

Solid Waste Management Study for Freetown, Sierra Leone

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Submitted To:

The Government of Sierra Leone,
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Submitted By:

Dave Sood
Consultant
11555 Holly Briar Lane
Great Falls, Virginia 22066, USA
Email: davesood@aol.com



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APPENDIX A.

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ABBREVIATIONS AND ACRONYMS

BOD	Board of Directors
CEQ	Council of Environmental Quality (U.S>0
DG	Director General
DM	Division Manager
EPA	Environmental Protection Agency
EHS	Environmental Health and Safety
EPS	Environmental Protection Section
FCC	Freetown City Council
FSWMC	Freetown Solid Waste Management Company
GHG	Greenhouse Gases (such as carbon dioxide and methane).
GOSL	Government of Sierra Leone
Le	Leone (Sierra Leone's currency)
LFG	Landfill Gas
MA	Monitoring Agent
MC	Municipal Corporation
M & E	Monitoring and Evaluation
MIS	Management Information Systems
MoHS	Ministry of Health and Sanitation
MoYS	Ministry of Youth and Sports
MSE	Micro and Small Enterprises
MSWM	Municipal Solid Waste Management
NGOs	Non-Government Organizations
NYMCOS	National Youth Multi-purpose Cooperative Society
O&M	Operations and Maintenance
SLRA	Sierra Leone Road Authority
SME	Small and Medium Enterprise
WHO	World Health Organization
YGCE	Youth Garbage Collection Enterprise

CURRENCY EQUIVALENTS

(Exchange Rate Effective December 20, 2003)

Currency Unit = Leone (Le)

US\$1.0 = 2,690 Le

EXECUTIVE SUMMARY

Solid waste management in Freetown poses costly and vexing problems. Included are low service coverage—averaging 40%, insufficient budgets, highly inadequate equipment, substantial inefficiencies such as high costs, low quality service, low labor productivity, poor public attitudes, and widespread illegal dumping. In addition, the long domestic insurgency heavily damaged or destroyed the existing infrastructure, and also, significantly contributed to the more than two-fold increase in population from estimated 850,000 in 1994 to the current estimates of 1.85M. In terms of waste management, there is a positive correlation between city's population size and both the percentage of waste removed and the rate of households enjoying regular waste collection. The increased population combined with the domestic insurgency, political strife, and accompanying economic crises had a profound impact on waste generation, straining the existing skeletal solid waste management (SWM) system.

Coupled with changing waste management authorities, the Freetown's solid waste management situation is on the verge of collapse. The large percentage of uncollected or illegally dumped waste in Freetown constitutes a disaster for human health and is also a cause of the environmental degradation. According to the local health authorities, the increased prevalence of parasites, tetanus, malaria, hookworm, cholera, and diarrhea in and around the city is mostly attributed to strewn wastes in the city.

The management of Freetown's waste is a history of institutional trials and abandonment, with most issues remaining unsolved. The newest authority, the Ministry of Youth and Sports (MoYS) was assigned the responsibility for in May 2003. The assignment came as a result of the failure of previous authorities—the Ministry of Health and Sanitation, the Freetown City Council, and the private sector to effectively manage Freetown's solid wastes. Unfortunately, the MoYS is also struggling with tight budgets, lack of qualified manpower, and no institutional authority and experience in waste management.

It is estimated that over 742 tons/day of garbage is generated in the metro Freetown area. Of this, over 84% is biodegradable organic waste, mostly from residential and vegetable markets. In addition, the limited Freetown industry contributes approximately 20 tons/day of wastes. Industrial wastes consist of mostly broken bottles (primarily from local brewery), waste cans, rags and plastic and small quantities of hazardous wastes. These wastes are usually unbagged and disposed by the industry at each of the landfills, at no cost.

To collect data and information for this study, during the 25-day field study, many individuals and organizations were interviewed. A list is included under Appendix A: Contact List.

Based on the field survey, it appears that, of immediate need is adequate waste management equipment—including skip trucks, skips, Front-end loaders, dustbins, and spare parts to repair and effectively mobilize the limited existing fleet. Simultaneously, for short- and long-term sustainable improvements, an independent lead institute with strong financial footings and executive authorities needs to be established.

To assist, the World Bank instituted this study to analyze the situation and define institutional, financial and other needs, and to propose mechanisms for a sustainable solid waste management (SWM) system in Freetown. To meet the requirements, the study is proposing establishment of an independent, autonomous institute, named, the Freetown Solid Waste Management Company, (FSWMC). The proposed institute must incorporate executive authorities and an effective management structure. For the long-term, sustenance of the FSWMC should be based on two key pillars: gradual implementation of cost recovery with social considerations, and an active participation by the community and the private sector. As part of this activity, the Bank is proposing to spend approximately \$3.6M, for emergency cleanup, and to help establish the FSWMC through purchase of the much-needed SWM equipment, and technical and training assistance over a period of two years. It is envisioned that successful implementation of the measures recommended in the study can help establish a long-term, 10-year and beyond, self-sustainable waste management system in Freetown.

1.0 Introduction

Solid waste management is much more than refuse collection and disposal. Wastes such as derelict vehicles, medical, toxic, and hazardous wastes pose special problems. For instance, management of medical wastes requires use of specialized technologies. Abandoned and derelict vehicles may require collection and promotion of scrap steel reclamation for efficient disposal. In addition, public awareness and attitudes towards waste can also affect a city's entire waste management system. For instance, key factors such as readiness to carry waste to a shared container, the willingness to segregate waste to assist recycling, the waste collection frequency, and the willingness to pay for waste management services have a direct bearing on the quality and cost of solid waste management. In addition, such factors as the opposition to siting landfills, political interference, and, in some developing countries such as India, the social groups from which waste management staff can be drawn, can also affect the cost and efficiency of solid waste management (SWM).

Sierra Leone's ten-year rebel war severely impacted Freetown's economy and its infrastructure. Most of the waste management equipment such as the skip trucks, skips and others were vandalized or completely destroyed. The war was instigated due great inequality, very high level of unemployment, and a large group of unemployed rural youth without any education or skills—a group that rebel leaders easily recruited and manipulated. By the end of the war, thousands of refugees migrated to Freetown, swelling its population from 800,000 in 1995 to an estimated high of 1.8M in 2003. Recent World Bank estimates indicate a projected annual population increase of 3.4% for Freetown, which would proportionately increase the solid waste quantities generated.

The result of heavy population migration has been squalor, poor housing, inadequate sanitation, congestion, pollution, poor public services, and chronic unemployment, particularly among the youth, most of who are without any employable skills. The ubiquitous pile-up of garbage, can be seen everywhere. Also, most city drains are clogged with garbage. A number of manhole covers have been removed to dump garbage. Many existing skips (large containers) that also act as transfer station for the solid waste are broken. Often, the garbage is strewn around, where scavengers, mostly children and wandering dogs, birds, pigs, and other stray animals, forage amongst the rubbish, spreading it around. City's coastal area residents dump the wastes into the sea. In poor neighborhoods, collected waste is often set on fire. The situation is a major contributor to the city's significant rise of the incidence of vector-propagated diseases.

If solid wastes are not managed properly, they can pose many environmental and human health risks. For instance, refuse blocking storm drains can cause malaria and other diseases. Fires set at disposal sites can cause major air pollution, causing illness and reducing visibility, making disposal sites dangerously unstable, and possibly spreading contaminants to adjacent property. Unfortunately, Freetown's poor bear a disproportionate burden of the impact of externalities resulting from poor management of municipal solid (and liquid) wastes.

Based on the fieldwork, the main issues apparent in the system are highly inefficient collection practices with quite a variable level of service, poor operating practices—including no environmental systems, highly inadequate and malfunctioning equipment, open burning of garbage, illegal dumping and littering, and a public with seemingly little sensitivity to the garbage around them or any awareness of what represents responsible waste management. The appalling garbage situation in Freetown, which borders collapse, needs effective remedial measures. A collapse of the system will adversely impact the living conditions of the city dwellers, further endangering their environment and health. Freetown's solid waste management system needs serious rehabilitation, first on an emergency basis, followed by development and implementation of long-term, sustainable measures. It also needs a change in behavior of individuals and the society.

A successful solid waste management depends on an efficient operational system from the outset. It is commonly recognized that four technical pillars of any SWM system are: (i) storage at or near the point of generation, (ii) collection of waste, (iii) street cleansing, and (iv) transport and disposal of wastes. Each of these precepts for sustainable SWM also requires careful planning and implementation by a financially sound, well-footed institute that has executive authorities and appropriate policy and legislative support. In addition, the participation, organization and management of relationship between all key stakeholders must also include consensus building throughout the planning process. Solid waste planning also requires regular revisions and updating.

A sound solid waste management system is also essential for sustained economic growth, which in turn can also help generate better revenues and potentially better waste management resources and services. Unfortunately, a sustainable solid waste management system is beyond the ability of any municipal government alone. To meet this need, SWM authorities in many countries are increasing involving private sector and communities as key participants.

In terms of solid waste management, in Freetown, there is too much to do, and at present, there is too little to do it with.

1.1 Historical Perspectives

Waste management in Freetown, under shifting authorities, has been treated as a political football.

In the 60s, the Sierra Leone Department of Health and Human Services (DOHSS) was assigned the responsibility. In 1971, DOHSS nominated Freetown City Council (FCC), an urban Health Authority to manage Freetown's solid wastes. However, the FCC had difficulty in providing the services, and in late seventies, given the hosting of Organization of African Union (OAU) conference in Freetown, the Health minister, while launching a "Keep the City Clean" campaign, also transferred the waste management to the Ministry of Health, DOHS's new name. In early 80's sanitation was added, and a new name—the Ministry of Health and Sanitation (MOHS) emerged. In 1987, the MoHS assigned the waste management responsibility to its (then newly created) public health units under its Environmental Health Division (EHD).

The EHD's Public Health Units, during the period of 1980-1990 got technical and financial assistance from the *Kreditanstalt für Wiederaufbau* (KfW) of the Federal Republic of Germany. The assistance included provision of waste management vehicles, equipment and consultancy services. The equipment provided was ten (10) skip trucks, two (2) tippers, two (2) front-end loaders, three (3) monitoring vehicles and one (1) one-track bulldozer. However, in 1994, given some political misunderstanding, and declaration of the German Ambassador as *persona non grata* by the Sierra Leone's government, the assistance was abruptly halted.

Also, during the above period, based on a strategy developed by German's, in 1982, a private contractor, Ajibu Jallah was hired to manage the city's solid wastes. As part of the contract, the EHD also leased its key solid waste management equipment to the contractor—which turned out to be a one-man firm. However, given poor performance, serious financial irregularities and adverse political interferences, in June 1993, the contract was abrogated. The EHD then resumed full responsibility of the physical execution of the services under the supervision of a Senior Sanitary Engineer.

Given the (sudden) withdrawal of the German government's support, and continuing poor EHD performance, alternative arrangements were necessitated. In 1994, the EHD attempted to contract out the services again. However, only one aspirant, a private firm was able to meet the government's pre-bid conditions. The sole-bidding firm requested twice the amount EHD was spending to keep the city relatively clean. During the period, Freetown's population was estimated at 800,000. The private bid costs could not be justified.

In 1995, under its Freetown Infrastructure Rehabilitation Program (FIRP), the World Bank, provided two (20 skip trucks, two (2) monitoring vehicles and thirty (30) skip containers) to the city. In addition, the project also provided one (1) truck in 1997. Unfortunately, by this time, most of the skip trucks provided earlier by Germany in 1985 had ceased to operate, creating an acute shortage of skip trucks needed to cope with the city's growing requirement. Coupled with the domestic insurgency, by this time, most of the equipment was damaged or destroyed. In 1999, based on government's request the British government provided used waste

management equipment including four skip trucks, three cesspit emptier, two waster bowzer, and 2 tippers. A number of these vehicles have since been grounded due to lack of maintenance.

