

4.6 Institutional Restructuring Plan

4.6.1 Objectives of the Institutional Restructuring Plan

The Institutional Restructuring Plan (IRP) has three strategic objectives. These are to:

- (a) To strengthen NCC's Department of Environment (DoE) so that it can effectively and efficiently manage its SWM responsibilities and services;
- (b) To strengthen the DoE so that it has the institutional capacity to manage and sustain the priority SWM projects proposed under the Master Plan; and
- (c) To propose a strategy for the future role and structure of the DoE as a whole.

The strategic goal of the IRP is to fully implement the IRP's proposed organisational arrangements for the DoE by May 2000 on the completion of a proposed Capacity Building Assistance Program (CBAP) which is recommended in the IRP.

The IRP proposes the most suitable institutional and organisational arrangements for the DoE, and defines and schedules the necessary implementing actions over the master plan period from 1999 to 2008 which will achieve the strategic objectives and this strategic goal.

4.6.2 Recommendations for SWM at the National Level

At the national level there is almost no regulation on solid wastes. No central government Ministry or body has been assigned with the responsibility for SWM policy and planning and there are no laws, regulations or codes of practice which comprehensively cover waste management.

On the basis of the evaluation of the current situation the following outline recommendations are made for the national responsibilities towards SWM.

The Ministry of the Environment and Natural Resources (MENR) should prepare a comprehensive national strategy and plan for solid waste management. This will:

- (a) set national objectives and policies on SWM;
- (b) define and assign institutional responsibilities for each category of waste, distinguishing between those of waste generators and those of local authorities;
- (c) set certain broad SWM goals, e.g., the number of municipal landfill sites to be constructed; and
- (d) set objectives and criteria for private sector involvement (PSI), e.g., whether to allow private sector BOOT arrangements for landfill sites or treatment facilities.

4.6.3 Recommendations for the Future Role and Structure of the Department of Environment

Participants in the Organisation and Management Workshop formulated the future role and organisational structure of the Department of Environment (DoE). Based on this workshop, it is recommended that the DoE's main roles are:

- (a) to provide environmental regulations;
- (b) to provide SWM services; and
- (c) to provide parks management services.

For this purpose the DoE will be reorganised into four (4) new Divisions:

- (a) SWM Division;
- (b) Environmental Planning and Management Division;
- (c) Parks Division; and
- (d) Administration Division.

The proposed organisational structure of the DoE is given in Figure 4.6-1 below which shows the four Divisions. A detailed chart of the proposed structure of the DoE is given in Subsection 4.6.7.

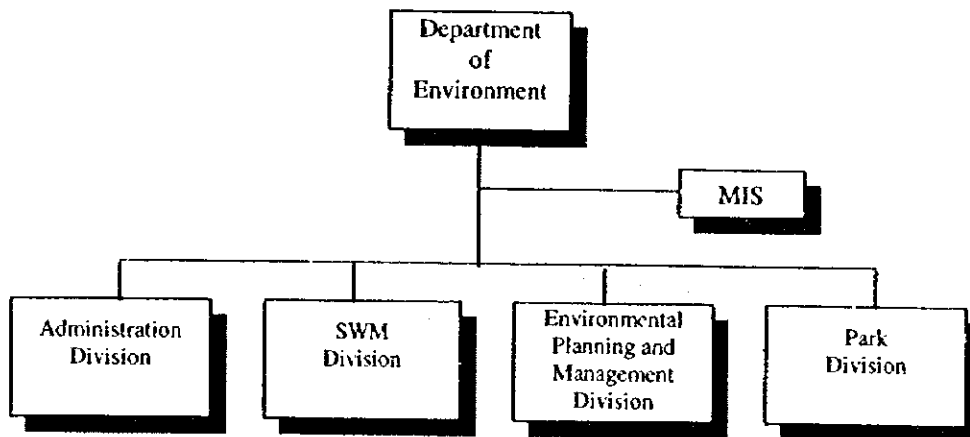


Figure 4.6-1 Proposed Organisational Structure of the Department of Environment

The SWM Division's main functions and responsibilities are to provide collection, street cleansing and disposal services. Through its Community Development Section, the Division will also work to facilitate the extension of self-help community schemes and the formation of local residents' associations to establish community-based primary collection.

4.6.4 Organisational Restructuring and Strengthening of the SWM Division

The primary focus of the IRP is the organisational restructuring and strengthening of the DoE's SWM functions. The DoE's SWM activities need substantial restructuring. A number of essential recommendations and actions for strengthening the SWM Division are the following:

(1) Restructuring of the Existing Organisation of the DoE's SWM Functions

A number of changes to the organisational structure of the DoE need to be made. These are stated in (a), (b) and (c) below. The proposed organisational chart of the SWM Division based on these recommendations is given in **Figure 4.6-3**.

- (a) Disposal is separately managed from Collection and Street Cleansing
- (b) Separate the Management of Collection from Street Cleansing
- (c) Reduce the Number of Vertical Levels in the Organisational Structure

(2) Establishing New Organisational Functions

A number of new functions need to be established in the SWM Division. These are:

- (a) new Community Development Section;
- (b) new Contract Management Section and contracting arrangements;
- (c) new Management Information Systems (MIS) capability under the Director of Environment; and
- (d) new Logistics Section under the Administration Division.

(3) Organisational Arrangements for the SWM Division's Operational Activities

The organisational arrangements for the SWM Division's operational activities and functions are as presented in **Table 4.6-1** below.

Table 4.6-1 Staffing and Responsibility of Each Operational Activity of the SWM Division

Operational Activities	Staffing	Responsibilities
Collection	Supervisor (Headman)	<ul style="list-style-type: none"> All the responsibility of handling the site, instructing the operation procedures and scheduling of drivers and loaders; contacting and reporting to NCC (District Inspector)
	Driver	<ul style="list-style-type: none"> Drives collection vehicle, checks the vehicle before and after operation and reports the result of vehicle inspection to the supervisor
	Loader	<ul style="list-style-type: none"> Loads solid waste from communal collection points to collection vehicle and sweeps the waste around the collection points
Street Cleansing	Supervisor (Headman)	<ul style="list-style-type: none"> All the responsibility of handling the site, instructing the operation procedures and scheduling of sweepers; contacting and reporting to NCC (District Inspector)
	Sweeper	<ul style="list-style-type: none"> Sweeps the waste on roads and picks up litter
Transfer Station	Site Manager	<ul style="list-style-type: none"> All the responsibility of handling the site, contacting and reporting to NCC
	Truck Scale Engineer	<ul style="list-style-type: none"> Operates truck scale to measure waste quantity and quality, and directs the vehicle driver to the designated transfer area
	Mechanic	<ul style="list-style-type: none"> Operates and maintains mechanical facilities
	Operator	<ul style="list-style-type: none"> Supports the transfer operation of waste
	Security Guard	<ul style="list-style-type: none"> Inspects safety against strangers, robbers and so on at the site
Final Disposal	Site Manager	<ul style="list-style-type: none"> All the responsibility of handling the site, contacting and reporting to NCC
	Secretary	<ul style="list-style-type: none"> Controls and regulates the schedule of the Site Manager, registers income and outlays daily management
	Chief of Engineering Section	<ul style="list-style-type: none"> Responsible for all engineering matters, planning and conducting of suitable landfill operation method
	Truck Scale Engineer	<ul style="list-style-type: none"> Operates truck scale to measure the waste quantity and quality, and directs dumping to the designated landfill area
	Site Inspector	<ul style="list-style-type: none"> Inspects safety against disaster at the site and illegal dumping
	Chief Operator	<ul style="list-style-type: none"> Controls daily operator's work and directs trucks to the designated landfill area at the site
	Operator	<ul style="list-style-type: none"> Landfills the waste
	Security Guard	<ul style="list-style-type: none"> Inspects safety against strangers, robbers and so on at the site

(4) Proposed Organisational Chart of the SWM Division

The proposed organisational structure of the SWM Division given in Figure 4.6-2 below reflects the recommendations and changes for the SWM Division.

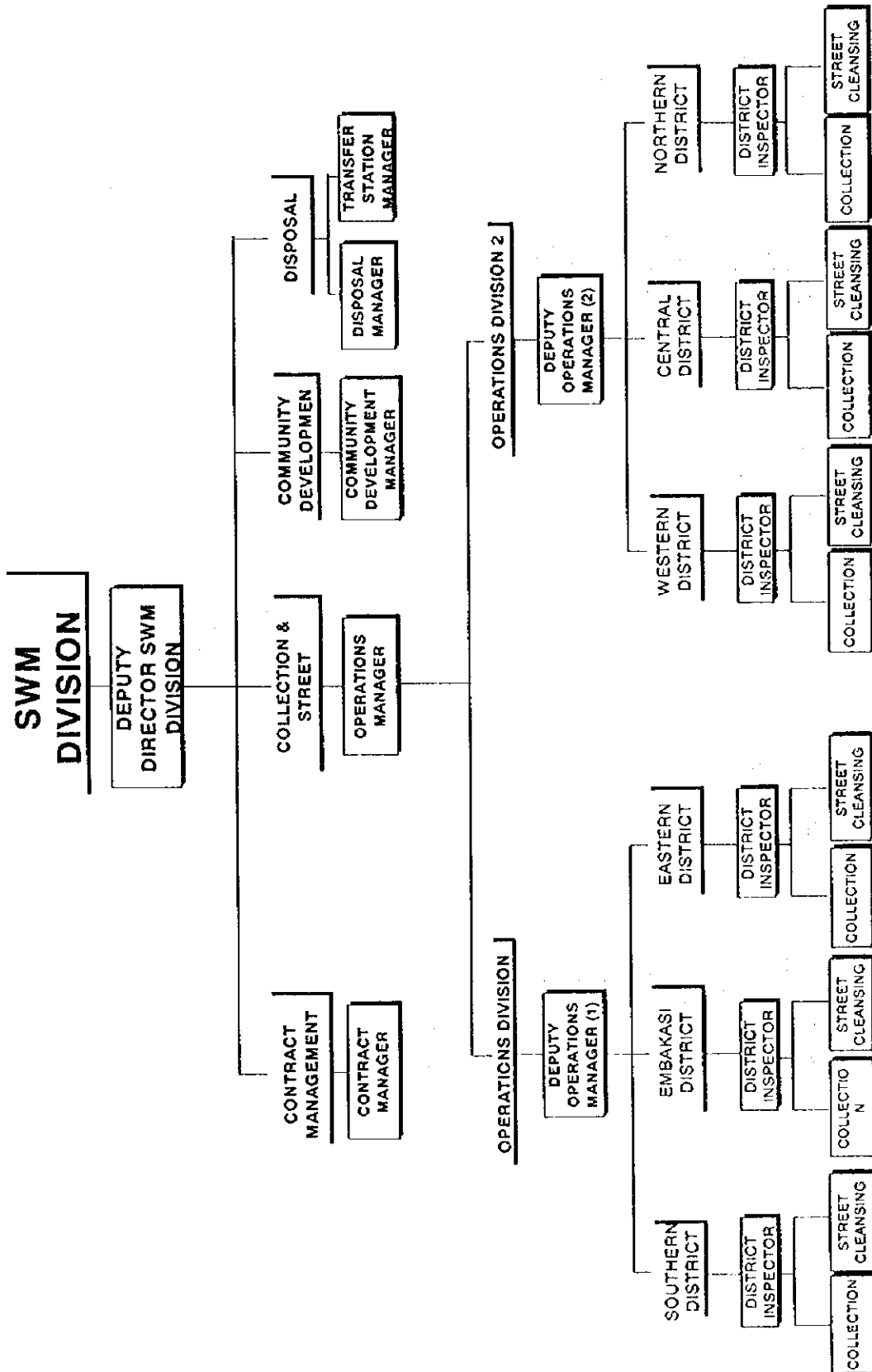


Figure 4.6-2 Proposed Organisation Chart of the SWM Division

4.6.5 Recommendations for Strengthening the Department of Environment's Environmental Planning and Management Division

It is recommended that a new Environmental Planning and Management Division is established in the DoE. Its mission is to prevent, minimise and mitigate the effects of environmental pollution in Nairobi. The scope of responsibilities covers local environmental needs for the media of solid wastes, air, water and soil.

Initially, the Division will be set up to regulate solid wastes only. Its main responsibilities will be to monitor the activities of (1) generators of waste, in particular, industrial, hazardous and clinical waste; (2) private waste operators, i.e., mostly collection companies, as well as; (3) the DoE. These activities are principally the transportation and disposal of solid wastes. The Division will also enforce the SWM legislation at the national and the local level, i.e., the proposed SWM By-laws and the new Environmental Act.

The Division would be organised into three (3) Sections; namely, Planning, Environmental Management and Environmental Impact Assessment (EIA) and all sections would each be organised into four (4) media Units; namely, solid waste, air, water and soil. Initially only the Waste Unit will be established. The proposed structure is given in Figure 4.6-3 below.

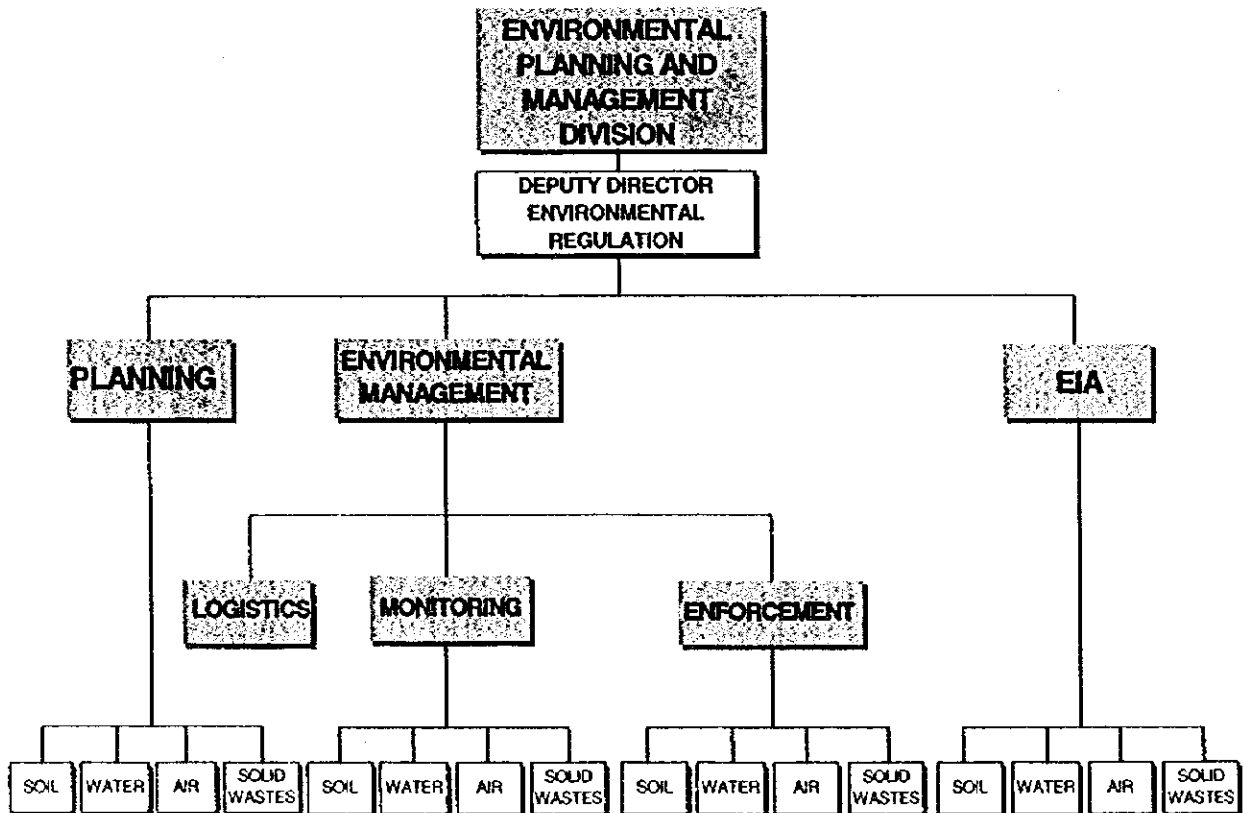


Figure 4.6-3 Proposed Structural Organisation of the Environmental Planning and Management Division

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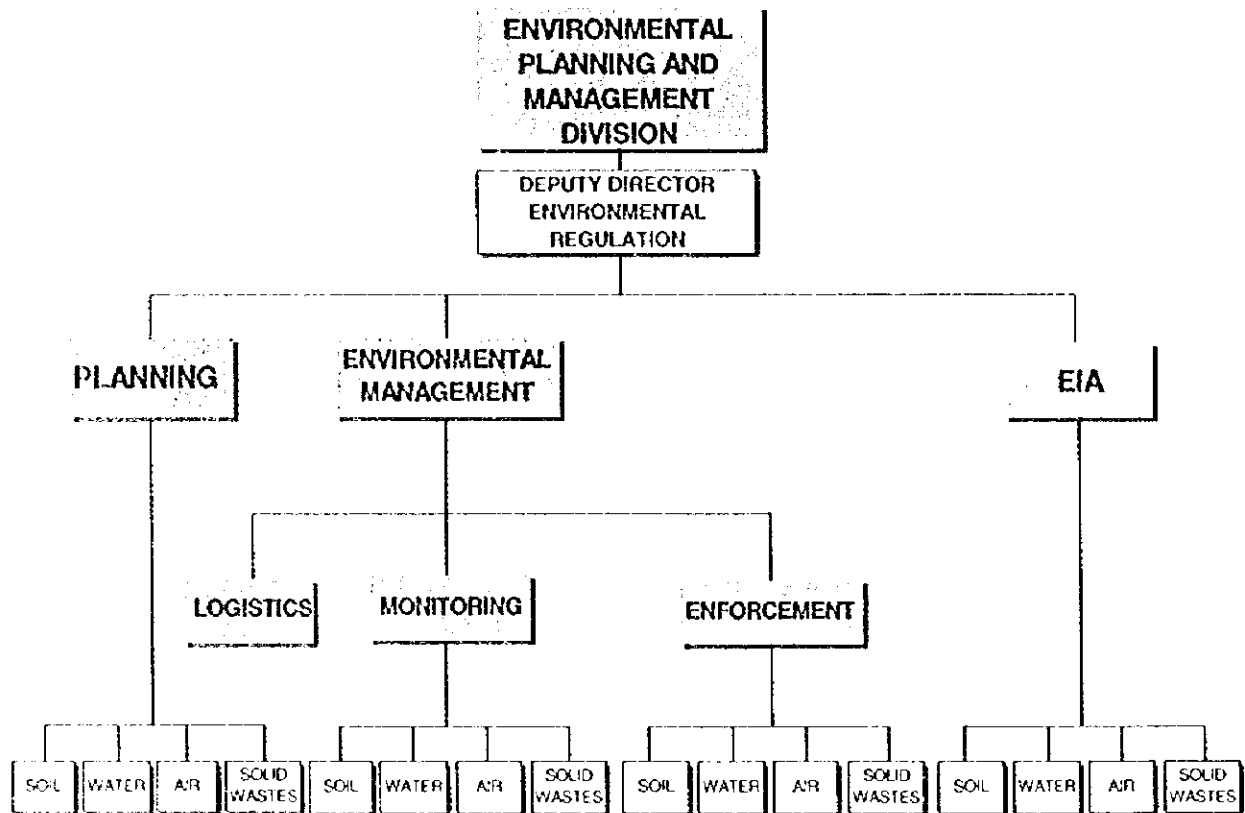


Figure 4.6-3 Proposed Structural Organisation of the Environmental Planning and Management Division

4.6.6 Recommendations for Strengthening the Department of Environment's Administration Division

It is recommended that the new Administration Division is structured into three (3) Sections which will manage the DoE's human resources, finance and transportation logistics, respectively. The new Deputy Director for Administration should have strong financial skills and analytical expertise.

