6.5 Formulation of a Master Plan for Solid Waste Management

6.5.1 Selection of optimum alternative

Based on the evaluation results and discussions with the Indonesian side, Alternative 1 has been selected because it is the most economical alternative.

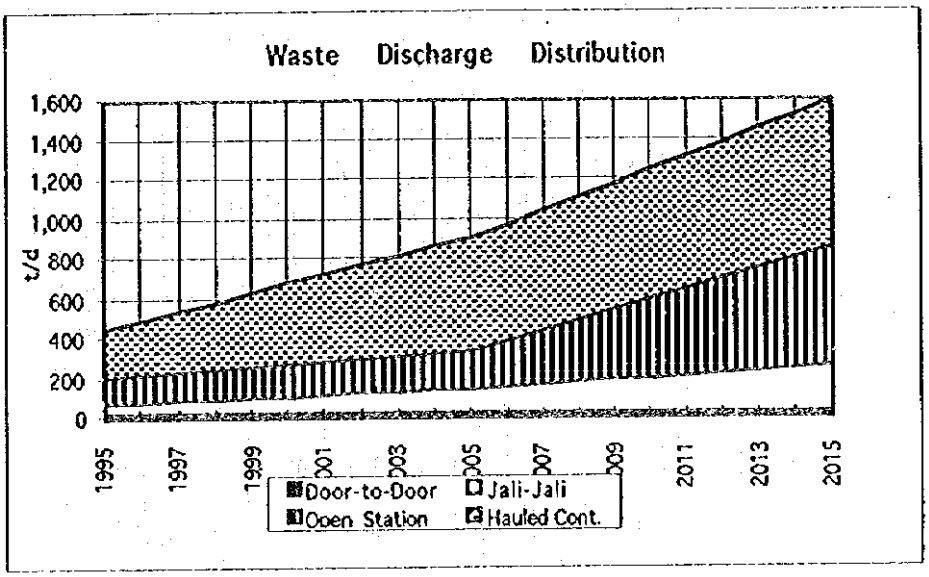
Discussion also covered timing of the construction of Samata disposal site. As a new housing estate is being constructed near the Tamangapa disposal site, it became clear that expansion of Tamangapa cannot provide sufficient capacity for waste disposal up to the year 2005. Therefore, early construction of the new disposal site at Samata should be considered. After examination concerning the possible capacity of Tamangapa under various conditions, it was decided to start operation of Samata disposal site in 2002.

Based on the above considerations for the future direction, this solid waste management master plan has been developed. The future solid waste flow is planned as shown in *Fig.* 6.7.

6.5.2 Plan for discharge, collection and transport

(1) Discharge

The Master Plan (M/P) includes the following types of discharge (the shares of each are shown in the following figure.) A summary of the four types is discussed below.



1) Door-to-door

Presently about 30 ton/day are collected from permanent bins constructed in front of the dwellings. In line with KMUP's plan to abolish these bins, the M/P shall limit collection from bins to 20 t/d.

2) Open station (TPS)

The M/P considers that the present 400 numbers of TPS will continue to be used up to around the year 2005, and starting from around the year 2000 open stations will be introduced in newly developed areas. No new TPS will be constructed and as conditions of the present TPS, deteriorate, they will be demolished and replaced by hauled containers or open stations.

3) Jali-Jali (calling system)

This system is common in Jakarta and other Indonesian cities but is not applied in KMUP. Under this system the residents are informed of the collection vehicle arrival by music or blowing of whistles. This system is appropriate in densely populated low income areas where it may be difficult to locate open stations and enforce discharge of packed waste.

Therefore the M/P considers introduction of this system in slums and densely populated areas in the old Kecamatan. This system will not be

considered in the new development areas. While this system may have some advantages, it obviously increases the time a collection vehicle spends in the collection zone, and thereby negatively effects vehicle utilization efficiency. The M/P therefore maintains the waste share discharged by Jali-Jali at around 15% of total discharged waste.

4) Hauled container

KMUP is presently increasing the share of hauled container system (HCS) in its solid waste collection and transport operation. Armroll vehicles and containers of capacity $6m^3$ are employed.

Although the residents may be relieved from the need to purchase plastic bags and will be free to discharge their waste at all times of the day, walking distances of up to 150 to 200 meters may be required. Containers shall be located in densely populated areas of more than 170 person/hectare as for as possible, to maintain walking distances to the containers of less than 200 meters.

(2) Collection and transport

1) Primary collection

This service is provided in most of the Kelurahan with no clear standards for when it should be applied.

At present there are approximately 400 to 450 persons employed in primary collection, with a similar number of carts. If this system is allowed to grow uncontrolled it is estimated that about 800 to 900 handcart employees will be employed in the year 2015. Needless to say this will increase the cost very much.

For streamlining of this service, the M/P considers that the present scale of primary service shall be maintained up to the year 2015. This means that in the years 1995, 2005 and 2015 the waste collected by primary collection will be approximately 40%, 30% and 20% respectively of the total waste collected.

This service shall be confined to the older Kecamatan and shall not be introduced in the suburban Kecamatan where development is under way. It is assumed that development there will be in an orderly manner and collection vehicle accessibility will be assured. In 2015 the estimated waste amount collected from these Kecamatan will account for roughly 70% of total waste to be collected from KMUP and it is therefore safe to consider that not more than 20% of the population will be living in slum and inaccessible areas in the older Kecamatan.

2) Secondary collection

a. Collection vehicle type

The following vehicle types were examined to determine their suitability for use in KMUP.

- Pick-up	3 m^3 haul capacity
- Tipper	10 m^3 and 6 m^3
- Armroll	10 m^3 and 6 m^3
- Compactor large	15 m^3 and 10 m^3

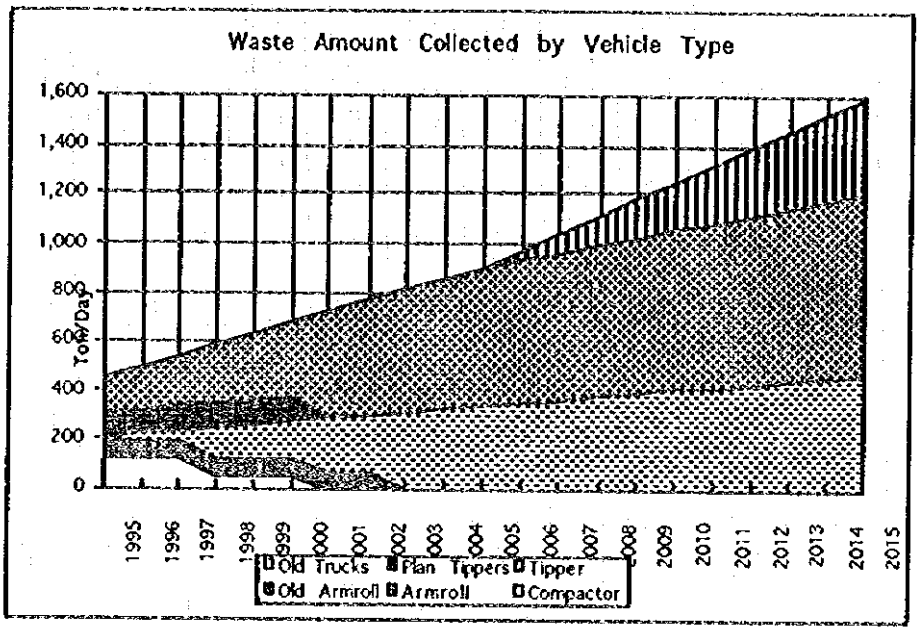
Based on the results of the examination, as reported earlier in this section the tipper medium, armroll medium and compactor medium vehicle types were selected. For each type, the narrow road conditions (this can also be witnessed in many of the relatively new development areas) in KMUP made the medium sized model more suitable than the larger model.

b. Collection vehicle requirements in the M/P

The collection vehicles required by type were calculated for the M/P duration (1995 to 2015). The calculation took into consideration the following:

⇒ Existing fleet
⇒ Existing plans for vehicles procurement
⇒ Vehicle usage up to 8 years

The following figure shows the share of waste to be collected by each vehicle type.



As shown in the figure, during the first year of the M/P the amount of waste to be hauled by vehicle category shall be as follows:

⇒ Old vehicles; 48% of total waste collected
⇒ Planned vehicles: 17%
⇒ New vehicles; 35%

3) Personnel

The personnel required during the M/P period for primary and secondary collection are supervisors, drivers, collection workers and handcart workers. These were calculated on the following basis:

⇒ Supervisors; One supervisor for about 15 vehicles plus supervisors for primary collection workers
⇒ Drivers; one driver for each vehicle (including standby vehicles) plus 5%
⇒ Workers; three workers for compactor and tipper and one for arnroll, with standby crews

Based on the above description the requirements in equipment and personnel on a yearly basis are as shown in *Table* 6.3.

(3) Implementation of the M/P

1) Improvement of operation

The M/P calls for gradually extending the service ratio to cover 95% of the population in 2015. Efficient waste discharge and vehicle utilization can help keep the number of vehicles down.

This efficient utilization can be achieved by increasing the trips per vehicle during a shift and proper loading of vehicles during each trip to make use of the vehicle haul capacity.

To maximize trip number it is necessary to reduce the time the collection vehicle spends in the collection zone. Eliminating as much as possible door-to-door collection and allowing discharge of waste three times per week will concentrate the waste at a lesser number of stops for the vehicle. Furthermore loading of packed waste from the stations into the vehicles is much quicker than loading of loose waste.

Proper loading of vehicles can be achieved by monitoring actual vehicle loading and determining whether collection routes need adjustment and supervision of crews. The truck scale at the disposal site should be used to maintain the necessary records on vehicle performance and trip

number. Placing of containers and selection of open station locations should be prepared based on households served and walking distances. Data on the RT/RW levels should be collected based on which the number of containers or open stations can be determined.

The M/P has been prepared on the premise that improvement will be gradual. This is in part due to the need to increase the public's awareness in order to obtain their cooperation regarding discharge every other day at fixed stations. As the socioeconomic conditions improve it will also be possible to increase the use of plastic bags by the citizens to discharge packed waste.

The operation indices are assumed to improve as follows.

A) Operation Indices by Vehicle Type

Indices	1995		2005		2015		
	Armroll	Tipper	Armroll	Tipper	Armroll	Tipper	Compactor
1) Vehicle number	34	69	65	71	83	90	49
2) Trip number/day	6.0	2.4	7.0	3.3	7.2	3.8	2.2
3) Loading time (min/t)	67.3	158.4	55.9	101.5	53.6	93.7	61.3
4) Haul/veh/day (t/veh)	7.1	3.0	8.4	4.2	8.6	4.9	7.8

B) Average Operation Indices

Indices	(existing) 1994	2005	2015
1) Vehicle number	95	136	222
2) Trip number/day	2.4	5.4	4.9
3) Loading time (min/ton)	163	73	67
4) Haul/veh/day (t/veh)	2.8	6.0	7.1
5) Ton/staff/day (t/person)	0.7	1.02	1.30
6) Unit cost (Rp./ton)	17,830	17,398	15,936

2) Procedure for implementation

i) Preparation for implementation

This M/P sets the framework for extension of collection and transport service and its improvement. It defines the broad requirements and goals needed to be achieved. It is now necessary for Dinas Kebersihan to immediately begin assembling the necessary data base to develop the details of the M/P and put it into effect as soon as possible. The data base shall comprise but not be limited to;

⇒ Complete waste collection vehicle inventory indicating number of years in use and vehicle operating conditions

⇒ Data base on the RT/RW level covering all KMUP showing population, land use, and waste amount generated
⇒ Maps of each RT/RW of sufficient scale to show sites where open stations/containers can be located, road widths, suitable vehicle routing and areas inaccessible to collection vehicles
⇒ Format for recording of data at the weighbridge in order to ensure that the required information for planning the work is available

ii) Primary collection service application

This service shall be minimized as much as possible to avoid the high cost burden. The plan for primary collection service shall be as follows;

⇒ Identification of areas difficult for vehicle access
⇒ Plot such areas on maps and estimate waste amount generated there
⇒ If walking distances can be maintained at less than 200 meters then provide container or open station at a site accessible to collection vehicles
⇒ For greater walking distances consider primary collection
⇒ Dinas Kebersihan shall prepare execution plan and supervise the work
⇒ Collection time of primary collection shall take into consideration the collection schedule of vehicles in case of bringing the waste to open station

iii) Expansion of collection service

Presently the old Kecamatan are those receiving the highest collection service levels. The M/P sets priority for service expansion in the older Kecamatan with gradual expansion towards the suburban Kecamatan. Following table shows the frame for expansion up to the year 2015, and the actual daily collection amounts by Kecamatan are shown in *Fig.* 6.8.

Expansion of Collection Service Ratio by Kecamatan

Kecamatan	Present	1995	2000	2005	2010	2105
1. Mariso	75%	80%	100%	100%	100%	100%
2. Mamajang	75%	80%	100%	100%	100%	100%
3. Makassar	75%	90%	100%	100%	100%	100%
4. Ujung Pandang	75%	90%	100%	100%	100%	100%
5. Wajo	75%	90%	100%	100%	100%	100%
6. Bontoala	75%	90%	100%	100%	100%	100%
7. Tallo	25%	60%	83%	85%	100%	100%
8. Ujung Tanah	50%	80%	100%	100%	100%	100%
9. Panakkukang	35%	60%	75%	80%	88%	92%
10. Tamalate	25%	60%	75%	80%	89%	92%
11. Biringkanaya	15%	60%	75%	80%	89%	93%
Total KMUP	60%	72%	85%	88%	93%	95%

In the suburban Kecamatan Dinas Kebersihan shall grasp the extent of new development implemented there or under planning / implementation stages. In line with the Panakkukang New Town development private developers shall be encouraged to implement waste collection and transportation on their own under standards approved by Dinas Kebersihan.

iv) Equipment assignment by zone

Fig. 6.9 shows the vehicle requirements for KMUP for the years 1995, 2005 and 2015, divided into 4 zones.

v) Community participation

As Dinas Kebersihan determines the type of discharge and collection service to be extended to each RT/RW based on its data base it is necessary to coordinate on both official and public levels with related RT/RW, LKMD, PPP, Kelurahan, and Kecamatan and other relevant organizations to secure community cooperation.

6.5.3 Intermediate treatment and final disposal

(1) General

In MINASAMAUPA area, there are three (3) disposal sites at present, Tamangapa for KMUP, Bonto Matene for Maros and Desa Mawang for Gowa. Tamangapa and Desa Mawang disposal sites shall be used up to 2001. After the year 2002, a new inter-municipal disposal site in Samata (hereinafter called Samata disposal site) shall start to operate for disposal of

solid waste generated in KMUP and Gowa. Disposal site in Bonto Matene will be used for Maros over the long term. Non-hazardous industry waste is mainly disposed of at the disposal site in KIMA industry estate at present but the municipal disposal site will accept non-hazardous industry waste in the future to prevent illegal dumping.

(2) Solid waste to be disposed of

Types of waste to be disposed of at Tamangapa and Samata disposal sites are:

a. Domestic waste and commercial waste
b. Street waste and ditch waste
c. Non hazardous industry waste

Concerning non-hazardous industry waste, KIMA disposal site shall be improved by employing control landfill method instead of open dumping by KIMA agency as soon as possible. After the year 2002, Gowa disposal site will receive non-hazardous industry waste in return for payment of tipping charge.

(3) Solid waste amount to be disposed of

Solid waste amount to be disposed of is estimated excluding non-hazardous industry waste, as follows.

Disposal Amount ton

Name of disposal site	At present	1995-2001	2002-2015	
Bonto Matene (from Maros)	0	4,900	260,500	
Tamangapa (from KMUP)	252,400	1,272,900	0	
Samata	0	0	5,055,100	from KMUI
	0	0	284,700	from Gowa
Desa Mawang (from Gowa)	-	65,800	0	

(4) Final disposal site

The necessary capacity of the final disposal site in MINASAMAUPA area until the year 2015 is summarized in the following table. Schedule of solid waste disposal showing accumulated solid waste amount to be disposed of is shown in *Fig.* 6.10.

Dimension of Final Disposal Site in MINASAMAUPA Area

Disposal period	Unit / year	Maros 1995-2015 21 year or more	Tamangapa 1993-2001 9 year	Samata 2002-2015 14 year or more	Gowa 1994-2001 8 year	KIMA - 2001 9 year or more
Amount	ton	311,500	1,525,300	5,339,800	79,000	
Volume	m^3	445,000	2,179,000	7,628,000	112,900	
Covering soil	m^3	74,200	363,200	1,271,400	18,800	
Required volume	m^3	519,200	2,542,200	8,899,700	131,700	
Depth and	m	10.5	14	14	7	
No. of layer	layer	3	4	4	4	
Necessary area	ha	7.1 or more	32.0	90.8 or more	2.7	
Waste type		Municipal waste	Municipal waste	Municipal waste	Municipal waste	Industry waste

Note: Waste volume; in place density 0.7 ton/m^3

Covering soil; Thickness 0.5 m for each 3 m of solid waste layer

(5) Facility plan of Tamangapa

Required facilities in Tamangapa are shown in *Fig.* 6.11 and *Fig.* 6.12. Tamangapa disposal site shall be expanded step by step to work within the financial constraints.

a. Total site area 32 ha
b. Total capacity 2,732,200 (solid waste 1,640,520 ton)
c. Waste amount to be disposed of 1,525,300 ton
d. Daily waste amount 610 ton/day in year 2001
e. Disposal method Semi-sanitary landfill
f. Waste to be disposed of
Domestic, commercial, street and ditch waste and non-hazardous industry waste
g. Equipment
- Track type tractor 18 ton class 2 unit
- Excavator 0.7 m3 class 1 unit
- Dump truck 5 m class 2 unit
- Pick up truck 2 unit
- Tank truck 1 unit
h. Personnel: Total 27 person

(6) Facility plan of Samata disposal site

Required facilities in Samata are shown in *Fig.* 6.13. Samata disposal site shall be constructed step by step.

a.	Total site area		Zone I 65 ha Zone II 56 ha
b.	Total capacity		11,302,000 m^3 (solid waste 6,781,200 ton)
c.	Waste amount to be disposed of		5,339,800 ton
d.	Daily waste amount		1,451 ton/day in year 2015
e.	Disposal method		Semi-sanitary or sanitary landfill
f.	Waste to be disposed of		Domestic, commercial, street and ditch waste and non-hazardous industry waste
g.	Equipment	-	Track type tractor 18 ton class 5 unit
		-	Excavator 0.7 m^3 class 2 unit
		-	Dump truck 5 m class 4 unit
		-	Pick up truck 2 unit
		-	Tank truck 2 unit
h.	Personnel:		Total 37 person

6.5.4 Plan for street sweeping and ditch cleansing

(1) Street sweeping plan

The Street Sweeping M/P calls for daily sweeping of Class I and II streets and once every two days sweeping of Class III streets. Mechanical sweepers will be introduced in the M/P in the year 1999 on the Class I streets. Beyond the year 2005, and as the number of mechanical sweepers is increased a portion of Class II streets will also be swept.

The following table shows the street sweeping plan in the M/P.

Street Sweeping M/P

	Unit	1995	2005	2015
1) Road Length				
Class I	km	121	140	157
Class II	km	122	161	200
Class III	km	87	146	205
2) Daily street length swept				
Mechanical sweeping	km	0	140	207
Manual sweeping	km	287	234	253
3) Required manpower				
Manual sweepers	person	195	163	172
Drivers	person	0	4	5
Supervisors	person	12	11	9
4) Required equipment				
Mechanical sweeper	unit	0	4	5
Hand cart	unit	195	159	172

The following table shows the equipment and manpower that will be required for street sweeping activity during the M/P.

Street Sweeping Equipment and Manpower Requirements

	1995	2000	2005	2010	2015	
1. EQUIPMENT						
1)	0	2	4	4	5	Mechanical Sweeper
2)	195	190	159	178	173	Handcarts
2. PERSONNEL	207	207	177	185	193	
1)	12	12	10	10	11	Supervisors
2)	0	3	4	5	5	Drivers
3)	195	193	163	170	177	Manual Sweepers

(2) Ditch cleansing M/P

The M/P assumes that the present 10 t/d waste amount cleaned up from ditches will remain the same in the future. It is assumed that waste discharge in ditches will decrease as waste collection service is expanded throughout KMUP.