Under the EHD's resumption of Freetown's waste management responsibilities, the waste management situation further deteriorated significantly. As before, key contributing factors were essentially the same. These included: high bureaucratic inefficiency, corruption allegations especially in the procurement of spare parts and existence of "ghost" employees, poor management, lack of accountability, and lack of funds. The continued restructuring also placed junior, inexperienced, and incompetent staff over the qualified and the experienced, adversely impacting staff morale and performance.

At this time, EHD's key solid waste personnel included its chief, a Senior Sanitary Engineer (SSE), one Sanitary Engineer (SE) and three Public Health Inspectors. In addition, EHD also had 57 junior staff and 328 laborers. In terms of equipment, the EHD's main operating equipment (until 1994) included 1 bulldozer, 9 skip trucks (average availability 80%), 2 dump trucks (90% availability), 2 loaders, 10 other vehicles, 3 cesspit emptier, and 229 5m³ vehicles. Waste containers (skips) were emptied according to the appraised requirements, daily or less frequently.

The current World Bank project aims to help Freetown manage its waste in an effective and sustainable manner. The project, based on recommendations of this study, will fund equipment for much-needed emergency and the short-term, two to four year cleanups, as well as helping establish an independent institute capable of implementing these activities. Equally important, for Freetown, the outputs can provide long-term sustainable solid waste management (SWM) services.

2.0 Analysis of the Existing Situation

As indicated earlier, the ten-year rebel war severely impacted the infrastructure, the agriculture, and the economy of Sierra Leone. The birth of the rebel movement in 1990 under the Revolutionary United Front (RUF) instigated by great inequality, high levels of unemployment, and a large group of rural youth without any education or work opportunities—a group that rebel leaders easily recruited and manipulated. Many people were maimed or killed, and their houses, properties, and productive resources were seriously damaged or destroyed. By the end of the war, thousands of refugees, mostly rural poor migrated to Freetown, swelling its population from 800,000 in 1995 to an estimated high of 1.85 million in 2003.

The population influx resulted in squalor, poor housing, inadequate sanitation, congestion, pollution, and poor public services, and chronic high unemployment, particularly among the city's youth—most of whom are illiterate and also unskilled. Given the above situation, SWM in Freetown further significantly deteriorated. Compounding this situation are the city's numerous high-density population areas, which present difficult challenges to managing solid wastes. In these congested neighborhoods, roads are small, and provide less space for storing wastes, either on the streets or within the yards of dense houses.

The ubiquitous pile-up of garbage is a significant contributor to the city's significant rise of the incidence of vector-propagated diseases. Currently, most of the city's drains are choked with rubbish. A number of manhole covers have been removed so that garbage can be dumped there. Where special dumps or public "dustbins" or containers (skips included) are provided, garbage is often dumped outside due to lack of capacity, poor collection, and/or public insensitivity. Open Dumps allow free access to waste pickers, animals, and flies; and often produce unpleasant and hazardous smoke from slow-burning fires.

Garbage can be seen everywhere, scattered, or in small or large piles, many of which are regularly set on fire used as a waste disposal option. Waste generation in Freetown far outstrips its collection and transport.

Since May 2003, the Ministry of Youth and Sports (MoYS) is responsible for managing the city's wastes. The transfer of solid waste management to the Ministry of Youth & Sports (MoYS) also created an ideal enabling environment to partially tackle unemployment, drug abuse, and the homelessness of city's vast numbers of unemployed youth. For collection, the MoYS has assigned the responsibility to one of its (non-professional) branches, called "National Youth Multi-purpose Cooperative Society (NYMCOS). Earlier, the NYMCOS youths were engaged in mostly voluntary services in the cleaning of strategic public places, streets, drainages, and sidewalks.

2.1 Characterization of Freetown's Solid Wastes

There are principally three main classifications of urban solid wastes: municipal, industrial and hazardous. However, what is defined or designated 'municipal waste' depends upon the individual city's definition of municipal solid waste. Nevertheless, most municipalities in Africa handle solid wastes from households, markets and institutions, street and public open

spaces, dead animals, and non-hazardous waste from processing and industries. This holds true for the Freetown, as well.

Solid waste streams are characterized by their sources, by the types of wastes produced, as well as by generation rates and composition. Accurate information in these three areas is necessary in order to monitor and control existing waste management systems, and to make regulatory, financial, and institutional decisions. Also, to estimate storage requirements and collection frequencies and devise suitable collection methods, it is important to know the volume, density and weight of solid waste produced. Knowledge of the sources and types of waste in an area is also required in order to design and operate appropriate solid waste management systems.

The generation rate of solid waste is usually given in kilograms per person per day (kpd) and its density in kilograms per cubic meter. The volume in liters per day (lpd) is then equal to the mass divided by the density.

There are eight major classifications of solid waste generators: residential, industrial, commercial, institutional, construction and demolition, municipal services, process, and agricultural.

Figure 1: Sources and Types of Solid Wastes

Source	Typical waste generators	Types of solid wastes
<u>Residential</u>	Single and multifamily dwellings	Food wastes, paper, cardboard, plastics, Textiles, leather, wood, glass, bulky items, and household hazardous wastes.
<u>Industrial</u>	Light and heavy manufacturing,	Housekeeping wastes, packaging, food wastes, demolition materials etc.
<u>Commercial</u>	Stores, hotels, restaurants, markets,	Paper, cardboard, plastics, wood, food wastes, hazardous wastes etc.
<u>Institutional</u>	Schools, hospitals, prisons,	Same as commercial government centers New construction sites, road repair, Wood, steel, concrete wastes etc.
<u>Municipal services</u>	Street cleaning Etc.	Street sweepings; landscape and tree Trimmings, general wastes from parks, sludge water etc.
<u>Process Wastes</u>	Heavy and light manufacturing	Slag, mineral tailings etc.
<small>(All of the above should be included as "municipal solid waste.")</small>		
<u>Agriculture</u>	Crops, orchards, vineyards, dairies,	Spoiled food wastes, agricultural wastes etc.

In Freetown, the waste stream is mostly made up of garbage, which constitutes 50-85 percent of all the waste. As indicated above, garbage includes household waste, market refuses, and waste from handling, storage and sales of produce and meals. Non-biodegradable solid waste or rubbish (paper, carton, cardboard, plastics, clothes, rubber, glass, ceramics, tin cans, etc.) is also part of this waste. Other wastes include: ashes, bulky waste, street sweeping, abandoned vehicles, non-hazardous industrial waste, construction and demolition waste etc. In addition, waste is derived from private and public institutions and city's septic tanks. One other source of solid waste in Freetown, though to a lesser quantity is coming from the imported second hand goods from the developed world. These old goods such as refrigerators, computers etc., are generally near the end of their life cycle and spend little time with their final owners before being put aside as waste.

Also, in regular household waste generation, plastics, paper and cartons, tin cans, glass, bottles and fiber are said to be on increase in selected neighborhoods, which may have a relationship to increasingly affluence and changing consumption habits in these neighborhoods. Electronic waste or E-waste however, is minimum.

Total quantities of wastes generated and characteristics of the Freetown's waste streams are not known. What has been stated above is based on field observations during the study and the work done in comparable economic, climate and population size cities? These estimates indicate that over 85% of this refuse is largely vegetable, biodegradable organic waste. Poorly collected, it is subject to much quicker putrefication, stronger stinks, and more flies. In the long rainy season of the Freetown, being uncovered, the waste becomes soggy, smelly and difficult to collect and transport.

Given these characteristics, the waste densities are high, estimated at 480 kg/m³. The density of waste has an important influence on the selection of methods for collection the wastes. The density of solid waste refers to the weight of one cubic meter of the waste. A high-density waste, as is the case with the Freetown solid waste, may have high proportions of soil, vegetable matter and moisture, whereas a low-density waste might be mostly plastic and paper packaging, with low moisture contents.

Based on an estimated waste generation rates, averaging 0.45 kg/person/day, the total daily waste generated is estimated at 745 tons/day. Construction, demolition debris and yard wastes are not included in this estimate, since these are highly variable and skew quantity assessments. However, medical, toxic, and hazardous wastes are included. In Freetown, these wastes currently are disposed off with regular wastes.

2.2 Review of Collection Practices

Refuse is and always has been a key pointer to the socio-economic condition of those who create it. In Freetown quantities of wastes generated are lower because of overall poverty, low consumption, and extensive scavenging or salvaging by beggars and the very poor.

The quantity of waste that can be collected each day depends upon:

- The number of workers assigned to the equipment;
- The type of containers used for storing the waste (e.g. piles on the ground, plastic bags, baskets, covered bins);
- The location of the containers (e.g. curbside, front gate, backyard);
- The road conditions for access (e.g. paved, unpaved, steep, narrow); and
- The traffic conditions (e.g. slow or congested, or rapid and clear).

There is no house-to-house collection of wastes in Freetown. One of the big problems is that the residents are unwilling and/or unable to pay for these services. In addition, large areas of the city are highly congested, constituting more than 60 percent of all city neighborhoods. Mostly low-income communities inhabit these. Moreover, waste storage at homes is based on poor storage practices, adding to the collection difficulties. Waste without sorting, is often stored in old leaky buckets, and used paper bags instead of a bin lined with plastic bags. Collection workers are not provided gloves and other safety tools for use.

Given the lack of house-to-house collection, pre-collection from homes to the public or communal skips placed at strategic spots in the city, has to be organized by households or some informal private groups. At present, household waste is dropped either by a family member, usually a child or a family servant. This is being done on a very limited basis by an arm of NYMCOS, doing the service for a negotiated payment from the households concerned. There is no transfer station, a situation common to most of Africa. Rubbish picked up from communal skips is moved straight for the two city's two disposal sites.

Waste collection for Freetown residents is free. The collection costs, by their nature, are capital intensive. For example, street sweeping in many developing countries, including India can cost as much as four times as refuse collection. Street sweeping is the basic way that streets, sidewalks, and public areas are kept clean. Also, collection and street sweeping together comprise the largest cost element, accounting for 70–90% of total costs in developing countries, according to the Asian Development Bank. It is lower, 60-70% in industrialized countries. No estimates are available for Freetown. Given the high costs, it is important that a waste collection system incorporates high efficiency and be regularly monitored for collection improvement and cost-savings. This is one aspect of SWM where private sector has been successfully used to bring improvements and efficiencies. For example, in Accra, Conakry, and a few other African metropolises, private sector has been introduced with varying degrees of success. In few cases, community groups under contracts are also providing this service.

To collect wastes, the MoYS has divided the city into four zones. East Zone 1 covers Calaba Town to Ferry Junction, East Zone 2 covers Ferry Junction to East End Police, Zone 3 covers East End Police to St. John, and Zone 4 covers St. John to 7 Battalion. Daily, three collection teams are mobilized by the Unit Manager of the MoYS. Each team consists of ten members who are given or have access to tipper trucks, wheelbarrows (each of 5-7 ton capacity), and related paraphernalia such as long and short brooms, rakes and shovels.

In addition, on the average, 100 street sweepers, most concentrated in the MoYS's Zone 3, are also employed to clean key residential and commercial streets. Manual sweeping is the norm, and no mechanical street sweepers are used. Street sweepers pick up their own sweeping

and place them in litter baskets for transport to the nearest skip. Poor, unpaved, marginal, or very hilly areas are seldom swept. Sound practice involves regularly scheduled debris and litter collection, even if sweeping is physically impossible. A once a month cleanup such as in a few neighborhoods represents a bare minimum of service. It should be increased to 7-10 times a month. Also, a sound practice involves a mechanism to respond to neighborhood complaints or notice that a cleanup is overdue.