The recommendations for these new Sections are dealt with in the following sections:

- (a) Financial Section;
- (b) Human Resource Management Section; and
- (c) Logistics Section.

The Deputy Director would also deputise in the Director's absence to perform administrative duties, e.g., head of Department meetings, attendance at Committees, etc.

4.6.7 Proposed New Organisation Structure for the Department of Environment

The proposed organisational structure of the DoE which is based on the recommendations in Subsections 4.6.3 to 4.6.6 above, is as presented in Figure 4.6-4. The structural changes can be summarised from the top down as follows:

- (1) Reorganise the DoE into four Divisions: SWM Division, Environmental Planning and Management Division, Administration Division, and Parks Division, and appoint four Deputy Directors to manage each of them.
- (2) In restructuring the Cleansing Section into the new SWM Division, (a) create a new Community Development Section and a new Contract Management Section in the Division; (b) separate disposal from collection and street cleansing, set up a new Disposal Section in the Division and appoint a Disposal Manager and a Transfer Station Manager; (c) appoint an Operations Manager for the Collection and Street Cleansing Section; (d) separate the daily management of collection from street cleansing; and, (e) reduce the number of vertical levels in the Division.
- (3) The new Administration Division manages the DoE's Human Resources, Finance and Logistics which are each organised into a Section. The Logistics Section will be responsible for the operation and maintenance of a new workshop at Kaloleni. A Management Information System (MIS) Section will be set up directly under the Director of Environment for ease of communication.
- (4) The new Environmental Planning and Management Division is organised into three Sections: Environmental Planning, Environmental Management, and Environmental Impact Assessment.
- (5) Deputy Directors head Divisions on Scale 3, Managers head Sections on Scale 4 and Assistant Managers head Units generally on Scale 5.

The restructuring will also include clearly defining and assigning functional responsibilities throughout the new organisation to all Divisions, Sections, Units and Sub-Units in the DoE. Currently, these responsibilities are not clearly assigned.

Likewise, staff responsibilities should be defined and assigned to all staff positions, i.e., job descriptions should be prepared for each staff position. Job descriptions are vital to clarify responsibilities, set accountability and use as a basis to assess an individual's performance.

The DoE will have to make these preliminary structural changes including the creation of new positions and appointment of staff between 1998 and 1999 as Preparatory Actions for the Capacity Building Assistance Program (CBAP). The key organisational development will be implemented under the CBAP in 1999. During the CBAP the organisational structure should be reviewed by the Organisational and Management Consultant and recommendations for further changes made.

4.6.8 Development of Key Management Capabilities

In addition to establishing an efficient organisational structure, there are a number of key management capabilities which the DoE needs to develop. Good management is essential to administer services cost effectively and efficiently. These key capabilities are:

- (a) effective senior management;
- (b) effective policy and planning;
- (c) setting objectives and measuring performance;
- (d) management information systems (MIS); and
- (e) improving managers skills and effectiveness.

It is recommended that the DoE receive capacity building assistance from an Organisational and Management Consultant to assist it in developing these capabilities.

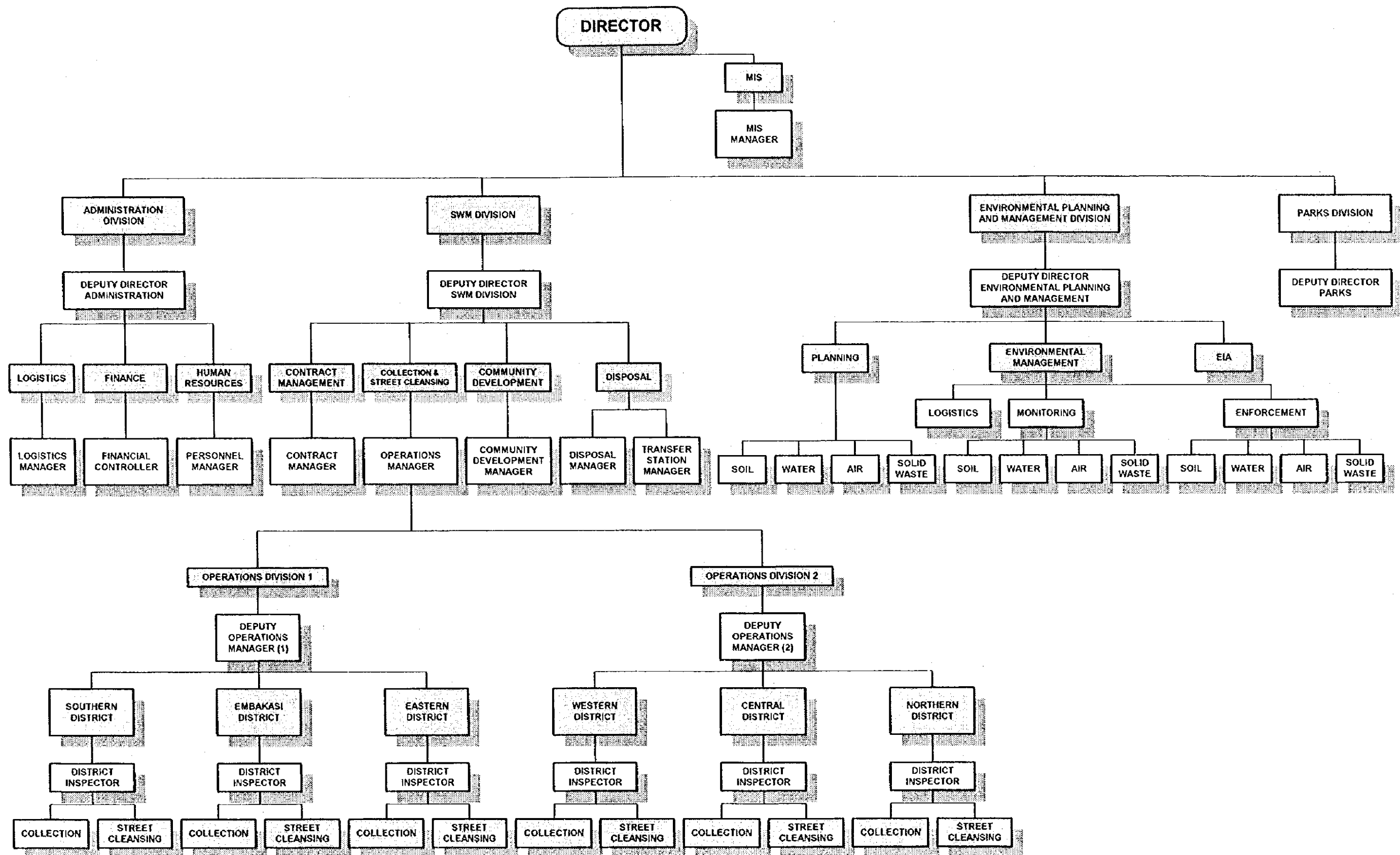


Figure 4.6-4 The Proposed Organisational Structure of the DoE

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4.6.9 Phased Implementation of the Institutional Restructuring Plan

The Institutional Restructuring Plan (IRP) delineates the actions and tasks for restructuring and strengthening the DoE. The central focus of the IRP is the strengthening of the DoE's SWM Division.

The IRP's main actions and tasks can be grouped into three key areas:

- (a) organisational restructuring of the DoE;
- (b) establishing new organisational functions; and
- (c) developing of key management capabilities.

Some of these actions can be implemented by NCC as Preparatory Actions, but most of them will require assisted implementation under the Capacity Building Assistance Program (CBAP). The CBAP will critically support the implementation of the IRP. It is recommended that the CBAP begin in April 1999 and continue until May 2000 with a total elapsed time of 14 months.

The IRP's actions and tasks are therefore phased in the following way:

(1) Preparatory Actions - 1998/1999

Preparatory Actions must be substantively implemented from 1998 to 1999 to enable the CBAP to begin. The components of these Actions are given below. They cover the key areas of:

- (a) organisational restructuring of the DoE; and
- (b) establishing new organisational functions.

(2) Strengthening under the CBAP - 1999/2000

The IRP's actions to be implemented under the CBAP cover the key areas of:

- (a) full development and implementation of the new organisational functions; and
- (b) development of key management capabilities.

A description of the CBAP is presented in **Subsection 4.6.10** below.

(3) Institutional Strengthening after the CBAP - 2000 to 2008

The CBAP will consider and, if appropriate, recommend further capacity building assistance to be implemented after its completion. Typically this would fall in the remainder of 2000 and 2001. The assistance would cover the further development of the DoE's new functions and key management capabilities.

Figure 4.6-5 illustrates the phasing of the three key areas of the IRP.

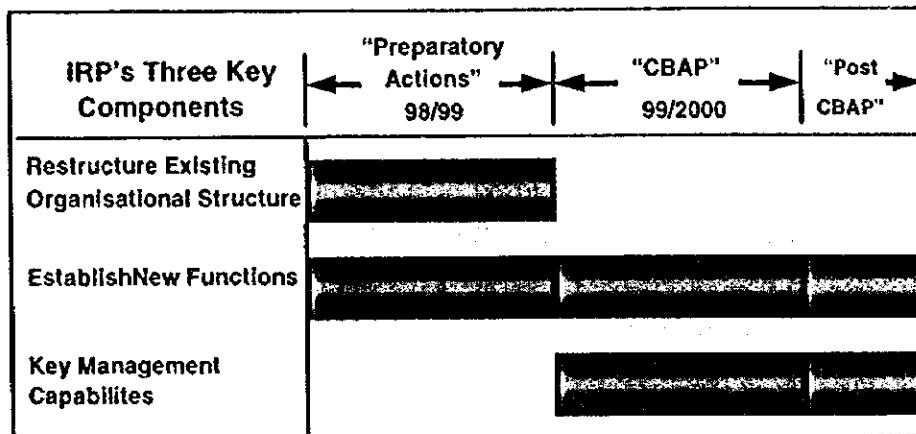


Figure 4.6-5 Phased Implementation of the IRP

4.6.10 Summary of the Capacity Building Assistance Program (CBAP)

The Capacity Building Assistance Program (CBAP) comprises a mixture of direct implementation assistance combined with training provided in classes or workshops, covering eight organisational components. It is recommended that the CBAP begins in April 1999 and continues for 14 months up to May 2000. It is intended that the IRP's recommendations will be fully implemented under the CBAP by May 2000.

These components are:

- (a) development of key management capabilities;
- (b) community development;
- (c) financial;
- (d) environmental regulation;
- (e) formatting and drafting of the SWM By-laws;
- (f) contract management;
- (g) human resource management; and
- (h) development of technical capability.

Each of these components will be prepared and managed by one consultant. The entire Program will be overseen and managed by the Organisational and Management Consultant. The majority of the training will be delivered by the consultants but some may be provided by Kenyan resources.

The phasing of the Capacity Building Assistance Program is from April 1999 to May 2000, giving its main components and the required inputs of each consultant. These inputs cover both implementation assistance as well as training. The timing of inputs is indicative and will be decided by the individual consultants.

Each consultant will assess the effectiveness of his capacity building and training and review the DoE's further needs after the CBAP's completion. They will then formulate a future capacity building program and recommend how it could be

financed. This might be through a donor agency, by the DoE itself, or a mixture of both.

The total cost of the CBAP of Kshs. 47,773,000 includes consulting costs, information hardware and software costs, and training costs, i.e., materials and venue costs. These costs are indicative only.

4.6.11 Training Program for the DoE

The DoE's SWM, Environmental and Administration Divisions need training to support their organisational restructuring. The approach is to firstly provide a substantial training program delivered through classes and workshops under the CBAP covering key organisational and management areas.

The CBAP training will be provided in 1999 and 2000 and will be managed by the Organisational and Management Consultant. Individual components will be delivered by each consultant for his specialist area. A key aspect of the training will be to train trainers wherever it is appropriate. Trainers will be identified and given short courses in training skills.

Some training may also be provided by Kenyan training organisations. The DoE and the consultants will decide what local resources can be used. Examples are the University of Nairobi's Industrial Resource Unit (successfully used for the Water Department's training program under the World Bank Nairobi Third Water Supply Engineering Project) and the Kenya Institute of Management (KIM).

After the CBAP is completed the DoE will inevitably require further training. The Organisational and Management Consultant and the Human Resource Consultant will assess the impact and effectiveness of the training provided under the CBAP. Based on this assessment they will review the DoE's further training needs, prepare a future training program and recommend how it could be financed. This might be through a donor agency, by the DoE itself, or a mixture of both.

4.7 Legal Restructuring Plan

4.7.1 Introduction

The Legal Restructuring Plan (LRP) proposes the most suitable legal arrangements for solid waste management in Nairobi City and defines the actions required to implement them.

The focus of the LRP is on the enabling legislation NCC should enact to ensure that it has the legal authority to effectively regulate SWM activities in Nairobi City.

Since a detailed study of the national level is beyond the scope of this Study only outline recommendations are given for the national level and their implementation is not defined.

The LRP is structured as follows:

- (1) Outline recommendations for legal reforms at the national level, in Subsection 4.7.2;

- (2) Recommendations for legal reforms for Nairobi City, in **Subsection 4.7.3**; and
- (3) Implementation of the LRP and capacity building assistance, in **Subsection 4.7.4**.

The Legal Restructuring Plan's recommendations are based on the findings of the Legal Study, Chapter 2, Section 2.4.

4.7.2 Recommendations for the National Level

Currently there is no single national law on SWM. Nor is there any national legislation on the management and control of hospital, industrial or hazardous wastes.

The Ministry of Environment and Natural Resources (MENR) has formulated the Environmental Management and Coordination Bill which has general provisions covering waste management and standard setting, disposal site licensing, the control of hazardous, industrial and hospital waste and environmental impact assessments. However, the provisions are general and these are not enough. A more comprehensive national law is required.

It is herein recommended that the Government of Kenya (GOK) through the MENR enact a comprehensive SWM law either as a National Act or a National Regulation. This should cover all types of solid waste and set responsibilities and conditions for their management and control.

Implementation of a national SWM Law would give NCC the proper legal authority to regulate SWM activities in the city more effectively.

4.7.3 Recommendations for Nairobi City

The existing laws provide a very limited basis for SWM and this is not an acceptable situation. It is herein recommended that in the absence of a comprehensive national legislation on SWM, NCC should move quickly to enact a new SWM By-laws.

This SWM By-laws should address and be based on the following fundamental principles:

First, the By-laws should clearly stipulate the policies and objectives to be achieved by SWM and state that NCC has the primary Duty of Care for SWM in Nairobi City;

Second, the By-laws should categorize solid wastes according to the characteristics presented by each category of waste;

Third, the By-laws should impose a statutory requirement for solid waste management planning on NCC;

Fourth, the By-laws should impose a Duty of Care on the generators of waste to handle all wastes in their charge in an environmentally sound manner and, in any case, to dispose of them only by giving it to an authorised collector of waste;

Fifth, the By-laws should impose a Duty of Care on all waste operators to handle all wastes in their charge in an environmentally sound manner and to dispose of them only at a licensed landfill facility;

Sixth, the By-laws should set standards for collecting, treating and transporting solid waste and for the proper management of sanitary landfills;

Seventh, the By-laws should impose a requirement for private sector SWM operators and landfill operators to be licensed by the NCC;

Eighth, the By-laws should specify the technical and financial qualifications to be met by waste operators including landfill operators;

Ninth, the By-laws should impose a requirement for Environmental Impact Assessment to be carried out and approved by the NCC before the licensing of any landfill site; and

Lastly, the By-laws should provide for "restraint notices" to be served by NCC to empower it to prevent situations of waste mismanagement which threaten the environment or public health.

The By-laws will also have to make general provisions for the handling of industrial, hazardous and clinical wastes since the DoE will have to collect and accept these wastes at its Dandora Dumpsite. It is hoped that NCC will cease to be responsible for collecting and transporting these wastes when the new Environmental Bill is enacted under which generators are responsible for their wastes, but NCC will still have disposal responsibilities for these wastes.

After enactment of the SWM By-laws the Environmental Planning and Management Division (EPM) will be responsible to enforce the By-laws as well as all provisions of the new Environmental Act. The EPM should also review the performance of the By-laws and recommend amending it as appropriate.

4.7.4 Implementation of the SWM By-laws

The EPM Division will cooperate and coordinate with the Town Clerks Department for formulating the new SWM By-laws. NCC should require assistance from a Legal Consultant to formulate and draft the By-laws in the CBAP as described in **Subsection 4.6.10**. The Consultant will formulate the By-laws with consideration on other international SWM legislations to ensure that Kenya complies with the international standards.

It is proposed that the By-laws is enacted by NCC between 1999 and 2000. It is also recommended that the By-laws would become a model legislation for other local authorities in Kenya.

4.8 Private Sector Involvement (PSI) Plan

4.8.1 Efficiency Context of PSI

(1) Background of PSI from the Worldwide Experience

According to a World Bank Report, *Private Sector Participation in Municipal Solid Waste Services in developing Countries, 1994*, local governments in developing countries spend 20-50% of total expenditure for solid waste

services. Even at such a high level of expenditure, the level of solid waste service is low, and only 50-70% of the solid waste is collected (Nairobi: 10% for expenditure and 5% in collection). This leads to an argument that private sector involvement should be encouraged because it is more efficient than public operation. Private sector efficiency is expected emanate from (1) management flexibility, (2) freedom of action, (3) greater financial discipline, and (4) accountability to market forces.

(2) Present Situations of Private Collection Companies

NCC estimates that about 60 private collection companies are in operation. In view of the insufficient solid waste management services by NCC, private sector contribution has recently been getting more and more important.

The result of the waste amount survey and the time and motion study conducted clearly shows that the number of crew of private companies is nearly one person less than that of NCC (see **Chapter 3 of Supporting Report Section E**). Since the amount of collected waste per trip, in other words, per crew, is almost the same between the private companies and NCC, it can be said that the waste carrying efficiency of the private companies is much better than that of NCC. Also, the working hours of the private companies are longer than those of NCC, and the total collection amount by the private companies accordingly exceed that of NCC. This results in the better quality of service by the private companies.

(3) Financial Model Analysis

By assuming a financial model of a hypothetical company, the viability, particularly in terms of financial condition of the private collection business, was examined. Details are described in **Supporting Report Section D**.

Based on the model, the collection cost of a private company is estimated at Kshs. 2,155 or US\$36.66 per ton of waste (see breakdown of cost in **Subsection 4.8.3**). In the case of a new collection system by NCC (Container System with Side Loader, Tippers and Wheel Loaders), the unit cost is estimated at Kshs. 2,291 or US\$38.96 (including costs for waste from roads and markets). As a result of this analysis, the unit cost for collection services by private companies is approximately 95% of that of NCC. This also indicates that the private companies are much more efficient than NCC.