The present cleaning system of gangs of 1 supervisor with 5 to 10 workers will continue. However the working conditions will slightly improve by introduction of backhoe excavator to assist in the effort. The ditch cleansing M/P shall be implemented as follows:

⇒ An inventory of the drainage system shall be compiled. The inventory should include data on ditch cross-section, lining condition, and locations which the ditch passes through (slum areas, commercial area, market, etc...)

⇒ A preliminary workforce shall be set up as follows; 11 supervisors, 3 drivers and 130 workers

⇒ Mechanical equipment shall be two (2) dump trucks and (2) backhoes (backhoes to be introduced in 1996 and 1997)

⇒ Ten (10) gangs shall be set up of 1 supervisor and 13 workers. The remaining supervisor shall have overall responsibility and assign backhoes and dump trucks to the gangs as necessary.

⇒ Depending on the work conditions, a number of gangs, say 8 will be assigned specific work lengths daily and the remaining two (2) gangs will be dispatched for emergency work as complaints come in from the citizens.

6.5.5 Recycling and other activities

Reduction of solid waste is one of the important targets of solid waste management specially in metropolis cities because every year it is becoming more and more difficult to obtain suitable sites for solid waste disposal on the one hand, and the need for environmental conservation has pushed developed countries to exert efforts to transform their societies to reduce waste generators on the other hand. There are many ways to reduce the amount of solid waste including economic, social and technical systems. The only way may be to incorporate a recycling system in the social fabric of the society. However, the following steps should be the first in the march for reduction of solid waste.

a. Promotion of recycling activity
b. Proper charge for solid waste based on solid waste amount

Although volume reduction of solid waste is not an urgent issue in Indonesia, promotion of existing recycling activity and trials of various systems for identification of suitable future systems are necessary for future development of recycling systems.

(1) Recycling of reusable material

KMUP shall promote volume reduction of solid waste. Recycling of reusable material is an important way to achieve volume reduction including the present recycling routes through scavengers. Paper, plastic, metal and glass will be major recyclable items. The target can be set to recycle 30% of reusable material (12% of total generated solid waste) in 2015 as follows. Because of the predicted increase in reusable material, volume reduction through recycling will be a continuous important issue.

Target of Recycling of Reusable Material

	1995		2005		2015	
	Ratio	Recycle	Ratio	Recycle	Ratio	Recycle
Paper	10.7	1.1	14.7	2.9	18.7	5.6
Plastic and textile	9.0	0.9	12.0	2.4	15.0	4.5
Metal	1.5	0.2	2.5	0.5	3.5	1.1
Glass	2.1	0.2	2.1	0.4	2.1	0.6
Total	23.3	2.4	31.3	6.2	39.3	11.8

(2) Separate collection

Separate collection is widely introduced in Japan for recycling of reusable material and for efficient use of intermediate treatment plant. KMUP shall introduce a recycling system in the future in cooperation with the present recycling routes, and some additional cost for collection will be necessary.

(3) Composting

As the putrescible matter forms the main component of solid waste, composting will be one way of reducing solid waste amount. Cipta Karya is implementing a pilot project for manual composting in KMUP. Because of the small scale of manual composting, it can be used in the future although working conditions are not desirable. Also, small scale composting devices used in detached houses can be introduced in the future.

(4) Pilot project for volume reduction

As mentioned above, Cipta Karya is implementing a pilot project for composting and another for small scale incineration. Pilot projects for volume reduction of solid waste shall be continued as much as possible.

For operation of small scale incineration it is very important to carefully examine the operation because as mentioned in section 3.4, the present domestic waste generated in KMUP is not suitable for incineration. However, results of field survey shows that office waste is suitable for incineration because it has high calorific values. Selection of waste type to be treated is one important factor to determine project success.

On the other hand the composting pilot project is expected to succeed because most of the waste is suitable for composting.

To reduce solid waste amount, service fee shall correspond to the amount of waste to be discharged, particularly for commercial waste. Tariff levels shall be sufficient to cover cost of solid waste collection, treatment and disposal. Tariff levels for commercial waste will be Rp. 26,500/ton for collection and disposal and Rp.9,000 for disposal only.

If all dischargers of commercial waste pay the above collection and tipping fees, they alone will cover 28% of the total costs and residents will cover the remaining 72%.

6.5.6 Arrangement of office and workshop

(1) Branch office and field office

By the year 2005, Dinas Kebersihan shall be converted to PD Kebersihan according to the national policy for metropolitan cities. At the same time, it is necessary to provide branch and field offices considering expansion of the collection service area. Two (2) branch offices and two (2) field offices are proposed to be established. The functions of each office are shown as follows.

Function of Each Office

	Head-quarters	Collection and Ditch	Street sweeping	Vehicle depot	Workshop	Disposal site
a. Headquarters office	O	O	O	X	X	X
b. Tamangapa	X	X	X	O	O	O
c. Panakkukang (future intermediate treatment site)	X	O	O	O	X	X
d. Biringkanaya	X	O	O	X	X	X
e. Samata	X	X	X	X	X	O

Panakkukang branch office shall be established as soon as possible because of the rapid development of the residential area in Kecamatan Panakkukang. Also it is recommended to obtain an additional site of around 4 ha for a solid waste management facility that may be introduced in the future such as incineration plant or recycling plant.

Biringkanaya branch office will be established at the time PD Kebersihan is established. This is considered in the year 2005 because of the large population increase expected in that area after year 2005.

Dimensions of the facilities will be as follows.

	Unit	Panakkukang	Biringkanaya
Personnel (excluding workers in 2015)	Person	128	22
Vehicle	Unit	101	(50)
Site of branch office	m^2	5,800	3,000
Building	m^2	600	360
Parking	m^2	4,000	2,000

(2) Maintenance of collection vehicles and workshop

1) Maintenance of collection vehicles and other equipment

KMUP will have many collection vehicles and heavy equipment for operation of the disposal site. Proper maintenance of this equipment is required to ensure efficient utilization. The number of collection vehicles in 2005 and 2015 will be 136 units and 222 units respectively. To ensure driving safety and maximum operating economy, periodical inspection and maintenance should be performed according to the maintenance schedule. Maintenance work will be categorized into daily inspection, monthly inspection and 2 yearly inspection. Daily inspection will be done by drivers and operators themselves. Monthly inspection including every 3, 6, 12 month inspection shall be done at the workshop newly constructed in Tamangapa through IUIDP scheme. Contracting out to private workshop shall be considered for the every two years inspection.

a. Content of monthly inspection and maintenance
   - Oil and filter change
   - Inspection and adjustment of each part
   - Exchange of component assemblies
   - Fixing of flat tire and tire change
   - Welding and painting
   - Light repair
   - Car washing

b. Content of every two years inspection
   - Periodical maintenance work and repair instructed for once every two years
   - Check of chassis and other components

- Overhaul work

2) Workshop

Required number of bays is estimated based on number of collection vehicles necessary to conduct collection service in the years 2005 and 2015 as shown in the following table.

The workshop in Tamangapa has enough space to conduct monthly inspection of collection vehicles up to the year 2005. However, capacity of workshop will meet a shortage after 2005 because monthly inspection work will increase according to the number of collection vehicles. Therefore, it may be better to contract out some parts of the monthly inspection work to private workshops, as the number of collection vehicles varies depending on extent of coverage of private collection service to be introduced. Also, it may be better to contract out other maintenance works including every two years maintenance of collection vehicles and maintenance of heavy equipment to private workshops. It is recommended to use the workshop in Tamangapa in future even after the disposal site has been moved to Samata after year 2002. Necessary workshop staff will be 18 persons.

Required Number of Bays

	2005	2015	Existing	Remark
Number of collection vehicle	136	222		
Monthly inspection				
a. Maintenance bay	4	7	5	6 hour/unit
b. Repair bay	2	3	2	24% of vehicle
c. Tire bay	1	1	-	1.2 day/unit
Every 2 year inspection				
a. Maintenance bay	1	2	-	40 hour/unit
b. Chassis test bay	1	1	-	
c. Painting & welding	-	1	1	
Total	9	15	8	

6.5.7 Private sector and community participation

(1) Privatization of solid waste management

1) Contracting out of solid waste management activities

The following activities shall be considered for contracting out.

a. Collection service
b. Street sweeping and ditch cleansing
c. Operation of final disposal site
d. Operation of workshop

Concerning collection service, it is recommended to concentrate effort on prompting contract out in the old city up to 2005 (around 30% of collection services) considering some limitations of private companies as dsscribed in section 6.3.6. In the Future City in Kecamatan Panakkukang and at Permunas housing estates in Tamaranleya and Sudiyan, developers are collecting solid waste using dump trucks at present together with collection of solid waste charge. Development of these systems will contribute to future expansion of private companies participation. It is desirable that contracting out shall be further expanded in new housing area in the suburbs. It is expected that 50% of collection service will be contracted out by the year 2015.

One strategy to clean up a certain area is to contract out the area under the condition of payment by weight collected and transported using unit price agreed in the contract.

As there are no contractors in KMUP interested in this field at present, various contracting-out systems shall be considered to attract private companies. These shall include;

a. Equipment ownership and operation

b. Operation only

b. Rental of equipment and/or labor

Contracting out of only operation of collection service (providing equipment by KMUP) will be the first step to introduce the contracting out system.

2) Other possibility for private participation

To reduce solid waste amount generated through economic activity, the charge level of solid waste shall correspond to discharged solid waste

amount. Also the charge shall be sufficient to cover cost of solid waste collection and disposal. If this principal is fully adopted in solid waste management in KMUP, collection service for large dischargers such as hotels and markets will be the most profitable fields in solid waste management. Therefore, these fields have the potential to attract private company participation in the case where the public sector will not subsidize large dischargers. If the private sector collects waste from some sources of solid waste in KMUP, the work load of the public sector will decrease. Therefore, retribution fee shall be set considering the policy of encouraging private sector participation.

(2) Community participation

1) Community participation

Public participation is indispensable to realize a clean and healthy urban environment. Also it has an essential function in ensuring efficient solid waste management. To achieve the targets of this master plan, residents are requested to follow the instructions of, and cooperate with the cleansing authority. These instructions shall encompass and the cean-up activity in the community and related campaigns shall be well prepared and implemented and shall include cleanliness competitions.

a. Proper storage and discharge of solid waste
b. Clean-up activities of surrounding area
c. Recycling and volume reduction of solid waste
d. Primary collection by community
e. Cooperation for fee collection

2) Public campaign

To ensure the cooperation of the KMUP citizens, KMUP shall prepare campaign programs for:

a. Maintenance of cleanliness of the dwellings and surrounding area
b. Guidance and instruction in proper storage and discharge of solid waste
c. Anti-illegal dumping
d. Recycling and volume reduction of solid waste

6.6 Cost Estimation

(1) General

Based on the conditions of cost estimation described in Section 6.4.5, the total cost has been estimated for each year.

The financial program for 1995 has been set based on the urgent program to improve solid waste management in KMUP according to the Mayor's instruction and IUIDP program,. However, expansion of Tamangapa disposal site shall be added although some part is already incorporated in the program.

(2) Yearly cost

Investment cost and operation and maintenance cost are estimated based on the implementation program set in the following section 6.9. However, it is noted that the cost is estimated based on direct operation although contracting-out is considered in the program. This is because it will be necessary for KMUP to prepare the equipment although contracting-out of operation can be introduced, but only when the cost is less than direct operation.

Total investment cost and OM cost are estimated as Rp. 123 billion up to year 2005 when sanitary landfill system will be fully employed. However, this figure may be too large when compared with the financial capability of KMUP, and therefore semi-sanitary landfill system will continue to be employed for the first stage construction of Samata disposal site to reduce the amount. The total cost under this condition is estimated to be Rp. 105 billion up to the year 2005 as shown in *Table* 6.4.

6.7 Institutional Plan for Solid Waste Management Sector

6.7.1 Comprehension of the present situation

(1) Solid waste management institution

The present Dinas Kebersihan has been exerting efforts in collection and transport of solid waste, street sweeping, ditch cleaning and night-soil desludging, since it was organized based on the Perda 11/1987 of KMUP concerning the Formation of Organizational Structure and Working regulation. The number of personal is 836 persons in total as of 1994. The current situation shall be referred to Article 5.10.1 in the Supporting Report (the Sp/R).

(2) Examination from legal aspects

Among the legislation concerning the Study, the following regulations are most deeply related to Dinas Kebersihan.

a. Law No.5/1974 and the government regulation No.6/1988 regarding provincial/local autonomy.

b. Perda of KMUP Nos.11/1987, 3/1990 and 2/1994 particularly, Perda No.2/1994 stipulates the provisions of penalty and punishment about illegal waste disposal.

c. Law No.5/1960 on Agrarian Basic Law concerning land and Presidential Decree No.55/1993 concerning land for public purposes.

d. Decree of Minister of Home Affairs No.80/1994, specially regarding the guidelines for Dinas and inter-municipal procedures.

e. Regulation No.1/1983 of the Minister of Home Affairs regarding the Guidelines of Cooperation between local enterprises and third parties, as referred to the reference No. 2.2.9 affixed in the Sp/R.

f. Document of Cipta Karya (September 15, 1995) concerning The Improvement of Community and Participation, especially Forms of Private Participation (types of contracts), as referred to the Reference No. 2.2.10 in the Sp/R).

(3) Development of human resources

1) Personnel training and education

a. Water Supply and Environmental Sanitation Center, Bekasi, West Java Province under Cipta Karya PU: Seven trainees have been sent to the center from KMUP in 1986 through 1992, though no trainee was sent by Dinas Kebersihan. Refer to the Sp/R(P.2-15~17).

b. LIDAP (Local institutional action plan) and RIAP (Revenue improvement action plan) of IUIDP (a project of the World Bank) for South Sulawesi province: Some personnel participated in the courses. Refer to the Sp/R(p.2-15)

2) Public education on salubrious-living environment

a. Education based on the inherent virtue of the society: Gotong Royong (community self-help) and Musyawarah (deliberation): In some communities, the education is provided the citizens with based on the inherent means but in the other, it is observed insufficient

b. Education at levels of educational institutes: It is active in the university level but is not always so at the lower levels than that of the university.

c. Education in community levels: It varies pursuant to a community and rather depends on the leadership of Lurah (head of Kelurahan) not only for LKMD but also for RW and RT. In the same manner, the leadership of chiefs of RW and RT. is influential to their residents on amelioration of community awareness of their living-environmental sanitation.

(4) Primary collection affected by change of fee collection

In KMUP, the LKMD had been entitled to keep 40% of the collected fee for primary waste collection in order to operate the primary collection mainly by handcart till October, 1994 when the fee collection for solid waste was changed from door-to-door to combining with the fee collection for electricity.

Thus, the collected fee for the waste collection has been remitted to the municipality of KMUP and has been a part of the Municipal revenue. Therefore the LKMD remains unconnected with the retribution for the primary waste collection from the people.

Now the primary waste collection is being conducted by the people consequently in most Kelurahan operation of hand cart has ceased.

(5) Community participation

Description is made in Article 2.4.3 and 4.2.4 in this Part I report. Article 3.2 in the Sp/R describes roles of community and citizens' participation (p.2-18~22).

(6) Participation of private sectors (the PPS)

Elliptical elucidation is made here in Article 4.2.5. Article 3.3 describes the PPS. Particularly, the mention is made on the SWM sector, commencing with contracting-out, comprising the activity of PT Asindo and PT Gowa Makassar Tourism Development etc.

No example of this kind has ever found to date in KMUP. However a few discussions were held with private companies, but nothing resulted from them.

1) PT. Praga Nusantara

The company had operated a waste collection service in Balikpapan, in the form of Contracting-Out with the city, so Dinas Kebersihan approached it in 1989 for discussions on contracting-out of waste collection in KMUP. Provision of the vehicles and an excessive fee were required for the waste collection. Thus the discussion did not reach agreement. It is reported that the company went into bankruptcy on liquidation after only one year's operation in Balikpapan and now no longer exists.

2) PT. Asindo

The company constructed, as a housing developer, the so-called future city, Panakkukang Mas, in KMUP and is operating waste collection only inside that area. Although the Study team made an effect to encourage it to expand its waste collection activities to other areas in KMUP, its answer was a total refusal.

3) Examples of the PPS in the SWM in other cities

a. Jakarta

Dinas Kebersihan makes a contracting-out with private companies for a portion of street-sweeping and waste collection. Article 5.10.1 shows the detailed table "a Facet of Records in Dinas Kebersihan" including the activity sphere of private sectors in Jakarta.

b. Surabaya

Dinas Kebersihan is working in cooperation with private sectors. So it is reported that Dinas Kebersihan Surabaya does not necessarily change its legal status from the existing Dinas to PD. Brief explanation is made in Article 5.10.1 in connection with the Reference No.2.2.12.

40% approximately of street sweeping is covered by 24 private companies.
35% approximately of solid waste haulage is fulfilled by 5 private companies.
Collection of night soil is delt with only by private sector under the control of Dinas Kebersihan. People pay its collection fee direct to the collecting companies.

c. Bandung

No information is made on a contracting-out with private companies from PD Kebersihan which was established and reformed from Dinas in 1985 by implication of the Asian Development Bank (ADB) in its local as one in the circle of the Bandung Urban Development Projects (BUDP) based on the Perda No.2/1985.

d. Medan

Article 5.10.1 describes the up to-dated situations of PD Kebersihan, Medan. PD Kebersihan, Medan has been keeping the staff members more than 2,000 as clarified below since PD was established in 1989.
Cooperative of scavengers: the PPS covers 27 Kelurahan of 151 in Medan for the primary waste collection.

e. Padan

Reference is made to Article 5.10.1. As for the PPSs in the SWM, C.V. Golongan Olahraga can be taken up for example.

(7) Comparison among KMUP, Bandung and Medan

Refer to the comparative table in the Sp/R, Article 5.10.1. tabulating the contents by legal type, channel of waste collection, retribution, number of staff, population and waste collection ratio.

6.7.2 Alternatives of the solid waste management institution for the M/P in KMUP

(1) Alternative I: Modified (improved Dinas Kebersihan)

1) Amelioration of Dinas Kebersihan according to the decree of Minister of Home Affairs No.80/1994 as stipulated in the Reference 8 of the Sp/R.

In light of Part Five/Articles Nos.529 to 574 regarding Dinas Kebersihan, the following functions of the existing Dinas Kebersihan shall be examined again to improve efficiency and effectiveness in function extending to upgrade of its services.

a. Technical implementation unit of Dinas (UPTD)

No word is found like UPTD in the present structure of Dinas Kebersihan. (Articles 529(1)f., 546(1)i., 572(1) etc.)

b. Community participation

Article 537(3) stipulates the improvement of community participation to be performed by sub-section of monitoring and guidance. However no function of monitoring is found in the present sub-section of guidance as for community participation.

c. Public relation (PR)

PR is observed insufficient, though the existing personnel might carry out its activity. It is provided in Article 550(2) as one of the duties of the employee affairs.

d. Data collection

Article 551 defines the data collection and planning section and Article 552 stipulates its function in detail for carrying out the duty.

It is hard by known whether the existing program, research and supervision section has enoughly attained the data collection on the cleansing program implementation.

2) Improvement points of the existing Dinas Kebersihan

As explained before, the waste collection by handcart has been in abeyance unless it is conducted by the people or with the money positively paid by the people to handcart workers since initiating the new system of collecting the retribution fee at the PLN counters in October 1994.