Street sweepers use brooms, litter baskets (1.0–1.5 m³ capacity), and wheelbarrow (most imported) to collect wastes. A street sweeper in Freetown is low paid and makes about 100,000 Le (\$33) per month.

Household waste in Freetown is collected via use of skips (containers), each with an average size of 6m³. These are strategically placed along various streets. At these skips, a family servant deposits the wastes. Given highly inadequate number of skips, such wastes are often deposited in small (illegal) dumps along city streets and market and business districts, making collection inefficient and expensive. Distribution of garbage skips and their average monthly collection rates are shown below in Table 2-1. *Distribution of Garbage Skips and Their Average Monthly Collection Rates*. In addition, key selection criteria for container selection is listed under APPENDIX: Figure A-4. *Key Selection Criteria for Container Selection*.

Overall, frequency of waste collection in the city is much higher on the eastern and to some extent central part of the city, given high population densities as compared to the western part of the city. The central part is the point of convergence for the population and a commercial district. In spite of a high servicing frequency, garbage piles are often present. Several streets are serviced twice a day. These streets include Monteque Street, Lewis Street, Kennedy Street, and P.W.D. at Tower Hill, Cole Farm, Ashobi Corner and Lumley Babador. The western zone has fewer containers and low collection frequency, given low commercial activity and low population density. The garbage problem is more acute in eastern and central Freetown. Also, given low pickup frequency, many skips are damaged by the metal corroding acidic leachates generated by the waste's decomposing organic matter.

A skip truck on any day may follow a single route. According to the MoYS, over 75% of total skips (containers) are severely damaged—with most beyond repairs. Poor maintenance, misuse such as setting garbage loaded skips on fire, natural wear and tear are key contributing factors to the deteriorated status. With an average working life of 3-year for a skip, poor replacement ratio has also contributed to this situation. Skips trucks are used to lift one skip (large container), using a chain and pulley system or hydraulic arm-lift, and taken to the nearest of the two landfills (open dumps). Currently, there a total of 54 containers/skips serving various sites at the four MoYS zones.

Also, waste Collection vehicle immobilization rate often reaches 70% in Freetown, reducing the rate of collection. In areas, where manual collection is performed, the volume of material to be collected often far exceeds the capacity of the collection system. To help the situation, a few community groups collect their own waste. However, often these are illegally disposed as garbage piles elsewhere.

Table 2-1. Distribution of Garbage Skips and Their Average Monthly Collection Rates

Zone #	Zone Range	# of Skips	Collection Frequency	Estimated Population
1	Zone 1: Calaba Town to Ferry Junction	11	30	185,000 – 200,000
2.	Zone 2: Ferry Junction to East End Police Stn.	9	20	185,000 – 210,000
3	Zone 3: East End to St. John	8	25	250,000-285,000
4.	Zone 4: St. John to Juba Bridge/7-Battalion	26	50	275,000-410,000
	Total No. of Operational Skips	54	31.2 (Avg.)	

Previously, the collection system in Freetown also used three to four (agricultural) tractors and trailers to collect and haul refuse. In 2001, the waste management agency, Ministry of Health and Sanitation (MoHS) loaned these to the Sierra Leone Road Authority (SLRA). However, for unknown reasons, this equipment was never returned these to the MoHS. It is recommended that the equipment is returned to the MoYS which will subsequently transfer these to the FSWMC, upon its establishment.

Collection in economically better neighborhoods, such as Signal Hill, and Wilkinson Street, is performed three to five times a week, on the average—a desirable collection frequency. However, poor neighborhoods are serviced less frequently, on the average, once a week. The reason cited for the variation are better roads in economically better neighborhoods making waste collection easy for vehicles.

Commercial areas in Freetown are generally serviced at night. For example, crowded areas such as Guard Street, a major commercial market with thousands of daytime shoppers, vendors, hawkers and others make daytime collection very difficult. In addition to containerized garbage, the street’s several large garbage piles are also serviced at night. Guard Street is also a regular dumping ground for the large quantities of (spoiled) produce coming from rural areas to Freetown. A good percentage of this produce gets spoiled during the journey to the market in the open trucks, which often breakdown and are stranded for one to two nights along the way to Freetown. As per the MoYS, about twenty trucks come to the street everyday. The street’s few skips are filled up with garbage quickly and the produce haulers dump their spoils in street’s open spaces during the wee hours. In spite of the relative regularity of cleaning, garbage piles at Guard Street can be seen on any day. Provision and timely servicing of adequate garbage containers such as adequate number of trailers could minimize such illegal dumping.

Freetown has no central sewage treatment plant. At the household level, 60 percent of the city’s total population uses pit latrines, and over 30% have septic tanks. Given improper maintenance and servicing, each of these systems represents serious health and environmental hazards to the public. The MoHS is responsible for emptying at cesspits at household and industrial levels. It uses slurry trucks or “cesspit bowzers.” At the Kingtom landfill, the collected faeces are spread in a polder with alternating pits, each currently overflowing, for dewatering and drying up. Upon drying, a polder’s contents are covered with soil and the product used as fertilizer after few months.

The existing polder (slurry pond) has run out of capacity. Its overflowing sewage is led through a 6-8 feet-connecting pipe to an unlined pit in its vicinity. This pit is further connected to a source of tidal water. An ongoing tide takes the untreated sewage out to the sea. Also, a number of families have set up homes close to the tidal pipe. Often, these families use waste plastic to prevent the sewage pass their front doors. There is no water supply in the area, and the situation presents an environmental and health nightmare.

Overall, waste collection in Freetown is very low. Estimates range from 35–55 percent of the total waste generated. Special pickup days are set up for removal of bulky items such as furniture, tree stumps and tree cuttings. Given the low collection rates, the uncollected waste is illegally dumped in open spaces, water bodies, and storm-drainage channels, buried, burnt or deposited along the streets or roadsides.

Based on the field work, the main issues apparent in the system are highly inadequate equipment, inefficient collection practices with quite variable levels of service; no environmental control systems; poor, unhygienic operating practices; open burning of garbage; extensive illegal dumping and littering; and a public with seemingly little sensitivity to the garbage around them or any awareness of what represents responsible waste management.

Commercial and industrial wastes are privately collected and transported to nearest dump site. For instance, the Freetown Brewery collects and deposits the waste at the nearest dumpsite, at no cost. The Brewery's liquid waste, mostly of unknown composition, is discharged untreated into a nearby stream. The Brewery has no wastewater treatment plant. A Brewery spokesperson indicated that a wastewater treatment plant is currently under consideration by Germany's Heinken Corporation, the owners of the Brewery. Collection from high-rise buildings, primarily office buildings, likewise is done using bulk containers or skips

2.3 Disposal Technologies

Freetown's wastes are disposed of at the city's two landfills, which are essentially open dumps. The open dump approach can be classified as the primitive stage of landfill development and is the predominant waste disposal option in Freetown. A default strategy for municipal solid waste management, open dumps involve indiscriminate disposal of waste and limited measures to control operations, including those related to the environmental effects of landfills. Uncontrolled open dumps have no environmental safeguards, pose major public health threats, and affect the landscape of Freetown.

The two landfills, Kingtom and Granville, respectively are located at the western and eastern ends of the city, respectively. In local terminology, a landfill is called "Bohemia". Originally, these landfills were designed as Controlled Dumps. In the U.S., and other high-income countries, open dumping of wastes is banned since 1970.

A synoptic view of the two landfills is provided in Figure 2-1. In addition to disposal at these landfills, there is significant illegal dumping of wastes at vacant lots, street corners,

roadside, the city's drains (mostly clogged with garbage), and the few streams from the mountainside that run into the sea.

At these landfills, domestic refuse and market-refuse, mainly from the public markets, form the bulk of the refuse deposited. Organic, biodegradable waste is the largest component of the refuse deposited. In addition, there are smaller amounts of industrial and street-refuse, as well as city's medical, hazardous, and toxic wastes. Dumping at the landfills is not done by category of refuse. All refuse is mixed and piled at available or accessible area(s) at each dumpsite. Some commercial and other institutions do their own dumping using their own refuse carts or vehicles. These establishments pay no fee to the MoYS or the city. A detailed view of the two landfills is provided in Figure 2-1, *Synoptic View of Freetown's Two Landfills*.

At each of the landfills, waste is tipped in heaps, and depending on the availability of the bulldozer, leveling of wastes occurs in a several-day rhythm. When available, a bulldozer works diagonal to slope. Also, all collected medical waste is disposed with regular waste, with the smaller fraction often coming up to surface, given infrequent bulldozing. Uncertain bulldozer availability often results in garbage piles that are intermittently burnt to reduce volume, and to make space for incoming garbage. With no fence, each of the two landfills provides uncontrolled access to a large number of stray animals and scavengers, mostly women and children, who work in smoke-filled air.

Open dumps as well as controlled dumps have the potential to significantly pollute areas groundwater. As water percolates through the solid waste in landfills, it absorbs chemicals and microorganisms present in the putrefying materials. The uncontrolled discharge of liquid formed in solid waste dumps or landfills, known as leachate, contaminates ground and surface waters, and thus, pose environmental and public health risks to the local area. In addition, the migration and emission of harmful gases such as methane (highly flammable, risk of explosion) need to be controlled and economically utilized, given its high calorific value. Methane, as a greenhouse gas also affects global warming 21 times more than carbon dioxide.

Granville Brook Landfill

started its operations at the end of eighties. The landfill is located at the neck of the estuary of Granville Brook, on the line between Greater Freetown and Kissy, on Bai Bureh Road—the busy, main highway from the city to the rest of the country. Unleveled heaps of refuse often obstruct the traffic. Down the valley of the estuary, on both sides, all along the Granville Bay, are residential slums. This swampy area is usually cultivated with rice and vegetables, and the workers use the streams for washing clothes and bathing their children. Thus, any site expansion plans may require maintenance of free flow of the Granville Brook.

Kingtom Landfill

is the older and larger of the two formal landfills. It started its operations in 1940s. Kingtom “Bohemia” is situated at the Congo Town Wharf area where the Congo Creek empties into the sea, southwest of Freetown, known as Kingtom. Flanking the long trough of the dump are the Kingtom cemetery to the north and a residential area to the south towards main Congo Town Road. The western side is bordered by a border-embankment against the ocean; the northern part has a discharge valve. Between the border embankments, the southern ascending slope leads to Ascension Town Road and the landfill forms a kind of lagoon. There are watercourses along the northern and southern sides. The site’s poor engineering and the gradients make maneuvering vehicles difficult. Moreover, being located within a bay of the Atlantic Ocean, Kingtom landfill is susceptible to floods.

Figure 2-1. Synoptic View of Freetown’s Two Landfills

The Ministry of Youths and Sport staff at each of the landfills (open dumps) includes five laborers, two supervisors, one clerk and one security. In addition, the MHD has one to two health inspectors and two security guards. Each of the two landfills has 1-2 room rudimentary office and no weigh stations or formal tipping area(s).

Skip trucks are used to transport skips to the city's wastes to the nearest dump. The 2-3 skip trucks are supported by two front-end loaders dump trucks to haul garbage. Skips trucks work around the clock. At each landfill, these trucks often have to drive over scattered waste dumps. Use of bulldozer is highly irregular, given the high daily rental costs (\$600/day), when available for renting from a private vendor. Given the city's congested environment, a large number of skips are hauled at night usually by a crew of four, including a driver. During the day, pushcarts, both small and large, transport wastes from neighborhood to the nearest skip or illegal dump, many of which seems to have never been cleared. In many of these skips, garbage is regularly set on fire to dispose of wastes. The MoYS estimates that over 40-50 percent of the total garbage in Freetown is disposed of illegally. It includes large quantities dumped in open drains, sewers and street corners.