A hypothetical profit and loss statement based on the financial model with a number of assumptions was also obtained. When the charge was set at Kshs. 250 per month, the net profit before tax was Kshs. 1,554,000. The break-even point concerning collection charge in this case was Kshs. 185.25.

4.8.2 Promotion of PSI in the Master Plan

(1) Role of PSI in the Master Plan

In the Master Plan, service coverage includes private sector involvement (PSI) and the existing PSI program of NCC in a cooperative way. This collaboration

is expected to result in the visible improvement of environmental condition in the city compared with the existing 25% of collection service coverage. In addition, new waste charges are set to finance the contract basically from new waste charges.

On the other hand, waste collection services by private companies are not controlled or monitored by NCC at present. NCC should regulate private companies with the least level of service standard in order to promote PSI through improving the reliability of PSI services to the people. It might be essential for those private companies to expand their business continuously to upgrade SWM services in the city up to the target year of 2008.

(2) Target Rate of PSI

Presently, private collection companies are collecting approximately 20% of waste produced. In the project years, such private companies are expected to keep playing an important role in the entire SWM services in Nairobi.

As for private companies, there are several advantages of contracting with NCC as follows:

- (a) The SWM business is solely administered by the company in a designated area. Thus, a stable operation of the company is expected in a certain contract period.
- (b) Contracting companies are deemed prestigious or reliable. This is a huge intangible asset of these company.
- (c) The company can extend extra SWM business to comparatively high income residents in the area. This will also give the company a new business opportunity.

Waste amount collected by PSI are estimated at 285 ton/day in 1997. In 2008, if 20% is collected by PSI, the amount would be 546 ton/day, which is about 1.9 times (see Table 4.8-1). Collection amount is expected to increase at 6.08% p.a. through the years, meaning that the market for the industry is expected to increase at 6.08%. It is noted that a sector of the business services in Kenya had a 6.8% growth rate from 1992 to 1996 (*Economic Survey 1997*). Considering the recent GDP growth rates, 3.0% in 1994, 4.8% in 1995 and 4.6% in 1996, the situation would be attractive to private companies looking for business opportunities with the expectation that the same level of growth is expected in the next ten years.

Table 4.8-1 PSI Collection and Its Growth

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total Waste	1,426	1,509	1,595	1,684	1,785	1,893	2,009	2,141	2,269	2,413	2,566	2,730
PSI Ratio	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
PSI Amount	285	302	319	337	357	379	402	428	454	483	513	546
Growth Rate	-	5.8%	5.8%	5.7%	5.8%	5.8%	5.9%	6.0%	6.0%	6.0%	6.1%	6.1%

Source: JICA Study Team

(3) Collection Service Area by Private Sector

The collection service area in the Master Plan was determined based on the present location boundaries. Nairobi City is administratively divided into eight divisions, i.e., Dagoretti, Kibera, Central, Parklands/Westlands, Pumwani, Makadara, Embakasi and Kasarani. These divisions are also composed of several locations and the total number of locations is 29. Based on the population projection in each location, solid waste generation can also be estimated on an area-wise basis.

In addition, daily collection and transportation work as well as street cleansing work is now carried out based on district-wise operations by NCC; in other words, NCC's SWM service area is divided into six (6) districts and each district has its own staff, equipment, office and depot. The boundary of these districts mostly traces a part of the location boundaries. Therefore, it seems that the daily operation and management of collection work will be much easier and smoother if the boundary of the service area is almost equal to the location boundary.

(4) Selection of the Possible Contract-out Area

The collection service area with PSI is selected by applying the following criteria:

- (a) High density and areas near the city centre will have higher priority because of their higher demand for improvement and efficiency of services.
- (b) High, middle income or other residential areas will require PSI because people who live in these areas have already had a chance to be provided with private collection services and, therefore, collection services with PSI will be easily acceptable.

NCC has started to contract-out the Central Business District (CBD) which is a part of Starehe. Ngara is located next to Starehe and it also has business and commercial areas.

According to a report entitled "*A Strategic Health Plan for the Nairobi Area, 1992*," high income areas include the following five locations: Karen/Langata, Kenyatta/Golf Course, Parklands, Kilimani and Roysambu. Considering the above, the area to be contracted out will be selected among Ngara, Karen/Langata, Kenyatta/Golf Course, Parklands, Kilimani and Roysambu.

(5) Order of Contract-out

As a result of the discussions with the Kenyan counterparts and the following considerations, the schedule of contract-out has been drafted.

- (a) Similar conditions to the present CBD contract-out area
- (b) Closeness to the city center
- (c) Equalisation of waste collection in an area
- (d) Enough interval for the preparation of the next area

In the project years, four (4) areas, namely, Ngara, Kenyatta/Golf Course, Parklands excluding Muthaiga and Kilimani, are selected to be contracted out. Table 4.8-2 shows the contract-out schedule of the planned areas. Shaded numbers are waste amounts which are planned to be collected by private companies. The locations of contract-out areas are also shown in Figure 4.8-1.

This schedule will be reviewed after evaluating the performance in the next contract-out at Ngara by a new Contract Management Section (CMS) under the SWM Division. Detailed responsibilities and roles of the CMS are described in Subsection 4.8.4.

Table 4.8-2 Schedule of Contract-out Area in the Master Plan

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total Waste Generation	1,509	1,595	1,684	1,785	1,893	2,009	2,141	2,269	2,413	2,566	2,730
Location											
Starebe											
Ngara	39	40	41								
Kenyatta/Golf Course	13	13	14	15	16	17					
Parklands (excl. Muthaiga)	126	133	139	148	158	168	180	192			
Kilimani	35	35	36	39	41	44	47	50	53	57	
Total PSI	129	134	138	188	198	208	237	248	466	494	585
PSI ratio by Contract-out (%)	8	8	8	10	10	10	11	11	19	19	21
Designed Total PSI ratio (%)	20	20	20	20	20	20	20	20	20	20	20

Note: Highlighted areas above indicate target waste amount by contracted private collector.



0 1 2 3 4 5km

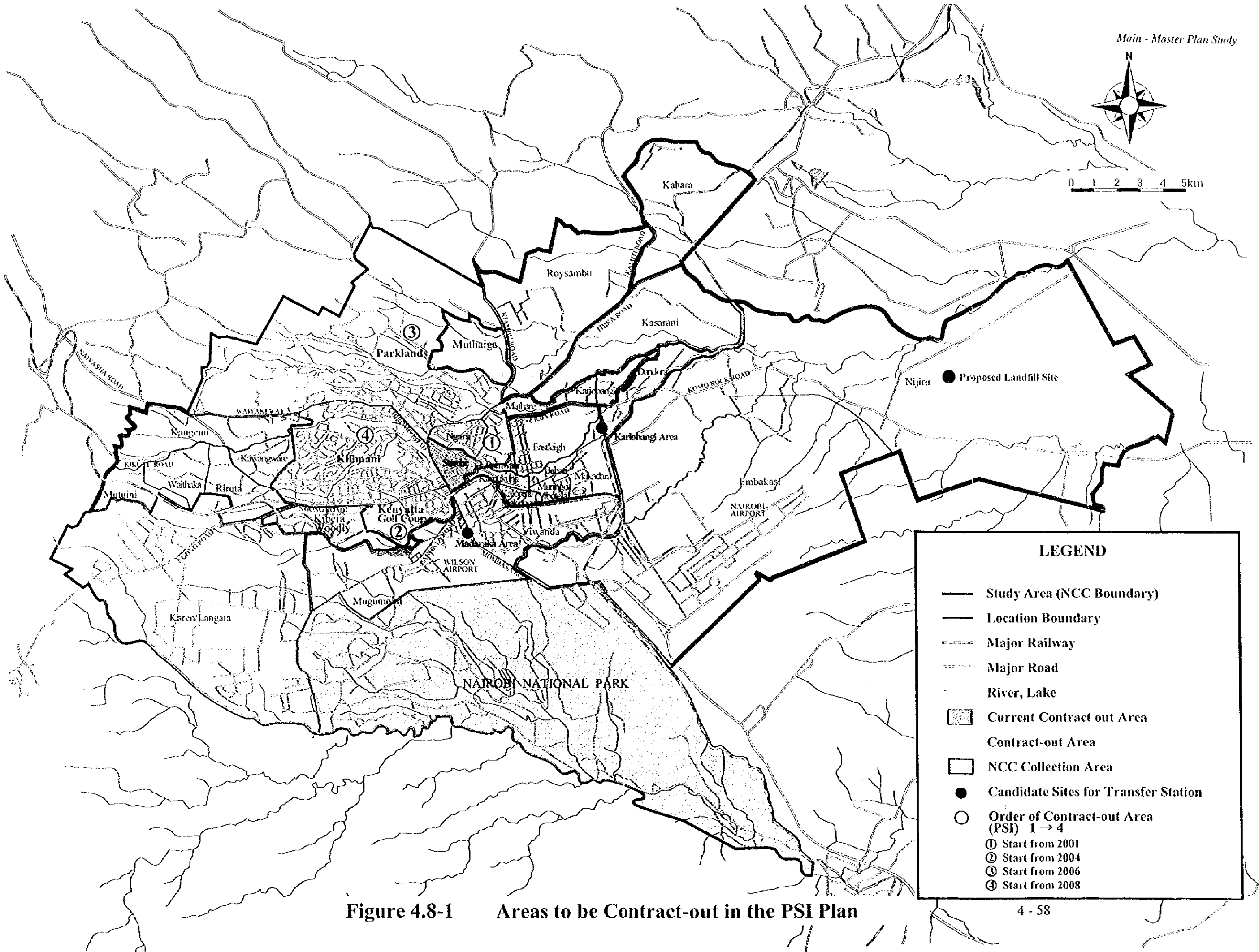


Figure 4.8-1 Areas to be Contract-out in the PSI Plan

4.8.3 Cost and Finance of Contract-out Services

(1) Estimated Cost of Contract-out Services

Cost of SWM services contracted out to private companies by NCC is estimated at Kshs 2,155 or US\$36.66 per ton of waste (see Table 4.8-3). Services include waste collection and street cleansing in the designated area. According to the contract-out schedule, the total cost of services is estimated at Kshs 2,142 million in 2000-2008 (see Table 4.8-4).

Table 4.8-3 Breakdown of Estimated PSI Cost (per ton of waste)

Unit: Kshs	
Operating Cost	
- Fuel/Oil	395
- Maintenance	43
- Waste Bags	214
- Wages	485
- Overhead	645
- Depreciation	178
Sub-total (1)	1,959
Financial Cost (2)	196
Total (1) + (2)	2,155

Table 4.8-4 Total Cost of Contracted PSI Services

	2000	2001	2002	2003	2004	2005	2006	2007	2008	total
Waste Amount by Contract PSI (ton/day)	138	188	198	208	237	248	466	494	546	2,723
Cost (Kshs million)	109	148	156	164	186	195	367	389	430	2,142

(2) Finance of Contract-out Services

Cost of contract-out services is combined with the operating cost of all other areas and charge revenues from all area users including households and commercial entities are used to finance the total cost. When the charge revenue is not enough, funds from the general account or subsidies from the central government are expected to finance the shortage.

The same billing system, namely, the water charge billing system should be employed. Even if contracted-out areas are enjoying higher quality of services than other areas, same tariff system should be applied to both areas for the following reasons:

- (a) Contracting-out is planned to be implemented in the high income areas where higher charges are expected to be applied by the new tariff system.
- (b) If two kinds of tariff system are employed, it would be complicated to enforce the system. In addition, since contracted-out areas are planned to increase in every two or three years, the charging system has to be adjusted frequently.

- (c) Since water charge areas do not necessarily coincide with the administrative areas where contracting-out schedule is based, troubles will arise in adjusting the water billing system.

4.8.4 Responsibilities and Roles of NCC for PSI Promotion

The Contract Management Section (CMS) under the SWM Division of the DoE, NCC would be responsible for the entire promotion of private sector involvement (PSI) in SWM. The functions and procedures in the PSI promotion will be established in the Capacity Building Assistance Program (CBAP) as stated in **Subsection 4.6.10**. The responsibility and roles of NCC, specifically CMS for both pre-contract award and post-contract award are summarised as follows:

(1) Responsibilities and Roles in the Pre-Contract Award Process

Responsibilities for preparing and awarding a contract are assigned among the DoE's proposed Contract Management Section (CMS), a proposed Contract Team (CT) and the Council's existing Tendering Committee (TC).

A Contract Team (CT) is set up for each contract and oversees the contracting process up to award.

The Contract Management Section (CMS) is responsible for each stage of the preparation and award of the contract, i.e., it formulates the contract strategy, prepares a contracting plan, carries out prequalification as appropriate, prepares the tender documentation, manages the invitation to tender, evaluates and selects the tender and awards the contract award. In this capacity the CMS acts as the Secretariat to the Contract Team (CT).

The CT's role is (1) to advise and approve the Contract Management Section's activities at each stage of the contracting process and (2) to ensure that the preparation and award of the contract complies with the local government legislation, NCC's policy, rules and regulations.

Membership of the CT would be drawn from the DoE, the Administration and Legal Sections of the Town Clerk's Department and the City Treasurer's Department. The member from the Administration Section would head the CT. The life of CT would only be for the period of contract preparation. The CT would cease on the execution of the contract.

The role of the Tendering Committee is to formally evaluate and select the winning tender on behalf of the NCC.

(2) Responsibilities and Roles in the Post-Contract Award Process

The CMS would be responsible to monitor the contract terms and conditions and needs to implement robust procedures.

The robust procedures need to be implemented to manage the important terms and conditions of the contract, which are:

- (i) variations to the contract;

- (ii) defaults;
- (iii) disputes;
- (iv) termination; and
- (v) carrying out VFM assessment.

4.9 Financial Improvement Plan

4.9.1 Financial Constraint to Solid Waste Management

As mentioned in Section 2.10, the overriding constraint to solid waste management (SWM) services in Nairobi is the financing of these services. NCC services are financed from NCC's General Fund and Services Charge Account. After salaries are paid, however, income is not enough to finance other expenditures, except in 1993/94.

The objective of the Financial Improvement Plan is therefore to improve and strengthen the financial condition of SWM services and to support sound or sustainable operation.

4.9.2 General Principles of SWM Finance for Households

The costs of SWM services for households are divided into two categories based on the above discussion; **capital investments** including vehicles and facilities as a part of improvement in social capital, which produce services continuously for their lives, are categorised as public service; **operating costs** for services of individual households which is produced from the capital investments are private service.

Following are general principles for financing SWM services based on the present financial situations of NCC:

Firstly, in principle, public service (capital investments) should be financed by general taxation or by funds from the General Fund.

Secondly, it is preferable particularly in situations where general taxation is severely constrained, that operating costs are recovered wherever possible through a waste charge rather than through general taxation.

Thirdly, cost recovery should be improved by reforming the budget system and improving efficiency of SWM operations on step-by-step basis.

Fourthly, where operating costs cannot be fully recovered through a waste charge after improving cost efficiencies, deficits should be financed through general taxation or subsidies.

Fifthly, charges should be collected from those in informal settlements because they will get at least a minimum level of services in the new system. However, charge rates and the collection method should be different taking into consideration their standard of living.

4.9.3 Financial Reform for SWM

(1) Establishment of Financial Autonomy of SWM Services

The DoE's SWM Division needs to be financially "ring fenced" by establishing a special account to ensure that these revenues are controlled and spent by the DoE for SWM services only and are not used to finance other services in NCC. The special account should be designed to have co-signatories of the DoE Director and the City Treasurer.

Additionally, funds for replacement of equipment and facility should be accumulated as depreciation in the operation of the system in order to sustain the operation after the equipment and facility initially introduced are finished.

These works will be done by a new Financial Section in the Administration Division of the DoE, and the special account will be opened from the beginning of year 2000.

(2) Subsidisation of SWM Services

Financial autonomy should not exclude the continued subsidisation of the DoE's SWM services by NCC's general taxation or the central government. This is because it is very difficult to recover operating costs fully through the DoE's own revenue sources, particularly in the early years of the Master Plan.

(3) Increasing Revenues

Presently, the main revenue sources available for SWM are waste charges from households and commercial entities and tipping fees. Costs are shared by households and commercial entities in accordance with their waste discharging rates on the basis of the Polluters Pay Principle (PPP). In the future when the private sector involvement system be established, licensing fees for private collection companies may be considered.

Creating a new tax or charges for SWM is not preferable. Thus, the existing charge system should be continued to be a main financial resource with some improvement including a step-up tariff system which changes rates in accordance with income of beneficiaries.

NCC is going to introduce a new tariff of Kshs. 100 for SWM instead of the present Kshs. 10 per month per household. Therefore, NCC should firstly collect the new tariff at least by 1999, and then an increased tariff will be adopted from year 2000. The average rate of the increased tariff is estimated at Kshs. 216 per month per household for the 100% grant case. Detailed analysis is described in Section 4.14.

(4) Billing and Collection Method

Currently the billing and collection of waste charge is carried out through the billing system of the Water and Sewerage Department. This should be continued for the following reasons:

- (a) a higher collection rate is expected;
- (b) the billing and collection systems are soon to be substantially upgraded under a World Bank technical assistance;
- (c) it has the ultimate sanction of disconnecting households which do not pay; and
- (d) it would take considerable time to set up and require significant technical assistance to establish a new system.

(5) Reform of Budgeting System of SWM Services

The budgeting system of SWM services' special account should be arranged to avoid such problems. They are:

- (a) revenues should not be accrued in the budget. Only cash receipts should be credited to the account;
- (b) revenue estimates should be based on the previous calendar year's actual cash collections;
- (c) recurrent expenditure should be estimated within revenue estimates based on the previous calendar year's actual revenue plus any approved charge increases. Expenditure ceilings should be established at the beginning of the budget process; and
- (d) revenue in excess of the estimates should be appropriated to capital expenditure. It should not be released until the revenue has been realised.

(6) Proposals for Technical Assistance

To implement the above recommendations, technical assistance will be made within the CBAP as described in **Subsection 4.6.10** focusing on establishing a new Finance Section in the Administration Division.

4.9.4 Calculation of Charges

Charges including tipping fees are calculated in accordance with the Polluter Pay Principle (PPP). So, the total cost for collection/transport including contracting-out services are shared in proportion to the **collection amount** of each user category. Same charge rates are applied to NCC areas and contracting-out areas (see **Section 4.13** for the details of PSI costs and charges). In the same manner, the total cost for final disposal is shared in proportion to the **dumping amount** of each user category.

Charges for each user categories (households and commercials) are calculated to cover such cost shares calculated in the way mentioned above. In addition, non-contracted service users should also bear their final disposal costs. In this case, NCC levies the tipping fees on the waste of such services by the companies. Thus, the non-contracted service users will share the cost indirectly through the companies.

The concept of cost-sharing is illustrated in **Figure 4.9-1**. Cost-sharing of each user category in 100% collection is shown in **Table 4.9-1**.