Some countermeasures are required for it to avoid an inactive situation of the primary collection by:

a. Supplying handcart workers through the LKMD with a certain amount of fund from KMUP in stead of having stopped 40% of the LKMD collected money form the people for the primary collection.

b. Employing them for it as and honorarium worker of Dinas Kebersihan, and/or

c. Setting up a thorough fee collection system for it in the community level, that is, Kelurahan through out KMUP if possible, thought such a measure is considered impractical at the moment.

d. Strengthening of planning The action plans are not always observed strong and effectively implemented particularly in the fields of waste collection and purchase of articles including equipment. In short the operation and management is carried out ad hoc. Planning should be strengthened and once a plan is formulated it should be conducted according to its schedule exactly as originally mapped out without taking up any ad hoc manner.

e. Necessity of the clear demarcation between standardized job and emergent job

Although ail the personnel make their best efforts to their respective duties the attainment is observed not necessarily satisfactory because they are liable to cope with any tasks in the same manner and/or mixed-up ones for routine work and emergent one. This is prone to

decrease efficiency of the work. It is a advisable to make a perspicuous classification of the job in inner rules and to resolutely tackle a problem averting an occasional solution.

f. Up-grading of the personnel capability

To cope with the introduction of a sanitary land filling system and the stepwise conversion of primary waste collection from the handcart system to a mechanized one, it is unavoidable that enforceable devices should be necessary for breeding up the personnel. It is also desired to strengthen the capability of the personnel in charge of budgeting.

Alliterative I shall not be introduced to the M/P in 2015 and the F/S in 2005 for Dinas Kebersihan because of:

- A reformation from Dinas to PD has been a nation-wide trend in Indonesia.
- Definite intent of KMUP to set up PD Kebersihan

It testifies the clear intention of KMUP of establishing PD Kebersihan possibly soon that KMUP has already prepared the draft though the suggestion is made about a modified/improved Dinas Kebersihan as Alternative I.

It is advisable, however, to improve the present Dinas Kebersihan referring to the aforementioned points until the establishment of PD Kebersihan by 2005.

(2) Alternative II: Establishment of PD Kebersihan (without contracting out)

Of 1 to 6 technical alternatives, Alternative 1 was selected out and confirmed as that for the M/P and the F/S in this Study. In the Framework of the technical Alternative 1, an institutional plan shall be mapped out as follows.

1) Framework toward 2015

Preparation for the establishment of PD Kebersihan (Municipal cleaning public enterprise) starting in 1996.

a. To examine the present organizational structure and the respective duties/tasks for reorganizing it toward the establishment of PD Kebersihan by the year 2000.

b. To prepare Perda for the conversion of the present legal status from Dinas to PD through the necessary procedures. The new Perda for this conversion was already drafted in February 1995.

c. To transfer the night-soil collection activity to the wastewater management institution, either PDAM or a transitional unit (from a project unit to its merging with PDAM) before the establishment of PD Kebersihan.

d. To set up a joint operation of the new TPA in Gowa with Dinas Kebersihan, Gowa in 2002 onward, based on the MINASAMAUPA concept after the preparation for it with the Gowa municipality.

e. To align and expand activities of PD Kebersihan under the guidance of Cipta Karya PU as for the extension of facility construction and increment of equipment and vehicles and that of the Mayor of KMUP as for the management under the umbrella of Ministry of Home Affairs.

f. To promulgate Perda(s) as necessary according to the expansion of PD Kebersihan toward 2015 to realize 95% of waste collection in 2015.

2) PD Kebersinan in 2005

In the course of the framework toward 2015, PD Kebersihan shall concisely be shown in the organization chart to be referred to *Fig.* 2.2.33 in the Sp/R. The *Fig.* 2.2.33 shows the Organization chart and umber of personnel to be 1,508 in total; 1,079 of staff members and 429:of primary collection workers

3) Required personnel for the M/P in 2015 (without contracting-out in any domain)

PD Kebersihan requires 2,099 persons in total in the year 2015 as roughly broken down as follows.

a. Staff members; 1,670 persons

b. Primary collection workers 429 persons

The workers for primary waste collection are included in the required number of personnel in the Alternative II, even though their status is not

a staff member of PD Kebersihan but an honorarium worker under the control of the LKMD, Kelurahan, because of being a type of employees to achieve a thorough waste collection since an O/M cost for them is summed up for a trial case. The case is financially feasible as the O/M cost is negligible compared to the investment costs.

Required Personnel for the M/P in 2015

(1) Head office (Bontoala) 284 persons	(a) President room:	6 persons (President and others)
	(b) Supervision council:	5 persons (Council members)
	(c) Internal auditing:	19 persons (general Financial & Tech-operation Auditors)
	(d) Development & research:	9 persons (Research, Analysis, Monitoring)
	(e) General director & department:	245 persons (general directors and personnel of 4 departments)
(2) Branches (Total: 1,386 persons)		
(a) Branch 1 (Bontoala) 222 persons	a. Administration b. Collection/Ditch Cleansing c. Streets sweeping	29 persons 150 persons 43 persons
(b) Branch 2 (Tamangapa) 184 persons	a. Administration b. Workshop c. Depot No.1	24 persons 32 persons 128 persons
(c) Branch 3 (Panakkukang) 630 persons	a. Administration b. Depot No.2 c. Collection/Ditch Cleaning d. Street sweeping	82 persons 113 persons 333 persons 102 persons
(d) Branch 4 307 persons	a. Administration b. Collection/Ditch Cleaning c. Street sweeping	40 persons 219 persons 48 persons
(e) Branch 5 43 persons	a. Administration b. TPA (from 2002)	6 persons 37 persons

Organization chart of PD Kebersihan in 2015 is shown in to *Fig.* 6.14.

(3) Alternative III: Establishment of PD Kebersihan (with Contracting-out)

In light of the participation of private sectors (the PPS) in public service sectors, specially in the SWM, Alternative III shall be mapped out based on the Alternative II and/or as its modified alternative with contracting-out, because of the following two main reasons.

- Difficulty and inefficiency in management of an institution like PD. Kebersihan with such a number of personnel as exceeding 2,000 persons.

- Introduction of Participation of Private Sectors (PPS) in Solid Waste Management (SWM) to be examined for reducing the number of personnel designed necessary for the PD. Kebersihan in 2015 due to the fact that the PPS magement (SWM) to be examined for reducing the number of personnel designed necessary for the PD. Kebersihan in 2015 due to the fact that the PPS in public sectors is a national policy of the Republic of Indonesia.

1) The PPS at present

Refer to Article 4, 2, 5, etc. Refer to Articles 2.4, particularly (2), 3.3.

a. Legal Aspects

Especial attention shall be paid to such regulations regarding local Article 2.4.2 Especial attention shall be paid to such regulations regarding local autonomy as the laws No.5/ regulations regarding local autonomy as the laws No.5/1962.

2.2.3 Perda No.2/1994, revision of No.3/1990 concerning punishment.

2.2.4 Perda No. 3/1990, conceming execution of cleaning service(a)

b. Minutes of understanding (MOU)

With a view to setting up a tied connection with a private company, it is popular for the first step that the MOU shall be signed for a joint venture/work agreement by and between both the competent representatives of public and private sectors after they reach the mutual agreement on the joint venture/work. In principle, the MOU is legally in force for six months unless otherwise a special clause is stipulated and is able to be extended for the same duration upon a further mutual agreement of both the parties.

It is strongly advisable that the MOU had better be signed as above mentioned, strictly after an F/S is carried out for the said joint venture/work even though the parties would be in dire need of the joint business. Especially, the sort of the work like the SWM is for different by nature from those of portable water supply, toll roads, etc., needless to say telecommunication because of being not necessarily a profit-oriented sphere.

c. Perda for a joint venture/work

As aforementioned about the local autonomy, it is legislatively implementable for a local government and/or PD under the umbrella of the government to conclude any type of contracts with private firms providing that Perda for the works stipulated in the contract (s) would be issued by Mayor in case of KMUP through the municipal parliament and promulgated by Governor. As regards legal procedures, no difficulty is found but anxiety rests with viability of the work to be contracted.

Saying in a nutshell, a financial issue to presumably remain should be cleared up and solved beforehand to make both the parties advantageous and profitable. This is because the parties entail the F/S particular for the financial facet to avert "in red" of a consortium/joint venture business, loss and/or increment of budget on the side of the public sector, "not paying of" of the private company contracted with, unforeseable problems relating to the management and operation on both the sides, and so on.

2) Potential of local company's involvement (LCI)

According to Dinas Kebersihan, it is possible to make a contracting-out with a private sector for the waste collection in condition that the private company could prepare at least vehicles by itself at its risk and account. The idea is considered not practical for the private company because of being unattractive to it. Investment costs of facilities like vehicles should be borne by PD Kebersihan and then negotiations could start with the candidate company to create favorable conditions for it under the leadership of KMUP.

In response to the question about the potentiality, a majority of the officials concerned explained that the potential would exist in KMUP, even though no company had ever finalized any contracting-out engagement with Dinas Kebersihan. With a great anticipation as described above, the Study Team is sure to put the PPS, into consideration for the SWN, KMUP towards 2015.

3) Potential of foreign enterprise involvement (FEI)

Observing the present situations from the FEI point of view, it can scarcely be said possible that there exists potentiality of the FEI in the SWM in KMUP where the PPS, even if locally, in unforeseeable and pessimistic.

However, every possible effort has to be paid to take a clue to finding any potential of candidates for the FEI by hook or crook.

a. Necessity of governmental leadership

b. Leadership of the regional governments starting with the municipality is indispensably required for creating conditions by law enough to attract potential candidates of the FEI.

c. Incentive measures shall be considered many and various for example in terms of governmental regulations specially relating with a tax such as its mitigation and/or holiday for a certain period as regards investments, conclusion of contracting-out, profit of the investment and/or of a joint venture business, etc., and with procedures such as ratio of capital shares and profit as well, remittance of profit etc., as far as compatible with the existing laws/regulations in force.

4) Real actions of approach

It is practically the must to take an action for the approach to institutions regarded as potential candidates for any supports in any mode and fields.

a. Banks are in a position not only to make a direct investment convincing in the FEI but also to inform foreign investors of the FEI in the SWM through their overseas branches.

b. Local giant enterprises are likewise considered capable of bringing out similar conditions to those of banks attracting the FEI here should the terms and conditions be both by law and financially favorable for the FEI.

c. Persuasion has to be applied as one of real actions to the Chamber of Commence and Industry, associations such as the Information and Communication Forum (FIK), GAPENSI (National Business

Association of Indonesia and so on in order to help checking and/or finding ways to potential foreign candidates.

5) Selection of profitable forms and/or domains

To make it easy to attract foreign investors, Dinas or PD Kebersihan, KMUP along with the other municipal institutions such as Dinas Tata Kota, Pendapatan etc., as well as Bappeda Tk. II shall prepare before hand some profitable forms and/or spheres of the SWM for the investors to presumably direct toward the FEI.

For example, the SWM in the new TPA is left to a joint venture business with some payable terms and conditions based on BOT form for a certain period. Major waste collection and/or haulage only by vehicle are contracted out to a consortium in whole or limited districts in condition that the consortium can pay off.

6) The PPS in the SWM towards 2015 in KMUP

Implementable types of the PPS

a. Reference 2.2.10, the Document of Cipta Karya, September 15, 1995 Clarifies the PPS and particularly describes the forms of contract reading as follows.

a. Service Contract b. Management Contract c. Lease Contract
d. Concession Contract e. BOT (Build, Operate & Transfer)
f. BOO (Build, Operate & Own)

The detailed elucidation shall be referred to the Reference 2.2.10.

7) Contracts corresponding to the case of the SWM in KMUP

Of the aforemention 6 forms of private participation, the a, b, and c, will be considered suitable for the case. However, no one can tell now which type of contract among these 3 forms will be most suitable for the case of KMUP without knowing conditions of future candidate private companies and/or associations which do not yet exist and cannot be foreseen at present.

The form depends on conditions of the candidate institutions, starting with whether or not they will have their own equipment/facilities for their

work purposes, whether they intend to utilize the existing assets or facilities of local government/local public enterprises and on what kinds of terms and conditions whether they are prepared to bear costs of repairing and space ports for the equipment/facilities and whether they are in a position to make new investments for enlargement of their activities. Thus, the wording of "Contracting-Out" shall be used here as an implementable type of PPS for the SWM in KMUP.

8) Franchise system

The Contracting-Out should be expanded to the private sector by introduction of Franchise area by area (district by district) to cope with the growth of population, should there be candidate bodies having similar or the same terms and conditions for the work.

In any Contracting-Out, it would be better to keep the existing method of fee collection by combining it with the fee collection for electricity which commenced in April, 1994, even though the tariff would be revised, insofar as possible, to secure funds for the SWM activities in KMUP.

Refer to Article 6.3.6 in which the private collection with a monopoly is itemized as one of the three and falls on the franchise.

Reference 2.2.16 in the Sp/R. The document of US Environmental Protection Agency/1976 stipulates the franchises in detail.

Due to the reason of the above, the franchise shall be not appropriate for the case of KMUP for the time being.

9) Document of Cipta Karya, September 15, 1995

It classifies the following scope for the PPS in the SWM.

(a) Solid waste collection from sources
(b) Solid waste transportation from sources to transfer depot or TPA
(c) Solid waste treatment
(d) TPA (Final disposal)

10) SW collection from sources

The primary waste collection has been carried out by the private sector in other cities such as Jakarta, Surabaya, Medan etc., though it is not

always as a whole, while Bandung largely relies on community participation like RT/RW.

The private sector in any form like a private company and/or association shall manage the primary waste collection, at least, in the existing area, the so-called City Core Zone (referred to in *Fig.* 6.9). Thus a reduction of 429 workers will at least be possible.

11) Secondary waste collection and haulage to TPA

It is the secondary waste collection and transportation to the TPA that is considered to be the most suitable job item to be performed by the private sector in the light of the experience of other cities, for example, Surabaya (about 35% of solid waste haulage is carried out by 5 private companies) and Jakarta (about 850 persons are working in the private sector as tabulated in the Sp/R, Article 5.10).

12) Street sweeping

Following the example of Surabaya where 40% is covered by 24 private companies and of Jakarta where 2,299 persons work as sweepers in the private sectors, it is natural that KMUP should follow them provided that such candidate private companies would be set up and/or exist in the future.

13) Solid waste treatment

Incineration: Investment amount is big

Compost: It does not attract the private sector due to a low-added value product.

Recycling: In KMUP there are neither associations nor co-operatives like scavengers. Refer to the Sp/R.

14) TPA (Final disposal site)

It is theoretically possible to arrange Contracting-Out to the private sector provided that the tipping fees would cover cost of investment for heavy equipment, materials for sanitary land-filling, facilities like a leachate treatment plant etc., and the O/M. In the light of the cases of other cities

in Indonesia, the Study team does not think it practical that the management of TPA as a whole should be left to the private sector.

15) Probable districts of the PPS

The Contracting-Out of the secondary waste collection and haulage to the private sector is designed from the view point of the population growth and the existing SWM well-known areas.

Waste collection for all the population in the 6 Kecamatan (Old city) and the increase in population of the 5 Kecamatan (Other areas) shall be covered by Contracting-Out to the private sector.

In other words, the Contracting-Out shall cover the waste collection for 458,699 persons of the 6 Kecamatan (30.2% of the total population) in 2005, and 1,138,699 persons of the 6 Kecamatan and the increased population of the 5 Kecamatan (51.8% of the total population) in 2015. Eventually, the increment in the population, 645,468, will occupy 37.8% of 1,706,769 persons in the 5 Kecamatan in the year 2015.

16) Assumed number of personnel in/after 2005 toward 2015

a. Primary collection; The number of workers for primary waste collection from sources to TPA such as containers, etc. shall be reduced by 429 persons.

b. Reduction of equipment; 23 new armrolls shall be reduced from 65 units planned in 2005 by Contracting-Out and likewise 25 new dump trucks from 73 units planned. Thus, out of a total of 144, 48 drivers will be reduced (as referred to in *Table* 6.3) from the Depot No. 2 which is the parking place of the vehicle for Kecamatan(s) such as Mariso, Mamajang, Makassar, U Pandang, Wajo, Bontoala etc.

c. Branch 1 (Bontoala); By Contracting-Out the secondary collection in the old city areas, the collection workers at Branch 1 will not be necessary. Thus, 118 persons (or at least 77 persons should ditch cleaning be separated) will be reduced.

d. Head office, administration & supervision at branches; Considering the minimal number of personnel necessary for the head office and the tasks of administration and supervision including the job of

controlling and inspecting activities of the private companies/associations contracted out to, the reduction in number shall be made, in principle proportionally to the remaining and/or necessary number of personnel at the respective-working places.

With 859 persons, PD. Kebersihan will be able to attain 90% of the collection ratio of solid waste from the total population (1,520,000) by Contracting-Out for 30.2% of the population in KMUP providing that the Contracting-Out can be materialized.

(4) Additional alternative III of the institutional M/P in the year 2015

1) Primary collection ; 429 persons for primary waste collection from sources shall be reduced in calculation of personnel as aforementioned.

2) Reduction of equipment ; By Contracting-Out, 111 drivers will not be necessary because:

(a) 24 new compactors out of the 49 units planned will be operated by the private sector.

(b) 41 new armrolls out of the 83 units planned will be dealt with as above.

(c) 46 new dump trucks out of the 92 units planned will be dealt with as above.

Thus 64 drivers will be reduced from a total of 128 at Depot No.1 and 66 drivers will be reduced from a total of 113 at Depot No.2.

3) Inspectors

It is essential for PD. Kebersihan to inspect and sometimes supervise the current conditions and/or methods of secondary waste collection and haulage to the TPA.

Therefore some inspectors are considered indispensable, particularly at the branches 1, 3 and 4, because the waste collection and transportation to the TPA shall be also be conducted under the supervision of PD. Kabersihan.

4) Head office and administration & supervision at the branches

Introduction of Contracting-Out to the private sector shall lead to reduction in the number of personnel of PD. Kebersihan accordingly. In

principle, the number shall be reduced in proportion to the remaining and/or necessary number of personnel at the respective places of work.

5) Number of personnel in Alternative III for the M/P in 2015

976 persons shall be required for the SWM of PD. Kebersihan KMUP in the year 2015 in condition that Contracting-Out to the private sectors will be smoothly implemented in the domain of primary waste collection, and that the secondary waste collection and transportation to the TPA will be under the control of PD. Kebersihan. The Breakdown of the 976 personnel is as follows.