For correct discharge of skips at the landfills, the hook of the skip truck must latch into the fixed skip bolt. However, due to overuse, it was noticed during field survey that this part is often damaged or missing. The situation makes discharging a more difficult and time consuming operation, and has the potential to damage skip truck. For this reason, damaged containers need immediate repairs.

Moreover, each of the landfills is also reaching its designed capacity. This is particularly true for Kingtom. The situation is exacerbated by the lack of proper equipment, in particular to level the refuse and to prevent "refuse hills." Having been pushed beyond their engineered limits, the two landfills have failed. Due to poor operational practices, each open dump has also degraded into potentially hazardous and toxic dump. Earlier, there were plans to relocate each of the two landfills: Granville, to further east in Allen Town, and Kingtom to Hamilton village in the city's west end. However, these plans were not implemented and no new sites have been identified. Also, a previously identified site in Allen Town is now heavily built. In the near-term, up to 5-year, efficient management of the current sites can extend their life. A bulldozer, with timely and assured availability is also essential for this option to gain traction.

Some vegetable gardening is done at the fringes of each of the landfills and squatters live in makeshift huts and are engaged in various small industries. Unfortunately, the discharge of leachates from open dumps to surface waters exposes down-gradient residents to disease organisms in their bathing, food irrigation, and drinking water supplies, as well as through eating (contaminated) food and fish. In early 1990's, cholera outbreak in Conakry, Guinea in settlements in the vicinity of open dumps was attributed to contaminated water from the dump. Given frequent burning of garbage at the landfills, the area residents, in particular those in the immediate vicinity face serious health risks from smoke inhalation. Proper management of the two landfills can effectively remedy this situation.

2.4 Cost Recovery

Freetown residents do not pay any user-fee for management of their garbage. For a system to be sustainable in the long run, cost recovery is crucial. However, the goal of cost recovery in Freetown can encounter significant difficulties, given that the idea of a welfare state is still very much alive.

In many developing countries, a user-fee is increasingly being incorporated in property taxes or electricity bills, or other means as cost recovery mechanism. In Freetown, at present, Seaside Youth, a 50-member subgroup of Youth Garbage Collection Enterprise (YGCE) is providing garbage collection services for a 500 Le (21 cents) per pickup at Fourbay Road. This service has been in existence for six months and is profitable as per YGCE. For the project, the MoYS have given two Banjo garbage collection vehicles, to the group, who from its profits bought a small trailer for \$2,000. Banjos (a vehicle shaped like a Banjo), is a mobile trailer and is locally designed and manufactured. In addition, the MoYS, as part of its cost recovery, is also experimenting with user fee from some businesses. Such initiatives should be monitored over time for potential success and scaling up.

2.5 Industrial, Hazardous, Toxic and Medical Wastes

Hazardous wastes contain highly persistent inorganic or organic chemicals and compounds with acute and chronic impacts on human health and on the environment that can cause immediate, short-term, public health problems as well as long-term human health and environmental problems. Direct contact such as during handling of waste is the most common exposure route. Hazardous wastes can be in the form of solids, liquids, sludge or even gases. They also vary in the degree of hazard posed.

Key industries in Freetown are plastics, soap manufacturing, tanneries, brewery, and others. The main hazardous and toxic wastes arising from these facilities, none of which has any effluent controls, are:

- Waste lubricating oil, motor and gearbox oils, and some cutting oil;
- Small amounts of organic solvents;
- Flesh and hide cuttings contaminated with sulfide and chromium salts; and
- Textile dyeing wastes which contain toxic metals like cyanide.

In addition, there is rubbish from production processes. The rubbish includes floor sweepings, rags, discarded cardboard and wooden packaging materials, broken glass, metal offcuts, and swarf, whilst the office waste is mainly paper and cardboard. Hazardous wastes contain highly persistent inorganic or organic elements, chemicals, and compounds with acute and chronic impacts on human health and environment. Inhalation of dust from waste storage or dumping sites may also constitute a hazard at the facilities.

There is no heavy industry, large production or processing of chemicals, oil refining or other similar industrial operations that can generate significant quantities of hazardous wastes in Freetown.

Overall, however, except for the Sierra Leone Brewery, the industrial units are small. All these units dispose of their wastes, mostly by private arrangements at the nearest landfill. Also, the Brewery also gives waste malt at no cost to area farmers who use it as cattle feed. In the city, used tires are often burnt to provide heat to small manufacturing operations, and smoke can be seen in a number of places around the city.

Often waste can be recycled. For example, chemical wastes from some industries (including tanning, dry-cleaning, photographic processing, and many chemical production industries) should be collected under close supervision and treated in appropriate ways before recycling. Some wastes are highly hazardous, require careful collection and storage, and can be expensive to treat. In many developing economies, priority attention has also been focused on changing to processes that use substitutes that are less hazardous, and to minimize the quantities that are discarded. Such an approach at this time may not be applicable to the Freetown industry, given the low volumes and lack of scientific and technical manpower and financial resources. Nevertheless, minimization and raw material substitution options should be preferred in dealing with any difficult waste.

No reliable estimates of the quantities of hazardous wastes produced by Freetown's approximately 23 manufacturing companies are available. A 1995 German study gives an estimate of 7,500 tons/year. It is likely that given poor economic growth, domestic insurgency and other factors, this quantity may not have changed. Key industries that have the potential to generate hazardous wastes include matches, soap, paint manufacturing, the large Germany's Heinken-owned brewery, chemical, kernel oil and other products.

There is no separation or pretreatment of the wastes or polluted effluents at any of these facilities. Also, there is no environmental monitoring, either voluntarily or by authorities of industrial wastes in Sierra Leone. Most industrial wastes are disposed off at the city's landfills by private arrangements. In a few cases, such as at Aureal Tobacco Company, wastes such as tobacco dust and cigarette wrappings are disposed at the facility. In some cases, the effluents are illegally discharged into city drains. Unfortunately, this is also the case at the Sierra Leone Brewery owned by Germany's Heineken. A used oil recycling facility located in the eastern outskirts of Freetown also highlights illegal waste disposal. The facility recycles used oil from the Freetown port, disposing the potentially dangerous residues in an unlined earthen pit at the facility. Sierra Leone also lacks industry-specific environmental regulations and has an overall weak institutional capacity. This aspect needs to be reviewed through establishment and strengthening of institutional framework.

2.5.1 Health Care Wastes

Health care waste is another category of waste that requires special care in handling and disposal. Health care waste (HCW) is defined as the total waste stream from a healthcare establishment, research facilities, laboratories, and emergency relief donations.

HCW, broadly classified includes communal waste and special waste. Communal waste usually has the characteristics of regular municipal waste—such as food waste, packaging materials, waste plastic, and office supplies. It can be safely disposed of with regular municipal waste. The remaining HCW is requires special attention and includes the following subcategories according to World Health Organization (WHO).

- *Infectious Waste*: Discarded materials from health-care activities on humans or animals, which have the potential of transmitting infectious agents to humans. These include discarded materials or equipment from the diagnosis, treatment and prevention of disease, assessment of health status or identification purposes, that have been in contact with blood and its derivatives, tissues, tissue fluids or excreta, or wastes from infection isolation wards. Such wastes shall include, but are not limited to, cultures and stocks; tissues; dressings, swabs or other items soaked with blood; syringe needles; scalpels; diapers; blood bags. Incontinence material from nursing homes, home treatment or from specialized healthcare establishment which do not routinely treat infectious diseases (e.g. psychiatric clinics) is an exception to this definition and are is not considered as infectious health-care waste. Sharps, whether contaminated or not, should be considered as subgroup of infectious health-care waste. Includes: Syringe needles, scalpels, infusion sets, knives, blades, broken glass.
- *Anatomic*: consist of recognizable body parts.
- *Pharmaceutical*: Consisting of/or containing pharmaceuticals, including: expired, no longer needed; containers and/or packaging,, items contaminated by or containing pharmaceuticals (bottles, boxes).
- *Genotoxic*: Consisting of, or containing substances with genotoxic properties, including cytotoxic and antineoplastic drugs; genotoxic chemicals.
- *Chemical*: Consisting of, or containing chemical substances, including: laboratory chemicals; film developer; disinfectants expired or no longer needed; solvents, cleaning agents and others.
- *Heavy Metals*: Consisting of both materials and equipment with heavy metals and derivates, including: batteries, thermometers, and manometers.
- *Pressurized containers*: Consisting of full or empty containers with pressurized liquids, gas, or powdered materials, including gas containers and aerosol cans.
- *Radioactive materials*: Includes: unused liquids from radiotherapy or laboratory research; contaminated glassware, packages or absorbent paper; urine and excreta from patients treated or tested wit unsealed radio nuclides; sealed sources.

Medical waste is generated by Freetown’s health care facilities such as hospitals—including private and public hospitals, general hospital and military hospital, Other types of health facilities include dental clinics, emergency medical care centers, dispensaries, outpatient clinics, military medical service centers and others, including veterinary hospitals. Freetown’s government medical hospitals include Connaught Hospital, PCMH Hospital, Children’s Hospital, Curney Barnes Hospital, Under Five Hospital, Kingharman Road Hospital, Rokupa Hospital, Macualey Street Hospital, and Children’s Hospital. The MoHS estimates that the total number of beds, including at the city’s major clinics and health centers (such as The Good Shepherd Clinic, Yearima Memorial Clinic and Lumley Health Center) is 1,455. Unfortunately, overall, the health care delivery is significantly deteriorated in terms of quality and patient care. There is no effective waste handling and disposal system in the city’s hospitals.

During visit to a few area hospitals, an absence of hygienic waste handling system was noticed. The staff expressed acute shortage of proper equipment including, smaller items such as receptacles. Given this situation, infectious wastes including syringes, needles etc., are collected and transported in open buckets.

No estimates of total quantity of medical wastes generated in Freetown are available. Depending upon the number of beds occupied, and based on similar city data, average rates can be projected at 0.55 kg/bed/day, to an estimated total of 727 kg/day. Likewise, the infectious waste can vary from 3%-30% of the total medical wastes. Several options can be used for safe handling and disposal of medical waste. These include incineration, non-burn technologies such as use of microwave (radiation) systems, shredding and sterilizing, shredding and chlorination, autoclave, electric arc systems and mechanical systems.

Proper management of HCW can minimize the risks both within and outside healthcare facilities. The first priority should be to segregate wastes, preferably at the point of generation, into reusable and non-reusable, hazardous and non-hazardous components. Other important steps are the institution of a sharps management system, waste reduction, avoidance of hazardous substances such as the PVC-containing products, mercury thermometers and others, wherever possible. ensuring worker safety, providing secure methods of waste collection and transportation, and installing safe treatment and disposal mechanisms.

2.6 Institutional Arrangements

As Section 2.1 indicates, management of Freetown's solid waste has been under shifting organizations, both public and private. Unfortunately, each change further deteriorated the system, bringing it on the verge of collapse. The MoYS, the current authority is struggling to manage the wastes under tight budget, limited trained manpower, lack of experience and little to no legislative authority. The organizational chart, APPENDIX *Figure 2-2, Ministry of Youth and Sports Organization Chart*, for the MoYS follows.

