strong political leadership in order to succeed in this matter. Also, the PTFSWM should play a basic role in defining the billing method, because the best solution would probably be the joint billing with energy or with water supply and sanitation, both utilities managed at the national level.

One possible intermediate solution to this problem would be the imposition of charges by MMDA, only for treatment and disposal of solid waste, leaving the collection and street sweeping activities left to the LGUs to decide how to finance it.

The proposal to the PTFSWM shall be made by MMDA after a detailed study carried out with the support of consultants familiar with the solid waste billing issue and with full consultation with the LGUs.

5.1.4 Redress of Social Inequities

One of the most difficult problems to address in solid waste management in the developing countries is that of servicing the unplanned low-income settlement areas. Extension of collection services to these areas in Manila is urgently needed, since almost 1/4 of the waste produced is either non-collected or self-disposed.

These areas, in general, do not allow access to regular trucks, even the most common tipper or dump truck, hampering the possibility of house to house collection. In this situation, the only way to effectively collect the wastes is to use labor intensive methods, carrying out the refuse manually to a suitable place where the refuse is then picked up by the collection trucks.

The operational phase where refuse is taken from the households to the collection points is known as "primary collection." The best results for this operation is achieved using non-conventional equipment and methods (this system is also known as "appropriate collection").

The most successful experiences in "primary appropriate collection" are those conducted through communal efforts using CBOs (community base organizations) and/or NGOs (non-governmental organizations). The CBO may be set up as a micro-enterprise or as a cooperative or even simply as a neighborhood association.

These micro enterprises usually employ workers living in the same region where the services are rendered, and use appropriate technologies (simpler tools, equipment and

vehicles). Selection of recyclable materials for selling and thus helping in making the project economically viable is many times associated with this type of service provision.

The financing of these systems is made either by government or directly by the service recipients or by both, sometimes with the aid of NGOs or external aid agencies. The way to provide these services will mostly be based in the above schemes, which are heavily dependent upon community participation and support.

The pilot studies of the Master Plan will conduct a feasibility study in a selected area of Metro Manila so as to draw conclusions and recommendations on how to implement this solution in the Metropolitan Area as a whole.

5.1.5 Involvement of Waste Pickers in Solid Waste Management

According to the WACS (Waste Amount and Composition Survey) recycling today in Metro Manila accounts for only 6% of the total waste stream, regardless of the extensive and intensive efforts made by the waste pickers (eco-aides) before collection, by the refuse workers (basureros) during collection, and by the refuse scavengers working in the disposal sites.

The present recycling activities also present health hazard problems for those involved in the collection and processing of recyclable materials, mostly to those working in the open dumps and inside the collection trucks.

Improvements in the amount and quality of recycling, regardless of other initiatives, shall be attained with more source recycling, (separate collection) and with the setting up of recycling facilities.

Source recycling improvement is very dependent on citizen participation and it will be achieved only if there is a commitment of the waste producers in storing the recyclable and non-recyclable components of the waste in different containers. The Master Plan recommends that an intensive and extensive awareness campaign be made in order to mobilize and motivate the citizenry to practice this separation.

Another way to improve the recycling rates achieved today is through the construction of recycling centers, preferably coupled with refuse transfer stations.

These transfer and recycling centers would comprise an unloading area, a storage space, and a transfer trailer loading equipment. Adjoining the transfer area would be a recycling facility, to where part of the wastes would be diverted for sorting by the waste pickers.

The sorting area would consist of simple rubber conveyor belts, where the refuse would be manually picked and placed in different containers for recycling, i.e., metals, glass, plastics, cardboard, etc. The pickers should be the present waste pickers of the dumpsite, organized in a cooperative arrangement and working on their own, with government support.

The government support would be, basically, the investment in the facility itself and the maintenance services necessary to keep the equipment running properly. Payment for the

utilities could also be left to the government. (his means that the operation will be subsidized, and this is necessary in order to make it economically viable).

Beyond sorting the wastes, cleaning the materials, packaging it and possibly some primary processing, as well as marketing and selling the recyclable materials would be left to the waste pickers under their cooperative.

The proposal of this Master Plan regarding this subject is divided in two strategies:

- (a) To improve the amount of recyclable materials and to ease the work of the waste pickers through the promotion of separate collection in Metro Manila. This effort should be made from the barangay level with full support of the proposed new MMDA section on community mobilization and environmental education.
- (b) To construct recycling centers, adjoining the proposed transfer stations and at disposal sites. This proposal is better depicted in section 4 - Technical System - of this report.

5.1.6 Capability Building of Workers Involved in Solid Waste Management

Present working condition of the street sweepers, collection crews, drivers and disposal site operators, belonging both to the private sector or the public sector operators, is very poor. They are not subjected to any type of training in order to better develop their tasks and do not receive any guidance on health or safety procedure aspects of their jobs.

This situation leads to a very poor efficiency on the collection job and to a high rate of accidents and labor diseases among the workers. As a matter of fact the formal workers compete in many instances, with the street and dump scavengers/recyclers, for the recyclable materials, slowing the collection tasks. Furthermore, they do not have any significant role in helping to educate the community on the best practices to ease the collection or to separate the waste into recyclable and non-recyclable.