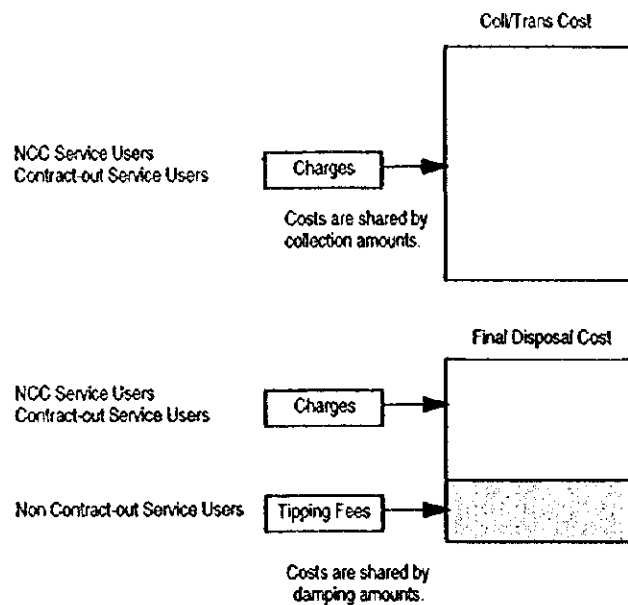


Figure 4.9-1 Concept of Cost Sharing

Table 4.9-1 Cost Sharing (100% Collection)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Collection/Transport									
Household	92.90%	92.98%	93.09%	93.20%	93.26%	93.39%	93.46%	93.55%	93.64%
Commercial	7.10%	7.02%	6.91%	6.80%	6.74%	6.61%	6.54%	6.45%	6.36%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Final Disposal									
NCC and Contract-out									
Household	81.82%	84.05%	84.02%	83.98%	84.67%	84.61%	92.79%	92.81%	93.64%
Commercial	6.26%	6.34%	6.24%	6.12%	6.12%	5.99%	6.49%	6.40%	6.36%
Non Contract-out									
Household	11.08%	8.94%	9.06%	9.22%	8.59%	8.78%	0.67%	0.73%	0.00%
Commercial	0.85%	0.67%	0.67%	0.67%	0.62%	0.62%	0.05%	0.05%	0.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

In terms of the commercial waste charge, the existing billing system of charging collection through the water charge system is continued in the plan, considering smoothness of implementation. The tariff employs a flat rate system, which is different from the household waste charge.

There is an idea that the commercial charge is changed in accordance with the size of the business entity such as number of employees, sales, equities, etc., assuming that waste production increases in proportion to such figures. The reasons why a discriminated rate tariff is not employed are data availability on business entities and required change in the existing charge calculation system in accordance with the size of commercial entity. In addition, the commercial share of total waste production is only about 6-7%. However, since a few number of entities have no water meter, there is another idea that charges are added to business license fees for which NCC has the authority in order to improve fairness and revenue.

4.10 Public Education and Awareness Plan

4.10.1 Overview of Findings

The significant findings of the analysis are:

- (a) A political commitment to provide improved waste management services is a fundamental requirement of the strategy;
- (b) The NCC is insufficiently aware of the nature and complexity of the SWM issues facing Nairobi or of its need to work with community groups in the provision of appropriate services;
- (c) The important role of the NCC is to facilitate the involvement of community organisations in the provision of appropriate solid waste management arrangements;
- (d) The importance of waste as a source of income for many Nairobi households has to be recognised during the formulation of SWM strategies; and
- (e) Programmes of civic education aimed at the very poor can be a source of public conflict and are not required.

4.10.2 Strategy Implications

The strategy implications of these points are summarised below.

(1) Raising Awareness Within the NCC

The NCC's own awareness of the requirements of a new solid waste management strategy is low, and is proposed to be enhanced through a programme of seminars and workshops directed at council officials prior to a public announcement on the implementation of the new strategy.

(2) Communications Strategy

Following a decision on strategy implementation, the NCC has to inform the public of the measures it proposes taking to improve SWM services and of how it proposes to fund these by increasing the existing low level of charges. A properly structured communications strategy is needed.

(3) Raising Public Awareness

Significant points are:

- (a) A public education and awareness programme should accompany the NCC's announcement of the new strategy. Any attempt to introduce it before the NCC has spelt out the steps it is to take to improve solid waste management conditions in the city would be futile.
- (b) Two video films edited by the JICA Study Team have to be used for raising general public awareness of SWM issues; one targeted at the adult population and the other at school-age children.

(4) Primary Education

Significant points are:

- (a) A "children's charter" is proposed to make school children more aware of solid waste issues. It involves a commitment by the NCC to provide high quality collection services to all schools and by children to keep their school compounds free from waste. It is reflected in a signed "Charter" prominently displayed in all schools.
- (b) A highly visible public commitment such as this would heighten children's awareness of the issues involved and place a duty on the NCC to meet its publicly declared obligations.
- (c) The City Education Department needs resources if it is to participate in raising awareness. Technical assistance is proposed (refer below) to provide two each of a video camera, VCR and TV subject to the NCC implementing the "Children's Charter".

(5) Recommendations

Essential recommendations are:

- (a) That a programme of workshops and seminars be prepared with accompanying fact sheets to improve the general awareness of NCC officials of the issues involved in the delivery of appropriate SWM services to the people of Nairobi.
- (b) That the NCC should work to ensure the success of the existing NCC-CBD private sector contract as a way of demonstrating its commitment and capacity to provide good quality solid waste services in the capital.
- (c) That a communications strategy be prepared to inform the public of the measures it proposes taking to improve SWM services and of how these are to be funded by increasing existing charge levels.
- (d) That two video films edited by the JICA Study Team have to be used to raise public awareness on SWM issues in Nairobi; one to be targeted at the adult population and the other at school-age children.
- (e) That the NCC implements a "Children's Charter" in which the NCC pledges to provide a good quality collection service and the schools to maintain conditions within school compounds.

(6) Proposals for Technical Assistance

Technical assistance required to implement the above recommendations is as follows:

- (a) The appointment of a Communications Specialist for a period of two (2) months (following completion and acceptance by the Kenyan authorities of the JICA Study Team findings and recommendations) with the following objectives: (1) to prepare relevant materials and organise a programme of workshops and seminars directed at council officers prior to a public announcement of the strategy being made; and (2) to prepare

- a communications strategy to accompany the NCC's public announcement of the measures it is to take to improve SWM services. The cost is estimated at Kshs. 3,500,000.
- (b) The provision of communications equipment, i.e., two each of a video camera, VCR and TV, to the Department of City Education (subject to the NCC implementing the "Children's Charter"). The cost is estimated at Kshs. 1,100,000.
 - (c) The total cost of public education for technical assistance is therefore estimated at Kshs. 4,600,000. This cost is included in the cost of the CBAP as mentioned in **Subsection 4.6.10**.

4.11 Preparatory Actions by NCC

4.11.1 General

Project implementation requires a large amount of cost and manpower in general. More importantly, proper organisational and institutional arrangements with appropriate management capability by the concerned officials are inevitably necessitated to carry out any project successfully.

The JICA Study Team strongly recommends that the Nairobi City Council (NCC) should take the actions mentioned in the following subsections which are thought to be self-endeavouring actions without a large capital investment in order to facilitate the proposed projects in the Master Plan.

4.11.2 Organisational Strengthening of the DoE

NCC needs to carry out a number of essential actions between 1998 and 1999 to strengthen the Department of Environment (DoE) and to prepare it for a capacity building assistance program (CBAP) which is proposed to be implemented from 1999 to 2000.

These actions are recommended in the Institutional Restructuring Plan, and cover:

- (a) implementing changes to the existing organisational structure; and
- (b) setting up a number of new sections and functions, and appointing new managers and staff.

Changes to the DoE's existing organisational structure can be summarised as:

- (a) reducing the number of vertical levels in the organisation and creating new positions for three Deputy Directors, an operations manager and two deputy operations managers;
- (b) separating disposal from collection and street cleansing services and establishing a Disposal Section; and
- (c) separating the management of collection services from that of street cleansing.

The new functions which need to be established are:

- (a) a new Community Development Section;
- (b) a new Environmental Planning and Management Division responsible for the environmental regulation of solid wastes;
- (c) a Contract Management Section;
- (d) a new Administration Division to manage the DoE's human resources, finance and general administration; and
- (e) appointment of an MIS officer.

The CBAP would be conditional upon the DoE implementing these actions.

4.11.3 Establishment of Financial Autonomy

NCC needs to carry out the following actions.

- (a) Organisation of a work team to work out the modalities of having a special account for SWM services in DoE. Modalities to include: revenue sources (revenue forecast, financial analysis of current revenues), collection method, tariff setting, schedule for collection of revenue and justification for financial autonomy.
- (b) Preparation for approval of the agreed modalities by NCC.
- (c) Setting-up of a temporary Financial Unit under DoE from the City Treasurer's Department to handle the preparatory actions while waiting for approval of the unit, and making of a monthly report covering the present cash flows of SWM services by DoE.

4.11.4 Promotion of Private Sector Involvement (PSI)

NCC needs to carry out the following actions.

- (a) Review of performance of the private collector contracted by NCC for cleaning the CBD area based on the outputs of "Contract Management" Workshop held on 8th and 9th January 1998.
- (b) Review of performance of NCC in the CBD contracts based on the outputs of "Contract Management" Workshop held on the 8th and 9th January 1998 (contract management, financial, etc.).
- (c) Continuation of the current private contract-out in the CBD area and its appropriate management/monitoring in consideration of the above items (a) and (b).
- (d) Identification of community based organisations which can be incorporated when contracting out for collection and transportation services under PSI.

4.11.5 Improvement of the Dandora Dumpsite

NCC needs to carry out activities to improve the final disposal system in Nairobi City, namely:

- (a) Improve and Sustain the Condition of Dandora site.
- (b) Strengthen the Operational Management of Dandora.

(c) Preparation Work for New Disposal Site(s).

(1) Improve and Sustain the Condition of Dandora Dumpsite

The condition of the Dandora Dumpsite should be improved and sustained by ensuring that the access road and dumping points are kept constantly clear, and that periodical land-filling and land reclamation of the existing dump area is carried out.

Either the DoE's heavy equipment should be repaired and used or, alternatively, equipment should be hired.

(2) Strengthen the Operational Management of Dandora

- (a) Increase the number of inspectors at the site.
- (b) Introduce controlled dumping. Zoning of the dumping area for hospital waste and others; hospital waste area should be covered by soil.
- (c) Recording and keeping data on the volume of solid waste dumped, and compare between collection record and dumped record.
- (d) Monthly monitoring the surrounding environmental conditions. The result of the monitoring should be reported to the director of DoE.
- (e) Prohibit dumping at night time. DoE have to issue letters of instruction to private companies mentioning the regulations of dumping at the Dandora Dumpsite.

(3) Preparation Work for New Disposal Site(s)

- (a) Take steps to acquire land for the disposal site(s).
- (b) Obtain the consent of neighboring residents for the construction of a new final disposal site(s) through EIA.

4.11.6 Improvement of Collection and Transportation Operations

NCC needs to carry out the following actions.

- (a) Establish a reporting system of daily operation of collection vehicles (in and out time, mileage, fuel consumption, name of the driver and loaders, any failures and problems) and a cross checking system to compare with records of a disposal site.
- (b) Make inventories of vehicles in other Departments which can be used for the collection and transportation work and request to use the vehicles temporarily for collection.
- (c) Add one more trips for collection of waste by introducing of job-shifting.
- (d) Check the existing vehicle's conditions and identify the necessity of repair and the quantity and cost of required spare parts, tools and equipment, and prepare a monthly report covering all repair and maintenance records.

- (e) Separate routine and logistics maintenance activities of DoE from the general workshop activities, possibly establish a small workshop at the Kaloleni Depot.
- (f) Reinforce the city inspection regarding condition of uncollected waste and report the result to the Cleansing Section daily and weekly.
- (g) Conduct at least two seminars for drivers on traffic regulations and safety.

4.12 Urgent Improvement Plan

4.12.1 Necessity of the Urgent Improvement Plan

Due to rapid urbanisation and migration in Nairobi, the present capacity of waste collection and disposal will not cope with an increase of the waste amount in the nearest time even if the above Preparatory Actions by NCC are done completely. To maintain at least the current situation, the Urgent Improvement Plan is required to be carried out as quickly as possible because the actual increase of the collection ratio will arise from the year 2000 due to arrangement and preparation of financial resources. The Urgent Improvement Plan comprises the following two projects:

- (1) Renewal of the existing collection vehicles, and
- (2) Improvement work for the Dandora dumpsite.

The scope of the Urgent Improvement Plan is to be defined in consideration of the existing human and financial resources of NCC. The Plan therefore does not require a greater number of additional manpower and operating cost rather than that of the current ones.

4.12.2 Renewal of the Existing Collection Vehicles

The Department of Environment (DoE) had been operating around fifteen (15) collection vehicles in the years from 1996 to 1997. However, except five (5) dump trucks procured in 1997 the newest vehicles, i.e., six (6) compactors have already had five year operation records, which are almost near the depreciation period and are frequently unavailable.

For the Urgent Improvement Plan, therefore, fifteen (15) dump trucks that are the same as the average available number of vehicles in the recent time are recommended to be procured. The specifications of the truck are also the same as those which were purchased in 1997.

4.12.3 Improvement Work for the Dandora Dumpsite

NCC has to use the existing dumping site until a new site(s) is constructed. Therefore, NCC should make efforts to improve and sustain the condition of the Dandora dumping site.

The DoE introduced three bulldozers to the dumping site from the end of October 1997. Two of them were hired and one was repaired to clean the public road and ensure the access road and dumping points. The two bulldozers from a private construction company were hired for only one month, but the activities were very

effective to improve the site conditions. The activities demonstrated that the introduction of heavy equipment is the most effective to improve the site conditions.

Accordingly, DoE has to maintain the repaired bulldozer very well and also to permanently operate a reasonable number of heavy equipment at the site. The reasonable number of heavy equipment for daily management is three (3) bulldozers and one (1) excavator. NCC has to keep an annual budget to hire or purchase two bulldozers and one excavator. The detail calculation is described in **Subsection 1.3.2, Supporting Report Section H.**

If NCC requires land reclamation of the old dumping area to improve the present site conditions, NCC has to introduce more number of heavy equipment.

4.12.4 Schedule and Cost of the Urgent Improvement Plan

The Urgent Improvement Plan will be driven by the present human and financial resources of NCC and will basically succeed the existing systems of collection, transportation and disposal. The specifications of the vehicles and machine will be the same as the existing ones. Therefore, it should not take a long time to procure the required vehicles and heavy equipment. This means that the Plan could commence from the year 1999.

Capital cost for the Urgent Improvement Plan is estimated at Kshs. 82.6 million and the operation and maintenance (O&M) cost is Kshs. 100.9 million. The total project cost of the Plan is Kshs. 183.5 million as summarised in **Table 4.12-1** below.

Table 4.12-1 Summary of Cost for the Urgent Improvement Plan

			Unit: Kshs million
Project	Capital cost	O&M Cost*	Total Cost
Renewal of the existing collection vehicles	48.8	93.2	142.0
Improvement work for the Dandora dump site	33.8	7.7	41.5
Total	82.6	100.9	183.5

* Operation and maintenance (O&M) Cost means costs of personnel, fuel and oil for vehicles and equipment, and spare parts and consumables only.

4.12.5 Impacts of the Urgent Improvement Plan

(1) Increase of Waste Collection Rate

The current collection coverage ratio or waste collection rate, i.e., proportion of the amount of waste collected to the total amount of waste generated, is estimated at about 25%. The total amount of waste collected is approximately 360 tons per day.

The proposed fifteen (15) dump trucks will collect an additional amount of waste. The existing truck carries 4 tons per truck per trip, and the present manual loading will also give two trips a day on average. Consequently, these new trucks will collect the amount of: $15 \times 4 \times 2 = 120$ ton/day.

Thus, the total collected amount will be: $360 + 120 = 480$ ton/day and, the total amount of generated waste in 1999 is estimated at 1,595 ton per day (see **Data Book (1), Table 1.2-2**). The waste collection rate is therefore: $480 \div 1,595 = 0.300 = 30\%$

The Urgent Improvement Plan will make the waste collection rate increase from the present 25% to 30% although the amount of generated waste will be growing more than 110% of the existing amount.

(2) Improvement of the Dandora Dumpsite

The improvement work will extend the existing disposal capacity and make longer life for disposing the waste on the site.

Keeping and maintaining the access road will facilitate unloading of waste on the designated area. Daily operations such as gathering of waste and application of cover soil on the waste will also reduce dust, odour and gas emission. These will result in less possibility of secondary pollution.

4.12.6 Financial Aspect of the Urgent Improvement Plan

The Urgent Improvement Plan has been examined from the financial viewpoint. In addition to the cost of the Plan, PSI contract cost was considered in the financial analysis. Revenues are charges collected from households and commercial establishments. The analysis was carried out on the following assumptions:

- (1) Estimation period is 1999 only.
- (2) O&M cost includes personnel cost which is required only for the Urgent Improvement Plan;
- (3) PSI contract cost is Kshs 39 million. It is increased by 1.07 times from Kshs 36 million, which is currently introduced in the central business district (CBD) area, because the collection amount is expected to increase as much;
- (4) Depreciation is not included;
- (5) Engineering cost is not included in the initial investment cost;
- (6) Capital cost is financed by subsidies or grant aid; and
- (7) Waste charge is 100 Kshs/month both for households and commercial establishments and levied on every water account.

It is estimated that the total cost of the Urgent Improvement Plan is Kshs 222 million including the PSI contract cost. Revenue which is estimated at Kshs 184 million could thus fully cover the costs for O&M and the PSI contract totaling Kshs 140 million. Unless the PSI contract cost is considered, the total cost of the Plan would be Kshs 184 million and just balanced. See **Table 4.12-2**.

Table 4.12-2 Result of Financial Analysis for the Urgent Improvement Plan

Unit: Kshs million

Item	Particulars	Amount
	Cost	
(1)	Capital Cost	82.6
(2)	O&M Cost	100.9
(3)	Sub-Total (1)+(2)	183.5
(4)	PSI Contract	38.6
(5)	Total (3)+(4)	222.1
	Revenue	
(6)	Households	173.1
(7)	Commercial Establishments	10.7
(8)	Total (6)+(7)	183.8
(9)	Balance (8)-(2)-(4)	44.3

4.13 Phased Implementation Plan and Priority Projects

4.13.1 General

The financial constraints of NCC will seriously affect project sustainability because the financial autonomy as well as the accounting system of NCC based on collecting the waste charges is a bottom line of the Master Plan. This section firstly estimates the financial cost of the Master Plan to be covered with different financial sources such as loan, grant, subsidy and waste charges. Secondly, a phased implementation plan is formulated from technical and institutional viewpoints and the result of this financial estimation. Finally, priority projects in the Master Plan are selected to conduct the Feasibility Study.

4.13.2 Financial Consideration

The preliminary estimation for the Master Plan projects was made from the financial viewpoint. This helps to consider how the projects are to be implemented, timing of start and the scale of the projects as discussed below. Here, project scales mean waste collection rates. Since the waste collection rate or collection coverage ratio is defined as proportion of the amount of waste collected to the total amount of waste generated, project dimensions of collection and transportation system and final disposal system depend on the collection rate.

(1) Assumptions/Conditions for Estimation

Assumptions/conditions for the financial estimation are basically the same as those employed in Section 4.14. It should be noted that all prices are indicated in 1997 prices.

The Master Plan projects include: (1) Capacity Building Assistance Program (CBAP); (2) Contract-out for private sector involvement; (3) Construction of a new final disposal site and its operation, including closure of Dandora; and (4) Collection/Transportation System which employs container system for the main collection system, transfers wastes through the transfer station to one final disposal site at Ruai; including Community Waste Management Project (CWMP).