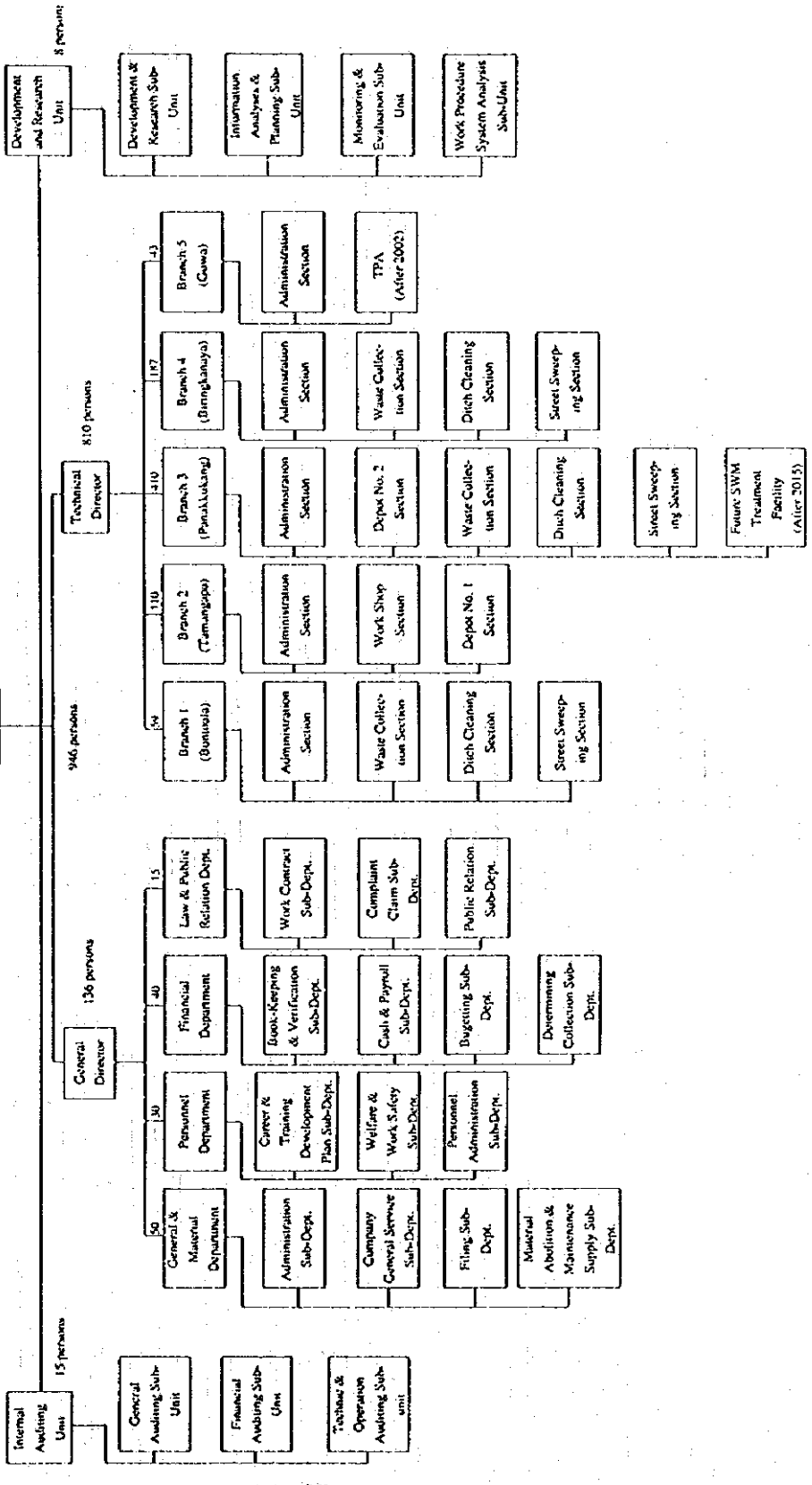
Required Personnel for the M/P in 2015

(1) Head office (Bontoala) 166 persons	(a) President room:	3 persons (President and others)
	(b) Supervision council:	3 persons (Council members)
	(c) Internal auditing:	15 persons (general Financial & Tach-operation Auditors)
	(d) Development & research:	8 persons (Research, Analysis, Monitoring)
	(e) General director & department :	137 persons (general directors and personal of 4 departments)
(2) Branches (Total: 810 persons)		
(a) Branch 1 (Bontoala) 59 persons	a. Administration b. Collection/Ditch Cleansing c. Streets sweeping	6 persons 10 persons 43 persons
(b) Branch 2 (Tamangapa) 110 persons	a. Administration b. Workshop c. Depot No.1	14 persons 32 persons 64 persons
(c) Branch 3 (Panakkukang) 410 persons	a. Administration b. Depot No.2 c. Collection/Ditch Cleaning d. Inspector e. Street sweeping	17 persons 47 persons 225 persons 19 persons 102 persons
(d) Branch 4 187 persons	a. Administration b. Collection/Ditch Cleaning c. Inspector d Street sweeping	10 persons 117 persons 12 persons 48 persons
(e) Branch 5 43 persons	a. Administration b. TPA (from 2002)	6 persons 37 persons

6) Organization Chart of Alternative III in 2015

The organizational structure of PD. Kebersihan (Alternative III) for the M/P in the year 2015 is shown below and is self-explanatory.

Organization Chart of PD Kebersihan, KMUP in 2015
(Alternative II)



6.8 Implementation Schedule

(1) Staging

The master plan period will be divided into two (2) phases and each phase will be further divided into two (2) 5-year period stages as follows (*Table* 6.5);

a. Phase I	Until year 2005	
	Stage I	Until year 2000
	Stage II	Year 2001 to 2005
b. Phase II	Year 2006 to year 2015	
	Stage III	Year 2006 to 2010
	Stage IV	Year 2011 to 2015

(2) Phase I period

As KMUP is implementing an important improvement program at present, this program shall be continued at the beginning of Phase I as an urgent program together with expansion of Tamangapa disposal site.

a. Continuation of existing improvement plan
   - Introduction and expansion of hauled container system
   - Introduction and expansion of night shift collection
   - Introduction of new fee collection system
   - Pilot project for small incineration and composting

b. Expansion of Tamangapa disposal site
   - Expansion of Tamangapa disposal site as semi-sanitary landfill site

In addition to the above urgent program, expansion of collection service, expansion of Tamangapa disposal site and construction of Samata disposal site are major projects up to 2005. To achieve these targets, improvement in collection service efficiency is also required. Step by step increase of tariff is also necessary to cover operation cost of solid waste management together with upgrading of the management capability of Dinas Kebersihan. Therefore, project components up to 2005 will be summarized as follows:

c. Expansion of collection service
   - Providing collection service to 85% of population (1,080,000 persons) up to 2000
   - Providing collection service to 90% of population (1,368,000 persons) up to 2005

- Procurement of collection vehicles and container necessary for above
- Campaign for proper discharge to use adequate container, etc.
- Procurement of necessary equipment for operation

d. Construction of Samata disposal site, Zone I
   - Construction of Samata disposal site, Zone I
   - Procurement of Heavy equipment

e. Construction of branch offices
   - Construction of Panakkukang branch office and depot
   - Construction of Biringkanaya branch office

f. Establishment of new organization
   - Establishment of PD Kebersihan
   - Establishment of organization for inter-municipal disposal site

g. Others
   - Periodical revision of tariff levels for fee collection
   - Study and research on recycling and reduction of solid waste
   - Introduction of contracting out system in old city area (around 30% of collection service)

(3) Phase II period

Expansion of collection service remains the main issue because of rapid increase of population. Concerning intermediate treatment and disposal, Samata disposal site, Zone II shall be constructed during phase II. If economic growth is high, introduction of incinerator shall be considered. Projects in this phase consists of:

a. Expansion of collection service
   - Expansion of collection service to 1,740,000 persons up to 2010
   - Expansion of collection service to 95% up to 2015
   - Introduction of compactor truck
   - Procurement of collection vehicle and container

b. Construction of Samata disposal site, Zone II
   - Construction of Samata disposal site as sanitary landfill site
   - Procurement of heavy equipment for operation

c. Others
   - Periodical revision of tariff of fee collection
   - Study and research on recycling and reduction of solid waste
   - Expansion of contracting out system in suburban Kechamatan (around 50% of total population)

6.9 Fee Collection

(1) New fee system introduced in 1994

Under the new fee system introduced in 1994 it is planned to collect around Rp. 1.7 billion as shown in the following table. More than 90% of that amount will be borne by residents and boarding houses.

New Fee Collection System Introduced in 1994

Category	Quantity	Ave. price (Rp/year)	Amount (Mill. Rp.)	Share (%)
Public facilities	2,025	0	0	0
Residential houses	132,080	8,030	1,060	62.5
Boarding houses	6,915	72,760	503	29.7
Hotels	75	108,400	8	0.5
Restaurant	421	220,600	93	5.5
Meeting hall	809	37,660	30	1.8
Total	142,325		1,694	100.0

(2) Future tariff

1) Policy of future tariff

As PD Kebersihan will be established before 2005, its financial base shall be established at the same time. Future tariff and income through fee collection are estimated based on the following conditions.

Under the new system of fee collection, 70% of operation and maintenance cost excluding depreciation will be covered. Therefore the following principals to set tariff level of domestic and commercial waste have been assumed.

i) Domestic waste
- In year 2000 operation and maintenance excluding depreciation shall be covered
- In year 2005 all cost excluding depreciation cost of disposal site shall be covered
- In year 2010 all cost shall be covered.

ii) Commercial cost
- In year 2000 all cost excluding depreciation cost of disposal site shall be covered.

- In year 2005 all cost shall be covered

Tipping charge at disposal site shall be set at a level to cover all cost of disposal.

2) Tariff of solid waste management

Based on the cost estimation of this master plan and above policy, tariff of solid waste management will be as follows.

Future Tariff of Solid Waste Amount

Year	Domestic		Commercial	Industry
	Rp/ton	Rp/cap/year	Rp/ton	Rp/ton
1995		1,310		
2000	18,670	2,840	27,880	12,420
2005	27,880	3,720	38,080	12,420
2010	38,080	5,450	38,080	14,450
2015	38,080	5,912	38,080	14,450

Amount to be collected is estimated as follows.

Estimated Fee Collection (unit : Rp. billion)

Period	Domestic	Commercial	Total	Industry
1995 - 2000	12.8	4.3	17.1	2.4
2001 - 2005	21.2	9.7	31.0	2.6
2006 - 2010	39.6	16.0	55.6	3.7
2011 - 2015	58.0	22.8	80.8	4.8
Total	131.7 (71.4%)	52.8 (28.6%)	184.4 (100%)	13.5

As the total cost of solid waste management will be Rp. 237 billion up to 2015, the above figure represents 77% of the total cost. Therefore, the remaining 23% shall be subsidized by the government including KMUP.

Also it is noted that repayment of interest, that will be necessary in the case of using loan, is not included in the above cost.

6.10 Priority Project

An urgent program to improve solid waste management is under implementation in accordance with the Mayor's instructions.

As a result of these efforts the old Kecamatan of KMUP are becoming rapidly cleaner. Also the Study Team has been informed that collected retribution fee amount in November (charge for October) was in line with the expected amount.

On the other hand, it is noted that there are some problems as follows:

i) Disposal amount in November is 270 ton/day that is less than 60% of estimated waste amount generated in KMUP. And it is almost the same amount as that collected at the beginning of 1994.

ii) Complaints are heard specially in the areas that are not served, in suburban Kecamatan and slums.

KMUP are primarily recommended to actively continue their efforts according to their plan. The expansion of service area is an urgent issue not only in old Kecamatan surrounding area but also in the suburban Kecamatan. In addition to this, expansion of Tamangapa disposal site has become an urgent need because of the limited capacity of solid waste disposal. These shall be carried out through local funds because they are pressing issues that cannot await the long process associated with introduction of new external fund.

Up to the year 2005, important projects concerning solid waste management according to the implementation schedule are as follows;

a. Further expansion of collection service through procurement and renewal of collection equipment and introduction of more efficient collection system
b. Expansion of Tamangapa disposal site
c. Construction of Samata disposal site in Zone I
d. Construction of branch office
e. Institutional reorganization to PD Kebersihan
f. Proper tariff system

The above five (5) projects are selected as the project components of the feasibility study based on this Master Plan of solid waste management.

Table 6.1 Condition of Existing & Potential Site of Final Disposal (TPA)

Description	Existing Site of TPA (Extention)			Potential Site for TPA		
	KMUP	GOWA	MAROS	KMUP	GOWA	MAROS
1 Location Kecamatan / Kelurahan :	Panakkukang Tamangapa	Sombaopu Desa Mawang	Mandai Bonto Mate'ne	Biringkanaya Bulurokeng	Sombaopu Desa Samata	Maros Baru Palisi
2 Disposal Land Area (Ha)	5.0 Ha	1.5 Ha	1.0 Ha	--	--	--
3 Required Land for 10 years (h = 10 m)	38 Ha	50 Ha	50 Ha	43 Ha	50 Ha	50 Ha
4 Distance from UP City Cente	14 Km	17 Km	30 Km	17 Km	17 Km	26 Km
6 Avarage Time for Transport (30 Km/hour)	28 Minutes	34 Minutes	60 Minutes	34 Minutes	34 Minutes	52 Minutes
7 Soil Condition	Clay Soil	Clay Soil	Clay Soil	Bed Rock Sand	Clay Soil	Clay Soil
8 Land Price	Rp.13,000/m2	Rp.4,000/m2	Rp.6,000/m2	Rp.15,500/m2	Rp.5,000/m2	Rp.6,000/m2
9 Land Use of Prospect Site	--	--	--	Rice Field Vacant	Vacant	Rice Field
10 Land Use of Surroundings	Residential Rice Field	Vacant	Vacant	Fish Pond	Rice Field	Rice Field
11 Land Productivity	Rice Field : 1 time/year	No-product	No-product	Rice Field Fish Pond	Rice Field : 1 time/year	Rice Field : 1 time/year
12 Toll Fee	None	None	Rp.300/mobil	Rp.300/mobil	None	Rp.300/mobil
Land Status of Surrounding	Private	Private	Munici.(100ha	Private	Private	Partly Private
13 Land Status of Site	Municipal	Municipal	Municipal	Private	Private	Partly Private
14 Topografic Condition	Hill & Flat	Flat	Flat	Flat	Hill & Flat	Flat
15 Distance from UP Boundary	2.0 Km	8.0 Km	9.0 Km	4.6 Km	1.2 Km	5.3 Km
16 Access from Main Road	0.2 Km	0.1 Km	1.3 Km	1.0 Km	1.5 Km	2.0 Km
17 Condition of Access Road	Asphalt Paved	(Soil) Not-Paved	(Soil) Not-Paved	(Gravel) Not-Paved	(Soil) Not-Paved	(Gravel) Not-Paved
18 Distance to Residential	0.2 Km	0.2 Km	1.5 Km	0.3 Km	0.2 Km	0.3 Km
19 View from Surounding Area	Partly Hidden	Hidden	Hidden	Hidden	Hidden	Partly Hidden
20 Natural Drainage Condition	Rainy Season : Flood	Normal	Normal	Rainy Season : Flood	Rainy Season : Partly Flood	Rainy Season : Flood
21 Depth of Ground Water		--		10 m	--	
22 Covering Soil	Available	Not-Available	Available	Not- Available	Available	Not-Available
23 Distance to close River	2.8 Km	1.0 Km	3.5 Km	0.4 Km	3.5 Km	2.5 Km
(measured from the edge) 24 Distance to Airport	> 3 Km	> 3 km	2.5 Km	> 3 Km	> 3 Km	2.2 Km
25 Dumping System	Controll Landfi	Open Dumping	Semi-Controll	--	--	--
Remarks	Interfere with Perumnas Extension Plan	Lake"Danau Mawang" located 0.4 Km north	Newly Planed for TPA		Two School located near the site	High-Tension wire exist

Table 6.2 Financial Comparison of each Alternatives

Financial Comparison	Unit	In 1993	In 2005	In 2015						
				Alt-1	Alt-2	Alt-3	Alt-4	Alt-5	Alt-6	Without
Population	1,000peseon	1,020	1,520	2200	2200	2200	2200	2200	2200	2200
Investment cost	Rp. million		30,547	85446	96427	87006	128339	317466	105490	79494
Operation and maintenance cost										
Depreciation	Rp. million		2,652	7,327	8,258	7,420	8,839	15,118	7,737	7,993
Personnel	Rp. million		1,616	2,132	2,397	2,178	2,162	2,357	2,202	3,160
Fuel and maintenance	Rp. million		2,161	3,858	4,331	3,880	5,077	4,097	4,076	4,612
Others	Rp. million		222	488	362	455	500	1,225	627	531
Total	Rp. million	4,558	6,651	13,805	15,348	13,933	16,578	22,797	14,642	16,296
(Total except depreciation)	Rp. million		3,999	6,478	7,090	6,513	7,739	7,679	6,905	8,303
Unit cost	Rp./ton		23,452	26,283	29,221	26,527	31,563	43,403	27,877	31,026
Unit cost except depreciation	Rp./ton		14,101	12,334	13,499	12,400	14,734	14,620	13,146	15,808
Investment cost per capita	Rp./capita		20,097	38,839	43,830	39,548	58,336	144,303	47,950	36,134
OM cost per capita	Rp./capita	4,469	4,376	6,275	6,976	6,333	7,535	10,362	6,655	7,407
Financial source										
Subsidy (Depreciation portion)	Rp. million	4,161	2,652	7,327	8,258	7,420	8,839	15,118	7,737	7,993
Fee collection	Rp. million	397	3,999	6,478	7,090	6,513	7,739	7,679	6,905	8,303
Fee per capita	Rp./capita	389	2,631	2,945	3,223	2,960	3,518	3,490	3,139	3,774
GRDP and cost										
GRDP Case A increase 6%	Rp. billion	1,171	2,356	4,220	4,220	4,220	4,220	4,220	4,220	4,220
Investment cost/GRDP	%		1.30%	2.02%	2.29%	2.06%	3.04%	7.52%	2.50%	1.88%
OM cost/GRDP	%	0.39%	0.28%	0.33%	0.36%	0.33%	0.39%	0.54%	0.35%	0.39%
GRDP Case B increase 8%	Rp. billion	1,171	2,949	6,366	6,366	6,366	6,366	6,366	6,366	6,366
Investment cost/GRDP	%		1.04%	1.34%	1.51%	1.37%	2.02%	4.99%	1.66%	1.25%
OM cost/GRDP	%	0.39%	0.23%	0.22%	0.24%	0.22%	0.26%	0.36%	0.23%	0.26%
Cost saving from without case										
OM cost	Rp. million			2,491	948	2,363	-282	-6,501	1,654	0
OM cost except depreciation	Rp. million			1,825	1,213	1,790	564	624	1,398	0
Unit cost	Rp./ton			4,743	1,805	4,499	-537	-12,377	3,149	0
Unit cost except depreciation	Rp./ton			3,475	2,309	3,408	1,074	1,188	2,662	0

Table 6.3 Primary & Secondary Collection and Transport Equipment and Person

EQUIP./PERSONNEL	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1. VEHICLES Tot. Veh.	105	111	116	119	122	127	131	134	136	138	138	151	165	172	183	191	197	201	209	212	224
1) Old Armrolls	9	9	9	9	9	9	9														
2) Old Rino DT	20	20	20																		
3) Old Flat Rino	11	11	11	11	11	11															
4) Old Covered	7	7	7	7	7	7															
5) Old Kijang/Isuzu	5	5	5																		
6) Plan Armroll	6	6	6	6	6	6	6														
7) Plan Dump Truck	20	20	20	20	20	20	20	20													
8) New Compactor												9	19	24	30	34	36	38	41	41	49
9) New Armroll	19	25	29	33	37	41	44	62	64	65	65	67	69	70	72	74	76	78	79	81	83
10) New Dump Truck	8	8	8	33	33	33	52	52	72	73	73	75	77	78	81	83	84	86	88	90	92
11) Handcarts	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429
12) Containers	241	282	315	342	367	400	418	441	455	463	541	555	572	580	601	615	634	680	690	700	709
2. PERSONNEL Tot.	825	839	850	857	863	873	884	890	893	900	900	951	1,000	1,027	1,070	1,098	1,115	1,132	1,158	1,169	1,212
1) Supervisors	26	27	27	27	28	28	28	28	29	29	29	30	30	31	32	32	33	33	33	34	34
2) Drivers	111	117	122	125	128	133	137	140	142	144	144	157	171	178	189	197	203	207	215	218	230
3) Workers	260	266	272	276	278	283	290	293	293	298	298	335	370	389	419	439	451	463	481	488	519
4) Handcart Workers	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429

Table 6.4 Cost of Solid Waste Management (1)

Spec.	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Sub total
Investment cost												
a. Collection	2,014	746	772	1,271	1,314	1,926	1,451	1,632	1,216	1121	2,156	15,619
b. Street sweeping	62	20	69	66	215	217	65	217	44	69	210	1,254
c. Ditch cleansing		114	114								114	342
e. Disposal												
Tamangapa	2,339	2,339			2,542							7,219
Gowa						7,961	7,961					15,922
Equipment	0	1,450	0	0	0	0	0	360	0	1,450	0	3,260
Sub total	2,339	3,789	0	0	2,542	7,961	7,961	360	0	1,450	0	26,401
f. Office												
Kampong Borong		1,000										1,000
Billing Kanaya											580	580
Total	4,415	5,669	955	1,337	4,071	10,104	9,477	2,209	1,260	2,640	3,060	45,196
g. Land aquistion												
Disposal site	1,950				1,300	3,250						6,500
Branch office		116									45	161
h. Administration	88	113	19	27	81	202	190	44	25	53	61	904
i. Engineering service	530	680	115	160	489	1,212	1,137	265	151	317	367	5,424
j. Physical contingency	441	567	96	134	407	1,010	948	221	126	264	306	4,520
Grand total	7,424	7,145	1,184	1,658	6,348	15,779	11,751	2,739	1,562	3,274	3,839	62,704