In order to address this problem in a comprehensive way, involving both the private as well as the public sector, it is recommended that the following actions be taken, at MMDA level:

- (a) Produce a set of basic standards to be followed by the public/private sectors, regarding labor conditions of the workers involved in solid waste management, specially in respect to number of working hours, uniform and shoes recommended, safety and protective gear required, etc. These standards should be imposed through the MMC to all service providers.
- (b) Conduct a training program, directed to all workers of the solid waste sector in Metro Manila, aimed to teach them the basic requirements and procedures to be met in their daily work. This training program could be organized in conjunction with some NGOs involved in solid waste management, and its content, although more simple and adjusted to Philippine reality, could be based on the courses given regularly by the APWA (American Public Works Association).

Funding for this training program could be sought through external cooperation agencies or multilateral organizations such as the ILO (International Labor Organization) and the training effort should start with the training of teachers to be assigned to several LGUs. Main subjects of this training and capacity building course should be:

- Occupational health and safety (for all employees)
- Refuse compactor truck and collection operation (for garbage collectors)
- Street cleaning methods (for street sweepers)
- Safe driving methods (for drivers)

5.2 Recycling

5.2.1 Definition and Rationale

Recycling is a very important activity in the management of solid waste not only for Metro Manila but also for the rest of the world. Recycling can be defined in a number of ways. In its strict sense, recycling is the reproduction of waste to new materials and products. There is another term used in the struggle for waste reduction, and that is 're-use,' which does not require a product to undergo any process, and in most cases, retains its original form to be used again. In the Master Plan on solid waste management, when recycling is mentioned, in most cases, it also includes re-use.

Why recycle waste? There are a lot of books, reports and documents that prescribe recycling, listing a number of reasons foremost of which are as follows:

- reduces waste
- conserves and effectively uses natural resources
- raises consumer consciousness of lifestyle
- spearheads a shift towards sustainable economic growth

The Philippines is now experiencing rapid economic growth, and with it, an increasing generation of wastes. In the case of Metro Manila, there are critical issues that need to be addressed, such as lack of land for solid waste management facilities, financial resources and public participation.

The Philippine Environmental Policy was declared *"to create, develop, maintain and improve conditions under which man and nature can thrive in productive and enjoyable harmony with each other; to fulfill the social, economic and other requirements of present and future generation of Filipinos and to ensure the attainment of an environmental quality that is conducive to a life of dignity and well-being."*

In light of this policy, a solution must be found to convert the mass consumption of resources and energy in Metro Manila into future resources circulating in an environmental friendly city, through recycling. By so doing, Metro Manila can be known as a 'recycling city.'

5.2.2 Targets of Recycling Activities in Metro Manila

The targets of recycling in Metro Manila, including major recyclable waste and recycled volume, are as follows:

(1) Major Recyclable Waste

It is recommended that the following recyclable wastes are promoted for recycling based on future waste composition and volume, and demand for recycling materials:

Recyclable Waste	Sources
glass (bottle, cullet) paper (newspaper, carton box, copy paper) plastic metal (steel can, aluminum can)	households
organic matter (kitchen waste from commercial areas)	markets restaurants

(2) Recycling Volume

At present, 6% of generated waste, or 327 t/day, is being recycled in Metro Manila. The estimated present recycling volume is shown in Figure 5.2.1. By 2010, it is required that 10% of total volume, or 980 t/day, should be recycled (refer to section 3.4 Planning Framework). However, collection at disposal sites by waste pickers and collection by collection vehicle crew will decrease gradually until 2005, which will adversely affect recycling rate. It is expected that recycling ratio will increase during the following stage:

- (a) collection at sources such as household; and
- (b) collection at intermediate facilities such as recycling centers and compost plants.

The volume of recyclable waste will be collected at generation stage and at intermediate facilities by 2010. Waste for recycling will be taken at intermediate facilities, including recycling centers and compost plants, at transfer stations and disposal sites.

Sixty percent (60%) of total recycled waste, or 570 t/day, will be collected at generation stage of which 7%, or 556 t/day will come from households. This recyclable waste from households includes glass, paper and metal (steel can and aluminum can). It is possible that used paper, which comprises 15 % of generation waste disposed of by institutional facilities, will be recycled.

Forty percent (40%) of total recycled waste, or 410 t/day, will be taken from intermediate facilities of which one-half, or 206 t/day, will come from residential and commercial areas (this is also recyclable waste at generation stage). The other half of waste will come from the market, and will be converted to compost, and it is estimated that the converted compost will retain 65% of its original volume.

Therefore, approximately 320 t/day of waste is required for composting, when 206 t/day of compost is produced.