(2) Project Cost

Project costs in accordance with waste collection rates are estimated for all the project years 1998-2008, where the waste collection rates are kept constant (see Table 4.13-1).

Table 4.13-1 Project Costs and Waste Collection Rates

Unit: Kshs million

	Waste Collection Rate			
	40%	60%	80%	100%
CBAP	47.8	47.8	47.8	47.8
Contract	2,141.8	2,141.8	2,141.8	2,141.8
Final Disposal				
Operation	174.6	240.5	308.3	378.5
Depreciation	103.8	152.7	211.5	260.0
Initial Investment	1,741.8	1,790.7	1,849.5	1,898.0
Engineering	70.5	70.5	70.5	70.5
Final disposal Total	2,090.8	2,254.4	2,439.8	2,607.0
Coll/Trans				
Operation	3,256.8	4,778.0	6,689.9	8,858.7
Depreciation	906.5	1,435.7	1,963.1	2,531.9
Initial Investment	2,251.3	2,822.5	3,406.0	4,048.5
Engineering	112.6	141.1	170.3	202.4
Sub-total	6,527.1	9,177.3	12,229.3	15,641.5
CWMP	29.6	29.6	29.6	29.6
Coll/Trans Total	6,556.7	9,206.9	12,258.9	15,671.1
Total	10,837.1	13,650.9	16,888.3	20,467.8

* Total cost may not be the same as indicated due to rounding.

(3) Financing Sources

(a) Initial Investment Costs

Sources which finance the initial investment costs including engineering fees are expected to be (a) 100% loan (interest rate: 8%, grace period: 5 years), (b) 50% grant aid and 50% loan (grant aid covering the costs in 1998-2000 and loan covering the costs in 2001-2008), and (c) 100% grant aid.

(b) Operating Costs

The operating costs come from revenues expected in the projections that are composed of the waste charges and/or subsidies. In case that the charge revenues are not enough to cover the costs, subsidies from the central government would be considered.

(4) Balances

Projections are examined in the way how the revenues balance the costs. Balances here mean those on revised cash flow basis, which assumes the depreciation is saved and just finances replacement cost. This assumption is vital for achieving the sustainability of the projects, otherwise, deficits would

consume replacement costs. The deficits mean that other finance sources, specifically, subsidies that are equivalent to the deficits are required to operate and maintain the projects.

(5) Projection Results

(a) Waste Collection Rates and Balances

Relations between waste collection rates and the balances are examined by setting up average household charges at 100, 200, up to 500 Kshs/month while commercial charges are fixed at those just covering the cost share for each case of financing. It should be noted that surpluses or deficits examined here are those of single-year base.

(i) 100% Loan

See Figures 4.13-1 to 4.13-3. If a charge of nearly Kshs. 400 is collected, this could finance all costs for 100% waste collection in 2000 which include loan interest, but it causes more Kshs. 585 million deficit in 2004, and Kshs. 1,071 million deficit in 2008. In the case of Kshs. 200, it brings Kshs. 551 million deficit in 2000, Kshs. 1,289 million in 2004 and Kshs. 1,919 million in 2008. On the other hand, if waste collection rate is reduced to 60%, a charge of Kshs. 400 produces Kshs. 420 million surplus in 2000, Kshs. 152 million surplus in 2004 and Kshs. 122 million deficit in 2008.

(ii) 50% Grant and 50% Loan

See Figures 4.13-4 to 4.13-6. If a charge of Kshs. 400 is collected, this could finance all costs for 100% waste collection and makes Kshs. 213 million surplus in 2000 but it causes more than Kshs. 42 million deficit in 2004, and Kshs. 543 million deficit in 2008. In the case of Kshs. 200, it brings Kshs. 371 million deficit in 2000, Kshs. 745 million deficit in 2004 and Kshs. 1,391 million deficit in 2008. On the other hand, if waste collection rate is reduced to 60%, a charge of Kshs. 400 produces Kshs. 553 million surplus in 2000, Kshs. 549 million surplus in 2004 and Kshs. 273 million deficit in 2008.

(iii) 100% Grant

See Figures 4.13-7 to 4.13-9. If a charge of Kshs. 400 is collected, this could finance all costs for 100% waste collection and makes Kshs. 213 million surplus in 2000 and causes Kshs. 83 million surplus in 2004, but the balance changes to Kshs. 195 million deficit in 2008. In the case of Kshs. 200, it brings Kshs. 371 million deficit in 2000, Kshs. 620 million deficit in 2004 and Kshs. 1,042 million deficit in 2008. On the other hand, if waste collection rate is reduced to 60%, a charge of Kshs. 400 produces

Kshs. 553 million surplus in 2000, Kshs. 661 million surplus in 2004 and Kshs. 567 million surplus in 2008.

These are as graphically illustrated below.

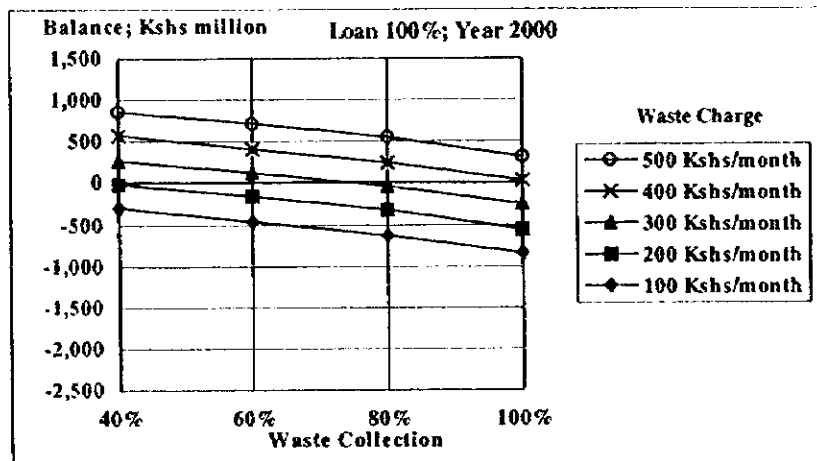


Figure 4.13-1 Waste Collection Rates and Balances (2000); 100% Loan

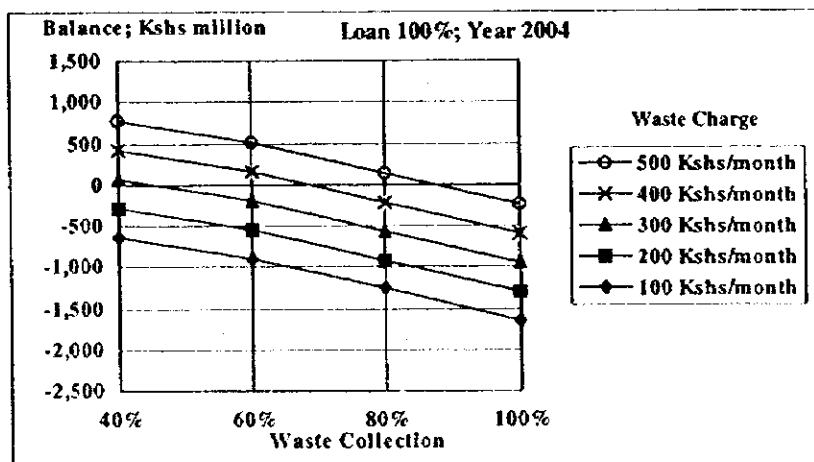


Figure 4.13-2 Waste Collection Rates and Balances (2004); 100% Loan

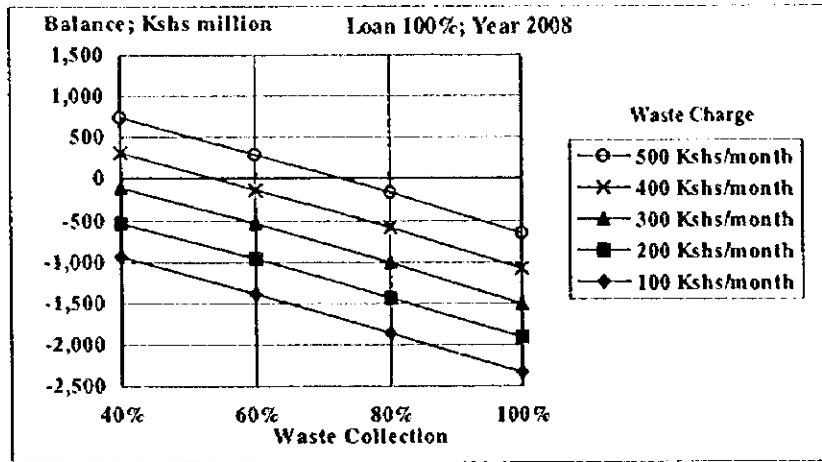


Figure 4.13-3 Waste Collection Rates and Balances (2008); 100% Loan

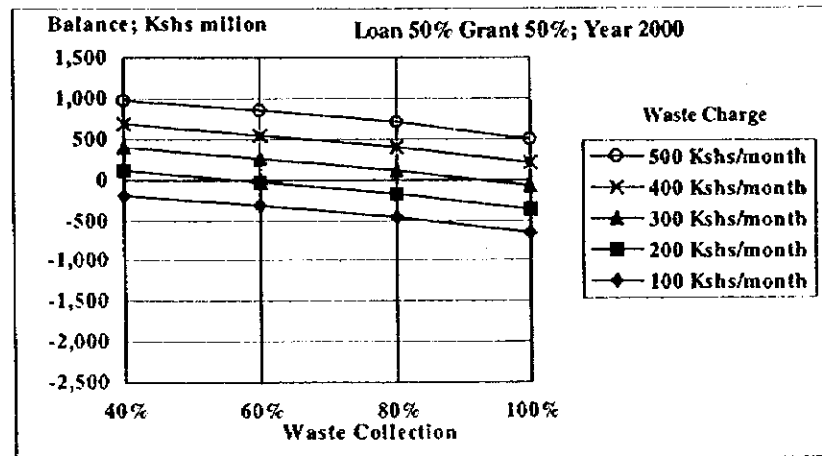


Figure 4.13-4 Waste Collection Rates and Balances (2000); 50% Grant and 50% Loan

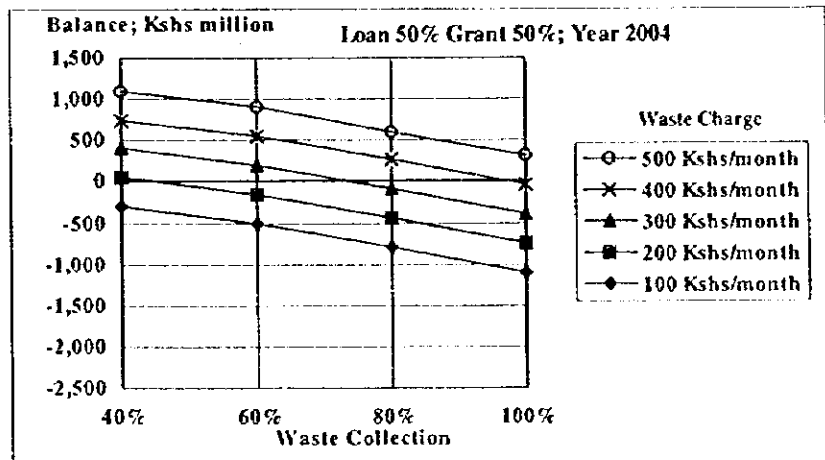


Figure 4.13-5 Waste Collection Rates and Balances (2004); 50% Grant and 50% Loan

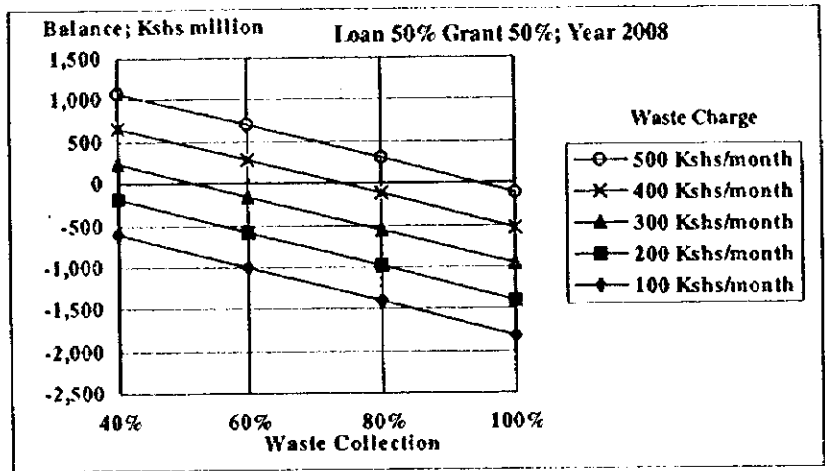


Figure 4.13-6 Waste Collection Rates and Balances (2008); 50% Grant and 50% Loan

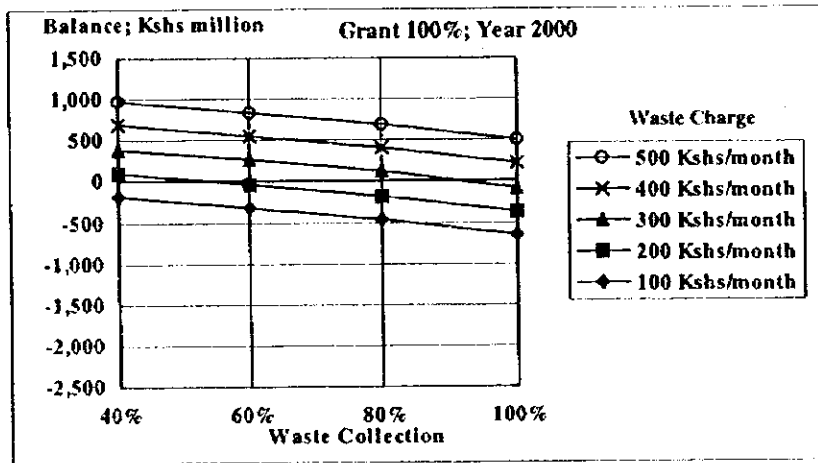


Figure 4.13-7 Collection Rates and Balances (2000); 100% Grant

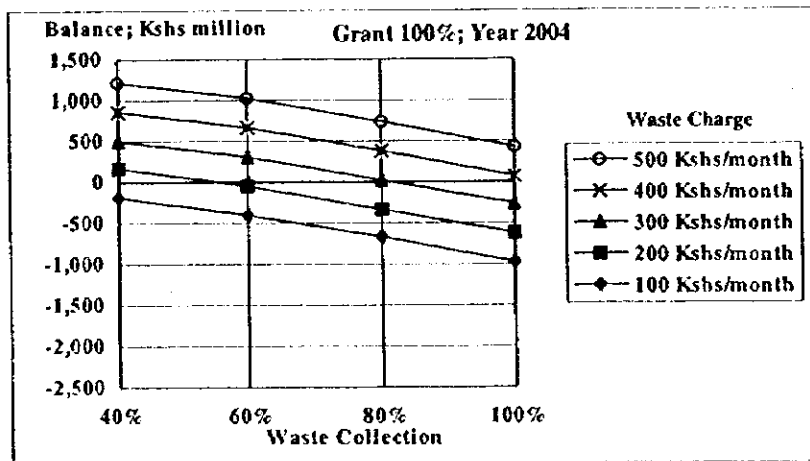


Figure 4.13-8 Collection Rates and Balances (2004); 100% Grant

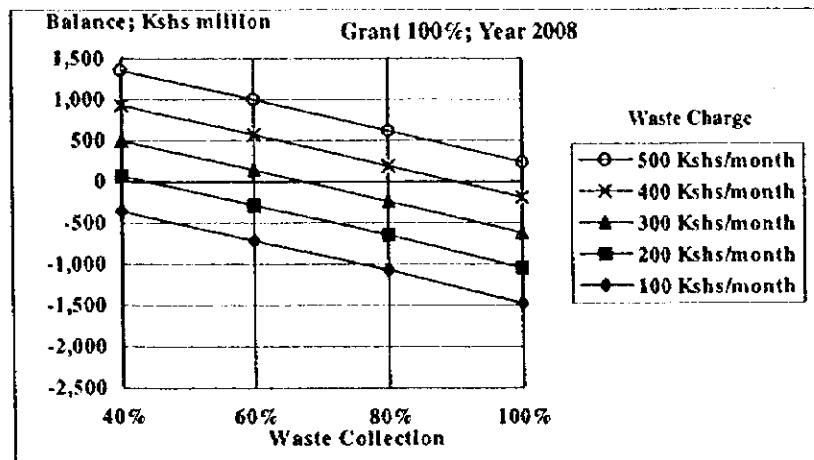


Figure 4.13-9 Collection Rates and Balances (2008);
100% Grant

(b) Waste Collection Rates and Charges

Here, average household charge which just balance the O&M costs and depreciation for each year is calculated in accordance with **Subsection 4.9.2, General Principles of SWM Finance**. In this case the total balances are deficit because capital cost and loan interest are not paid by households. The charge which would make up for the operating costs and depreciation is the same whatever is the finance source. On the other hand, commercial charges and balances differ depending on the finance source. Thus, all year average household charge is 165 Kshs in 40% waste collection, 229 Kshs in 60%, 304 Kshs in 80% and 388 Kshs in 100%, as shown in Table 4.13-2 below. Commercial charges are presented in Table 4.13-3.

Table 4.13-2 Required Waste Charges Per Family Depending on Waste Collection Rates
Charges Per Family; Unit: Kshs/month

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Avr.
40%	165	169	158	149	155	147	181	176	182	165
60%	211	218	210	203	212	213	253	254	266	229
80%	261	274	276	277	292	295	337	340	354	304
100%	327	352	355	359	376	380	425	430	446	388

Table 4.13-3 Required Waste Charges Per Commercial Account Depending on Waste Collection Rates

Charges Per Commercial Account (Loan 100%); Unit: Kshs/month										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	Avg.
40%	464	488	478	466	470	458	553	545	545	501
60%	648	659	652	642	645	634	685	680	677	660
80%	844	848	841	832	834	824	849	844	840	840
100%	1,056	1,053	1,047	1,037	1,039	1,029	1,032	1,027	1,022	1,036

Charges Per Commercial Account (Loan 50%/Grant 50%); Unit: Kshs/month										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	Avg.
40%	359	353	345	337	340	331	404	398	398	366
60%	457	495	489	482	484	476	517	512	511	494
80%	565	657	652	645	647	639	659	656	653	644
100%	709	832	827	820	821	813	816	813	809	809

Charges Per Commercial Account (Grant 100%); Unit: Kshs/month										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	Avg.
40%	359	352	326	302	308	287	319	305	309	316
60%	457	455	432	411	422	415	446	442	452	437
80%	562	572	567	561	582	575	594	591	600	580
100%	709	735	731	726	749	742	748	747	757	740

In the case where the initial investment costs are financed by a 100% Loan, the total balance is Kshs. 3,367 million deficit in 40% waste collection, Kshs. 3,814 million deficit in 60%, Kshs. 4,440 million deficit in 80% and Kshs. 5,029 million deficit in 100%. In the case of a 50% Grant and 50% Loan, total deficits are Kshs. 954 million, Kshs. 1,023 million, Kshs. 1,103 million and Kshs. 1,179 million, respectively. The deficit should be compensated by subsidies from the central government or any other special financing resources. The required amounts of subsidies that would make up for loan interest and redemption are shown in Table 4.13-4.