Operation and Maintenance	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Sub total
Personnel	1,664	1,690	1,712	1,730	1,716	1,719	1,723	1,726	1,730	1,737	1,717	18,861
Collection	870	886	898	906	913	924	937	943	947	954	954	10,132
Ditch cleansing	139	139	139	139	139	139	139	139	139	139	139	1,529
Street sweeping	231	241	251	261	240	232	223	218	218	218	198	2,531
Final disposal	35	35	35	35	35	35	35	37	37	37	37	390
Others	389	389	389	389	389	389	389	389	389	389	389	4,279
Fuel	845	1,007	1,105	1,190	1,282	1,398	1,482	1,600	1,664	1,727	1,850	15,150
Collection	765	924	1,020	1,105	1,185	1,288	1,372	1,456	1,520	1,585	1,696	13,916
Ditch cleansing	11	14	16	16	16	16	16	16	16	14	14	165
Street sweeping	0	0	0	0	12	25	25	37	37	37	49	222
Final disposal	69	69	69	69	69	69	69	91	91	91	91	847
Others												0
Maintenance	402	427	445	455	471	491	503	536	541	541	550	5,358
Collection	307	323	335	344	352	364	375	382	386	392	392	3,952
Ditch cleansing	5	11	17	17	17	17	17	17	17	11	11	157
Street sweeping	17	20	20	21	29	37	38	46	47	47	56	378
Final disposal	73	73	73	73	73	73	73	91	91	91	91	871
Others												0

Operation and Maintenance	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Sub total
Others	285	298	311	322	332	343	355	377	388	398	411	3,821
Collection	48	55	59	63	67	71	75	79	81	84	89	771
Ditch cleansing	15	15	16	16	16	16	16	16	16	15	15	172
Street sweeping	12	12	13	13	13	13	13	13	13	13	13	141
Final disposal	93	99	106	113	119	126	134	152	161	169	177	1,450
Others	117	117	117	117	117	117	117	117	117	117	117	1,287
Depreciation	1,923	2,086	2,227	2,340	2,465	2,611	2,727	2,954	3,053	3,135	3,320	28,842
Collection	1,071	1,158	1,229	1,284	1,333	1,403	1,451	1,496	1,524	1,548	1,642	15,139
Ditch cleansing	14	28	42	42	42	42	42	42	42	28	28	392
Street sweeping	42	49	50	52	73	94	95	116	117	119	140	947
Final disposal	796	851	906	962	1,017	1,072	1,139	1,300	1,370	1,440	1,510	12,364
Others												0
Total												0
Collection	3,061	3,346	3,541	3,702	3,850	4,050	4,210	4,356	4,458	4,563	4,773	43,910
Ditch cleansing	184	207	230	230	230	230	230	230	230	207	207	2,415
Street sweeping	302	322	334	347	367	401	394	430	432	434	456	4,219
Final disposal	1,065	1,126	1,188	1,250	1,312	1,374	1,449	1,671	1,750	1,828	1,907	15,922
Others	506	506	506	506	506	506	506	506	506	506	506	5,566
Total	5,118	5,507	5,799	6,035	6,265	6,561	6,789	7,193	7,376	7,538	7,849	72,032
(Exclude depreciation)	3,195	3,422	3,572	3,696	3,800	3,950	4,062	4,239	4,323	4,403	4,528	43,190

Table 6.4 Cost of Solid Waste Management (2)

Spec.	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Sub total	Total
Investment cost												
a. Collection	2,757	2,068	2,330	3,392	3,734	2,418	1,963	2,578	3,408	3,317	27,965	43,584
b. Street sweeping	85	236	214	85	237	91	215	223	112	210	1,708	2,962
c. Ditch cleansing								114			114	456
d. Disposal												
Tamangapa											0	7,219
Gowa					12,100	12,100					24,200	40,122
Equipment	360	140	0	80	720	0	1,450	0	500	140	3,390	6,650
Sub total	360	140	0	80	12,820	12,100	1,450	0	500	140	27,590	53,991
f. Office												
Kampong Borong											0	1,000
Billing Kanaya											0	580
Total	3,202	2,444	2,544	3,557	16,791	14,609	3,628	2,915	4,020	3,667	57,377	102,573
g. Land aquistion												
Disposal site				2,800							2,800	9,300
Branch office											0	161
h. Administration	64	49	51	71	336	292	73	58	80	73	1,148	2,051
i. Engineering service	384	293	305	427	2,015	1,753	435	350	482	440	6,885	12,309
j. Physical contingency	320	244	254	356	1,679	1,461	363	292	402	367	5,738	10,257
Grand total	3,970	3,031	3,155	7,211	20,821	18,115	4,499	3,615	4,985	4,547	73,947	136,652

Operation and Maintenance	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Sub total	Total
Personnel	1,865	1,921	1,950	2,001	2,035	2,062	2,086	2,115	2,130	2,170	20,335	39,196
Collection	1,010	1,063	1,091	1,138	1,169	1,188	1,206	1,234	1,246	1,293	11,638	21,770
Ditch cleansing	139	139	139	139	139	139	139	139	139	139	1,390	2,919
Street sweeping	201	203	204	206	206	214	220	221	223	216	2,114	4,645
Final disposal	40	41	41	43	46	46	46	46	47	47	443	833
Others	475	475	475	475	475	475	475	475	475	475	4,750	9,029
Fuel	1,875	2,020	2,079	2,206	2,302	2,371	2,436	2,510	2,576	2,705	23,080	38,230
Collection	1,698	1,839	1,898	2,013	2,087	2,156	2,221	2,295	2,356	2,467	21,030	34,946
Ditch cleansing	14	14	14	14	14	14	14	14	14	14	140	305
Street sweeping	49	49	49	49	49	49	49	49	49	67	508	730
Final disposal	114	118	118	130	152	152	152	152	157	157	1,402	2,249
Others											0	0
Maintenance	658	760	810	894	960	986	1,010	1,050	1,063	1,155	9,342	14,700
Collection	482	576	626	691	739	761	788	827	833	917	7,243	11,195
Ditch cleansing	11	11	11	11	11	11	11	11	11	11	110	267
Street sweeping	56	57	57	57	57	58	58	59	59	67	585	963
Final disposal	109	116	116	135	153	153	153	153	160	160	1,404	2,275
Others											0	0

Operation and Maintenance	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Sub total	Total
Others	456	477	492	515	535	551	567	584	601	619	5,397	9,217
Collection	91	99	102	109	113	116	120	124	127	133	1,134	1,905
Ditch cleansing	15	15	15	15	15	15	15	15	15	15	150	322
Street sweeping	13	13	13	13	13	13	13	14	14	14	133	274
Final disposal	194	207	219	235	251	264	276	288	302	314	2,550	3,999
Others	143	143	143	143	143	143	143	143	143	143	1,430	2,717
Depreciation	3,667	3,999	4,214	4,522	4,783	4,964	6,646	6,919	7,141	7,524	54,378	83,219
Collection	1,845	2,058	2,170	2,333	2,451	2,528	2,635	2,730	2,758	2,942	24,450	39,589
Ditch cleansing	28	28	28	28	28	28	28	28	28	28	280	672
Street sweeping	141	142	143	143	144	145	146	147	148	169	1,468	2,415
Final disposal	1,653	1,771	1,873	2,018	2,160	2,263	3,837	4,014	4,207	4,385	28,180	40,543
Others											0	0
Total											0	0
Collection	5,126	5,635	5,887	6,284	6,559	6,752	6,970	7,210	7,320	7,752	65,495	109,405
Ditch cleansing	207	207	207	207	207	207	207	207	207	207	2,070	4,485
Street sweeping	460	464	466	468	469	479	486	490	493	533	4,808	9,027
Final disposal	2,108	2,252	2,367	2,561	2,762	2,877	4,463	4,653	4,872	5,062	33,978	49,899
Others	618	618	618	618	618	618	618	618	618	618	6,180	11,746
Total	8,519	9,176	9,545	10,138	10,615	10,933	12,744	13,178	13,510	14,172	112,531	184,562
(Exclude depreciation)	4,853	5,178	5,331	5,616	5,832	5,969	6,099	6,259	6,369	6,648	58,153	101,343

Table 6.5 Implementation Schedule of Solid Waste Management

		Phase I		Phase II
	1995-2000	2001-2005	2006-2010	2011-1015
Collection	a. Continuation of existing improvement plan - Hauled container system - Night shift collection b. Expansion of collection service to 85% - Procurement of collection vehicle and container - Introduction of new discharge method - Improvement of TPS	a. Expansion of collection service to 90% - Procurement of collection vehicle and container - Improvement of TPS - Expansion of new discharge method	a. Expansion of collection service to 93% - Procurement of collection vehicle and container - Introduction of compactor truck - Improvement of TPS	a. Expansion of collection service to 95% - Procurement of collection vehicle and container
Intermediate treatment	a. Pilot project for small incineration plan and composting			(a. Introduction of incineration plant if economically possible)
Final disposal	a. Expansion of Tamangapa disposal site - Construction - Procurement of equipment b. Start of construction of Desa Samata Disposal site (c. Improvement of KIMA)	a. Construction of Desa Samata disposal site and operation	a. Operation of Desa Samata disposal site - Procurement of heavy equipment	a. Expansion of Desa Samata disposal site
Street sweeping and ditch cleansing	a. Procurement of equipment b. Procurement of equipment		a. Procurement of mechanical sweeper	
Privatization and other activity	a. Preparation of privatization a. Study and research	a. Introduction of contract out (Old city area, 30% of collection) b. Construction of branch office	a. Expansion of contract out to new housing estate (40%)	a. Expansion of contract out (50% of collection)
Organization	a. Preparation for establishment of PD Kebersihan b. Preparation for inter-municipal operation of disposal site	a. Establishment of PD Kebersihan b. Establishment of Inter-municipal operation of disposal site		
Fee collection	a. Introduction of new fee collection system b. Introduction of new tariff for commercial waste	a. Revise of tariff	a. Revise of tariff	a. Revise of tariff
Campaign	a. Campaign for proper discharge	a. Campaign for proper discharge	a. Campaign for proper discharge	a. Campaign for proper discharge

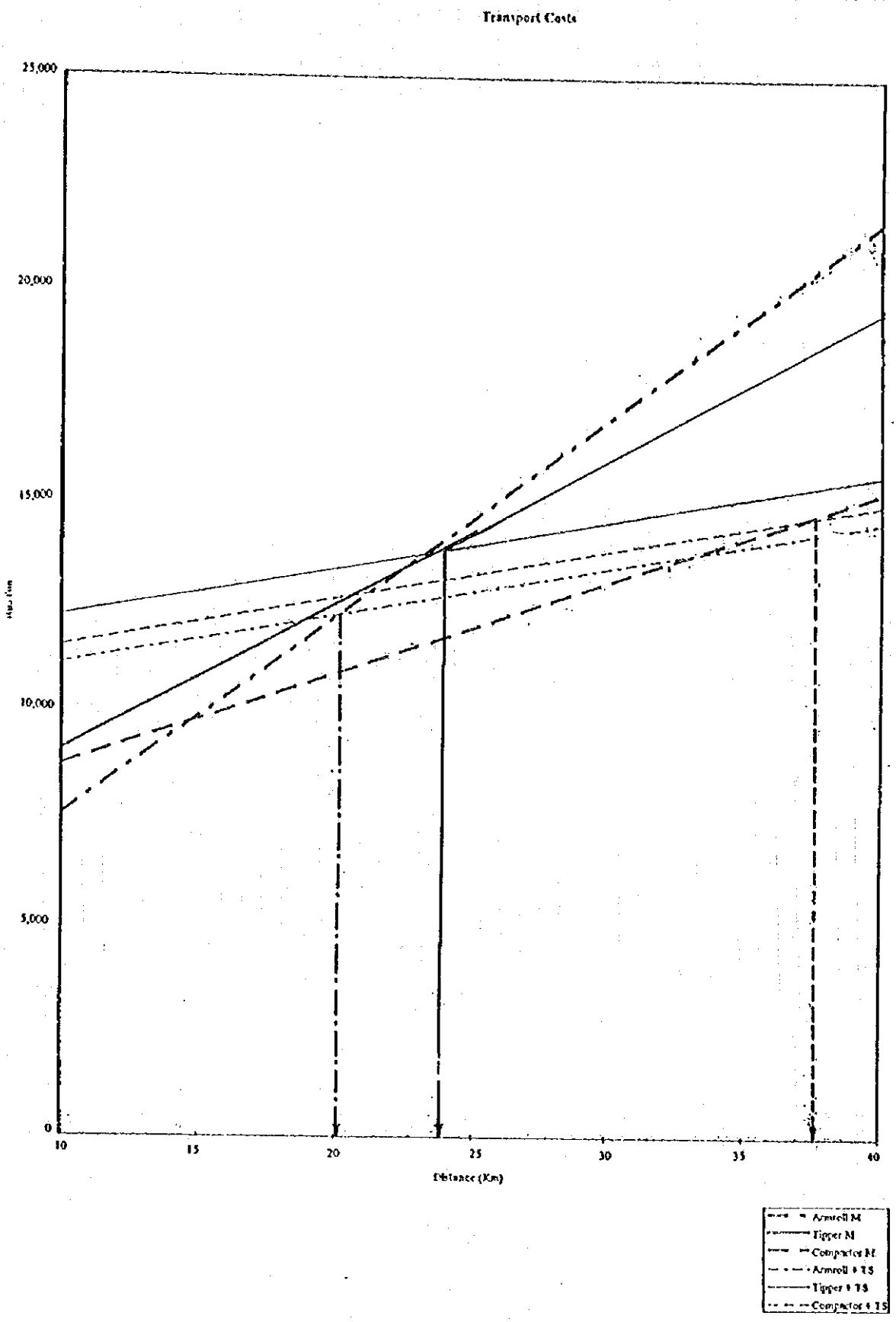


FIG. 6.1 Study on Direct Haul and Transfer Station Necessity

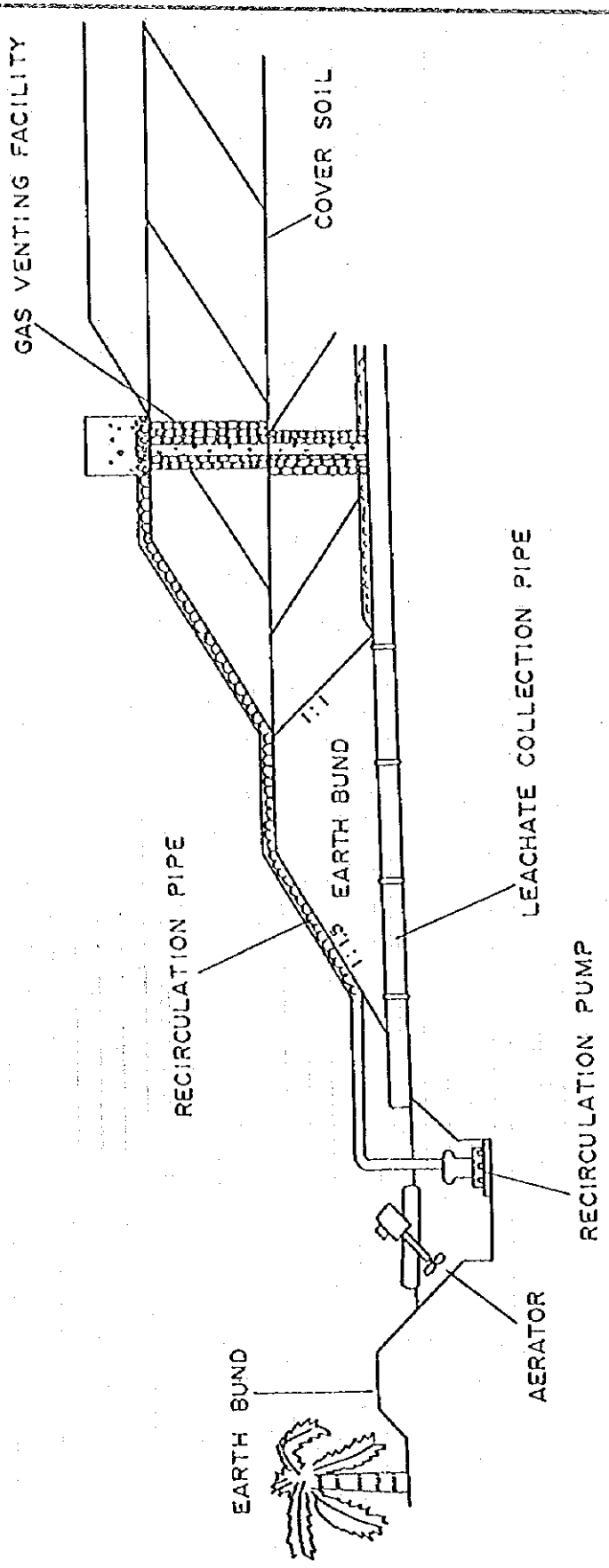


FIG. 6.2 Recirculatory semi-aerobic landfill system

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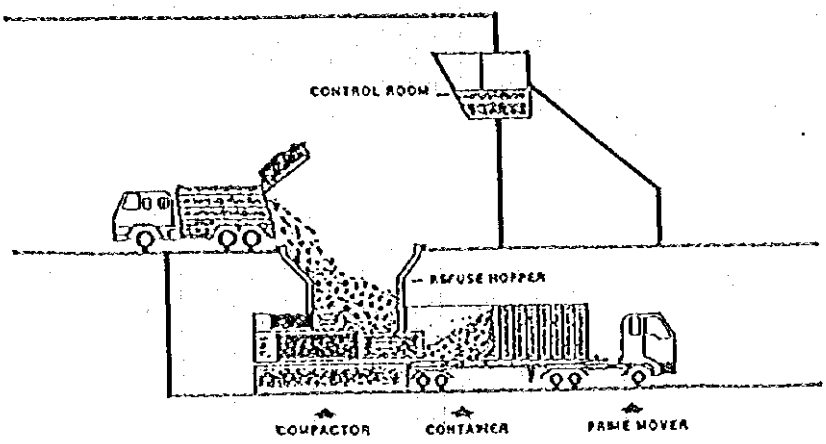