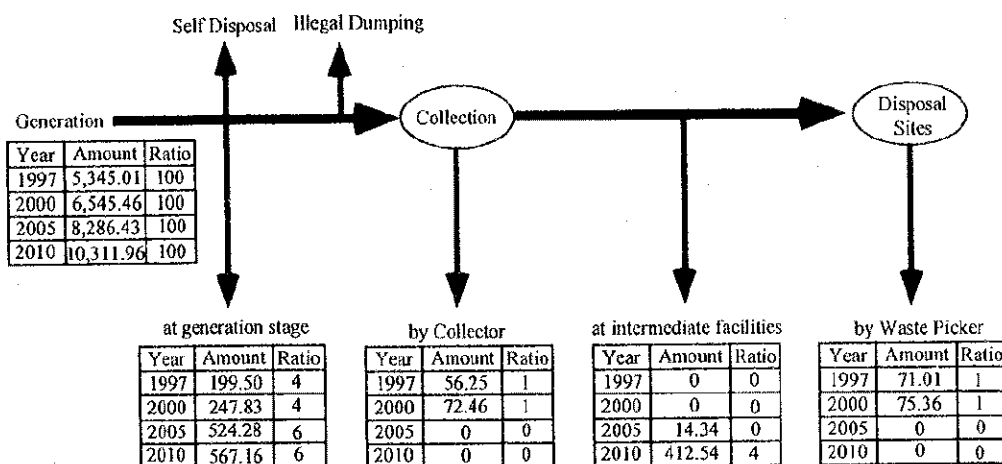


Figure 5.2.1 Flow of Recycling Waste Volume

Table 5.2.1 Distribution of Recycled Waste Volume in 2010

Type of Waste	Generation Amount	At Generation Stage		At Intermediate Facilities		Amount of Recycled Waste	
	t/day	t/day	%	t/day	%	t/day	%
Household Waste	7,904	556	7	171	2	727	9
Commercial Waste	1,687	0	0	34	2	34	2
Market Waste	609	0	0	206	34	206	34
Institution waste	75	11	15	0	0	11	15
Total Amount	10,312	567	58	411	42	978	10

5.2.3 Planning Issues on Promotion of Recycling

The following problems for promotion of recycling in Metro Manila are identified:

- no regulation for promotion of recycling;
- no government support for recycling;
- no incentive of recycling for private sector;
- weak management and financial abilities of private recycling sector;
- insufficient cooperation of business sector, consumers and government for promotion of recycling;
- unstable buying prices of recyclable waste; and
- small market of recycling products.

Planning issues to be solved in the Master Plan are selected based on identified recycling problems. The linkage between the identified recycling problems and the planning issues is shown in Figure 5.2.2.

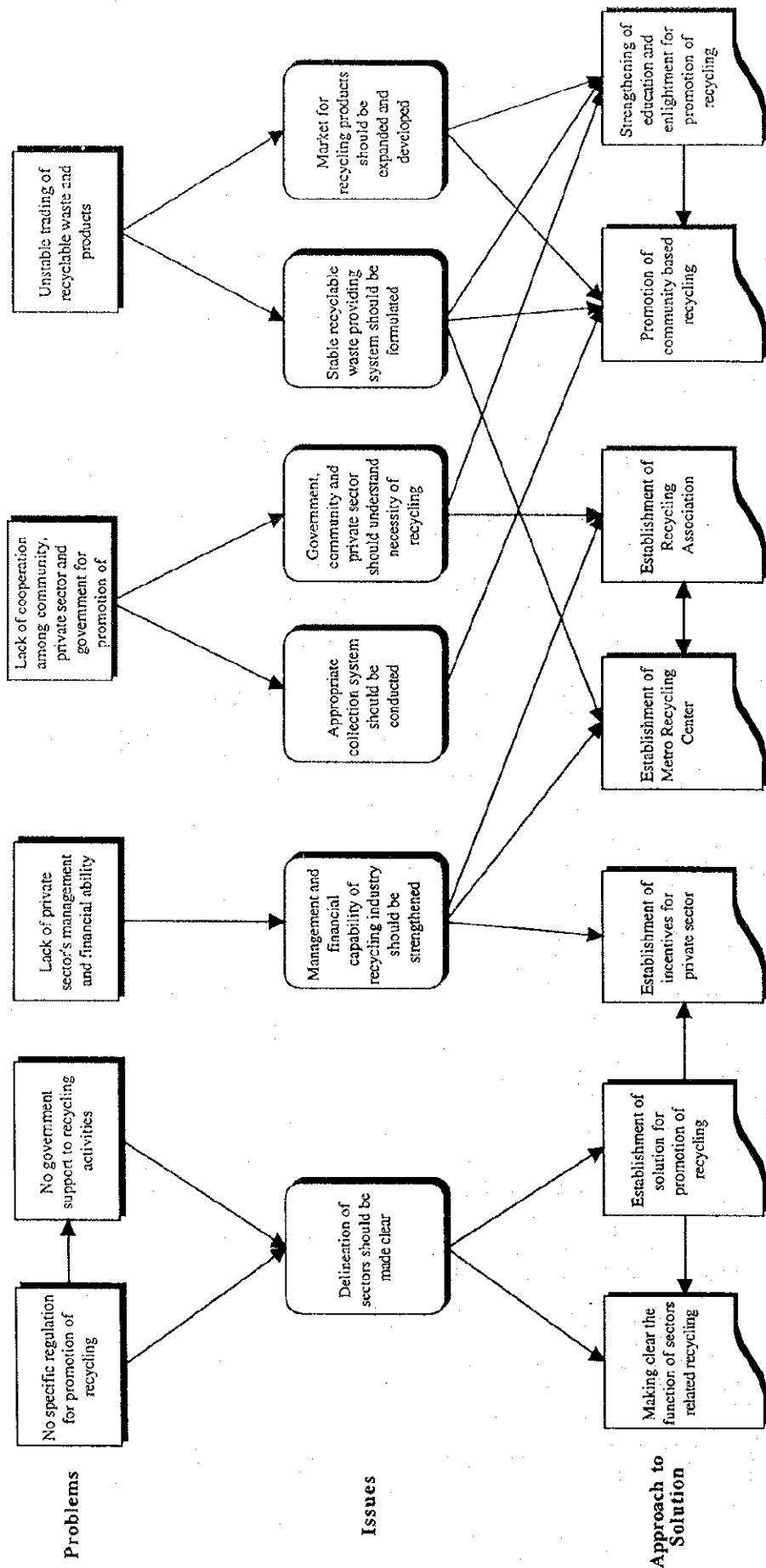


Figure 5.2.2 Problems, Issues and Approach

The issues that have to be addressed in the Master Plan are as follows:

- (a) delineation of government, community (consumers) and private sector responsibility;
- (b) strengthening of management and financial capability of recycling industry;
- (c) effective implementation of waste segregation/collection for recycling;
- (d) promotion of need to recycle among government, community and private sector;
- (e) establishment of suitable supply system of recycling materials; and
- (f) expansion and development of recycling products and market.

5.2.4 Strategies for Promotion of Recycling

If recycling should be sustained, the following should be promoted and developed:

- to produce recyclable products;
- to decrease recycling cost; and
- to buy recycled products.

The approach to address the issues mentioned above focuses on three major concerns: strengthening of recycling system, providing support to private sector, and promotion of community-based recycling. Details of the approach are as follows:

- (a) to clarify the function of sectors related to recycling;
- (b) to establish a resolution on promotion of recycling;
- (c) to promote community-based recycling;
- (d) to establish a "recycling center";
- (e) to establish incentives for the private sector;
- (f) to organize a recycling association; and
- (g) to strengthen education and enlightenment for promotion of recycling.

Government support is vital if a 'recycling society' is to be achieved. MMDA and the LGUs should support recycling activities, e.g. organize communities for segregation and group collection at the source level, and provide facilities to undertake it. Recyclable waste flow and functions of proposed organization and facilities are shown in Figure 5.2.3.

Recycling is presently a profitable business in Metro Manila, notwithstanding the fact that it is usually in the hands of a few businessmen who have limited resources and management capability. However, the recycling environment cannot be overly optimistic for the future for the following reasons:

- the increasing volume of imported recyclable materials; and
- the lack of quality, volume and form of recyclable waste from Metro Manila

Tariff cuts worldwide have caused a decrease in the prices of imported goods, and that means waste paper, too. Presently, the Philippine recycling industry does not have enough financial and management capability, so that it easily reacts to dictates of the market. As a result, the recycling environment is unstable. For example, in recent months, buying price of waste paper has gone down in Metro Manila, causing an excess supply of recyclable waste paper.