The public at large is also generally non-cooperative, given the lack of education and awareness, and very weak penalties for non-compliance. For instance, penalty for littering, established in 1962 is 25 Le (9 cents) per occurrence is very low and ineffective. In Sierra Leone, environmental legislation and its enforcement are in a shambles. The environmental division in the Ministry of Land and Environment has a total of eight employees to manage environmental issues across Sierra Leone. It lacks enforcement authority. Also, by-laws and statues overall are non-existent. Furthermore, solid wastes environmental laws are scattered across several agencies. For example, the FCC and the MoHS have their own waste management regulations. Governance at the city level is also weak, suggesting a need to empower the city's poor, and develop multi-stakeholder partnerships with NGOs, community organizations, and government agencies, etc. Sound environmental decision-making requires not only the knowledge and understanding of environmental laws, regulations and agency procedures, but also qualified in-house staff capable of enforcing these regulations. All key players need to be involved to achieve sustainable success.

Some recommended changes have been identified. For example, the mandate of the Environmental Protection Act of 2000 is "to provide for the effective protection of the environment, the administrative machinery to ensure such protection and for other related matters." In addition, an informed public can do much to improve the effectiveness of SWM. However such initiatives are only feasible in an enabling institutional setting. This requires

assignment of an administrative strategy to meet set management goals, and marshaling of finance and human resources to implement all phases of the program. A new institution (Section 4.1) is being proposed with the ultimate target of changing the existing vicious circle to a positive circle by implementing a sustainable SWM.

3.0 Technical Options

Several technical options are available for collection, treatment and disposal of solid wastes. However, each option must be considered in the context of technical, economic and institutional suitability. This must include characteristics of wastes, appropriateness of technology including in the context of Sierra Leone's technical standards, cost effectiveness, environmental benefits and institutional capacity. In Freetown, another important consideration is creation of employment for vast number of unemployed city youth. The following table 3-2 lists typical municipal solid waste management (MSWM) costs in developing countries.

Table 3-1. Typical MSWM Costs in Developing Countries.

Sr. No.	Service	Cost
1	Collection	US \$ 15 – 45 per ton
2	Street Sweeping	US \$ 10-20 per km
3	Transfer	US \$ 5-15 per ton
4	Disposal	US \$ 3-10 per ton

3.1 Options for Collection

Planning for improved solid waste collection services must take into account existing conditions, organizational structures, practices and attitudes. Investigations should cover the following specific subjects:

- The amount and characteristics of solid waste;
- Present responsibility for solid waste collection;
- Existing solid waste collection services; any financial incentives or other financial consideration, which affect the quality of service provided;
- Attitudes of householders and solid waste collectors; and
- Recycling practices, if any.

A number of the above items have been covered earlier in the report. For collection, several types of waste collection options are feasible for Freetown. These can be divided into (i) manual, (ii) by use of animals, and (iii) mechanical. A selected option(s) must be appropriate and at least in the short term, compatible with the existing system. The latter is particularly important where budgets and institutional capacity is weak. Productivity levels of various systems are shown under APPENDIX: Table A-11: *Productivity Levels of Various Collection Systems*.

In collection systems, in terms of equipment, special emphasis should also be placed on the types of vehicles. For instance, selected vehicle(s) must be appropriate to the terrain, the waste characteristics, the roads, and the manner of waste discharge and (physical) capability of the crew. Current skip trucks can carry a single skip of maximum 8m³. Considering the cost of fuel, manpower and overhead costs for the single container transportation, the system is considered inefficient and uneconomical. For the long-term, alternate options need to be explored. In addition, skip (container) selection must follow sound selection criteria, since their design and size can help facilitate waste collection. Key container selection criteria includes:

- **Select containers made of local, recycled, or readily available materials.**
- **Make containers easily identifiable, either due to shape, color, or special markings.**
- **Choose containers that are sturdy and/or easy to replace or repair, can withstand prolonged high-temperatures, and can handle a long rainfall season.**
- **Consider identifying containers by generators address or name or code number to help provide a greater sense of responsibility and/or a tendency to keep the container clean.**
- **Use containers that are appropriate for their terrain.**

Use of house-to-house waste collection systems should be started initially on a pilot scale to gain useful information, for potential introduction on a gradual basis, starting with the economically better neighborhood that are willing to pay a user fee. In Freetown, options to contract out this service to private organizations such as the NYMCOS, given the organization's experience and access to large number of unskilled, cheap labor should be explored. Under World Bank funding, house-to-house waste collection through private sector participation has been successfully implemented in Ethiopia and Guinea.

In the neighboring Conakry, Guinea, (2002 population 1.8M) which has many similar solid waste attributes and economic situation like Freetown, the collection of MSW is provided by private operators, on a fee-basis, to subscribed households and commercial establishments. As of the end of 2001, 31 private operators, mostly small and medium enterprises (SMEs), provide the collection services to the whole metropolitan area, collecting over 90% of the solid waste generated in Conakry. The waste is disposed of at the city's 39 small transfer stations by the SMEs from where it is transported in bulk by the city to its sanitary landfill. The city has also rehabilitated the existing open dump to a sanitary landfill. The city is also currently exploring the potential of electricity production through methane recovery at the landfill. As the proposed FSWMC (section 4.1) takes a foothold, it is recommended that the Conakry experience is analyzed for potential use in Freetown.

House-to-house collection will also require use of plastic bags or similar other disposable containers. The commonly used bags that are given by shops to wrap small purchases are too small and not strong enough, so it is necessary to use larger, stronger sacks. Appropriate bags can be provided by the organization that collects the wastes, and the cost built into user for each household. These bags are usually used as liners within a rigid container. The use of bags at the household level is hygienic. It also reduces the amount of dust that escapes when the waste is being loaded into the truck, in comparison to other storage methods. However garbage bags should not be left outside for a considerable length of time, since stray or other animals looking for food are likely to tear them apart. It is better to take the bags to the nearest skip for disposal. Also, location of the skips (central containers) must be convenient to users, accessible to the collecting trucks, and they should not obstruct the road or pedestrian walkway.

to improve waste collection and overall SWM in Freetown, in the current context are divided into emergency measures, short term (two to four years) and medium- long-term (ten-year and beyond) improvements. Given the limitations of this study, most of the focus is on the first two options.

Based on a field review of the existing situation, it appears that waste collection can be positively improved by increasing the number of skip trucks, skips, garbage and dustbins—with all containers strategically placed, increased collection crews and provision of better collection equipment and tools. Proper placement of waste containers is also important. At this time, large skips (6-8m³) should not be placed more than 200 meters apart. Often, one such container can meet the requirements of approximately 2,000 people (300–400 households in Freetown). As the greater number of skips becomes available, such distance for skips should be kept between 50-100 meters. At present, skips are highly inadequate, unevenly distributed, and often area of sites is not delineated.

During the field visit, the above situation was noted in the newly developed areas, in particular on the eastern and western outskirts. It is important to integrate solid waste system with (new) settlement development. In problem areas, such as narrow streets, lighter and smaller containers can be placed. They can be manually carried to the skip trucks or larger skips by collection staff. Also, durable plastic containers of varying sizes are now available in the marketplace. If suitable, their inclusion can help reduce operational costs.

Table 3-2 Emergency Clean-up Collection Needs, lists short-term emergency needs. Various equipment items such as the number of skips, wheelbarrows and dustbins shown in the table are indicative of the minimum quantity that can be projected, keeping in view the budget limitations, procurement and other constraints, as applicable to the emergency cleanup. The suggested quantity in no way reflects the adequate needs of the SWM system in Freetown. In addition, employment of up to 150 temporary additional laborers for a period of three months (budgeted at an average monthly salary of \$100, the prevailing rate) is envisaged. This cost is included in the indicated totals labor budget of \$50,000 in the Table 3-2. In addition, additional supervisory staff on a temporary basis can be hired for emergency cleanup projected period of three months. As the Freetown Solid Waste Management Company (See Section 4.2) gains a foothold, some or this entire staff, as needed after careful screening can be retained in the new organization. Furthermore, in line with the current practice, cleaning and collection work will be carried out around the clock for 3-months. This is considered essential given the limited number of skip trucks available for the operation.

Table 3-2. Total Emergency Cleanup Collection Needs

Sr. No.	Item	Existing Quantity	Quantity Needed	Size/Remarks	Unit Cost	Total Cost (US \$)
A. Equipment						
1	Skip Trucks	3	3	Compatible	75,000	225,000
2.	Skips	54	30	5 – 7 m ³	3,800	114,000
3.	Tractors	-	4	38-45HP/each	10,000	40,000
4.	Trailers	-	30	3 ton, with hydraulic tipping	5,000	150,000
5.	Motor Bikes	1	4	Regular	2,500	10,000
5	Dustbins	Unknown	175	1-3 m ³	400	70,000
6.	Wheelbarrows/ Pushcarts	-	30	Galvanized.	700	21,000
7.	Brooms, rakes, spades, plastic bags etc.	Inadequate	As needed	High quality	N/A	4,500
Subtotal A: Equipment						650,000
B. Labor: Additional for three months						
Manual Labor		Variable	160		100	48,000
Supervisory		Two	One		660	2,000
Subtotal B: Labor						50,000
C. O&M Costs						10,000
Subtotal O&M Costs						10,000
D. Studies/Public Relations/Training.						
Subtotal D: Studies/Public Relations/Training.						0
Grand Total (A+B+C+D)						\$710,000

The emergency cleanup cost also includes cleanup costs of the city’s numerous illegal dumpsites and clogged drains. For the operation, the indicated equipment, labor and other resources must be procured in a timely fashion. In addition, the SLRA should provide the services of 1-2 dump trucks at no cost to the MoYS during the emergency cleanup period of three months. The proposed additional labor can be contracted out to the NYMCOS by the MoYS, which will provide the oversight function to the operation.

The short-term cleanup should be led by the MoYS (with oversight by the FSWMC) and assisted by the MoHS and the FCC in terms of sharing of equipment and cleanup responsibilities. Cleanup of clogged city drains should be coordinated with the SLRA, which has jurisdictional authority on the drains.

Initial emergency cleanup efforts should focus on removing the larger illegal dumps--the “hot spots,” such as near Anne Walsh School and Bombay Street Junction. Additional containers, including mobile trailers should be placed at the heavily congested residential and

commercial areas. These should include Guard Street, Kline Street and others. In the same manner, residential communities, such as those around Kissy Street, should get preference due to high population density. As the clean up progresses, other areas with guidance from the MoYS can be included. It is estimated that the emergency cleanup operation will take approximately three months from its start date.

Following the emergency cleanup, a short-term waste collection and disposal plan need to be developed and improvement, as the FSWMC gets a foothold. All such efforts should be based on sound planning, experience gained from emergency efforts, and provision of increased equipment, manpower and budgets etc., At this stage, a pilot program for door-to-door collection should be implemented. In addition, other measures such as user charges, and private sector involvement should also be explored to establish long-term sustainability of SWM.

Recycling and Reuse is considered an important element of waste collection. At present, recycling in Freetown is very limited, and practiced in a highly informal manner. Recycling is a series of activities that includes collecting recyclable materials that would otherwise be considered waste, sorting and processing recyclables into raw materials such as fibers, and manufacturing raw materials into new products. Common household items that contain recycled materials include newspapers and paper towels; aluminum, plastic, and glass soft drink containers; steel cans; and plastic laundry detergent bottles. In Freetown, numerous scavengers, mostly women and children, working at the two landfill sites, at illegal dumps and garbage skips pick up saleable items such as plastic sheets, cans, and coconut shells for sale to local industry. Given unhealthy and often smoke-filled environment, especially at the two landfills, the practice poses considerable health risks to scavengers.