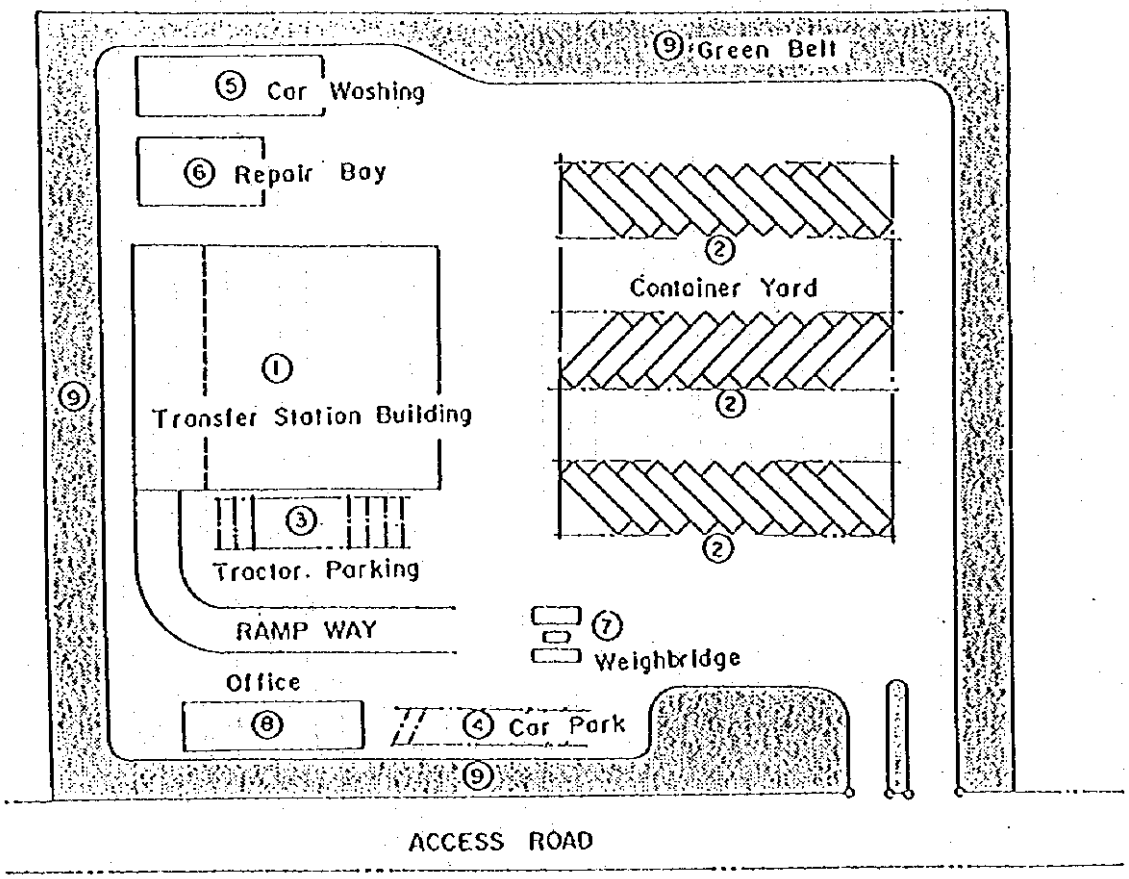

FIG. 6.3	Model layout of transfer station

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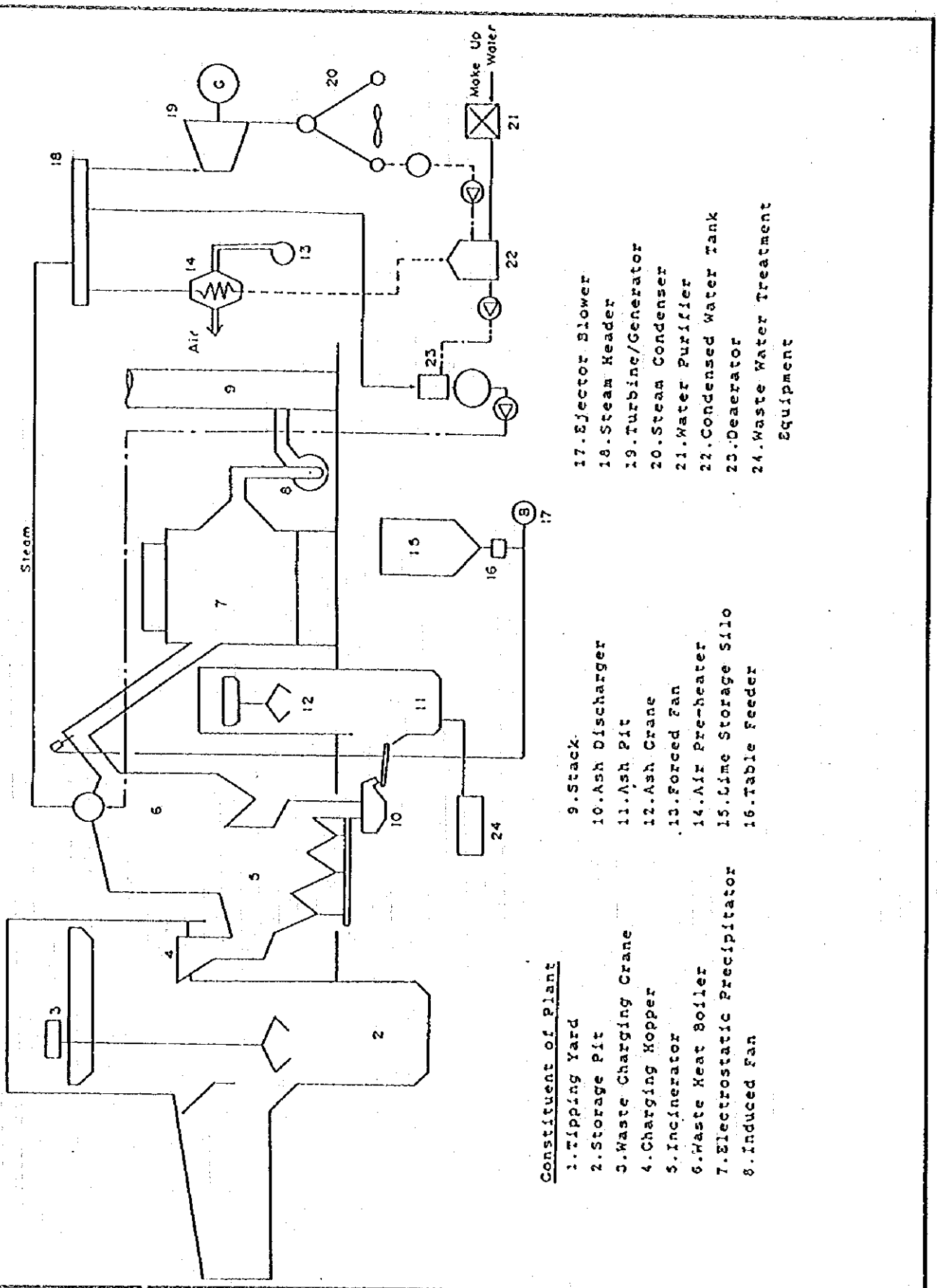

FIG. 6.4 Schematic flow diagram of incineration plant

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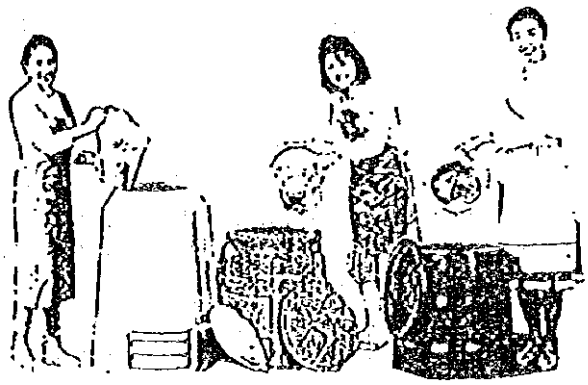
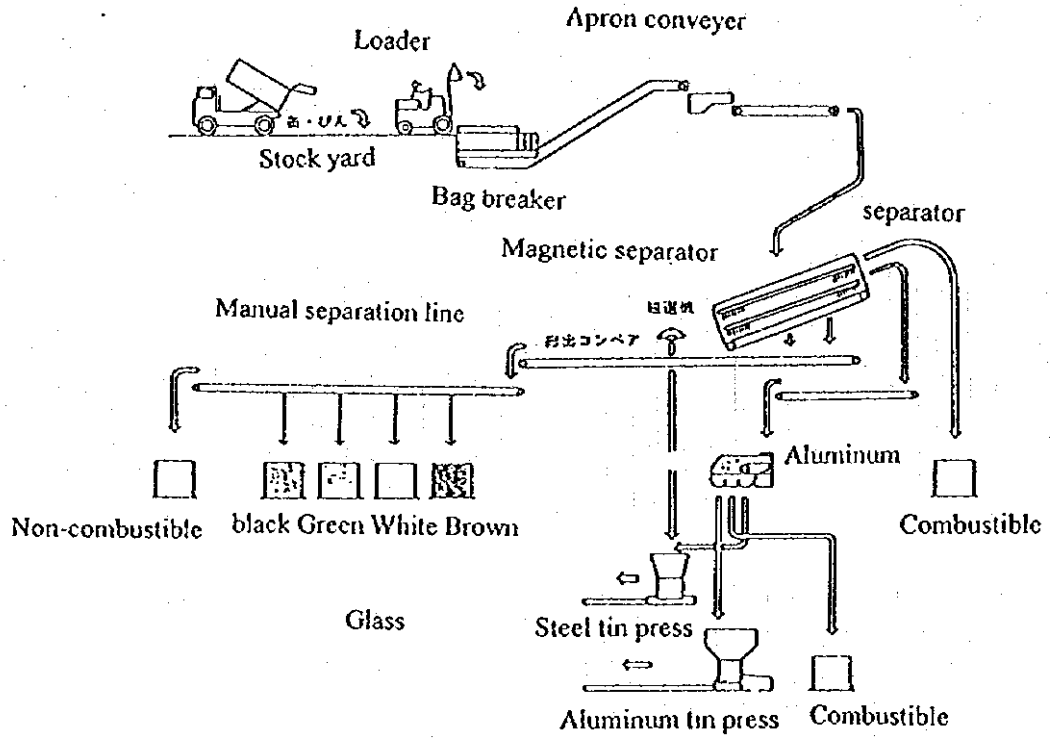
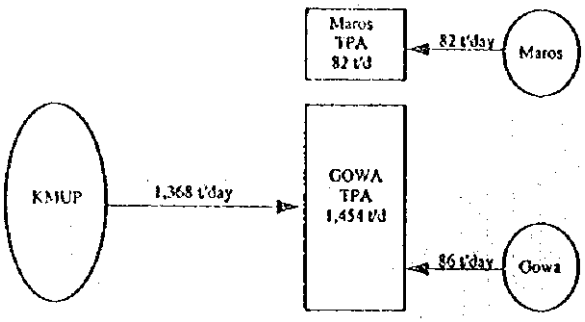


Composting device for household

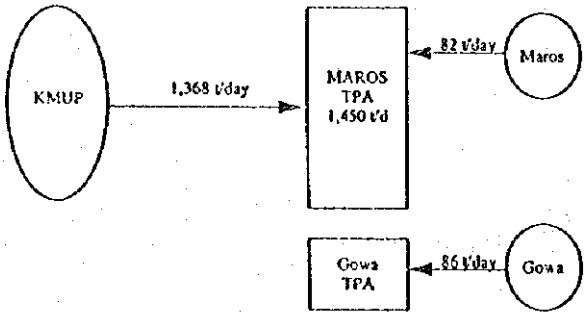


System flow of reusable material separation in Yokohama city

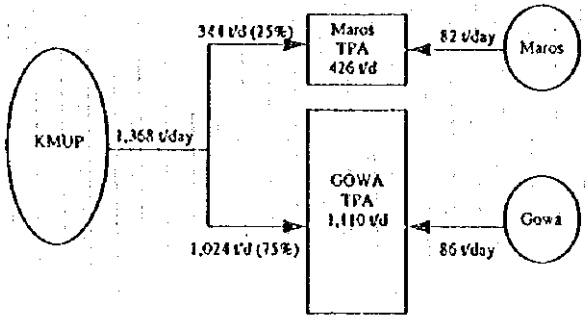
FIG. 6.5	Composting and recycling example



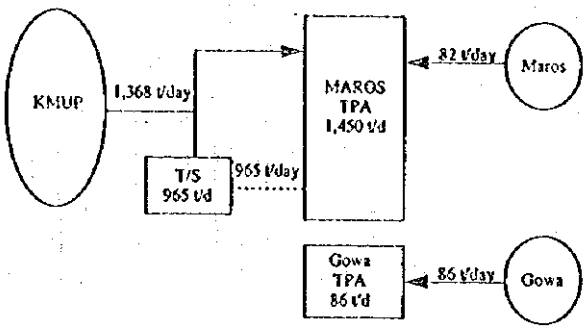
Alternative 1 - GOWA Disposal Site



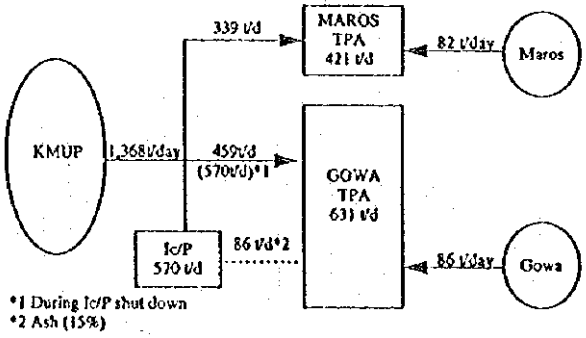
Alternative 2 - MAROS Disposal Site



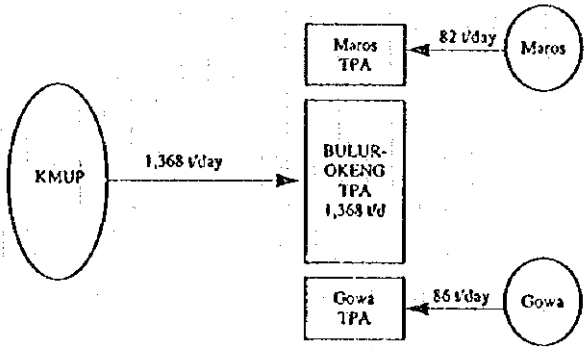
Alternative 3 - GOWA and MAROS Disposal Site



Alternative 4 - T/S and MAROS Disposal Site



Alternative 5 - I/P and GOWA & MAROS Disposal Sites



Alternative 6 - BULUROKENG Disposal Site

FIG. 6.6 SWM Alternatives in 2015

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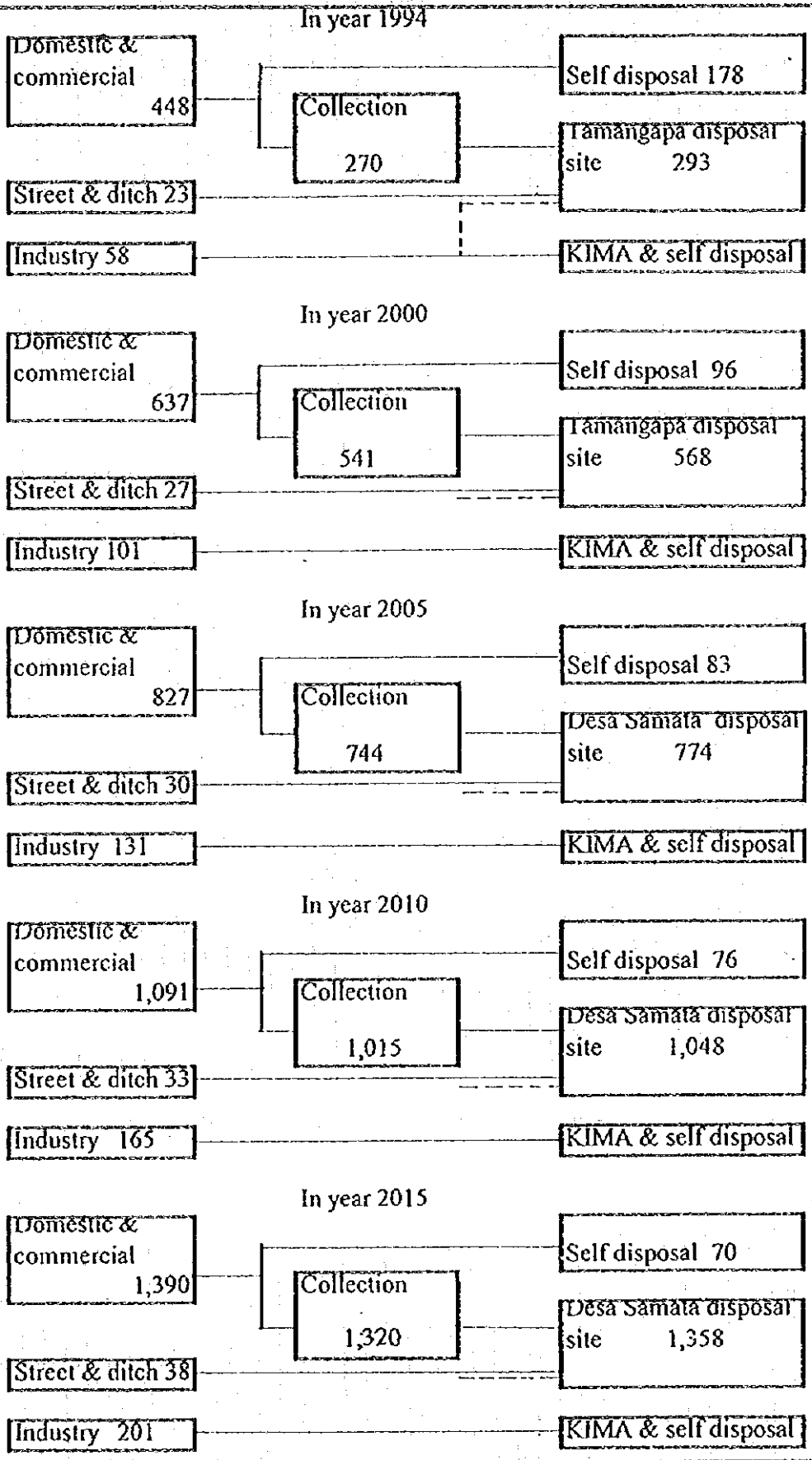

FIG. 6.7 Solid Waster Flow

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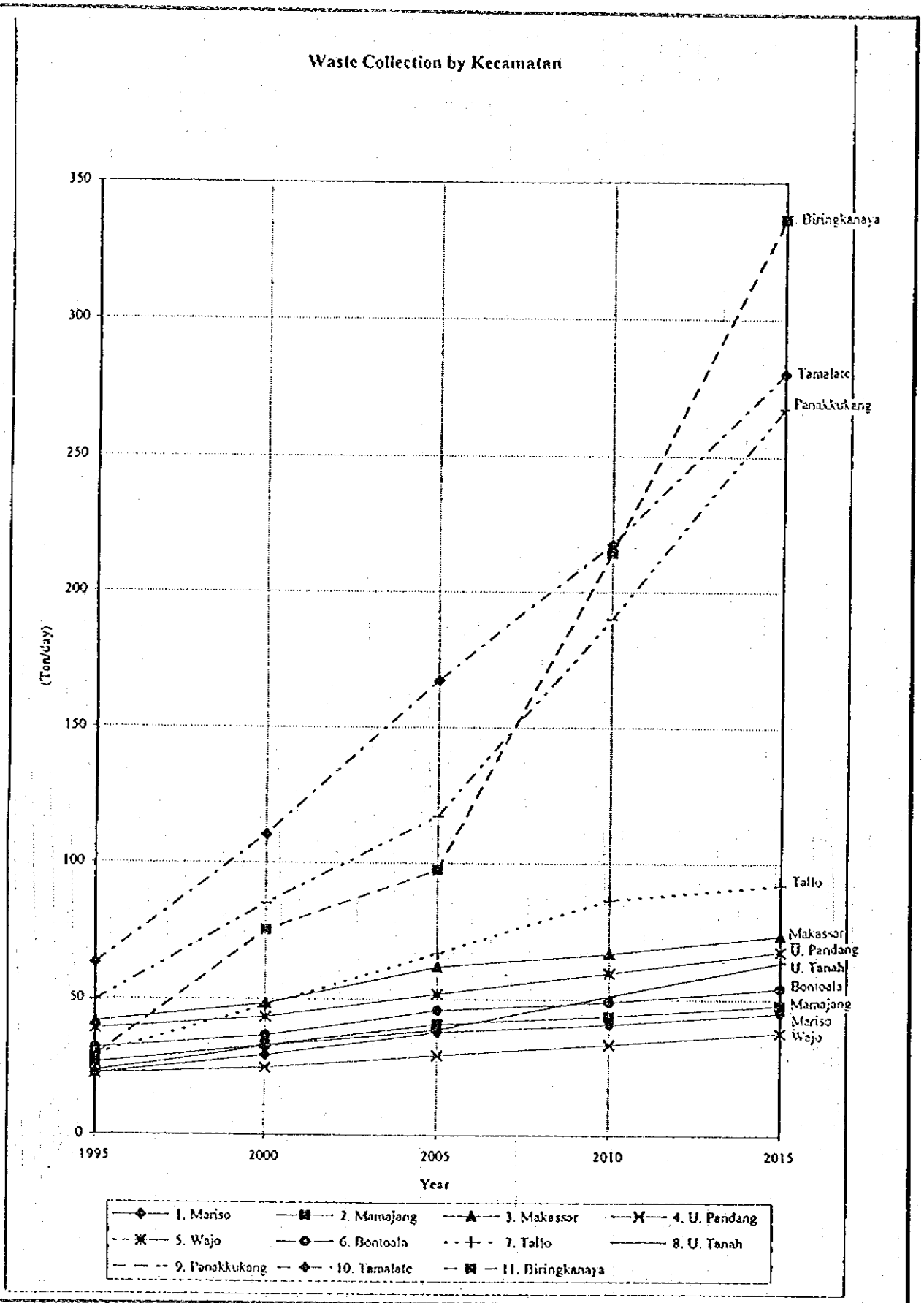