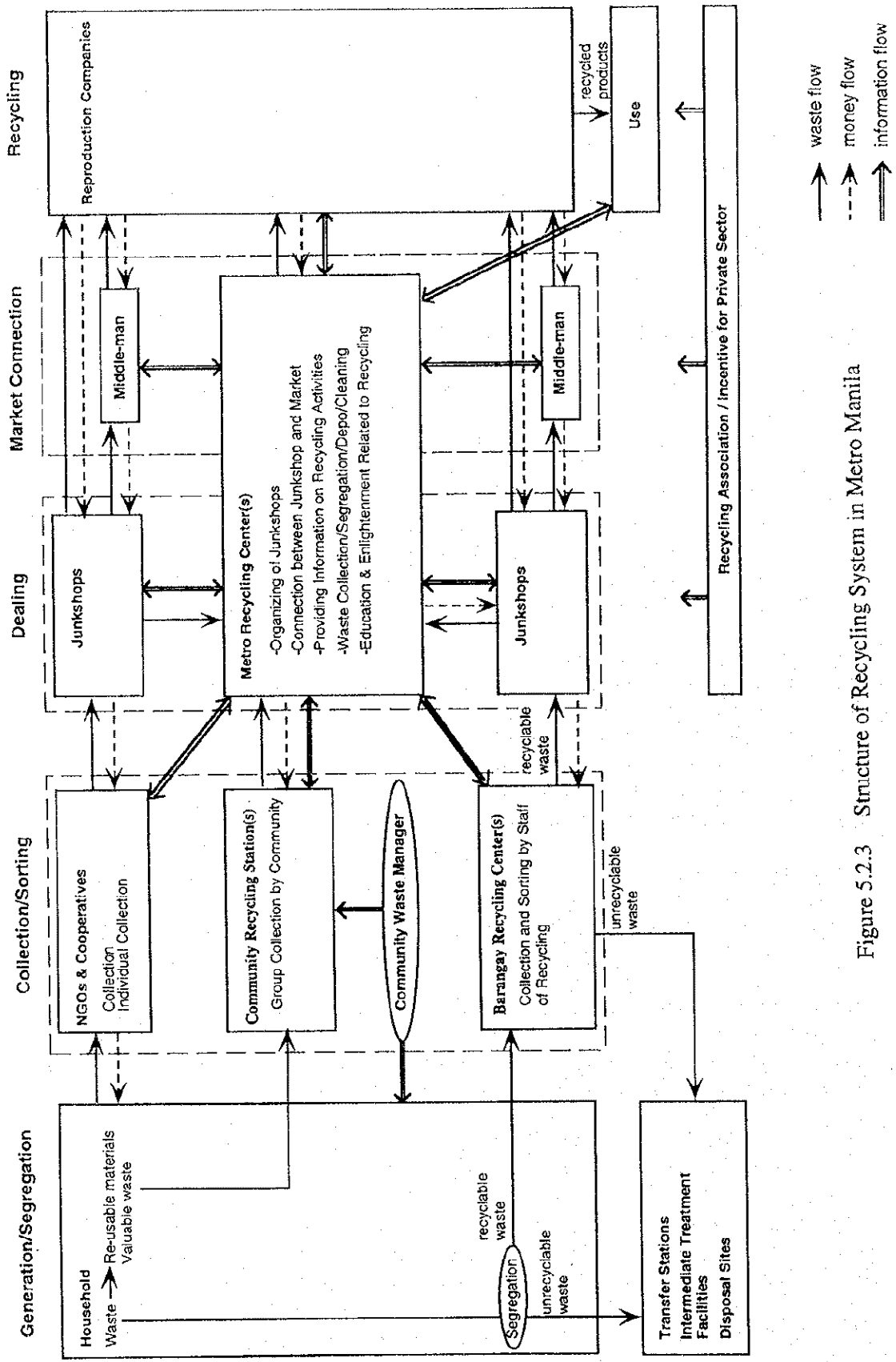


Figure 5.2.3 Structure of Recycling System in Metro Manila

Quality, volume and form of recyclable waste are the determining factors to motivate purchase by recycling factories. 'Clean,' uncontaminated waste is good for recycling process. Therefore, strategies for promotion of recycling are as follows:

- (1) Segregation should be conducted to secure quality of waste, and it is found that recyclable waste generated at source provide better and quality materials. Value should be added into recyclable waste by securing appropriate quality and volume, and by packing.
- (2) Support to the private sector is proposed through incentives. This could be accomplished through the establishment of a recycling center and a recycling association, in order to contribute management and financial capability that is lacking in private sector recycling activities.
- (3) Segregation at generation source is required for effective recycling so that community-based recycling and education/enlightenment are recommended.

5.2.5 Directions for Approach to Solutions

- (1) Clarification of Function of Sectors Related to Recycling

The important players in recycling are government, private sector and community (consumers). However, their functions are not clear at present. Figure 5.2.4 shows the proposed role and responsibilities for each sector in the establishment of a recycling society, while Table 5.2.2 lists the desired 'action' by individuals toward a 'recycling society.'

The Government should provide good environment for the recycling society through guidance and support for private sector and community. The Private sector should make efforts for development of recycling technology and decreasing cost, for increasing ratio of using recycled materials for production, and promotion for increasing recyclable products.

Table 5.2.2 Desired Action Toward a Recycling Society

Activity	Desired Action
Buying	<ul style="list-style-type: none"> • no buying of over-wrapped goods • buy recycled products • buy used-goods • buy recyclable products which can be recycled easily
Using	<ul style="list-style-type: none"> • no using of disposable goods • re-use goods for other purpose when they cannot be used for original purpose • donate products that can be reused by others
Storage/ Discharge	<ul style="list-style-type: none"> • segregate waste, at least, into recyclable waste and unrecyclable waste (if possible, by material basis, e.g. glass bottle, steel can, aluminum can, newspaper, carton box, PET Bottle) • if necessary, wash food container and others which can be recycled (to prevent spoilage and odor) • no mixing of recyclable waste with alien substance • no discharging of recycled waste mixed with unrecyclable waste • no throwing of recycled waste • clean storage

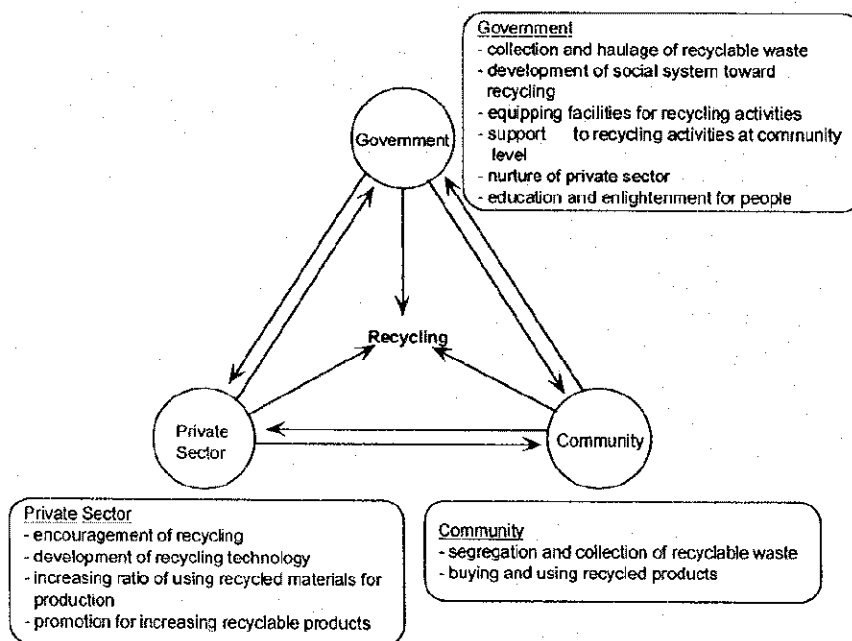


Figure 5.2.4 Role and Responsibilities of Each Sector on Recycling

(2) Establishment of a Resolution for Promotion of Recycling

P.D. No. 1152 1977 (Philippine Environmental Code), stipulates a regulation “to encourage, promote and stimulate technological, educational, economic and social efforts to prevent environmental damage and unnecessary loss of valuable resources of the nation through recovery, recycling and re-use of waste and products.” However, there is no specific resolution and regulation for promotion

of recycling, which can serve as a basis for government's activities toward the achievement of a 'recycling society.' Therefore, Metro Manila Council should adopt and establish a resolution for promotion of recycling as a political goal in order that LGUs, the private sector and communities in Metro Manila can systematically carry out recycling based on their stipulated functions.