Table 4.13-4 Required Subsidies Depending on Waste Collection Rates

Balance (Loan 100%); Negative Figures: Subsidies; Unit: Kshs million										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
40%	-111	-172	-215	-246	-437	-504	-533	-550	-598	-3,367
60%	-133	-201	-246	-278	-508	-583	-618	-638	-689	-3,894
80%	-153	-229	-278	-314	-585	-668	-706	-727	-780	-4,440
100%	-180	-264	-315	-353	-669	-757	-796	-819	-876	-5,029

Balance (Loan 50%/Grant 50%); Negative Figures: Subsidies; Unit: Kshs million										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
40%	0	1	-42	-74	-109	-107	-161	-197	-266	-954
60%	0	5	-40	-74	-111	-115	-176	-219	-294	-1,023
80%	0	10	-40	-77	-118	-124	-193	-240	-321	-1,103
100%	0	11	-40	-79	-125	-133	-205	-259	-349	-1,179

4.13.3 Step-by-Step Implementation of Projects

Implementation timing and scale are very important and need examination from the various viewpoints for successful installation.

(1) Implementation Schedule on Step-by-Step Basis

When a new system is introduced in the activities which will widely affect the people and the costs are huge, it is usual that the system be implemented on a

step-by-step basis in order to avoid irreversible failure and achieve smooth installation considering the improvement of skills of the operators, administrative staff and so on. On the other hand, frequent enhancement of the system is intricate in following governmental procedures and often brings confusion. Considering these factors, three to four year interval is suitable for step-ups. Since the project period is 11 years and the new system is expected to start in 2000, the second step starts in 2004 and the third or final step starts in 2008 or the target year. Therefore, the Master Plan is divided into three (3) implementation stages.

(2) Target Waste Collection Rate of Each Implementation Stage

Since the current waste collection rate is very low at approximately 25%, a stepwise increase in waste collection rate is to be made in each stage as mentioned above to attain the goal of 100%. In the initial stage of the project, the collection rate is to be proposed at more than half of the generated waste, i.e., 60% to realise visible improvement of the environmental condition. The collection rate will accordingly go up to 80% in the second stage of 2004 and 100% by the year 2008. The collection rate or collection coverage ratio in this study means the proportion of amount of waste collected to the total amount of waste generated.

From a financial point of view, monthly payment of Kshs. 327 per family will be required as the waste charge in 2000, Kshs. 376 in 2004 and Kshs. 446 in 2008 (see Table 4.13-2 above) if the waste collection rate is set up at 100% from the beginning of the project term. This charge amount is quite high compared with the present charging Kshs. 10 for refuse removal by NCC. Even if 80% collection rate is adopted, the waste charge in 2000 will be Kshs. 261.

As a result of the Public Awareness Survey, the average willingness to pay ranges from Kshs. 212 to Kshs. 61 answered by high, middle and low income residents (see Subsection 4.2.2). Other surveys in the Study, such as a questionnaire survey in the Experimental Collection Work, also support this result. Considering these results, it is recommended that the waste collection rate is to be raised on a step-by-step basis, and less than 60% collection rate in 2000 will be appropriate.

(3) Required Number of Vehicles and Equipment for the Phased Implementation

Based on the above stepwise increase of waste collection rate, i.e., 60% in 2000, 80% in 2004 and 100% in 2008, the number of vehicles and equipment required for collection is presented below (figures for 1998 and 1999, which include the number required for the Urgent Improvement Plan, are shown as reference).

Table 4.13-5 Vehicles and Equipment Required for the Phased Implementation
(Waste Collection Rate: 1998-2003; 60%, 2004-2007; 80%, 2008; 100%)

No	Items	Quantity										
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Collection/Transport												
1	Detachable-container truck	41	43	45	47	49	51	83	87	92	97	139
2	Container	927	967	1008	1055	1104	1156	1873	1968	2074	2186	3143
3	Trailer truck	14	15	15	16	17	18	25	27	28	30	40
4	Side loader	20	21	22	23	24	25	40	42	45	47	67
5	Dump truck	9	10	10	11	11	12	19	20	21	22	32
6	Wheel loader	9	10	10	11	11	12	19	20	21	22	32
7	Water sprinkler	2	2	2	2	2	2	3	3	3	4	5
8	Inspection car	22	22	22	22	22	22	22	22	22	22	22
9	Tow truck	1	1	1	1	1	1	2	2	2	2	2
10	Parking lots	6	6	6	6	6	6	6	6	6	6	6
Final Disposal												
11	Bulldozer	3	3	3	7	7	7	12	12	12	12	12
12	Excavator	1	1	1	1	1	1	1	1	1	1	1
13	Dump truck	0	0	0	2	2	2	3	3	3	3	3
14	Jeep	0	0	0	1	1	1	1	1	1	1	1

The project implementation on the step-by-step basis is evaluated in detail in Section 4.14, Evaluation of the Master Plan.

4.13.4 Project Implementation of Each Stage

(1) Year 1998 - 1999 (Preparatory Actions and Urgent Improvement Plan)

The Preparatory Actions in major components of the Master Plan, as described in Section 4.11, are to be carried out between 1998 and 1999.

The Urgent Improvement Plan comprising renewal of the existing collection vehicles and improvement of the Dandora dumpsite is also planned to start in 1998 and actually will be operating from 1999.

(2) Year 1999 - 2003 (First Implementation Projects)

The First Implementation Stage from 1999 to 2003 has the following projects to be implemented:

- (a) Capacity Building Assistance Program (CBAP): 1999 to 2000;
- (b) A new SWM By-laws be enacted in the CBAP between 1999 and 2000;
- (c) Financial reform for SWM within the same program of CBAP;
- (d) Collection of tariff of Kshs. 100 per month per household for SWM be started at least by 1999;
- (e) Designing the final disposal site in 1999;
- (f) Community Waste Management Project (CWMP) from 1999;
- (g) Designing the collection vehicles and other equipment and facilities including a transfer station and a preventive workshop in 1999;
- (h) First stage construction of the final disposal site be completed at the end of year 2000;

- (i) Procurement of heavy equipment for landfill operation in 2000;
- (j) Procurement of the collection vehicles and other vehicles be completed within 2000;
- (k) Construction of the transfer station (first phase) and the preventive workshop be completed within 2000;
- (l) New tariff system be started from 2000;
- (m) Raising awareness within NCC in 2000;
- (n) Establishing communications strategy in 2000;
- (o) Public campaign and education from 2000;
- (p) Second stage construction of the final disposal site be completed at the end of year 2001;
- (q) Review of the CBAP from 2001;
- (r) Contract-out for Ngara from 2001; and
- (s) Third (final) stage construction of the final disposal site be completed at the end of year 2002.

(3) Year 2003 - 2007 (Second Implementation Projects)

The Second Implementation Stage from 2003 to 2007 has the following projects to be implemented:

- (a) Designing and procurement of heavy machine for landfill operation in 2003;
- (b) Designing and procurement of the collection vehicles and other equipment in 2003;
- (c) Construction of the transfer station (second phase) be completed within 2003;
- (d) Continuation of the CWMP between 2003 and 2007;
- (e) Review of performance of the contract-out at Ngara in 2003;
- (f) Contract-out for Kenyatta/Golf Course from 2004;
- (g) Increase of the tariff rates from 2004;
- (h) Public campaign and education focusing on business establishments and recycling industries from 2004;
- (i) Further capacity building program, if necessary, between 2004 and 2007;
- (j) Review of performance of the contract-out at Kenyatta/Golf Course in 2005; and
- (k) Contract-out for Parklands excluding Muthaiga from 2006.

(4) Year 2007 - 2008 (Third Implementation Projects)

The Third Implementation Stage from 2007 to 2008 has the following projects to be implemented:

- (a) Designing and procurement of heavy machine for landfill operation in 2007;
- (b) Designing and procurement of the collection vehicles and other equipment in 2007;
- (c) Construction of the transfer station (final phase) be completed within 2007;
- (d) Continuation of the CWMP in 2008;
- (e) Review of performance of the contract-out at Parklands in 2007;
- (f) Contract-out for Kilimani from 2008;
- (g) Increase of the tariff rates from 2008;
- (h) Continuation of public campaign and education focusing on business establishments and recycling industries in 2008; and
- (i) Preparation of study on a pilot compost plant of the capacity 50 tons per day in 2008.

Based on the above scheduling, the Master Plan from 1998 to 2008 is to be implemented, as shown in **Figure 4.13-10**.

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Future Goals	
Target Collection Rate	25%	30%	60%	60%	60%	60%	80%	80%	80%	80%	100%		
Financial and Institutional Aspect				1st Implementation Stage			2nd Implementation Stage			3rd Implementation Stage			
(1) Institutional Restructuring Plan	Preparatory Actions by NCC		Capacity Building Program (CBAP)	Further Capacity Building Program, if Necessary			Further Capacity Building Program, if Necessary					Full Responsible for SWM by NCC	
(2) Legal Restructuring Plan			Establishment of SWM Policy under the CBAP	Further Capacity Building Program, if Necessary			Further Capacity Building Program, if Necessary					Full Responsible for SWM by NCC	
(3) Private Sector Involvement Plan	Preparatory Actions by NCC		Establishment of Community Management Section under the CBAP	Contract-out of Ngara			Contract-out of Ngara			Ngara		Full Privatisation (Contract out)	
			Regulation of Private Collectors	Review of Performance of Ngara			Contract-out of Kenyatta/Golf Course			Kenyatta/Golf Course			
(4) Financial Improvement Plan	Preparatory Actions by NCC		Financial Reform under the CBAP Establishment of Financial Autonomy	Review of CBAP			Further Capacity Building Program, if Necessary					Full Financial Autonomy for SWM by NCC	
			Collection of Tariff of Kshs 100	Increase of Tariff Rates in accordance with the Increase of Service Levels (1)			Increase of Tariff Rates (2)			Increase of Tariff Rates (3)			
(5) Public Education and Awareness Plan			Establishment of Community Development section under the CBAP	Public Campaign/Education			Public Campaign/Education Focusing on Business Establishments/Recycling Industries					Establishment of SWM Culture	
			Raising Awareness of NCC										
Technical Aspect													
(1) Collection and Transportation Plan	Preparatory Actions by NCC		Community Waste Management Project (CWMP) (1)			CWMP (2)			CWMP (3)			Full Privatisation (Contract-out) Introduction of Separate Collection System	
			Design (1)	Procurement (1)	New Collection/Transportation System								
(2) Waste Reduction, Recycling and Intermediate Treatment plan	Design/Procurement for the Urgent Improvement Plan		Urgent Improvement Plan	Construction of Transfer Station, Workshop, Parking Lots	Design/Procurement (2)			Additional Collection/Transportation System					Treatment of Waste in Combination of Composting, Incinerator etc.
					Resource Recovery (Target : 5% in 2008)								
(3) Final Disposal Plan	Preparatory Actions by NCC		Design (1)	Construction (1)	Construction (2)	Construction (3)						Operation of Complete Sanitary Landfill Reuse of Closed Landfill Site(s)	
				Procurement of Heavy Machine (1)	Design/Procurement (2)			Design/Procurement (3)					
Design/Procurement for the Urgent Improvement Plan		Urgent Improvement Plan											

Note : Procurement (excluding replacement and including the Urgent Improvement Plan in the Procurement (1))

	Container Trucks	Side Loaders	Dump Truck (Toppers)	Trailers	Containers	Wheel loaders	Sprinklers	Inspection Vehicle	Recovery Trucks	Parking Lots	Bulldozer	Excavator	Dump Truck	Jeep
(1)	51	25	12	18	1156	12	2	22	1	6	7	1	2	1
(2)	45	22	10	12	1030	10	2	0	1	0	5	0	1	0
(3)	42	20	10	10	557	10	1	0	0	0	4	1	0	0

Figure 4.13-10 The Master Plan Schedule (1998-2008)

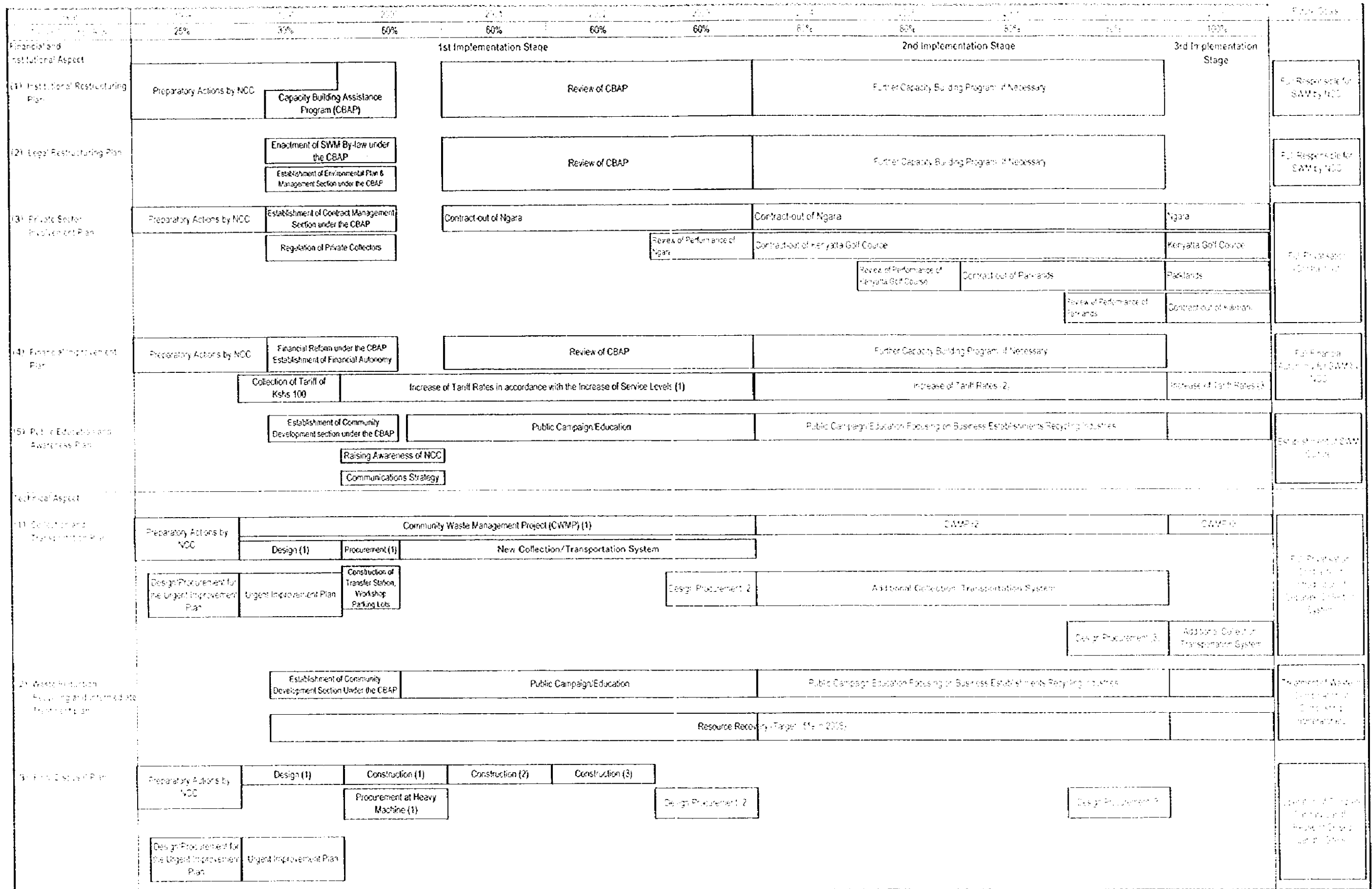


Figure 4.13-10 The Master Plan Schedule (1998-2008)

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4.13.5 Project Cost of the Master Plan

The project cost of the Master Plan and cost of each stage presented above is summarised in Table 4.13-6 below. The total project cost of the Master Plan is Kshs. 17,310 million.

Table 4.13-6 Project Cost of the Master Plan

Unit: Kshs. million

Item	1st Stage 1999 - 2003	2nd Stage 2003 - 2007	3rd Stage 2007 - 2008	Total 1999 - 2008
CBAP	47.8	0.0	0.0	47.8
PSI Contract	575.8	1,136.6	429.5	2,141.8
Final Disposal				
Operation	96.4	153.5	53.2	303.2
Depreciation	44.4	98.4	32.5	175.3
Initial Investment	1,756.5	78.3	63.2	1,898.0
Engineering	65.3	2.9	2.3	70.5
Total	1,962.6	333.2	151.3	2,447.0
Collection/Transportation				
Operation	1,972.8	3,270.9	1,269.9	6,513.5
Depreciation	563.3	962.2	353.2	1,878.6
Initial Investment	1,878.3	1,118.3	1,052.0	4,048.5
Engineering	93.9	56.4	52.6	202.9
Sub-total	4,508.2	5,407.7	2,727.6	12,643.6
CWMP	12.0	13.6	4.0	29.6
Total	4,520.2	5,421.3	2,731.6	12,673.2
Grand Total*	7,106.4	6,891.1	3,312.3	17,309.8

* Total cost may not be the same as indicated due to rounding.

4.13.6 Priority Projects

Based on the results of the Master Plan Study, the following plans are selected as priority projects of SWM with technical and financial optimality as well as urgency of issues taken into consideration.

(1) Institutional and Financial Aspects

(a) Institutional Restructuring and Financial Reform

Organisations related to SWM sections shall be rearranged, taking into consideration of providing the minimum requirements of collection and transport services, future waste recycling and reduction. At the same time, a special account for SWM shall be established and the budgetary system be reformed. On the other hand, collection charge shall be increased to 100 Kshs/month for households with continuing existing billing system, where collection charges are billed with water charges. An increase of the charge rate will be accordingly made from year 2000.

(2) Promotion of Private Sector Involvement

Solid waste collection services shall be commissioned to private companies in the areas of Ngara, which is located in the next to the Central Business District (CBD) where the current contract-out has already been started by the NCC.

(2) Technical Aspect

(a) Construction of a New Final Disposal Site

The existing Dandora site shall be closed and a new disposal site shall be constructed in Ruai Area.

(b) Improvement of the Collection and Transport System

Basically, the NCC shall provide a minimum level of service equally throughout Nairobi City. From the viewpoint of technical and financial optimality, a container type collection with side loaders and dump trucks shall be implemented for achieving 60% collection including private collection services.

4.14 Evaluation of the Master Plan

4.14.1 Financial Evaluation of the Master Plan

(1) General

(a) Objectives of Financial Evaluation

The principal objective of this financial evaluation is to examine the variability of the Master Plan from the viewpoint of a management body with the monetary inflow/outflow calculation.

(b) Methodology

This analysis is conducted based on an estimation in terms of revenues and costs on the proposed SWM plan. Additionally, sources of required funds are assumed as follows.