FIG. 6.8 Daily Waste Collection by Kecamatan

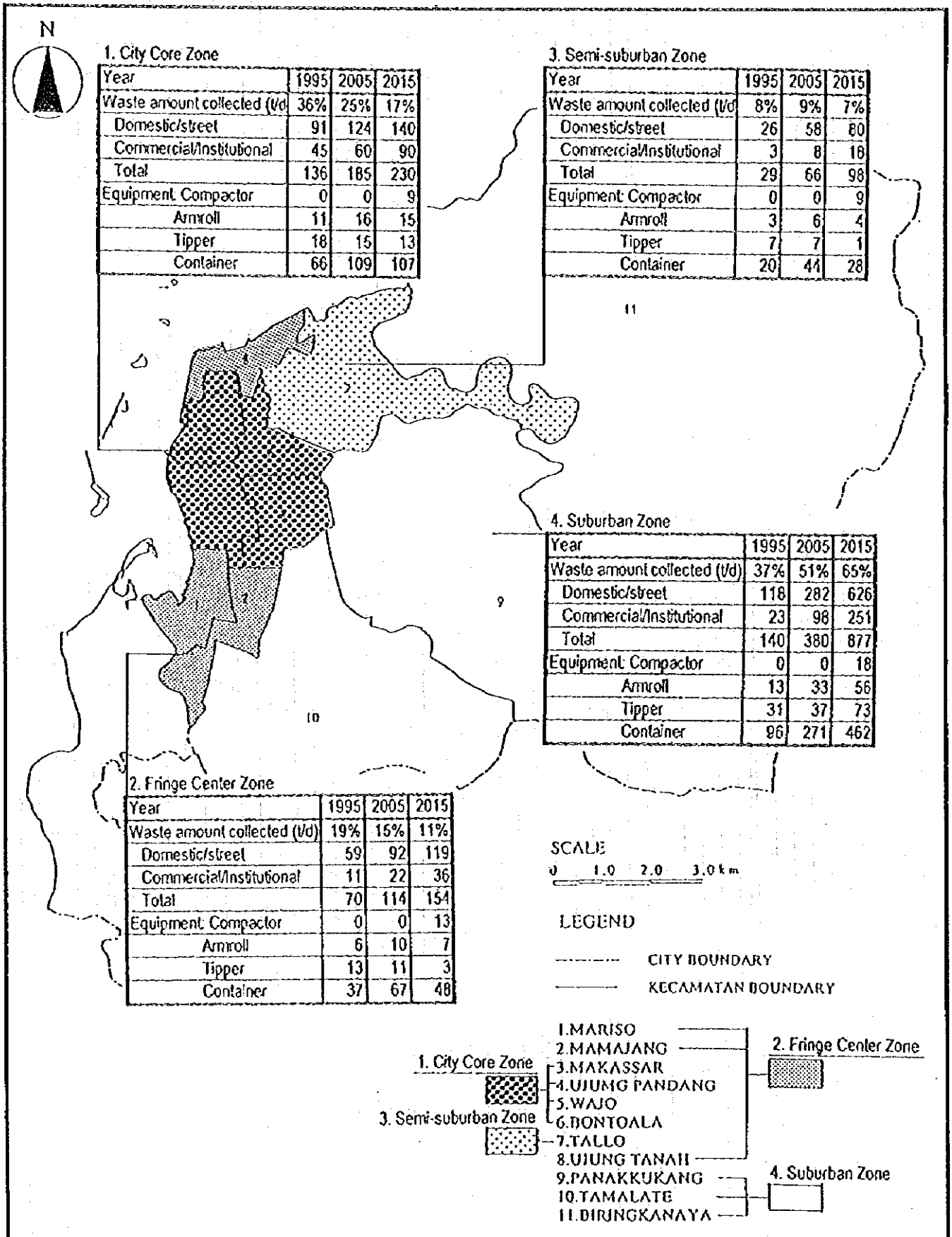

FIG. 6.9 Waste Collection and Equipment Requirement by Zone

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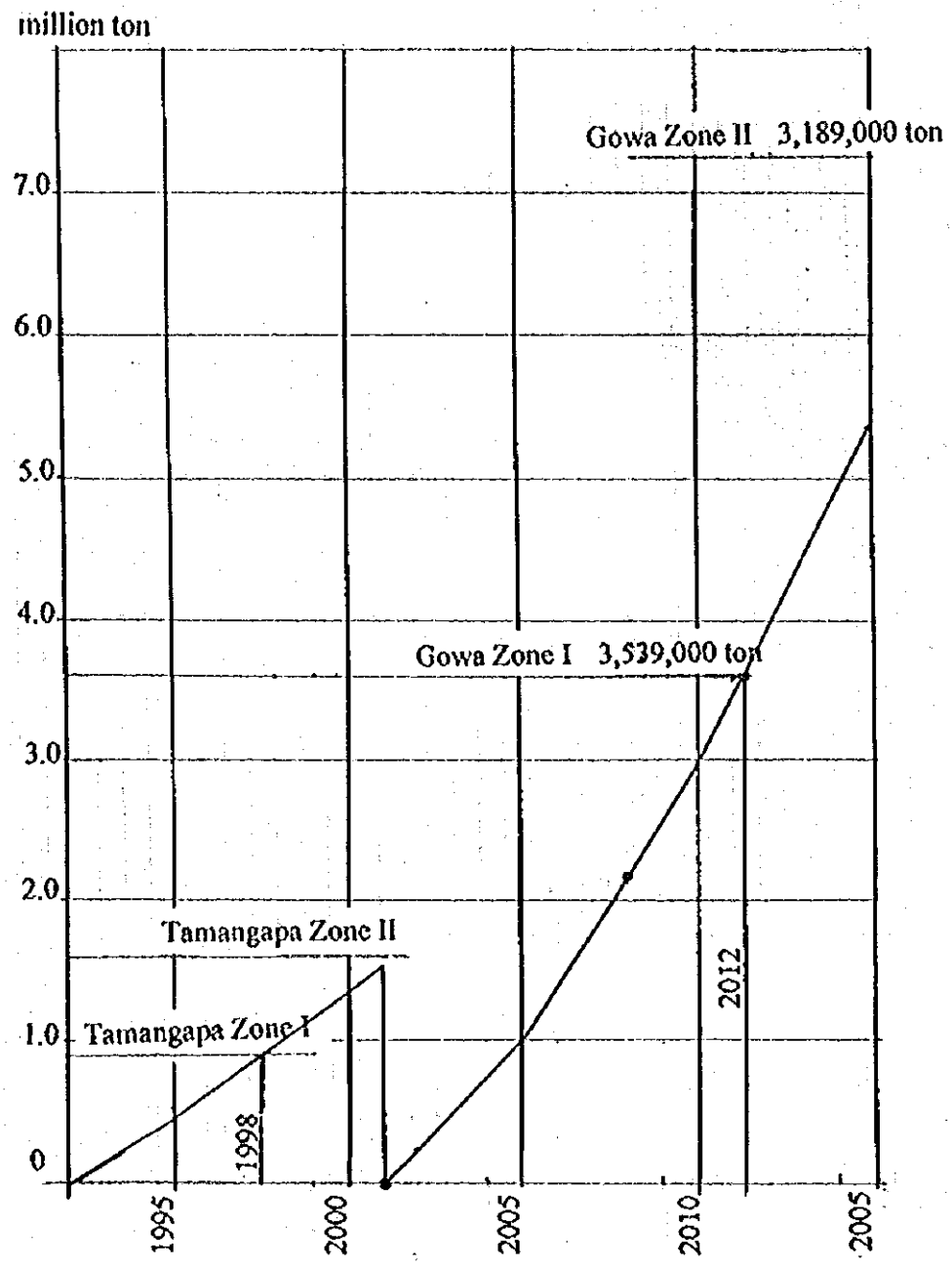

FIG. 6.10 Schedule of Final Disposal

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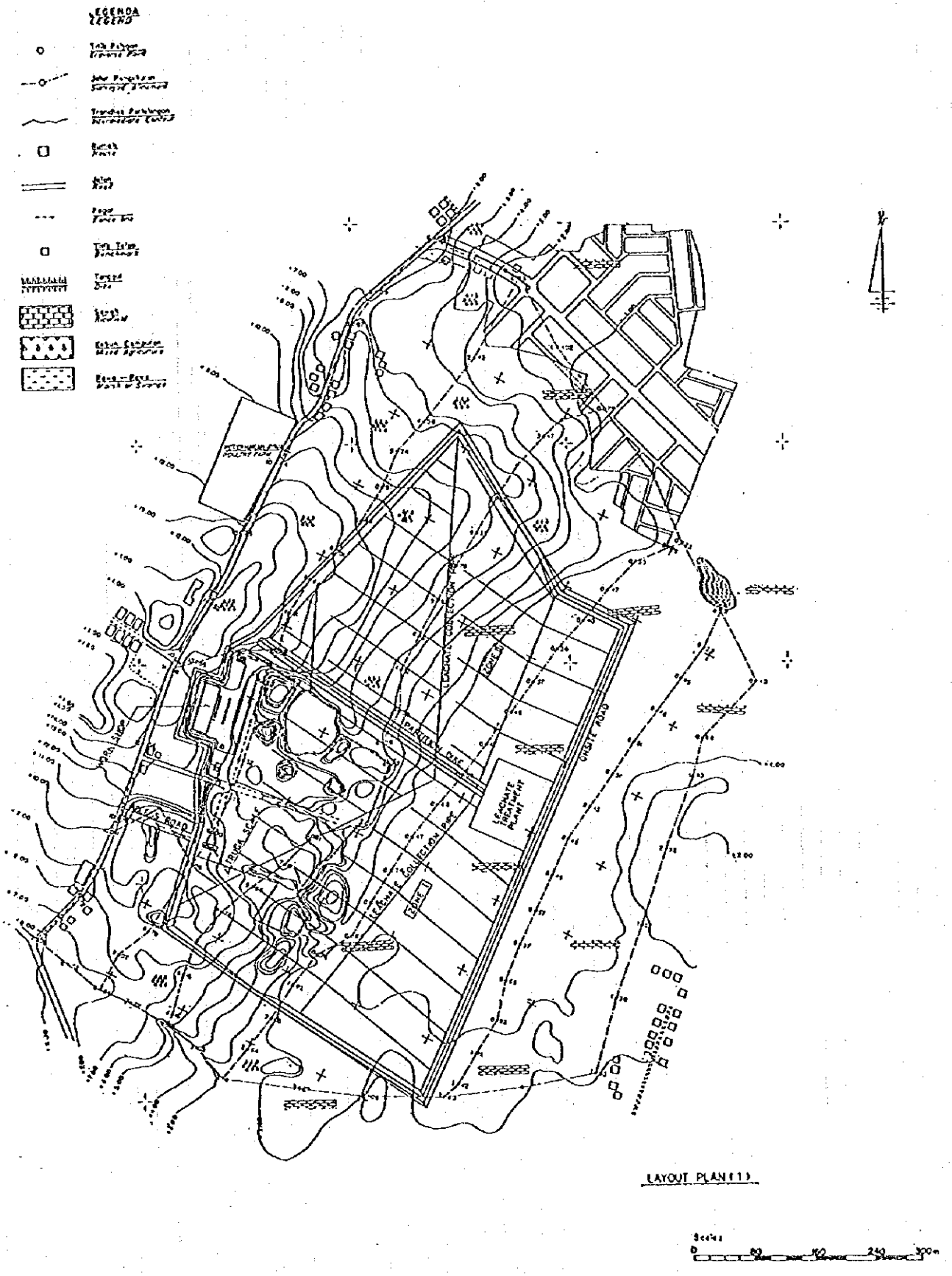

FIG. 6.11	Layout Plan of Tamangapa Disposal Site

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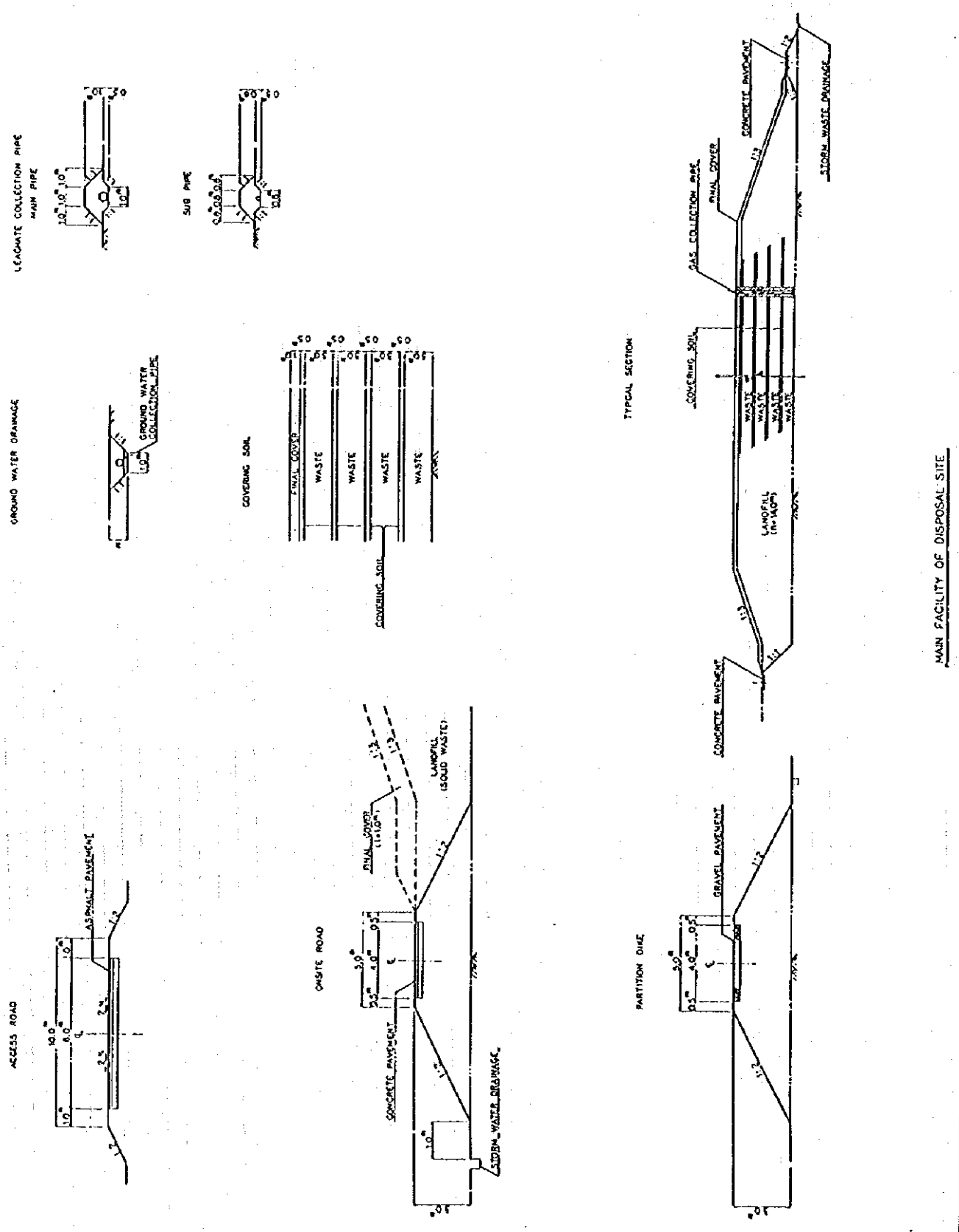

FIG. 6.12 Typical Facilities of Tamangapa Disposal Site

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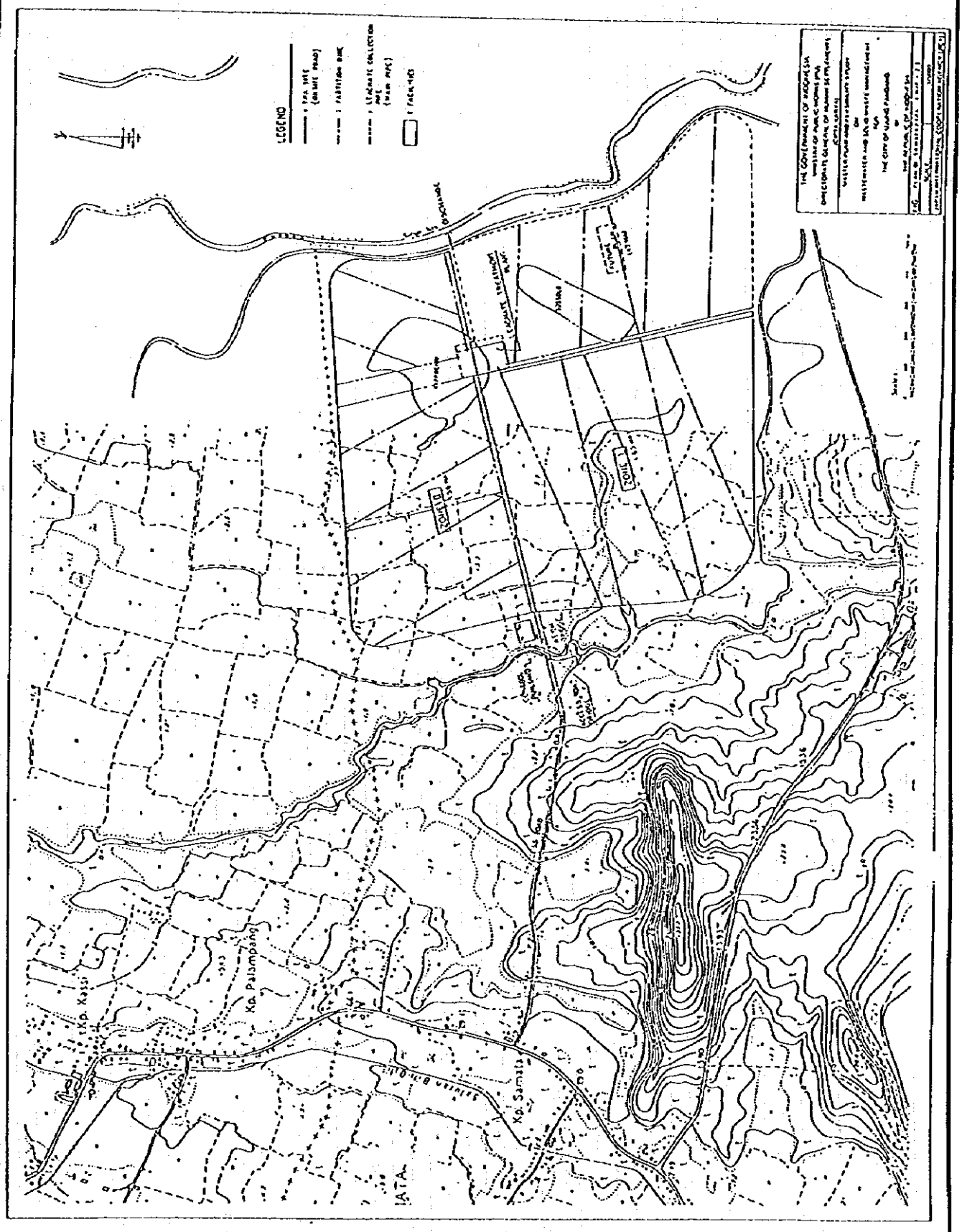

FIG. 6.13 Layout plan of Samata Disposal Site

MASTER PLAN AND FEASIBILITY STUDY ON WASTEWATER AND SOLID WASTE MANAGEMENT FOR THE CITY OF UJUNG PANDANG IN THE REPUBLIC OF INDONESIA

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FIG. 6.14 Organization Chart of PD Kebersihan,KMUP in 2015

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CHAPTER 7

EVALUATION OF MASTER PLAN

CHAPTER 7 EVALUATION OF MASTER PLAN

7.1 Technical, Environmental and Social Evaluation

7.1.1 Technical aspects

The technologies applied to this Study was selected based on the view point of appropriate technology for the Study Area, as already mentioned in sections 5.2 and 6.2. Accordingly, all the systems recommended in the Master Plan, except for pilot project which aims to prove the practicability and applicability of new systems, could satisfy the required features like economics, simplicity acceptability and adaptability for residents. Practicability of these systems has been demonstrated through the full scale operational systems in Indonesia.