It is very important that MMC exert all efforts to inform the public about the resolution through various tools, such as newspapers, radio, brochures, and seminars.

The contents of the proposed resolution to be established by MMDA is as follows:

- policy for promotion of recycling
- responsibilities of each sector
- goals of recycling
- objectives of formulating a recycling plan
- formulation of incentives
- action for support of a recycling society

(3) Promotion of Community-Based Recycling

Community participation is very important not only for recycling activities but also for total waste management. It is expected that of the total waste generation, 10%, or 980 t/day, would be recycled by 2010. It is indispensable that segregation and collection are conducted at source level for achievement of this target. The following are proposed for promotion of community-based segregation and collection:

- waste segregation
- Community Waste Manager
- reinforcement of existing collection system
- Community Recycling Station/Barangay Recycling Center
- awards for recycling activities
- education and enlightenment

Segregation is a minimum requirement for recycling, especially at the household level. It therefore requires the cooperation of the people, so that a community-based segregation of waste can be effected with the supervision of the Community Waste Manager. The establishment of Community Recycling Stations and Barangay Recycling Centers are proposed to contribute to community-based recycling. (A Metro Recycling Center(s) is also proposed, which will not only be for collection and segregation but also provide recycling information, organize junk shops, etc. A description is provided in (4) Establishment of a Metro Recycling Center).

Once the recycling system has been set up, it is paramount that the community manifests their support through the purchase of recycled products. Therefore, the residents should be enlightened about recycling and their education on this matter should be strengthened.

A more detailed discussion of the above components follows:

- (a) Segregation: Segregation is indispensable for recycling. Unsegregated waste is garbage, while segregated garbage becomes resources. Waste segregation should be started and recycling should follow suit, so that the introduction of incinerator can be implemented as soon as possible. At the latest, segregation will have to be conducted in most areas by 2005.

At the first phase, household waste is divided into **recyclable waste** and **unrecyclable waste**. In the next phase, recyclable waste will be divided further according to material. We should inform people that if waste is sorted, it becomes more valuable.

Recyclable waste includes glass bottle, broken glass, newspaper, carton box, copy paper, steel can, aluminum can, other metal, plastic.

- (b) Community Waste Manager: The role of a Community Waste Manager (CWM) or *Tagapamahala ng Basura*, in Filipino, is to initiate solid waste management on a community basis. The Barangay Captain will appoint the CWM from residents, and, for example, the CWM will receive P1,000 as allowance that will be shouldered by MMDA (30%), municipal government (40 %) and Barangay Office (30 %), a modified version of the Barangay Environment and Nutrition scholarship (a program of DOH).

The functions of the CWM are the following:

- (i) disseminate government information to community;
- (ii) organize campaigns and events related to community-based solid waste management; and
- (iii) initiate promotion of waste reduction and appropriate manner of recycling

MMDA and municipal governments will provide manuals and information kits through seminars and counseling tours.

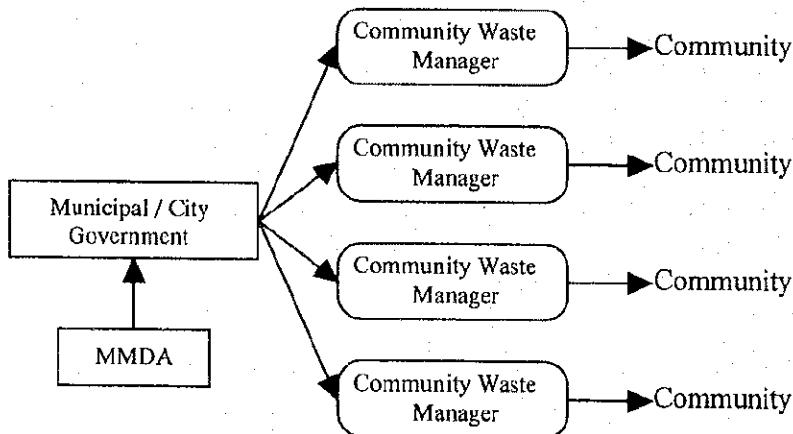


Figure 5.2.5 Structure of Community Waste Manager

- (c) Reinforcement of Existing Collection System: At present, there are NGOs that undertake waste collection; especially, cooperative associations collect recyclable waste, such as glass bottle, paper, plastic container, and others. In some subdivisions, the homeowners' associations try to conduct group collection for recycling. However, they do not have enough facilities and equipment, such as depots and pushcarts. This is where the Metro Recycling Center comes in. It will provide information on how to segregate and collect waste in an organized and efficient manner, and introduce them to NGOs who can give them support. It is recommended that LGUs provide financial assistance.
- (d) Community Recycling Station /Barangay Recycling Center: As mentioned earlier, community-based recycling activities consist of two types: Community Recycling Station(s) and Barangay Recycling Center(s). A community recycling station will be established in areas where there are no collection activities. Figure 5.2.6 depicts waste flow through Community Recycling Station(s) and Barangay Recycling Center(s). The concept of recycling center/station is promotion of effective collection and sorting at community and barangay levels, as follows:

Community Recycling Station

Community Recycling Station will be managed by the community itself, such as subdivision, homeowners' association, etc., and the office is also community-based, like in a community center. The functions of a Community Recycling Station are as follows:

- (i) promotion of community based recycling activities;
- (ii) collection of re-usable and recyclable waste; and
- (iii) providing a venue for dialogue.