According to the U.S. Environmental Protection (USEPA) in 1999, recycling and composting activities prevented about 64 million tons of material from ending up in landfills and incinerators. In addition, estimates indicate that as 2003, U.S. recycled approximately 28 percent of its waste, a rate that has almost doubled during the past 15 years. Also, given the wide use of lead-acid and other batteries, the USEPA, in 1996 promulgated a Battery Act to help minimize environmental and health damages as a result of illegal disposal. A key element of the act requires the efficient and cost-effective collection and recycling or proper disposal of used nickel cadmium (Ni-Cd) batteries, used small sealed lead-acid (SSLA) batteries, and certain other regulated batteries. An organization called the Rechargeable Battery Recycling Corporation (RBRC) is the lead organization in recycling most of the portable rechargeable batteries commonly found in cordless power tools, cellular and cordless phones, laptop computers, camcorders, digital cameras, and remote control toys. Car batteries are legally required to be recycled by auto shops and auto manufacturers. In Freetown, lead-acid batteries are illegally recycled in a few backyard smelters or disposed of at the landfills in an unsound manner.

At present, there are a few private recycling industries profitably operating in Freetown. These industries manufacture footwear, wheelbarrows, cooking pots, watering cans and other items using recyclable materials. However, there is no formal program of waste recycling and waste materials recovery, in spite of scarcity of virgin materials, the high electricity costs (14 cents/kWh), the very high poverty and unemployment levels, the large market for used goods and products made recycled plastics and materials. Equally important also, is the existence of large number of workers, especially the illiterate youths potentially available at low wages. As an

effective SWM tool, FSWMC should explore recycling opportunities, both for the short- and long-terms. As a recycling option, composting also offers the potential to reduce waste volumes to save landfill space. Other opportunities such as anaerobic digestion of degradable organic wastes can provide a low cost energy source (biogas), and nutrient-rich byproduct slurry for agriculture use. Biogas contains 55-60% combustible methane. The FSWMC should consider setting up pilot programs for recycling, preferably with community and/or industry participation.

In some developing countries such as those in Latin America, cooperatives have been formed to buy and sell at greater profits recyclable materials. Developing-country experience shows co-operatives were found to have better negotiating power, are able to obtain operating loans routinely, and provide their workers better benefits and better working environment. Under the arrangement, a network of middlemen who operate their business according to supply and demand conditions purchases various waste materials. They, in turn, sell to buyers in bulk purchases. Municipal workers—street sweepers and city garbage collectors are also involved in the sorting of waste during collection round and selling the recovered materials to middlemen who are often located on the route to the landfill.

3.2 Options for Disposal

Several technology options are practiced for waste disposal in developing countries. Included are open dumps, controlled dumps, sanitary landfills, anaerobic composting, incineration, and gasification and wet oxidation. Often, landfills have proven to be a vital component of any well-designed municipal waste management system. They are the ultimate repositories of a city's municipal wastes; after all waste management options have been exercised. Each of these options offers certain advantages and disadvantages. For instance, open dumps, while having the lowest initial capital investment and operating costs, have high environmental contamination risks and limited lifespan. In this study, landfills and open dumps are used interchangeably.

As Freetown grows and produces more waste and its solid waste collection systems become more efficient, the environmental impact from open dumps is likely to become increasingly intolerable. Therefore, the conversion of open or operated dumps to engineered landfills and sanitary landfills is an essential step to avoid future costs from present mismanagement. Controlled dumps, for instance, have basic environmental amenities: site is fenced, scavenging is organized, waste is covered by soil daily, fires are extinguished and stormwater is re-routed around the site so it does not mix with the waste. Also, they are more environmentally sound than open dumps; however, open dumps do not provide full protection against environmental and public health hazards.

The first step and challenge in upgrading open dumps to sanitary landfills involves reducing nuisances such as odors, dust, vermin, and birds. Sanitary landfills are similar to controlled dumps but built and operated with full environmental controls including a liner, leachate treatment, and the flaring or economic use of landfill gas (LFG). The gas is produced by the anaerobic decomposition of organic wastes, and is mixture of methane (55–60%), carbon dioxide and trace quantities of hydrogen sulfide and other toxic gases. Since the LFG cannot escape, gas must be collected for destruction or where economical, used as an energy source. IN

a landfill, the gas is generally drawn from a number of vertical wells drilled through the depth of the waste mass or from horizontal perforated pipes laid in gas permeable trenches distributed through the wastes. These wells or trenches are then connected to a gas ring main and under an applied vacuum the gas is piped to a central lower/fan or gas compressor unit. Further stages including condensate traps, particulate filters, chillers or gas pressure boosters may also be included in the overall collection system. Uncontrolled landfill gas migration from a site poses a threat not only to the global environment but also to human health and can also pollute the local environment. As a greenhouse gas, methane has twenty times the damaging effect as compared to carbon dioxide, the leading GHG.

At this time, for Freetown, open dumps appear to be the only viable SWM disposal option. Over time, 2-year and beyond, the FSWMC should consider incorporating better options such as controlled dumps, and for the long-term, five years and beyond, a sanitary landfill. A controlled dump, unlike an open dump is sited with respect to site's hydrogeology, has well-planned capacity, is intermittently provided with a soil cover for its waste, is fenced and incorporates other useful features such as basic record keeping and controlled waste picking. Finding an ideal site, planning and designing a new landfill is a lengthy and costly affair, often only feasible with external financial aid. The FSWMC therefore should look in to all these options in a timely manner. A sanitary landfill requires sound management and engineering practices. At present, such skills may not be available in Sierra Leone. Also, unfortunately, without pre-sorting a sanitary landfill prevents recovery of recyclable items, and scavenging activities that support livelihood for a number of families.

Incineration as disposal options for solid wastes allows unsorted, non-bulky solid waste to be fed directly into the furnace and combusted. Incineration significantly reduces the amount of waste to be landfilled and requires very little land. The process produces ash, which generally is landfilled as well as gas and liquid emissions that require treatment. Incineration however is not an effective option to dispose of municipal solid waste in Freetown because of the unsuitable technical characteristics of the waste (high moisture and organic content and low calorific value), high construction and operating costs, and attendant environmental risk due to weak monitoring and enforcement. Also, lower cost land disposal usually has proven to be a more practical waste disposal option than incineration. Given these constraints, even for Freetown's medical and toxic waste, incineration is not recommended at this stage, and relatively safe landfill disposal alternatives for medical wastes have been identified elsewhere in this report.

Also, it is suggested that each of the two existing open dumps be immediately provided with access to a bulldozer on a regular basis. Other items include provision of a fence, improved access roads, small office facility at each location, and controlled waste picking by scavengers. In the short run, with better management and increased equipment availability, the existing waste disposal practices can be better footed and improved alternatives can be planned and implemented. It must also be noted that improving and "upgrading" open waste dumps does not necessarily have to be difficult or expensive. It should not be regarded as an alternate to a new site, but it can significantly prolong the existing site's life span and reduce the negative environmental impacts. The upgrading can also give time to the FSWCM to engage in a serious siting procedure for a new landfill. For the longer haul, 10-year or more, new landfill sites must be identified and developed and managed based on sound principles.

Each of these disposal options requires sound planning and an established institutional support capable of providing needed equipment, manpower, budgets, policy guidelines and oversight. As the FSWMC gains foothold, these can be looked into. In the long run, a sanitary landfill has proven to be the most desirable option in many developing countries.

Successful example of private sector participation in SWM in developing countries is illustrated by an organization called the SIMEPRODE in Monterrey, Mexico. The organization operated three transfer stations and the landfill for the state of Nuevo Leone. The transfer stations served the metropolitan area of Monterrey, with approximately 3.5 million inhabitants. The landfill served the metropolitan area of Monterrey, and 75-80% of the remaining state of Nuevo Leone. The management of SIMEPRODE is by political appointment. Recent elections in the State of Nuevo Leone however changed the organization's administration. The new upper management at SIMEPRODE came from the private sector and was paid private sector equivalents. SIMEPRODE currently operates as a private company—with its own budget—and is responsible only to its board of directors, comprised of the governor, three mayors, and representatives from industry and the unions. There has been considerable improvement in the delivery of the services.

For emergency cleanup, in addition to the equipment listed under *Table 3-2 Emergency Clean-up Collection Needs*, availability of bulldozer for leveling wastes at the landfills is a critical requirement. It must get immediate and urgent attention. At present, as previously indicated, the MoYS is renting the bulldozer from a private vendor at high costs (\$600/day). However, often the funds and/or the rental bulldozer have not been available. The result is that heaps of unloaded garbage that are intermittently set on fire to gain space for incoming garbage. As a (temporary) alternate to renting a bulldozer, the FSWCM should try to gain access to one from the SLRA, which uses bulldozer in its roadwork. The waste disposal operation—emergency cleanup, and also near- and long-term needs require a bulldozer.

Given the existence of numerous, citywide illegal waste dumps, clogged drains and scattered wastes around street corners, it is difficult to give an estimate of the total waste quantity for removal under the emergency cleanup phase. This quantity may run into several hundred tons or more. As a pre-planning measure, the FSWMC should conduct a survey to gauge the quantities, and develop specific-area priorities covering the existing MoYS collection zones. Simultaneously, the FSWMC should also implement appropriate measures such as making transportation arrangements and creating disposal space at each of the landfills to dispose of collected wastes. It is recommended that for this, the existing equipment such as payloaders with sufficient bucket capacity be mobilized from the SLRA. Given the urgency of cleanup, all strategies should be deployed in a timely manner, and with full participation of the FSWMC.

For the short-term, several items can be suggested for improvement of disposal options. These include a fence for each landfills, office space, additional vehicles, improved vehicle access, and controlled access for scavengers. Moreover, the workers should also be provided with gloves, masks, uniforms, and periodic medical checkups. Effective monitoring and evaluation should also back the process.

Long-term, 10-year and beyond, new landfill sites are needed. The indicated period is based on the assumption that the current landfill operation incorporates the recommendations indicated earlier to help prolong each landfill’s life. Also, each new site selection and its development must be based on sound scientific criteria and community input in site selection. Most communities are known for their NIMBY—Not In My Backyard syndrome, adding to the difficulties of a landfill site location. Thus community participation in site selection is important. Also, as indicated earlier, a site’s design and development must use sound engineering principles. Key characteristics of municipal landfill management systems are listed below in Table 3-3. *Key Characteristics of MSW Landfills.*

Table 3-3. Key Characteristics of MSW Landfill

Type	Characteristics	Advantages	Disadvantages
Open Dump	<ul style="list-style-type: none"> • Poorly sited • Unknown capacity • No cell planning • No leachate management • No gas management • Only occasional cover • No compaction of waste • No fence • No record keeping • Waste picking and trading 	<ul style="list-style-type: none"> • Easy access • “Extended” lifetime • low initial cost • Aerobic decomposition • Access to waste pickers • Materials recovery, income 	<ul style="list-style-type: none"> • Envntl contamination • Overuse, many noxious sites • Unsightly, needs remediation • GW and SW contamination • Risk of explosion, GHGs • Vectors, disease • Shorter lifetime, little • Indiscriminate use, vermin • No record of landfill content • Least efficient for materials recovery
Controlled Dump	<ul style="list-style-type: none"> • Sited WRT hydro-geology • Planned capacity • No cell planning • Grading, drainage in site prep • Partial leachates management • Partial or no gas management • Regular (not usually daily) cover • Compaction in some cases • Fence • Basic record keeping • Controlled waste picking and trading 	<ul style="list-style-type: none"> • Less risk of Envntl contamination • Permits long-term planning • Low initial cost • Easier rainfall runoff, reduced risk • Moderate cost, reduced risk • Extended lifetime • Controlled access and use • Valuable information • Materials recovery, income, low risk to pickers 	<ul style="list-style-type: none"> • Perhaps less accessible • Envntl contamination • Cost • Slower decomposition • Maintenance • Harassment, possible displacement of pickers and buyers • Loss of recyclable resources

Type	Characteristics	Advantages	Disadvantages
Sanitary Landfill	<ul style="list-style-type: none"> • Site based on an Environmental Assessment (EA) • Planned capacity • Designed cell development • Extensive site preparation • Full leachate management • Full gas management • Daily and final cover • Compaction • Fence and gate • Record volume, type, source • No waste picking 	<ul style="list-style-type: none"> • Minimized Envtl. risk • Permits long-term planning • Reduced risk at and from site • Reduced risk from leachate • Reduced gas risk • Vector control, aesthetics • Extended lifetime • Secure access, gate records • Valuable information • Eliminate risk to pickers 	<ul style="list-style-type: none"> • Access, longer siting process • Cost • Preparation time • Slower decomposition • Maintenance, staff • Equipment • Displacement of pickers and buyers, loss of recyclable resources

Once the current situation is stabilized and strengthened with appropriate equipment, budgets and effective management--in particular, through the establishment of a lead institution, for the long-term, 10-year and beyond, better disposal options such as a sanitary landfill must be considered. As indicated earlier, in a sanitary landfill, solid wastes are placed on or in the ground at a carefully selected location by means of engineering techniques that minimize pollution of air, water and soil, and other risks to human health, animals and environment. Moreover, aesthetic considerations should also be taken into account.