Table 4.14-1 Sources of Required Funds for Financial Analysis

Case	Initial Investment	O&M Costs and Depreciation
1	100% Loan	<ul style="list-style-type: none"> • Average charge per households: 100, 200, 300, 400 and 500 Kshs/month • Charges for commercial: full cost cover • Deficits are covered by annual budgets or subsidies
2	50% Grant Aid and 50% Loan	<ul style="list-style-type: none"> • Average charge per households: 100, 200, 300, 400 and 500 Kshs/month • Charges for commercial: full cost cover • Deficits are covered by annual budgets or subsidies
3	100% Grant Aid	<ul style="list-style-type: none"> • Average charge per households: 100, 200, 300, 400 and 500 Kshs/month • Charges for commercial: full cost cover • Deficits are covered by annual budgets or subsidies

In addition, the financial viability of the project is examined here by checking how expenditures of the Master Plan can be financed with

simulating revenues over the project year, 1998-2008. Especially, an estimated cash flow table is constructed over the project years.

(2) General Assumptions/Conditions

The following assumptions are made for the financial analysis.

- (a) Project life (Calculation Period): 1999-2008.
- (b) Inflation factor is excluded with applying 1997 constant prices. (regarding the inflation factor, see item (9) below.)
- (c) An Operation and Management Unit is assumed for SWM in the Department of Environment (DoE).

(3) Project Cost

Project cost in 1998-2008 is estimated as follows:

**Table 4.14-2 Project Cost of the Master Plan
(1999-2008)**

Unit: Kshs million	
Collection/Transportation Cost	
Operation	6,513.5
Depreciation	1,878.6
Contract PSI	2,141.8
Initial Investment	4,048.5
Engineering	202.9
Total	14,785.4
Final Disposal Cost	
Operation	303.2
Depreciation	175.3
Initial Investment	1,898.0
Engineering	70.5
Total	2,447.0
CBAP	47.8
CWMP	29.6
Total Cost	17,309.8

Note: Cost for public education is included in the CBAP.

(4) Construction/Investment Schedule

Construction and investment in vehicles and others are assumed to be carried out in accordance with the most effective procurement schedule. The construction/investment schedule is shown in Table 4.14-3.

Table 4.14-3 Construction/Investment Schedule

Unit: Kshs million

	1993	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Coll./Transp.												
Vehicle	0.0	828.7	39.5	30.0	40.8	548.4	72.5	77.0	83.0	710.9	0.0	2,430.7
Parking	0.0	56.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.7
Transfer Station	0.0	945.0	0.0	0.0	0.0	393.8	0.0	0.0	0.0	393.8	0.0	1,732.5
Depot	0.0	31.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.5
Sub-Total	0.0	1,861.9	39.5	30.0	40.8	942.2	72.5	77.0	83.0	1,104.6	0.0	4,251.4
Final Disposal												
Construction	0.0	70.5	667.9	338.0	405.1	0.0	0.0	0.0	0.0	0.0	0.0	1,481.5
Heavy Equipment	0.0	0.0	118.5	0.0	0.0	78.3	0.0	0.0	0.0	63.2	0.0	260.0
Dandora Closing	0.0	0.0	0.0	227.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	227.0
Sub-Total	0.0	70.5	786.4	565.0	405.1	78.3	0.0	0.0	0.0	63.2	0.0	1,968.5
CBAP	0.0	23.9	23.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.8
CWMP	0.0	2.4	2.4	2.4	2.4	2.4	3.2	3.2	3.2	4.0	4.0	29.6
Total	0.0	1,958.7	852.1	597.4	448.3	1,022.9	75.7	80.2	86.2	1,171.8	4.0	6,297.3

Note: Engineering costs are included.

(4) Long-Term Loan**(a) Conditions**

The following long-term loan conditions are assumed considering those of existing loans.

Table 4.14-4 Conditions of Long-Term Loan

Interest Rate	Repayment Period	Grace Period
8%	10 years	5 years

(b) Loan and Repayment Schedule

The loan and repayment schedule based on the construction/investment schedule and loan conditions is shown for the 100% loan case in Table 4.14-6.

(5) Consideration of Excess Personnel

Presently, staff numbers of the Cleansing Section are 31 for administrative, 111 for drivers, 339 for loaders, 1,640 for sweepers, 303 for supervisors/headmen and 17 for the final disposal site. Although the staff number in the final disposal site will increase for the new service, it is expected that the number of existing staff exceeds the necessary personnel for the new collection/transportation system because the new system will be operated in a more effective way.

On the other hand, it is also expected that the number of staff can be reduced by more than 10% every year by suspending new employment as well as improving effectiveness of the organisation. However, the number of existing staff would still exceed that for the new system for 60% waste collection case. Table 4.14-5 compares these numbers.

Table 4.14-5 Comparison of Staff Numbers for Collection/Transportation Services

Personnel	Present (1997)	After Reduction in 2000	New System in 2000
Administrative	31	23	15
Drivers	111	81	128
Loaders	339	248	224
Sweepers	1,640	1,195	672
Supervisors/Headmen	303	221	145
Total	2,424	1,768	1,184

Source: NCC and JICA Study Team

It is estimated that around 600 personnel in the new SWM Division will be excess personnel in 2000 when the new systems are planned to start. Thus, such excess personnel needs to be absorbed by staff reallocation among Departments in NCC, work sharing and/or laid-off, if possible.

An extra cost for the excess personnel is projected at Kshs 122 million for the years of 2000-2008. Especially, the extra cost would be Kshs 54 million in 2000, which is 4% of the total revenue in 1994/95. Although this extra cost would be required unless reallocation or laid-off of the staff is accomplished, it is actually extremely difficult to deal with such personnel issues without any political and social pressure. Therefore, the **Financial Projection below is carried out in consideration of 10% natural reduction of the existing number of personnel.**

Table 4.14-6 Loan/Repayment Schedule
(Unit: Kshs million)

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total		
Investment	0.0	1,968.7	852.1	597.4	448.3	1,022.9	75.7	80.2	88.2	1,171.8	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6,297.3	
Repayment																												
Loan 1						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loan 2						195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	195.9	1,959.7
Loan 3						85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	85.2	852.1
Loan 4						59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	597.4
Loan 5						44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	448.3
Loan 6						102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	1,022.9
Loan 7						7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	75.7
Loan 8						8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	80.2
Loan 9						8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	86.2
Loan 10						117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	1,171.8	
Loan 11						0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4.0
Total						0.0	195.9	261.1	340.8	385.7	487.9	495.5	503.5	512.1	520.3	529.7	433.9	348.6	288.9	244.1	141.8	126.2	117.6	0.4	0.4	0.4	6,297.3	
Debt Outstanding	0.0	1,968.7	2,810.9	3,408.3	3,856.5	4,879.4	4,759.2	4,588.3	4,303.7	5,089.8	4,805.9	4,110.4	3,608.9	3,094.7	2,465.4	1,835.7	1,401.8	1,053.2	764.3	520.2	378.4	244.2	118.0	0.4	0.0	0.0	0.0	
Interest	0.0	156.7	224.9	272.7	308.5	380.4	360.7	364.7	344.3	407.2	368.5	328.8	288.5	247.6	197.2	148.9	112.1	84.3	61.1	41.6	30.3	19.5	9.1	0.0	0.0	0.0	4,785.9	

(6) Projection Results

Examination of financial viability was carried out for the optimum plan selected in Section 4.5, which employs container collection method, transfer wastes through the transfer station to one disposal site at Ruai. The following examination results using the estimated cash flow by changing the target collection rate were obtained. Charges for commercial entities and tipping fees levied on non-contracted companies were decided by the share of waste collection.

(a) Charges and Balances

Relations between waste collection rates and the balances were examined by setting up average household charge at 100, 200, ..., 500 Kshs/month while commercial charges and tipping fees were fixed at those just covering the cost share for each case of financing with consideration of three types of financial sources for initial investment costs. Negative balances were assumed to be financed by subsidies.

Balances here mean those on revised cash flow basis, which assumes the depreciation is saved and just finances replacement cost.

(i) Case 1: Capital Costs Financed by 100% Loan

The total amount of the loan is Kshs. 6,297 million (US\$107 million), interest due from 2000 to 2008 is Kshs. 2,850 million (US\$48 million), and repayment due from 2004 to 2008 is Kshs. 1,691 million (US\$29 million). The estimated balances are shown in Table 4.14-7. Commercial charges and tipping fees are shown in Table 4.14-8. Relations between household charges and the total balances are shown in Figure 4.13-1.

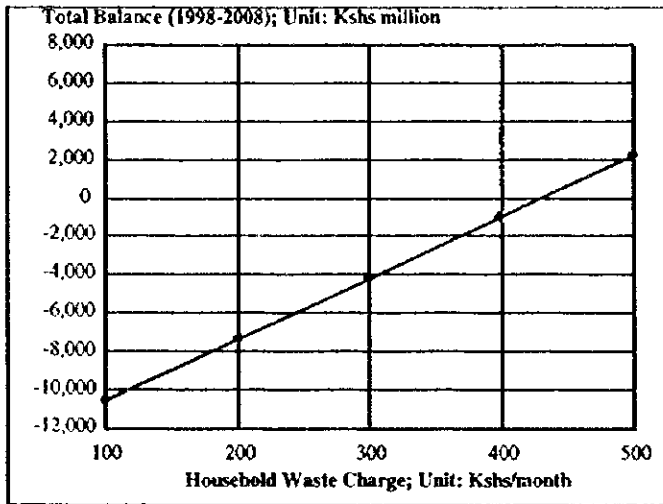
Table 4.14-7 Estimated Balances of Revised Cash Flow (Single Year Base); 100% Loan

Household Charge	Unit: Kshs million											
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
100 Kshs	0	0	-481	-576	-613	-642	-1,239	-1,352	-1,591	-1,671	-2,300	-10,464
200 Kshs	0	0	-189	-271	-293	-307	-887	-985	-1,205	-1,267	-1,876	-7,280
300 Kshs	0	0	103	35	26	27	-535	-617	-820	-863	-1,452	-4,096
400 Kshs	0	0	395	340	346	362	-184	-250	-435	-459	-1,029	-912
500 Kshs	0	0	687	645	666	697	168	118	-50	-54	-605	2,272

Note: New charge system starts in 2000.

Table 4.14-8 Commercial Charges and Tipping Fees; 100% Loan

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
Commercial (Kshs/month)	599	610	603	594	867	856	881	876	1,117	804
Tipping (Kshs/ton)	84	112	110	108	114	111	110	109	106	106



**Figure 4.14-1 Household Charges and Total Balances;
100% Loan**

If 200 Kshs/month is applied as an average charge for households, the deficit will amount to Kshs. 189 million in 2000 and it will expand year by year to Kshs. 1,876 million in 2008, which exceeds the total revenue of NCC in 1994/95, i.e., Kshs. 1,320 million. The total deficit is Kshs. 7,280 million. This deficit should be financed from the General Fund of NCC or the subsidies from the central government.

The above calculation includes the revenue from informal settlements. In case that revenue is not expected, the deficit in 2008 by the Kshs. 200 charge will be about Kshs. 1,989 million.

(ii) Case 2: Capital Costs Financed by 50% Grant Aid and 50% Loan

In this case, capital cost from 1998 to 2000 which amounts to Kshs. 2,811 million (US\$48 million) is assumed to be financed by a grant aid and the remaining Kshs. 3,486 million (US\$59 million) is financed by a loan under the same conditions as Case 1. Interest due from 2002 to 2008 is Kshs. 1,092 million (US\$19 million) and repayments due from 2006 to 2008 is Kshs. 371 million (US\$6.3 million). The estimated balances on a single year base are given in Table 4.14-9. Commercial charges and tipping fees are shown in Table 4.14-10. Relations between household charges and total balances are shown in Figure 4.14-2.

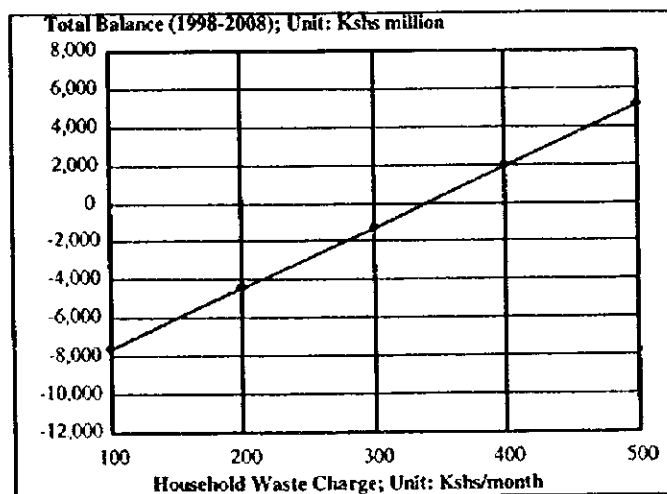
**Table 4.14-9 Estimated Balances of Revised Cash Flow (Single Year Base);
50% Grant and 50% Loan**

Household Charge	Unit: Kshs million											
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
100 Kshs	0	0	-339	-366	-403	-433	-842	-886	-1,151	-1,254	-1,916	-7,591
200 Kshs	0	0	-47	-61	-84	-99	-490	-519	-765	-850	-1,492	-4,407
300 Kshs	0	0	244	245	236	236	-138	-151	-380	-446	-1,068	-1,222
400 Kshs	0	0	536	550	555	571	213	216	5	-42	-644	1,962
500 Kshs	0	0	828	855	875	906	565	584	391	362	-220	5,146

Note: New charge system starts in 2000.

Table 4.14-10 Commercial Charges and Tipping Fees; 50% Grant and 50% Loan

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
Commercial (Kshs/month)	469	481	475	468	688	679	701	697	891	638
Tipping (Kshs/ton)	58	100	98	96	102	101	100	98	93	93



**Figure 4.14-2 Household Charges and Total Balances;
50% Grant and 50% Loan**

If 200 Kshs/month is applied as an average charge for households, the required subsidy is Kshs 47 million in 2000 and it will increase to Kshs 490 million in 2004 and Kshs 1,492 million in 2008, which still exceeds the total revenue of NCC in 1994/95, i.e., Kshs 1,320 million. The total required subsidy from 1999 to 2008 is Kshs 4,407 million.

The above calculation includes the revenue from informal settlements. In case revenue cannot be expected, the required subsidy in 2008 by the Kshs 200 charge will be about Kshs 1,604 million.

(iii) Case 3: Capital Costs Financed by 100% Grant Aid

The total initial investment amounts to Kshs. 6,297 million (US\$107 million), which is assumed to be financed by grant aid. The estimated balances on a single year base are given in

Table 4.14-11. Commercial charges and tipping fees are shown in **Table 4.14-12.** Relations between household charges and the total balances are shown in **Figure 4.14-3.**

Table 4.14-11 Estimated Balances of Revised Cash Flow (Single Year Base); 100% Grant
Unit: Kshs million

Household Charge	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
100 Kshs	0	0	-339	-369	-361	-357	-690	-728	-928	-986	-1,466	-6,224
200 Kshs	0	0	-47	-64	-41	-22	-338	-361	-543	-581	-1,042	-3,040
300 Kshs	0	0	244	242	279	313	14	7	-158	-177	-618	145
400 Kshs	0	0	536	547	598	648	366	374	228	227	-195	3,329
500 Kshs	0	0	828	852	918	982	717	742	613	631	229	6,513

Note: New charge system starts in 2000.

Table 4.14-12 Commercial Charges and Tipping Fees; 100% Grant

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
Commercial (Kshs/month)	469	461	438	418	589	582	601	598	757	561
Tipping (Kshs/ton)	58	89	87	85	91	90	89	87	83	83

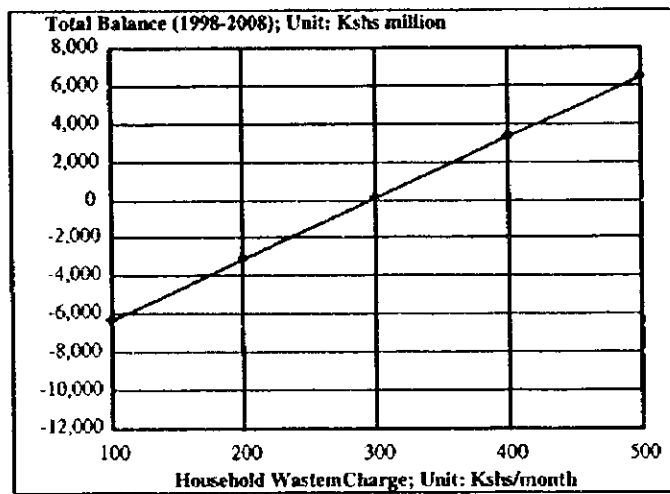


Figure 4.14-3 Household Charges and Total Balances; 100% Grant

If 200 Kshs/month is applied as an average charge for households, the required subsidy will be Kshs 47 million in 2000 and it will increase to Kshs 338 million in 2004 and Kshs 1,042 million in 2008, which amounts to 79% of the total revenue of NCC in 1994/95, i.e., Kshs 1,320 million. The total subsidy required is Kshs 3,040 million.

The above calculation includes the revenue from informal settlements. In case revenue cannot be expected, the required subsidy in 2008 by the Kshs 200 charge will be about Kshs 1,154 million.

(b) Household Charges Covering O&M Costs and Depreciation

Average household charge which just balance the O&M costs and depreciation for each year is calculated in accordance with **Section 4.9.2, General Principles of SWM Finance**. In this case the total balances are deficit except the 100% Grant case because loan repayment and loan interest are not borne by households. Such deficit is assumed to be financed by subsidies. The household charge is the same whatever is the finance source. On the other hand, commercial charges, tipping fees and balances differ depending on the finance source.

All year average household charge is Kshs. 295. In the case where initial investment costs are financed by 100% loan, the total subsidy required is Kshs. 4,241 million. In the case of 50% Grant and 50% loan, the total subsidy required is Kshs. 1,367 million. (see Tables 4.14-13 to 4.14-15)

Table 4.14-13 Charges Covering O&M and Depreciation Costs; 100% Loan

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Ave/Sum
Household Average (Kshs/month)	-	-	216	221	213	207	296	298	341	344	446	295
Commercial (Kshs/month)	-	-	599	610	603	594	867	856	881	876	1,117	804
Tipping (Kshs/ton)	-	-	84	112	110	108	114	111	110	109	106	106
Balance (Kshs million)	0	0	-141	-207	-252	-286	-549	-624	-662	-685	-834	-4,241

Note: Charges are shown in all year average and balances are shown in total in Ave/Sum column.
Negative figures in the Balance indicate the required amount of subsidy.
New charge system starts in 2000.

Table 4.14-14 Charges Covering O&M and Depreciation Costs; 50% Grant and 50% Loan

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Ave/Sum
Household Aver. (Kshs/month)	-	-	216	221	213	207	296	298	341	344	446	295
Commercial (Kshs/month)	-	-	469	481	475	468	688	679	701	697	891	638
Tipping (Kshs/ton)	-	-	58	100	98	96	102	101	100	98	93	93
Balance (Kshs million)	0	0	0	3	-43	-77	-152	-158	-222	-269	-450	-1,367

Note: Charges are shown in all year average and balances are shown in total in Ave/Sum column.
Negative figures in the Balance indicate the required amount of subsidy.
New charge system starts in 2000.

Table 4.14-15 Charges Covering O&M and Depreciation Costs; 100% Grant

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Ave/Sum
Household Aver. (Kshs/month)	-	-	216	221	213	207	296	298	341	344	446	295
Commercial (Kshs/month)	-	-	469	461	438	418	589	582	601	593	757	561
Tipping (Kshs/ton)	-	-	58	89	87	85	91	90	89	87	83	83
Balance (Kshs million)	0	0	0	0	0	0	0	0	0	0	0	0

Note: Charges are shown in all year average and balances are shown in total in Ave/Sum column.
New charge system starts in 2000.