The objective is for residents to regularly bring re-usable and valuable waste to the Community Recycling Station, such as glass bottle, newspaper and carton box, or to conduct group collection. The collected, re-usable and recyclable waste will then be sold to junk shops, NGOs and cooperatives. It is expected that the manner of collection and environmental health awareness will improve through participation of recycling. Furthermore, the money from the sale can be used for operation of the recycling station, staging of events and other community activities. Relevant sectors can provide sources for establishment of Community Recycling Station.

Table 5.2.3 Contribution of Participants to the Community Recycling Station

LGUs	Barangay Office	Community
- technical advice	- community organization - financial subsidy	- area for waste depot

Barangay Recycling Center

Barangay Recycling Centers are established in barangays, founded by LGUs and barangay offices. Barangay Recycling Centers can engage the services of unemployed residents, waste pickers, eco-aides, and students to perform any of the following functions:

- (i) collection and haulage of recyclable waste (segregated by residents), by Station employees from the homes to the Center;
- (ii) sorting of collected waste;
- (iii) organize recyclable waste, such as binding
- (iv) selling of sorted recyclable waste

Table 5.2.4 Contribution of Participants to the Barangay Recycling Center

LGUs	Barangay Office	Community
- technical advice	- organizing	- segregated recyclable waste
- finance	- finance	

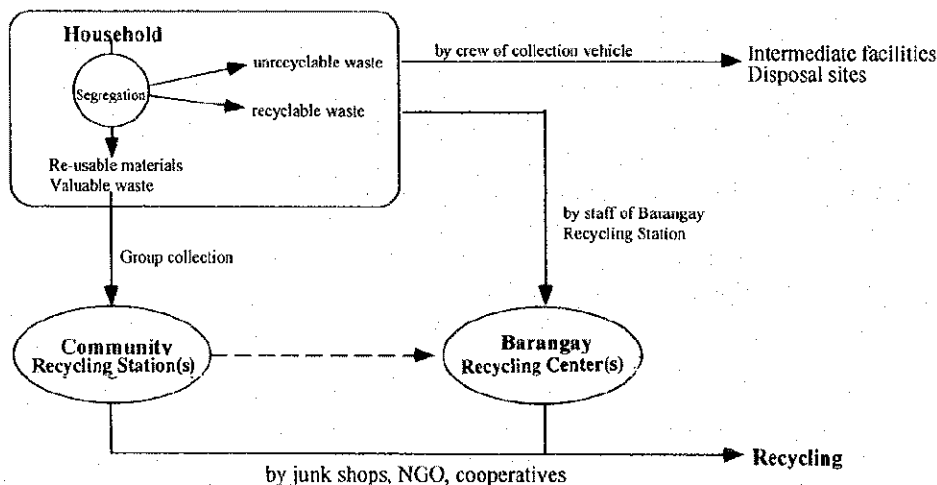


Figure 5.2.6 Waste Flow through Community Recycling Station(s)/Barangay Recycling Center(s)

- (e) **Establishment of Awards on Recycling Activities:** The Philippine government established Executive Order No. 214 of 1994, which is the Clean and Green Program. Its objectives are to inculcate in the minds of the Filipinos the values of discipline, self-reliance, resourcefulness, cooperation, cleanliness and environmental awareness; and to help transform rural and urban areas all over the Philippines into clean and green communities that are healthy and pleasant to live in. It covers the entire country. The “Cleanest and Greenest Barangay of Metropolitan Manila is one of eight categories of awards in the Clean and Green Program.

A Metro Manila Recycling Contest is proposed, with the aim to promote recycling activities in Metro Manila. Either MMDA, Metro Manila Council or the proposed Recycling Association can spearhead the contest. Through this contest, people will be roused to the idea of recycling. The contest shall offer awards to the following categories:

Individual Category

- who makes an effort in recycling activities
- who either invents or comes up with a method, equipment or idea on recycling

Community/Barangay/NGO (including school) Category

- which conducts segregation and collection for recycling
- which presented the best record for recycling

Private Sector Category

- which segregates recyclable waste
- which contributes to community based recycling

- (f) Education and Enlightenment: Community cooperation is indispensable for recycling—from segregation to the ‘use’ stage. It is important that segregation is done appropriately so that recycling materials can be provided. But this is just half the battle fought. In order that the whole process is proclaimed successful, there should be a market for it. Therefore, education and enlightenment should be enhanced for promotion and continuation of recycling. Educational and enlightenment programs are proposed in section 5.4 “Education and Enlightenment Plan.”