3.3 Equipment Needs

For the existing SWM operation, severe shortage and/or severely malfunctioning equipment is a major constraint to better management. During the field study, in terms of equipment, the following key deficiencies were identified:

- Highly inadequate number of skips (containers) and dust bins;
- Insufficient skip trucks and front-end loaders;
- Serious lack of spare parts, tires, utility vehicles, and motorbikes for effective monitoring and supervision;
- Inadequate protective gear—gloves, helmets, boots, nose masks, overall clothes, raincoats, etc.;
- Inadequate cleaning tools and equipment such as shovels, rakes, wheelbarrows, etc.;
- No bulldozer(s) and no low-bed prime movers—when bulldozer(s) are not available;
- Improperly maintained landfills—absence of fence, office/work space, tipping areas etc.;
- Insufficient budgets and trained manpower; and
- No health and safety measures, including absence of first-aid kits and other on-site medical provisions.

The existing fleet has very few operational vehicles such as skips trucks, tipper trucks, and front-end loaders. Also, of the total, over 55% are usually non-operational at any time, primarily due to misuse, and lack of funds to repair the broken equipment. APPENDIX: Table A-6 *Workshop and Garaged Equipment Needing Repairs or Replacement*, lists various equipment with the MoYS. In addition, appendix table No. lists key equipment needing urgent repairs.

Poor equipment availability is the major factor contributing to the chaotic and deplorable waste management situation in Freetown. The existing equipment often malfunctions, is poorly maintained, and sometimes misused. The backup support, by way trained staff and properly equipped workshop, is poor at best. Adversely compounding the situation is more than doubling of the Freetown's population during the last ten years. Changing waste management authorities have also played havoc with the system. There is also a need to dismantle, remove, and transport to safe disposal sites obsolete parts and equipment, after careful evaluation and audits. Needed corrective measures face gargantuan challenges.

In addition, similar equipment in varying quantities is also used by the MoHS for its use sewage collection and transport operation. It is recommended that on an availability basis, this equipment be shared with the MoYS. For better implementation, inter-agency and also public cooperation should also be sought. This should include pooling equipment, additional personnel (such as from the MoHS and the SLRA) and personnel and management resources. A list of equipment with the MoHS is shown under APPENDIX: Table A-3 List of Current Equipment at the MoYS. Also, current list of waste management staff is shown under APPENDIX: *Table A-4. Current List of Waste Management Staff at MoYS.*

Thus, for emergency cleanup, it would be necessary to efficiently mobilize existing equipment at the SLRA, the MoYS and the MoHS, hire (temporarily) additional refuse collection and management staff. Emergency short-term funds would be needed for repair of the malfunctioning and disabled equipment and hiring of additional staff. According to the MoYS, over 60% of the non-functioning items need to be junked.

Any equipment selection must be based on a number of criteria. Included are waste characteristics and quantities, physical infrastructure, the number and types of existing equipment, target collection rates, budgets and available institutional support. Due consideration must also be given to types of vehicles and chassis in current use. Spare parts availability and maintenance expertise should also be considered in selecting newer equipment type. In addition, before finalizing the list, taxes, duties and import restrictions also need to be considered.

The proposed equipment type and the quantity for emergency and short-term, 2-4 years is based on keeping the above criteria in view, the field observations, and consensus opinion of the MoYS, the MoHS and the SLRA relevant staff. In addition, labor-intensive approaches were given due consideration given the need to employ large number of city unskilled youth.

3.4 Industrial, Hazardous and Toxic Wastes Management

Industrial solid waste can be managed either on site—at the facility where it is generated—or transported site to commercial facilities. On-site disposal is usually done through the use of municipal and industrial wastewater facilities and off-site, they are disposed off at (regulated) land disposal facilities such as landfills, waste pits and incineration or waste-to-energy incineration facilities like cement kilns. A variety of treatment, recycling, and other management options -- such as stabilization and solidification – can also be used for many types

of industrial wastes. In the U.S., nearly 99 percent of hazardous wastes are managed on site at the facility itself or treated and discharged through a wastewater treatment facility.

At present, due to limited industrial activity, insignificant quantities of such wastes are produced in Freetown. Thus, for the short-term, safe and less costly disposal options can be used. For example, often, used oil can be economically recycled or disposed of by burning in properly equipped furnaces. It can be stated that most wastes can be recycled. However, recycling economics and technical options may vary with the nature and location of the waste. Some wastes are highly hazardous and expensive to treat. In industrialized countries, priority attention has been given to changing the feedstocks that are less hazardous. Other efforts have focused on minimizing the quantities that are discarded. In most cases, minimization and raw material substitution options have been preferred in dealing with any difficult waste. Such practices may not be applicable to Freetown, given small quantities of industrial and toxic waste generated and lack of technical know-how and manpower.

Nevertheless, industrial and toxic wastes must be managed carefully. For example, chemical wastes from some industries (including tanning, dry-cleaning, photographic processing and many chemical production) must be collected and disposed of in an environmentally sound manner. Similarly, slaughterhouse wastes may need proper handling and as one disposal option for Freetown, these can be buried in special trenches at suitable sites at each of the two open dumps. .

There is no pretreatment of the industrial wastes or effluents at any of Freetown's industrial facilities. Also, there is no environmental monitoring--either voluntary or by authorities--of industrial wastes in Sierra Leone. At present, most industrial wastes are disposed off at the city's landfills by private arrangements. Some industries, such as the Aureal Tobacco Company in Freetown, dispose their wastes including tobacco dust and cigarette wrappings at the facility itself. Furthermore, almost all industrial facilities (illegally) discharge their effluents into the city drains. Unfortunately, such is also the case at the large Sierra Leone Brewery owned by Germany's Heineken. In addition, a used oil recycling facility located in the eastern outskirts of Freetown also highlights illegal waste disposal. The facility recycles port oil, disposing the potentially dangerous residues in an unlined earthen pit at the facility. Given the lack of industry-specific environmental regulations and little to no enforcement of the existing regulations, illegal disposal continues. This aspect needs to be reviewed through the establishment and strengthening of institutional framework.

For example, the private manufacturing facilities should be required to determine the quality and quantity of their wastes through systematic monitoring and maintain good records. This data should be reported to the government who should also require them to dispose of all wastes in an environmentally sound manner and in accordance with the prevailing standards. While the existing environmental laws are not industry-specific, they do provide guidance on disposal of hazardous materials such as oils, organic solvents, acids and alkalies and other major pollutants. There are also provisions requiring licenses or permits for commencing activities that may have adverse environmental impacts.

Sierra Leone's National Law for Environmental Protection makes the Department of Lands, Housing, and Environment as the agency entrusted with the mandate to coordinate environmental activities in the country and to implement national policies. Within this department is an Environmental Protection Section (EPS), which is the focal point for national and international environmental activities. At present, the EPS has rudimentary staff and little budget.

Long-term options for effectively managing industrial wastes may include use of better manufacturing practices that incorporate better practices such as waste minimization and the cleaner production. At the government level policy and legislative support, implementation and strict environmental regulatory enforcement could be useful tools for effective management of industrial wastes. Details and relevance of such approaches are beyond the scope of this study.

3.4.1 Disposal Options for Medical Wastes

Proper medical waste disposal requires placing toxic and infectious wastes in polythene bags with minimum thickness of 100 microns, and sizes ranging from 60x100 cm. Sharp discards—syringes, scalpel blades etc., should be placed in cut- and puncture-resistant containers, such as disposable plastic bottles or thick cardboard boxes. For transport to the landfill, these should be placed in plastic bags, and closed off with a plastic strip that cannot be reopened. No reuse of the bags or any compression of infectious waste should be allowed. All containers must be properly labeled.

For Freetown, given absence of safer systems, hospital waste may be disposed of jointly with regular wastes. However, it is strongly recommended that hospital wastes are carefully separated, labeled and transported to one of the two open dumps. At each site, workers must dump the bagged/containerized wastes directly from the truck into the pit without handling. A smaller truck could be assigned for these needs. Final disposal should be done in a specially designated cell, which should be covered with a layer of lime and at least 50 cm of soil. This should be followed by at least one-meter thick regular municipal wastes, and always placed more than two meters from the edge of the deposited waste. Also, pits where infectious wastes are deposited should not be reopened.

Cost recovery for disposal of medical wastes can be through user charges, based on the "polluter pays" principle, where each hospital or clinic pays according to the volume of waste generated. Some facilities may not be willing and/or able to pay the full cost and, as experience in many countries has shown that in such situations, there is a tendency to illegally or indiscriminately dispose of medical wastes. In such situation, subsidies or other financial incentives may be warranted. After a careful review, these should be considered on case-by-case basis. Also, unlike general waste, the use of Micro and Small Enterprises (MSEs) is not recommended for management of hospital and healthcare wastes. Unfortunately, experience in other countries has shown that MSEs have a tendency to illegally dispose of hospital waste at unauthorized locations, to avoid following the required procedures and to (illegally) maximize profits. A careful monitoring can help minimize this practice.

For the long run, detailed study to dispose of city's medical and toxic wastes using technically and economically sound technologies should be initiated. Training and awareness programs also need to be initiated. Trainees must include hospital administrators, MSW staff, relevant local/regional decision-making authorities and others. In addition, use of incineration, as medical waste disposal technology should be explored. Incineration can completely destroy certain infectious medical waste such as syringes, body parts and tissues, and can also treat certain classes of hazardous wastes such as insecticides, pesticides, waste solvents, types of hydraulic fluids and some oily sludges.

4.0 The Institutional Arrangements

An effective implementation strategy for the SWM in Freetown, requires an innovative approach in terms of establishing a new lead agency, which is institutionally and financially on sound footings, has transparent dealing, and is devoid of political interferences. Moreover, such an institution must be driven by three basic concepts: accountability, autonomy and incentives. It should establish its long-term viability through incorporation of a sound organizational structure capable of providing increased efficiency and effectiveness as well as self-sustenance. It should set schedules, and performance measures, and monitor progress. However, establishment of such an institute is only feasible when there is willingness on the part of authorities to take risks, bear additional costs, at least initially, in the expectation that these changes will pay off in the long run.

Based on the analysis of the existing situation, a new institute, named the Freetown Solid Waste Management Company (FSWMC) is proposed.

4.1 The Freetown Solid Waste Management Company

As indicated above, a sound institution is essential to sustainable SWM operation. Experience in developing countries has shown that an effective waste management institute should be autonomous, and has executive authority to design, monitor and implement sustainable solid waste management strategies. Furthermore, given the needs for its multi-sectoral role, such an institute must also have authority, visibility, adequate budgets, legislative and policy support, administrative capacity, and a strong constituency to advocate its plans and their potential implementation.