(c) House hold Charges Covering All Costs

Average household charges, commercial charges and tipping fees, where the total charge revenue just balances the total cost at the end of the project year 2008, are estimated for each case of financing just for reference purposes.

Household charge is Kshs. 424 on average in the 100% Loan case, Kshs. 337 in the 50% Grant and 50% Loan case, and Kshs. 295 in the 100% Grant case. (see Tables 4.14-16 to 4.14-18)

Table 4.14-16 Charges Covering All Costs; 100% Loan

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
Household Aver. (Kshs/month)	276	292	293	294	435	438	500	504	658	424
Commercial (Kshs/month)	599	610	603	594	867	856	881	876	1,117	804
Tipping (Kshs/ton)	421	417	417	417	420	420	421	421	419	419

Table 4.14-17 Charges Covering All Costs; 50% Grant and 50% Loan

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
Household Aver. (Kshs/month)	216	230	231	231	346	348	398	401	525	337
Commercial (Kshs/month)	469	481	475	468	688	679	701	697	891	638
Tipping (Kshs/ton)	58	252	252	252	255	255	256	256	220	220

Table 4.14-18 Charges Covering All Costs; 100% Grant

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
Household Aver. (Kshs/month)	216	221	213	207	296	298	341	344	446	295
Commercial (Kshs/month)	469	461	438	418	589	582	601	598	757	561
Tipping (Kshs/ton)	58	89	87	85	91	90	89	87	83	83

(7) Calculation of FIRR, NPV and B/C

(a) Notes on the Calculation

Concerning ordinary development plans, the Financial Internal Rate of Return (FIRR) is calculated. The FIRR is a discount rate that equates the present value of revenues with the present value of costs (operation and capital costs) during the project life.

The purpose of calculating FIRR is to examine financial viability, or to estimate the efficiency of investment comparing it with other projects' FIRR. With the following reasons, FIRR calculation is not necessarily appropriate to evaluate the proposed Master Plan:

- (i) FIRR is calculated with market prices. However, waste charges cannot be decided solely by a market mechanism. Rather, to set up suitable waste charges or prices of SWM services is one of the major purposes of this project.
- (ii) FIRR is a measure to find out how higher a fund invested produces returns and how fast the invested principal can be redeemed. Usually, investment in SWM projects are not expected to produce returns. It is very difficult to redeem funds invested in capital costs with financial sources such as waste charges which are even billed at the maximum amount of consumers' willingness to pay.

Thus, FIRR is calculated here with changing SWM charges or prices for the purpose of reference and should be treated carefully.

In addition, FIRR, Net Present Value (NPV) and Benefit/Cost (B/C) Ratio are calculated for the case where capital costs are financed by 100% loan only in this analysis. The reason is that grant aid is not extended with the consideration of efficiency of capital investment. If

grant aid is extended, the FIRR of the project would naturally improved. This does not mean, however, that the efficiency of the capital investment is improved.

(b) Additional Assumptions/Conditions

FIRR, NPV and B/C are to be calculated with the following additional assumptions:

- (i) Calculation is carried out from the viewpoint of management unit of the new system, i.e., the SWM Division of the DoE. The calculation is not subject to the DoE or NCC as a whole.
- (ii) Revenues and operating costs are flattened after 2008.
- (iii) Replacement of vehicles, facility and equipment is carried out after their economic lives expire.
- (iv) Calculation period: 1998-2029 (32 years)
- (v) Discount rate applied: 12%
- (vi) Non-depreciated value is deemed negative cost in the final year of the calculation period. However, this assumption is not applied to the civil works of the transfer station, parking lots and the final disposal site.
- (vii) Additional final disposal site is constructed next to the first one with the same conditions.

(c) Calculation Results

The calculation results are as follows:

Table 4.14-19 FIRR, NPV and B/C

Charge for Household (Kshs/month)	FIRR	NPV (Kshs)	B/C
100	-	-8,987,299,793	0.30
200	-	-6,614,610,666	0.49
300	-	-4,241,921,539	0.67
400	-	-1,869,232,412	0.85
500	17.45%	503,456,715	1.04

(8) Sensitivity Analysis

Sensitivity analysis of the above-mentioned projection results was carried out on the cases of increasing project cost. Analysis for the changes of revenue are already examined above. Therefore, analysed here is how the average household charge which just balances the O&M and depreciation costs will change. Also analysed is the balance if the project costs of the collection/transportation system and the construction of the final disposal site are increased by 10% based on 1997 prices.

All year average household charge increases from Kshs. 295 to Kshs. 321, or 8.8% up. In the case where the initial investment costs are financed by 100% loan, the total subsidies required increases from Kshs. 4,241 million to Kshs. 4,659 million, or 9.9% up. In the case of 50% Grant and 50% loan, the total subsidy required increases from Kshs. 1,367 million to Kshs. 1,503 million, or 9.9% up. Further, FIRR, NPV and B/C deteriorate to 5.71%, (-)520,369,853 and 0.96, respectively, for the Kshs. 500 case in Loan 100%. (see Tables 4.14-20 to 4.14-22)

Table 4.14-20 Charges for Cost Up; 100% Loan

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Ave/Sum
Household Aver. (Kshs/month)	-	-	237	241	232	225	323	326	369	372	484	321
Commercial (Kshs/month)	-	-	655	667	659	649	945	934	961	955	1,216	877
Tipping (Kshs/ton)	-	-	93	124	121	119	126	123	122	120	117	117
Balance (Kshs million)	0	0	-156	-227	-277	-314	-604	-686	-727	-752	-917	-4,659

Note: Charges are shown in all year average and balances are shown in total in Ave/Sum column.
 Negative figures in the Balance indicate the required amount of subsidy.
 New charge system starts in 2000.

Table 4.14-21 Charges for Cost Up; 50% Grant and 50% Loan

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Ave/Sum
Household Aver. (Kshs/month)	-	-	237	241	232	225	323	326	369	372	484	321
Commercial (Kshs/month)	-	-	514	525	519	511	749	740	762	758	968	695
Tipping (Kshs/ton)	-	-	65	111	109	107	113	111	110	108	103	103
Balance (Kshs million)	0	0	0	3	-47	-84	-168	-174	-244	-295	-494	-1,503

Note: Charges are shown in all year average and balances are shown in total in Ave/Sum column.
 Negative figures in the Balance indicate the required amount of subsidy.
 New charge system starts in 2000.

Table 4.14-22 Charges for Cost Up; 100% Grant

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Ave/Sum
Household Aver. (Kshs/month)	-	-	237	241	232	225	323	326	369	372	484	321
Commercial (Kshs/month)	-	-	514	503	478	456	644	636	650	646	821	610
Tipping (Kshs/ton)	-	-	65	98	96	94	101	99	98	96	92	92
Balance (Kshs million)	0	0	0	0	0	0	0	0	0	0	0	0

Note: Charges are shown in all year average and balances are shown in total in Ave/Sum column.
 Negative figures in the Balance indicate the required amount of subsidy.
 New charge system starts in 2000.

(9) Consideration of Inflation Factor

It should be noted that the financial analysis and results so far exclude the inflation factor and described in 1997 fixed prices as mentioned in the assumptions. When such results are applied in an actual operation, inflation should be taken into consideration. Tables 4.14-23 to 4.14-26 show waste charges and estimated household affordability as described in Subsection 4.2.2 when the inflation rate continues at 9% per annum (1996 figures) throughout the project years.

If 9% rate of inflation continues, prices will increase 1.3 times in 3 years or in 2000, 1.83 times in 7 years or in 2004, and 2.58 times in 11 years or in 2008.

Thus, in the situation where prices are continuously increasing, frequent review of charge levels is required in order to avoid the revenue shortage.

Table 4.14-23 Charges with Inflation; 100% Loan

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Household Aver. (Kshs/month)	-	-	280	312	327	346	541	594	740	814	1,151
Commercial (Kshs/month)	-	-	776	861	928	996	1,584	1,705	1,914	2,074	2,881
Tipping (Kshs/ton)	-	-	109	158	169	180	208	222	240	257	274
Balance (Kshs million)	0	0	-183	-292	-388	-479	-1,004	-1,243	-1,439	-1,622	-2,152

Note: New charge system starts in 2000.

Negative figures in the Balance indicate the required amount of subsidy.

Table 4.14-24 Charges with Inflation; 50% Grant and 50% Loan

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Household Aver. (Kshs/month)	-	-	280	312	327	346	541	594	740	814	1,151
Commercial (Kshs/month)	-	-	608	679	731	785	1,258	1,354	1,522	1,650	2,298
Tipping (Kshs/ton)	-	-	75	141	151	162	187	200	216	232	239
Balance (Kshs million)	0	0	0	4	-66	-129	-278	-314	-483	-636	-1,160

Note: New charge system starts in 2000.

Negative figures in the Balance indicate the required amount of subsidy.

Table 4.14-25 Charges with Inflation; 100% Grant

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Household Aver. (Kshs/month)	-	-	280	312	327	346	541	594	740	814	1,151
Commercial (Kshs/month)	-	-	608	651	674	700	1,077	1,160	1,304	1,415	1,952
Tipping (Kshs/ton)	-	-	75	125	133	143	167	179	193	206	215
Balance (Kshs million)	0	0	0	0	-0	0	0	0	0	0	0

Note: New charge system starts in 2000.

Table 4.14-26 Household Affordability with Inflation

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Top 45% Level	201	225	252	283	317	356	400	449	504
Top 30% Level	261	292	328	367	412	462	519	583	655
Top 15% Level	322	360	403	451	506	569	639	717	806

(10) Examination of Service Level

(a) Assumptions/Conditions

In case that the revenues which are necessary to achieve a 100% waste collection ratio in 2008 are not attained, the reduction of service level may be taken into consideration. Different service levels or project scales are thus examined.

Reduction of service level are considered not only from the viewpoint of revenue but on how the new system can be started without difficulty. Thus, the target levels are assumed to be as follows: 40% in 2000, 50% in 2004 and 60% in 2008 which include services contracted to private companies.

(b) Project Cost

Project cost in case of reduced level of services in 1999-2008 is estimated as follows:

Table 4.14-27 Project Cost in Case of Reduced Service Level (1999-2008)

Unit: Kshs million

Collection/Transportation Cost	
Operation	3,884.0
Depreciation	1,108.8
Contract PSI	2,141.8
Initial Investment	2,822.5
Engineering	141.1
Total	10,098.2
Final Disposal Cost	
Operation	199.7
Depreciation	111.8
Initial Investment	1,789.1
Engineering	70.5
Total	2,171.0
CBAP	47.8
CWMP	29.6
Total Cost	12,346.6

Note: Cost for public education is included in the CBAP.

(c) Construction/Investment Schedule

Construction and investment in vehicles and others are assumed to be carried out in accordance with the most effective procurement schedule. The construction/investment schedule is shown in Table 4.14-28.

Table 4.14-28 Construction/Investment Schedule

Unit: Kshs million

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Collection/Transportation Cost												
Vehicle	0.0	437.2	8.0	4.0	12.0	233.8	23.0	31.8	24.0	329.2	0.0	1,142.9
Parking	0.0	56.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.7
Transfer Station	0.0	945.0	0.0	0.0	0.0	393.8	0.0	0.0	0.0	393.8	0.0	1,732.5
Depot	0.0	31.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.5
Sub-Total	0.0	1,470.4	8.0	4.0	12.0	667.5	23.0	31.8	24.0	722.9	0.0	2,963.6
Final Disposal												
Construction	0.0	70.5	667.5	337.3	404.5	0.0	0.0	0.0	0.0	0.0	0.0	1,479.8
Heavy Equipment	0.0	0.0	89.1	0.0	0.0	29.4	0.0	0.0	0.0	34.2	0.0	152.7
Dandora Closing	0.0	0.0	0.0	227.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	227.0
Sub-Total	0.0	70.5	756.6	564.3	434.5	29.4	0.0	0.0	0.0	34.2	0.0	1,859.5
CBAP	0.0	23.9	23.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.8
CWMP	0.0	2.4	2.4	2.4	2.4	2.4	3.2	3.2	3.2	4.0	4.0	29.6
Total	0.0	1,567.2	790.9	570.7	418.9	699.3	26.2	35.0	27.2	761.1	4.0	4,906.5

Note: Engineering costs are included.

(d) Loan and Repayment

In the 100% Loan case, the total amount of the loan is Kshs. 4,901 million (US\$83 million), interest due from 2000 to 2008 is Kshs. 2,337 million (US\$40 million), and repayment due from 2004 to 2008 is Kshs. 1,425 million (US\$24 million).

In the 50% Grant and 50% Loan, capital cost from 1998 to 2000 which amounts to Kshs. 2,359 million (US\$40 million) is assumed to be financed by a grant aid and the remaining Kshs. 2,542 million (US\$43 million) is financed by a loan. Interest due from 2002 to 2008 is Kshs. 865 million (US\$15 million), and repayment due from 2006 to 2008 is Kshs. 325 million (US\$5.5 million).

(e) Projection Results

Household charge which just balances the O&M costs and depreciation for each year is calculated in accordance with **Subsection 4.9.2, General Principles of SWM Finance**. In this case the total balance is a deficit except the 100% Grant case because loan repayment and loan interest are not borne by households. Such deficit is assumed to be financed from subsidies. The household charge is the same whatever is the financial source. On the other hand, commercial charges, tipping fees and balances differ depending on the financial source.

Household charge is Kshs. 191 on the average. Commercial charge is Kshs. 558 in the 100% Loan case, Kshs. 423 in the 50% Grant and 50% Loan case, and Kshs. 363 in the 100% Grant case. (see **Tables 4.14-29 to 4.14-31**)

Table 4.14-29 Charges in Reduced Service Level; 100% Loan

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Ave/Sum
Household Aver. (Kshs/month)	0	0	165	168	158	149	181	175	211	211	266	191
Commercial (Kshs/month)	0	0	406	427	418	408	577	565	637	630	778	558
Tipping (Kshs/ton)	0	0	79	132	130	127	126	124	124	122	119	119
Balance (Kshs million)	0	0	-118	-178	-221	-252	-450	-517	-549	-568	-659	-3,514

Note: Charges are shown in all year average and balances are shown in total in Ave/Sum column.
Negative figures in the Balance indicate the required amount of subsidy.
New charge system starts in 2000.

Table 4.14-30 Charges in Reduced Service Level; 50% Grant and 50% Loan

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Ave/Sum
Household Average (Kshs/month)	-	-	165	168	158	149	181	175	211	211	266	191
Commercial (Kshs/month)	-	-	359	316	309	302	432	423	479	474	538	423
Tipping (Kshs/ton)	-	-	38	114	112	110	109	107	107	106	98	98
Balance (Kshs million)	0	0	0	-3	-46	-78	-125	-125	-181	-219	-336	-1,113

Note: Charges are shown in all year average and balances are shown in total in Ave/Sum column.
Negative figures in the Balance indicate the required amount of subsidy.
New charge system starts in 2000.

Table 4.14-31 Charges in Reduced Service Level; 100% Grant

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Ave/Sum
Household Average (Kshs/month)	-	-	165	168	158	149	181	175	211	211	266	191
Commercial (Kshs/month)	-	-	359	351	325	301	361	342	372	367	452	363
Tipping (Kshs/ton)	-	-	38	96	94	92	91	89	90	89	83	83
Balance (Kshs million)	0	0	0	0	0	0	0	0	0	0	0	0

Note: Charges are shown in all year average and balances are shown in total in Ave/Sum column.
Negative figures in the Balance indicate the required amount of subsidy.
New charge system starts in 2000.

4.14.2 Justification of the Master Plan

(1) Technical Aspect

(a) Collection and Transportation Plan

The collection and transportation plan does not include large-scale civil works except construction of the transfer station. If the financial situation of NCC results in a better position than expected, the collection rate can be increased from 60% in the initial stage to match the improvement of finances without so much difficulty. The most important thing is to prove to the residents that NCC can improve its performance in order to obtain confidence from them. Once NCC obtains trust from the people, it is expected that NCC could initiate much more cooperation as well as higher charges from the people who will be benefited by NCC's SWM services.

(b) Final Disposal Plan

Even though the target collection rate is reduced, the disposal site still holds the same capacity as in the 100% case. Thus, if the financial situation of NCC results in a better position than expected, the collection rate can easily be increased to match the improvement of the finances. Further, the lower the collection rate, the longer the site can be used. That is, if 100% collection is employed, the disposal site will be full soon after the target year based on the estimated waste generation.

(2) Social Aspect

It is expected that scavengers will move to the new disposal site after construction. Keeping all the scavengers out of the site would be difficult and careful control is required of the managers at the site.

If the new disposal site were constructed in the Ngong Road Forest Area, very strict management and control would be required because the site is near the city center and is designated as a forest conservation area. On the other hand, the candidate site in the Ruai Area is located next to a sewage treatment facility and, in addition, few houses are located. Therefore, it is expected that the location in Ruai Area will cause few impacts from the social viewpoint.

As for the introduction of a container system, it would be effective if people are well informed about the places for waste dumping and collection. Awareness on proper waste disposal should be improved. Regarding the construction of a transfer station, sufficient consideration is required since the same scavenger problem is expected as the final disposal site. Social impacts should be fully taken into consideration in selecting the location which is not yet decided by the authorities concerned.

(3) Economic Aspect

From the economic viewpoint, the following matters are expected with the implementation of the Master Plan:

- (a) Improvement of the urban environment which will contribute to the enhancement of public health, which in turn will increase human life expectation and reduce medical costs;
- (b) Improvement of the urban scenery, which in turn will increase income and foreign exchange from tourism, an important industry in the Kenyan economy because Nairobi City is an important gateway to Kenya and East Africa where every foreigner has to get through to visit places of Kenya and other East African countries;
- (c) Improvement of human resource quality through capacity building and public education, which in turn will strengthen the economic base and expand employment opportunities; and
- (d) Improvement of the reputation of Nairobi City and Kenya as a final result, which in turn will initiate people's confidence and promote national unification.

(4) Environmental Aspect

The new final disposal site is expected to eliminate or decrease the factors influencing public health and the environment by utilising the method of sanitary landfill. In addition, the site is designed with technical considerations to minimise environmental impacts.

The study shows that if the new final disposal site were constructed in the Ngong Road Forest Area, a designated forest conservation area, it would cause an environmental problem. On the other hand, the location in Ruai Area would cause fewer impacts on the environment.

The container system would reduce negative impacts including dust, noise, traffic jam and odor in the waste collection. In terms of the construction of a transfer station, Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) would be required when the location is decided.

See **Chapter 8, Environmental Impact Assessment, Main Report (Feasibility Study)** for details.

(5) Conclusion

The target collection rate of 100% is an ideal goal for all the residents of Nairobi, and plans for pursuing the goal are to be carried out with dedication and dispatch. However, in case that the revenue necessary to achieve the target is not attained, the collection rate will be reduced as analysed in the preceding **Section 4.14**.

Even though the service level is reduced, in other words, if the target collection rate is 60%, implementation of the proposed projects in the Master Plan will

bring large benefits to the residents of Nairobi since the Plan contributes to remarkable improvement from the present conditions.

Therefore, the Government of the Republic of Kenya including the Nairobi City Council (NCC) should promote the Master Plan to the next stage of project implementation at the earliest possible time.