In conclusion, the proposed Master Plan is justified from the view point of technical aspects.

7.1.2 Environmental and social aspects

(1) Mitigation of water pollution

Present total pollution load generation of the whole Study Area is 23,800 kgBOD/day. The share of pollution load from blackwater is 10,500 kgBOD/day (44%) and the remaining wastewater is 13,300 kgBOD/day (56%). Average specific pollution load generation is 1.4 kgBOD/day/ha. At present blackwater from the people who lack any toilet facility or adequate treatment facilities and the remaining wastewater is discharged to environment. It causes severe water pollution, especially in the Old City where the water quality of ditches and canals as BOD has exceeded 100 mg/ℓ.

Future total pollution load generation of the whole Study Area in 2015 is estimated at 83,200 kgBOD/day, which is 3.5 times higher than the present one. The share of pollution load from blackwater is 23,100 kgBOD/day (28%) and the remaining wastewater is 60,100 kgBOD/day (72%). Average specific pollution load generation is 4.7 kgBOD/day/ha. This indicates that without strenuous efforts to reduce the pollution load discharge to environment water quality of surface waters will aggravate to unbearable level.

The pollution load discharge under the conditions of both "with" and "without" the proposed Master Plan, in the year 2015, is compared as shown below.

Area	Pollution Load Discharge (kgBOD/day)	
	WITH Master Plan	**WITHOUT** Master Plan
On-site System Area	18,500	18,500
Off-site System Area	3,700	37,400
Total	22,200	55,900

The pollution load reduction by the proposed Master Plan for wastewater management in the year 2015 is estimated at 33,700 kgBOD/day, from 55,900 kgBOD/day under the without Master Plan condition to 22,200 kgBOD/day under the with Master Plan condition. The specific pollution load discharge will remain less than 1.8 kgBOD/day/ha based on the Kelurahan-wide data.

As a result, the proposed Master Plan for wastewater management up to 2015 will ensure the water quality of surface water bodies in the whole Study Area to be less than 30 mgBOD/ℓ (refer to *Fig.* 5.5).

Even though the pollution load reduction in on-site area, under both the condition of with and without the proposed Master Plan, is insignificant, as only pollution load due to blackwater is assumed to be removed, the elimination of potential bacterial pollution and the resultant public health improvement with the provision of proper on-site sanitation system is very significant.

Besides, the proposed Master Plan is expected to contribute to the mitigation of groundwater pollution presently caused by inadequate treatment of blackwater, not only in the off-site area but also in the on-site area.

At present, the number of cases suffered from diarrhea is about 40,000 to 50,000, as mentioned in section 2.3. The mitigation of surface water and groundwater pollution achieved with the proposed Master Plan will contribute to decrease in the number of patients suffered from water-borne diseases including diarrhea, thereby contributing to the enhancement of public health of inhabitants.

(2) Improvement of living environment

Present total generation of solid waste in KMUP is 471 ton/day except industry waste, and the amount of uncollected waste by Dinas Kebersihan reaches 200 ton/day except industry waste, resulting in a collection ratio of about 57%. This has resulted in the proliferation of illegal solid waste dump sites, which causes severe deterioration of living environment.

Future total generation of solid waste of the whole Study Area in 2015 is estimated at 1,438 ton/day except industry waste, which is more than 3.1 times the present one. It is obvious that existing capacity of solid waste collection service would be extremely inadequate to deal with this situation and consequently illegal dump sites would proliferate further resulting in severe deterioration of living environment, if no countermeasure will be taken.

With the completion of the proposed Master Plan for solid waste management, the whole Study Area except for those area with low population density less than 50 persons/ha will be provided with regular solid waste collection service, and collection service ratio will increase to 95%. Consequently illegal dump sites will disappear in the whole Study Area.

Moreover, at present the combination of unpacked waste and irregular collection service leads to the places of solid waste disposal by residents (TPS) becoming sources of insects and rodents. This problem will be solved with the implementation of this Master Plan for solid waste management in which packed disposal of wastes and regular collection service is proposed.

In conclusion, the proposed Master Plan for solid waste management will contribute to improvement of living environment of the Study Area to a great extent.

7.2 Institutional Evaluation

7.2.1 Wastewater management

(1) Type of institution

The institution in the organizational structure of PDAM (Alternative II) is introduce to the M/P.

Alternative	I	II
Type of institution	PDAL (Independent)	PDAM (Amalgamation)
Nation-wide trend	—	○
Easiness of fee collection	—	○
Prumpt function with existing institution	—	○
In light of the present debt of PDAM	○	—
Convenience of breeding up engineers	—	○
Intent of KMUP	—	○

(2) Comparison with the other cities

Bandung PDAM can be compared to PDAM of KMUP in 2015 because the present population of Bandung and the forecast population of KMUP in 2015 are similar and both the institutions are PD.

Name of City	Year	Population (Unit:thousand)	Staff number of PDAM	Staff in charge wastewater	Service ratio (%)
KMUP	2015	2,200	1,910	250	100%
Bandung	1994	2,058	945	153	unknown

In light of the diffusion ratio (63%) of water supply by Bandung PDAM, the wastewater collection ratio is far less than that, which was said to be something about 20% in Bandung though the exact ratio is still unknown.

Comparison is made as follows on the relation between the staff number in charge of watewater and the service ratios.

(153 x 100)/250 = 61% Should the ratio of Bandung PDAM be 61% for wastewater, Bandung PDAM is on the same level as that of PDAM, KMUP in 2015.

(3) Organizational structure

1) The present PDAM

As the present PDAM is the institution taking over the transitional unit (BPAL), it is used for the PDAM with a wastewater management institution in 2015, though its structure has been changed twice for about 10 years as above mentioned.

2) Bandung PDAM and other others

Bandung PDAM is broadly utilized for reference. PT PAL JAYA, Jakarta is referred, particulary in the process of establishment and on the point of fee collection. The wastewater public enterprise of Yokohama is also checked but not always referential because of difference in socio-economic conditires.

(4) Conclusion

- Alternative II is more appropriate of the M/P than Alternative I.
- The M/P can be evaluated well even though the proposed number of personnel is maximal in water supply and minimal in wastewater to achieve 100% of wastewater collection service ratio in 2015.

7.2.2 Solid waste management

In this Study, there are three alternatives that is:

Alternative I: Modified and improved Dinas Kebersihan as explained in the Article 6.7.2

Alternative II: Establishment of PD Kebersihan without contracting-out as mentioned in the Article 6.7.2

Alternative III: Establishment of PD Kebersihan with contracting-out as elucidated inn the Article 6.7.2.

Evaluation shall be made on the two stages, that is:

First stage: Comparison between the alternative I and II/III

Second stage: Comparison between the alternative II (self management) and III (partial contracting out).

Since the criteria are different between the case of comparison for the legal forms/status (Dinas and PD) of the institution and that of comparison for the management types (without contracting out and with contracting out) of the institution.

(1) Legal form of the institution (Comparison on the 1st stage)

Alternative	I	II/III
Type of Institution	Modified /improved Dainas	PD Kebersihan
Nation-wide trend	—	O
Self-sustainability	—	O
Subsidy	O	—
Broadness of autonomy	—	O
Entity fro loan	—	O
Intent of KMUP	—	O

Remarks; "O" means appropriate while "—" does not

Thus, PD (local public enterprise) shall be selected as an appropriate type of the institution and introduced to the M/P

(2) Type of the institution (Comparison on the 2nd stage)

Form of the institution is fixed as a PD (Local public enterprise) in the evaluation of alternative I(Modified /improved Dinas) and the Alternative II/III (PD). Based on the national policy concerning privatization in the public sector, Alternative III is designed pursuant to Alternative II considering the introduction of Contracting-Out with the private sector which has been agreed on as one of forms/types of privatization.

1) Comparison between Alternatives II and III

Alternative	I	II/III
Number of persons	2,099	975
National policy	—	O
efficiency in management	—	O
Consolidation in management	O	—
Financial burden	—	O
Profitability	Not clear	Not clear
Intent of KMUP	—	O

Remarks; "O" means appropriate while "—" does not

2) Comparison with other cities

The comparison shall be made among KMUP, Bandung and Medan based on the explanation of PD. Kebersihan (Director), Medan (on November 20, 1995) and on the premise that PD. Kebersihan will be able to introduce the Contracting-Out to the private sector in the sphere of primary, and secondary waste collection, and haulage to the TPA as planned for the year 2015.

Name of City	Year	Population (unit: 1,000)	Name of,	Start/Number	Contracting	Service
KMUP	2015	2,200	PD	975 persons	51.8% in population	95%
Bandung	1995	2,100	PD	1,930 persons	—	88%
Medan	1995	2,000	PD	2,469 persons	○	75%

Remarks; "O" mean not contorting out while "-" shows implementation of contracting out

The population is similar in the three cities, though attention shall be paid to the year 2015 for KMUP. PD is common to the 3 cities. KMUP ranks first for service ratio reaching 95%.

Reference is made to the Organization Chart of PD Kebershihan, KMUP in 2015 (Alternative III) as illustrated in the Article 6.7.2.

(3) Conclusion

(a) The Alternative III is the most appropriate for the M/P.

(b) The M/P can be evaluated well even though future Contracting-Out is still uncertain.

7.3 Financial and Economic Evaluation

7.3.1 General

With the prospective project beneficiaries pertaining to the present and future industrial, commercial and residential consumers in sight, the project comprising the two components of sewerage and solid waste is in line with the strategy adopted by the government to achieve important social and economic policy goals in the eastern region of the country. The project will help augment both the availability and reliability of urban sanitation services in the city, thus providing one of the basic prerequisites for further welfare growth and potential industrial and tourism investments there.

7.3.2 Project affordability

In line with the model configuration and indicative parameters as articulated in section 3.3.2, affordable fund or estimate of maximum borrowing capacity of the city has been prepared by making available fund projection for the project period. The total *funds available* for the sanitation subsectors (sewerage and solid waste) in KMUP, within the time-slice of 20 years, will be Rp.237.6 billion ($105.6 million) as per 1995 price up to the year 2005, of which about 65 percent of funds (62.8%) emanates from the public sector. In addition, Rp.490.9 billion ($218.2 million) from the year 2006 up to the year 2015 would arise from both of the public and the private sectors, combining to a total of Rp.728.5 billion ($323.8 million) at maximum. With this and an estimated annuity of Rp.13.5 billion to Rp.15.8 billion ($6 to 7 million, the city could get borrowings on "bi-lateral funding scheme" where the borrower pays back interest charge without debt carry-overs during the disbursement period around Rp.101.3 billion (US$45 million), thus making it possible for the project to be formulated, on SLA re-lending terms and conditions, at maximum Rp.180.0 billion ($80 million) in association with grant from the central government and fiscal transfer from the provincial government and/or equity participation standing at Rp.67.5 billion ($30 million) and Rp.11.3 billion ($5 million), respectively.

It will be noted that in the year 2002 the city may face the highest financial burden in debt payment once the proposed project be initiated in 1996 on external funds. Financial healthiness of the city as borne out by debt service ratio (DSR) will be ranging at 17 percent (multi-lateral scheme) to 12 percent (bi-lateral) over the period up to 2005. In keeping with generally acceptable criterion of 20-25 percent

of DSR as a benchmark cut-off point of financial soundness for public administrative bodies, external fund borrowing with these relatively low-end figures of DSR will not undermine the credibility of the city. Given that the city's current financial obligation to cover debt services incurred to the preceding external borrowings be kept at Rp.3.4 billion ($5 million) annually, DSR will grow incremental one (1) to four (4) percent over the same period, which is still within the safety range.

7.3.3 Economic and social justification

With due recognition of an importance of households demand for the provision of government subsidized health services where available public funds are so scarce, credible estimates of the private value of medical treatment are in need to prioritize public budgeting. Knowledge of households demand for service is also important to set prices for public medi-cares to balance out, or at least recognize, the policy objectives of cost recovery and those of broad availability.

Viewed in this light, the World Bank undertook a study on willingness to pay for medical care,, thereby made it possible to empirically estimate the value of healthiness, or life of people in Indonesia. Taking advantage of their findings, the economic analysis took part in the Report in search of another possible insight to quantitatively evaluate the economic feasibility and externality accruable to the project proposed in KMUP as follows.

The sewerage and solid waste disposal services will reduce morbidity or medical expenditures by creating and expanding the coverage and technically more efficient ways for treatment and disposal. In particular, the introduction of on- and off-site facilities mix and public education campaigns would by and large contribute to raise public awareness and peoples' welfare in a sound urban environment.

With the new and incremental supply of the sewerage and solid waste management services, the associated benefits of the project will be the positive health, institutional and social impact and an improved policy and financial environment for the urban sanitation subsectors concerned. In the field of environmental beautification, the project will reduce health hazards to the public by eventually creating well designed and appropriately located off-site sewerage system, in lieu of the existing unsanitary and costly on-site system, for the sewerage subsector, and by reducing unauthorized dumps and unsanitary open landfills associated with better operation systems of waste collection and landfills for the solid waste subsector, thereby making it possible for the people in the city to be better-off.

Provided that the full economic value of the health effect is reflected by an individual's "willingness to pay" to avoid a mortality risk with a very small probability, say, an increment of 0.0001, it is hypothetically estimated that "willingness to pay" in Indonesia would be clustered in the range of Rp.16,875 ($7.5) to Rp.39,375 ($17.5) per person per year. This "willingness to pay" across all people would be further summed up leading up to an estimated value of a statistical life. Given the foregoing postulate is to be held, the implied economic value of an avoided statistical death would range from Rp.168.8 million ($75,000) to Rp.393.8 million ($175,000). Let the economic value of an avoided death be equivalent to the discounted present value of lifetime income, inter alia, Rp.22.5 million ($10,000) in Jakarta and Rp.11.3 million ($5,000) (note that the average household income per annum has been estimated at Rp.3 million) in KMUP, 168.8 million ($75,000) falls about in the middle of Rp.11.3 million ($5,000) and Rp.393.8 million ($175,000), thereby making it possible to approximate the economic value of the health effect.

In view of the foregoing, it could be acceptable to consider that the economic value attributable to the project would be about Rp.84.4 billion ($37.5 million) per annum, with the range of Rp.11.3 billion ($5 million) to Rp.393.8 billion$ ($175 million), if and only if about 500 deaths annually be attributed to the sanitation causality in KMUP[1].

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[1]In respect of the hypothetical figures shown here, see the World Bank *Indonesia Environment and Development: Challenges for the Future*, 1994, P. 253, also see V. Lavy and J. Aquigley *Willingness to Pay for the Quality and Intensity of Medical Care, Low-Income Households in Ghana*, WB, 1993

CHAPTER 8

RECOMMENDATION

CHAPTER 8 RECOMMENDATION

1. Immediate Implementation of Master Plan

The existing environmental condition of the Study Area is far from satisfactory. Especially main canals and the coastal sea waters of Losari bay are heavily polluted due to discharge of untreated wastewater from human activities and illegal dumping of solid waste. Goundwater of the Study Area is also heavily polluted due to inadequate treatment of blackwater.

The result of the Study indicates that without effective measures to restore environmental sanitation it would be impossible to avoid further aggravation of the environmental condition, and this aggravation will cause severe damages to the sanitation and living environmental condition of the Study Area.

In order to mitigate the progressing deterioration of environmental sanitation in the Study Area, an immediate implementation of the proposed Master Plan is required.

Accordingly, it is recommended to commence adequate financial procurement to initiate the master plan as soon as possible.

2. Promotion of Private Sector Participation

In the long run, contract out to private companies for parts of solid waste management activities will help to avoid unnecessary expansion of the public service, inefficient operation and cost-up. It is therefore recommended to establish the necessary regulations or guidelines to promote private companies participation nation wide.

3. Enhancement of Environmental Awareness

The result of the Study shows that people's awareness on deterioration of environmental sanitation is still quite low. This lack of environmental awareness is an important factor attributed to deterioration of environmental condition of the Study Area. A very significant attribution of this lack of environmental awareness is the illegal dumping of solid waste in ditches and drains and discharge of toilet waste to public water bodies.

Hence, enhancement of environmental awareness including public health education is strongly recommended as the key of environmental sanitation improvement.

4. Immediate Land Acquisition

Should KMUP have enough land for final disposal of solid waste for more than 20 years, a key issue on solid waste management would be solved. This is because land acquisition for disposal site for the long term is very difficult in any metropolis. This study may be the time to secure the land for final disposal site for KMUP in the long term. It seems that all authorities are in agreement to use Desa Samata disposal site that is proposed by this study. Although many arguments will be raised at the time of implementation, one target shall be to secure a final disposal site that can be used for more than 20 years.

5. Development of Surface Water Quality Monitoring System

At present there are no monitoring stations of surface water quality in KMUP. For understanding the trend in time series and to expedite the necessary environmental improvement measures, establishment of permanent monitoring stations and measurement of water quality at regular time interval is very necessary. Hence, it is recommended to develop monitoring system of surface water quality. This program shall include the training of monitoring staff.

The water quality parameters monitored shall cover, among others, pH, BOD, COD, DO and FC (fecal coliform). For water quality analysis, a laboratory with sufficient analytical equipment is necessary. Laboratory of Hasanuddin University have the potential to be such a laboratory. Accordingly, it is recommended that provision of necessary equipment and training of laboratory staff be advanced further at the earliest.

6. Improvement of Groundwater Quality Monitoring Activity of Dinas Kesehatan

Monitoring of groundwater quality is not less important than that of surface water quality. Groundwater quality monitoring activity is conducted by Dinas Kesehatan that includes mainly the determination of total coliform (TC) level.

As the improvement of this monitoring activity, it is recommended that not only total coliform but also BOD, COD and NO_3N shall be measured regularly. It is also recommended that all the data shall be recorded in a database.

7. Improvement of Industrial Wastewater Management

The characteristics of industrial wastewater vary widely and are recognized as one of the major source of pollution associated with rapid industrial development. From this view point, industrial wastewater especially hazardous wastewater shall be treated adequately. Hence it is recommended that regulations to enforce installation of adequate treatment facilities by industries be implemented by the concerned governmental institution.

Presently all large scale industries in the Study Area are planned to be confined to the KIMA industrial estate which has its own wastewater treatment facility.

Accordingly, in addition to the enforcement to confine large scale industries to KIMA, improvement of the operation and maintenance of the existing wastewater treatment system of KIMA is recommended.

8. Appropriate Management of Industrial Waste

Present operation to the industrial waste disposal site at KIMA industrial estate should be immediately improved and sanitary landfill operation introduced there. A study of the composition of industrial waste is necessary to determine any treatment that may be required prior to disposal.

9. Control of Illegal Dumping Site

Illegal dumping sites located in many parts of KMUP should be identified. Where economically feasible such sites should be acquired, fenced in and control landfill operation be introduced there. Otherwise the illegal dumping shall be stopped and the land be restored.

10. Recycling and Volume Reduction

Recycling is presently carried out by the initiative of the private sector mainly in the form of scavenging. While scavengers operating at the disposal site are registered at the municipal authority, those operating in the city or the buyers and sellers of the reusable materials from the scavengers are not registered.

It is recommended that authorities take more interest in this activity, assisting those involved while encouraging the active participation of the citizens in separating the waste at the generation points or developing industries that rely on separated materials as raw materials.

11. Computerization and Data Base

Solid waste characteristics are sensitive to seasonal and source-economic changes. Fluctuations in amount and composition on daily, monthly and annual basis are expected. It is therefore strongly recommended to periodically execute the following field surveys and studies.

- Population and land use by collection zones
- Waste amount by collection zone and generator
- Recycling amount by waste material
- Environmental monitoring at final disposal site
- Cost analysis of solid waste management activity

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