(4) Establishment of a Metro Recycling Center

The recycling center is the core of recycling in Metro Manila. Its aims to promote recycling through the following functions:

- (a) enhance the value of recyclable waste through the collection of mass volume of recyclable waste and treatment of waste;
- (b) organize junk shops;
- (c) provide information related to recycling, such as technology, buying and selling price, exchange of recyclable waste;
- (d) serve as link between waste generation source and market; and
- (e) education and enlightenment for promotion of recycling

MMDA, LGUs and the private sector will provide the financial resources to establish the Metro Recycling Center, while junk shops and recycling companies will serve as tenants.

Integration of Recycling Industry

It is expected that treatment and trading of recyclable waste will be done effectively, if recycling industry firms can be united. Buying and selling prices

also can follow market price. It may be even more advantageous if the Center is conveniently located for secondary and tertiary middlemen.

Dissemination and Exchange of Information

The Recycling Center will serve to network with government, private sector and communities, and through information related to recycling activities. It will more specifically function as follows:

- (a) provide information and opportunity for interchange of re-useable waste among residents;
- (b) strengthen citizen participation;
- (c) provide know-how of community organizing for recycling activities;
- (d) introduce recycling technology and cases;
- (e) educate and enlighten on promotion of recycling awareness; and
- (f) coordinate events for recycling.

The following facilities can be set up at the Metro Recycling Center, if necessary:

- stockyard and sorting yard of recyclable waste;
- space for junk shops
- cleaning, breaking, sorting of metal facilities
- recyclable waste trading center
- database and library
- lecture rooms with audio-visual equipment

(5) Establishment of Incentives for Private Sector

- (a) **Financial Incentives:** The Department of Trade and Industry (DTI) established "the 1997 Investment Priorities Plan," which provides incentives, such as tax exemption, tax credits, additional deductions from taxable income, and non-fiscal incentives to categorized industries and activities. The recycling industry is one of the Environmental/Ecological Supporting Facilities that can be granted incentives. Firms need to be registered with the Board of Investments of DTI. However, most junk shops are classified into small business, so that they cannot pay the registration fee to be categorized as such. On the other hand, the trade of recycling materials and its market are unstable and sensitive; for example, local recycling companies have been slapped with tariff cuts on imported goods, including recyclable materials by the General Agreement on Tariffs and Trade (GATT). Junk shops need to be upgraded so that financial incentives can be considered.
- (b) **Social Incentives:** In a number of developed countries, a logo is printed on products to indicate that they are made of recycled materials. Figure 5.2.7 presents three logos used in Japan, Germany and Canada. The mascot for recycled products was one of two winners of the 'Draw a Mascot Contest' sponsored in June 1997 by MMDA and the JICA Study on SWM.

Oftentimes, an identifying mark becomes an incentive for purchase of recycled products in a mature society. It is recommended that the Recycling

Center or Recycling Association come out with an official logo to identify recycled products based on a definite criteria.

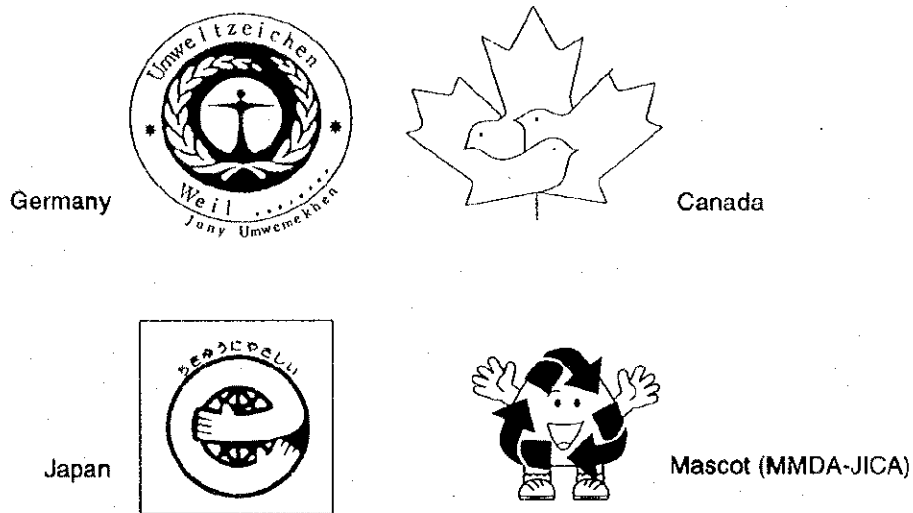


Figure 5.2.7 Sample Logos of Recycled Products

(6) Establishment of Recycling Association

The private sector engaged in the recycling business, especially junk shops, can be classified as small business. Business, like the trading of recyclable waste, is usually on cash basis. Their trading manner and accounting system are not transparent.

It is recommended that a Recycling Association be established for the following important roles:

- (a) work for the recognition of the recycling industry;
- (b) organize and coordinate the private business sector
- (c) encourage more businessmen to go into recycling
- (d) upgrade recycling technology

The following sectors may be involved for establishment of the association: Junk shops, recycling companies, NGOs, academe, government (DTI, DENR, MMDA, LGUs etc.).

(7) Education and Enlightenment for Promotion of Recycling

Education and enlightenment are required for promotion of recycling, because residents are the key players in a recycling society. Therefore, educational and enlightenment programs should be strengthened. Detailed plans are described in the following section.