The current organization, the MoYS, (as well as its predecessor, the MoHS) has many shortcomings, especially on the management and implementation side. In addition to severe shortage of equipment, the staff capacities at all levels are very weak. As indicated earlier, the MoYS is also struggling with inadequate budgets, lack of experience, and lack of authority. On the operational side, records and information related to the SWM costs are highly inadequate and spread over several agencies. The current system also lacks internal controls. In addition, an institutional and regulatory framework is severely lacking for procurement, and legislative enforcement. For the current World Bank project minimum standards will have to be set and implemented.

Thus, in the context of Freetown, there is a dire need of a sound institute, as indicated above.

During the field visit, several discussions were held with the MoHS, the Sierra Leone Road Authority (SLRA), several permanent secretaries and others. A list of contacts is indicated under APPENDIX: *Table A-8, Contact List*. A common consensus of these discussions was that the current arrangement is unsound and unlikely to be effective or sustainable especially in the long term. The MoYS also agrees with this viewpoint, however, with a caveat—its youths (and two key staff) must be employed by a new organization. Reverting the SWM to the MoHS, the previous manager, is not recommended in view of its historically poor performance and allegations of corrupt practices.

Based on the above, establishment of the proposed independent institute, the Freetown Solid Waste Management Company (FSWMC), under the auspices of the central Ministry of Local Government (MLG), is mandatory. The FSWMC, as the central authority must be an autonomous body, and must have full authority to independently manage all aspects of SWM in Freetown. Initially, upon the FSWMC's establishment, binding contracts to hire MoYS's youth labor should be established for a foreseeable future. Over time, as the new institute, the FSWMC establishes itself, all of the MoHS waste functions including, environmental and waste-related health aspects should be transferred to the FSWMC. An organizational chart for the FSWMC is shown in *Figure 4-1: Proposed Organization Chart for Freetown Solid Waste Management Company*. However, a seamless transition based on transparency and openness between the existing organization, the MoYS and the SWM system need to be assured through appropriate planning.

Freetown Solid Waste Management Company (FSWMC) is proposed to be the lead organization for managing solid waste. As an autonomous organization under the auspices of the MLG, financially and institutionally, the FSWMC will exercise significant independence. The FSWMC must also articulate a development agenda with a profound conviction to bring about meaningful and visible changes. It should clean wastes, but also create jobs, support and empower communities, encourage private sector participation in the SWM, and establish an overall sustainable SWM framework through cost recovery and active private sector participation. Its key objective will include be putting in place a renewal process aimed at:

(i) Increasing the quality, relevance, focus, coherence, and effectiveness of the SWM operation in Freetown; (ii) establishing a strengthened work planning, implementation, and monitoring methodologies and systems to better track and monitor the SWM operation's activities; (iii) reducing administrative and overhead costs of the SWM operation; (v) improving the quality of the SWM staff and adjusting its skill mix to current challenges; (iv) improving external and internal communication policies and systems; (v) consolidating the SWM donor funding base; and Others.

Key players that will interact with the FSWMC are:

Ministry of Local Government (MLG) as a central ministry, and the parent of the FCC, will provide access to Sierra Leone's central government to help establish appropriate policies and regulatory framework, get adequate budgetary allocations, visibility, and coordinate international donor assistance. The MLG's minister will work closely with the MoYS minister as well as the proposed Advisory Committee.

Ministry of Youth and Sports (MoYS) should transfer the existing solid waste management workforce and equipment, including workshop to the FSWMC. In addition, it should provide youth on a contractual basis, preferably through the NYMCOS for emergency cleanup operations, likely to begin during the later part of 2004. The FSWMC will communicate manpower needs for this and future activities in a timely manner. It is anticipated that after the emergency cleanup is completed, the MoYS's role should be limited to supplying youth labor on a contractual basis.

Ministry of Health and Sanitation (MoHS) for the near-term, should continue to provide liquid waste management services. However, as the FSWMC establishes its roots, this function, including sewage management should be transferred to the FSWMC. It is recommended that this transfer takes place within a year of the FSWMC's establishment. In addition, the MoHS should assist the FSWMC in the environmental and health aspects of solid waste management. As ex-solid waste manager for Freetown, the MoHS brings institutional knowledge and experience as well as personnel experienced in solid waste management. It is recommended that the MoHS transfer to the FSWMC the needed personnel, equipment, and other resources. Also, existing equipment building under its control should be transferred to the FSWMC.

Advisory Committee: Given the complex nature of solid waste management, the multi-agency participation, and a poor performance record as well as political interference, it is proposed that an Advisory Committee, in a watchdog capacity be established. An organizational chart for the Advisory Committee is indicated under Figure 5-1. Various members (by title) have been drawn from all the above participating organizations as well as legislative and community leaders recognized for their service to the Freetown community. It is proposed that cost of services of each member is funded by his/her parent organization. They will be funded by their individual organization. It is suggested that the Advisory Committee meets at least six times a year to provide services such as:

- To resolve problems and provide assistance in trouble shooting;
- To assist in inter-agency communications;
- To prevent or minimize political interference and misuse of equipment;
- To safeguard and represent minority participant interests; and
- To act as sounding board for the community.

The FSWMC's charter will detail composition and duties of its Board of Directors, voting mechanisms, cost-sharing agreements, and other specifications, as needed for an effective framework. On the implementation side, this will include responsibilities for providing new ideas, technologies and skills, and clear accountability procedures. Over time, with a good track record, the FSWMC can evolve into a contracting agency performing on management contracts for other municipalities.

In the beginning, the FSWMC will generate its finances through budget allocations and donor assistance. However, over time, the FSWMC will be self-financing through user fees, business licenses, and other effective means. It will have the authority to contract out, monitor, and supervise the SWM operations, and regulate uncontrolled dumping and disposal by others. The FSWMC, to the extent feasible, will also be responsible for decentralization of field operations. It will also help the Sierra Leone government in establishing enabling policy and regulatory frameworks for the SWM in Freetown. Such policies also help raise public consciousness towards environmental issues, helping lay the groundwork for a conceptual framework at national level.

The FSWMC will also establish various performance indicators and clear line supervision among its various activities. This may require upgrading the staff skills number. All

remunerations including per diems must be fully documented. The company should incorporate clear and merit-based recruitment procedures and an equitable structure of compensation in line with relevant principles embodied in a code of conduct. It is suggested that an FSWMC committee is timely established to develop procedures for staff recruitment, a compensation structure and other rules in consultation with the MLG and others, as appropriate.

It is essential for the effectiveness and success of the FSWMC that its resources are utilized and spent for the intended purposes. Thus, effectively functioning financial management and accountability mechanisms are essential. This DM will ensure that proper controls are maintained. In this regard, the FSWMC should also consider using a suitably qualified and experienced independent firm as a “monitoring Agent” (MA). The Agency can monitor procurement of equipment and other items, works and services; screen and recommend for approval withdrawal applications; and monitor expenditures out of the FSWMC to ensure that funds are only disbursed for the purposes for which they have been provided, and in accordance with the applicable (such as the World Bank) procedures and acceptable financial and auditing standards. Employment of the MA should take place in accordance with the procurement procedures of the World Bank’s current funding. Also, an MA may not necessarily monitor 100% of transactions; it should adopt a high sampling ratio. The Monitor should report its findings to the FSWMC’s BOD and the Advisory Committee, in addition to the FSWMC.

An organizational chart for the FSWMC is provided below in Figure 4-1. *Proposed Organizational Chart for Freetown Solid Waste Management Company.*

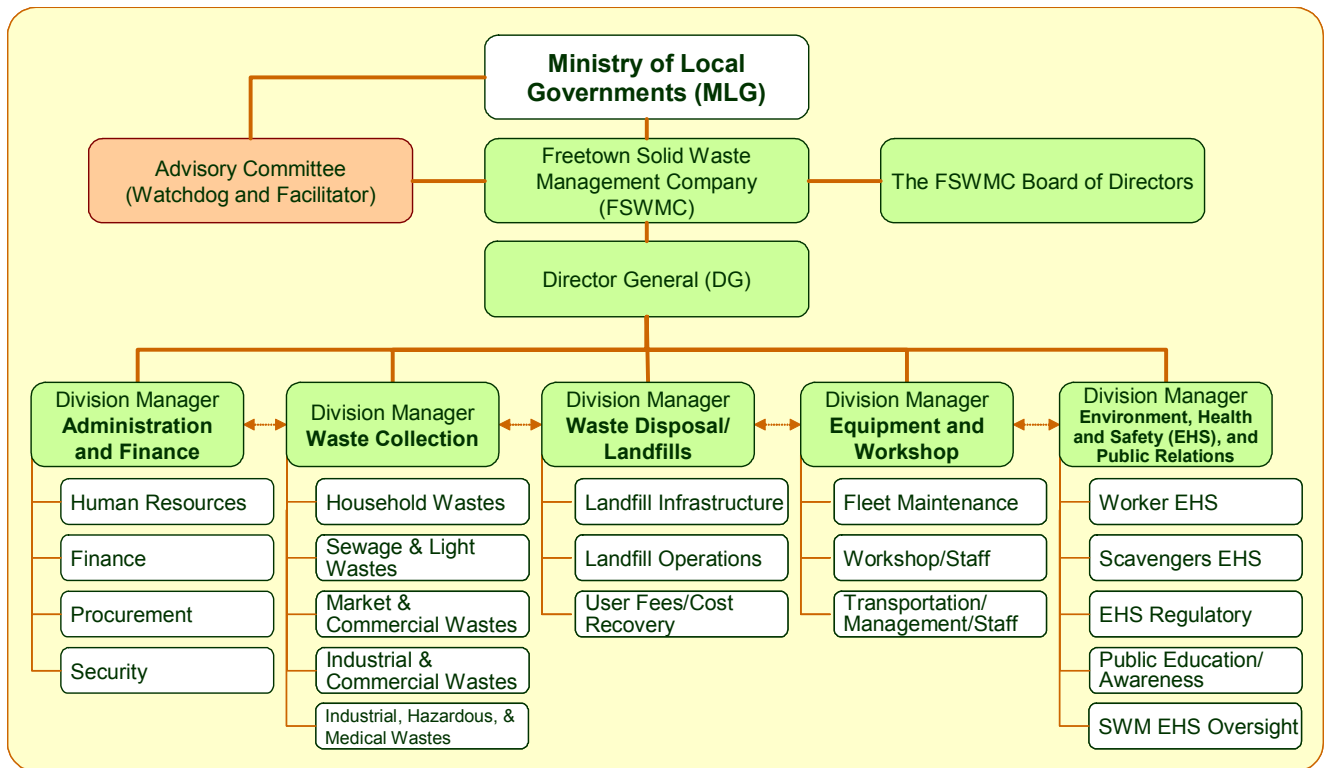


Figure 4-1. Proposed Organizational Chart for Freetown Solid Waste Management Co.

4.1.1 The Board of Directors

A Board of Directors (BOD) will be elected for the FSWMC, in accordance with its charter and various provisions. The Board will provide guidance and oversight to the FSWMC, in accordance to its charter. The BOD's members will be elected from the community, the government, the industry and professional sector, including legal and engineering. Each elected individual will also bring solid reputation in integrity, honesty and work performance. It is proposed that the BOD consists of five members. It is proposed that each member works on a nominal salary, paid out of contingency by the FSWMC. It is recommended that the BOD meets every three months, or earlier, if needed.

4.2 THE FSWMC Management Staff

The FSWMC will be staffed with well-qualified and experienced professionals recruited on a competitive basis. The proposed reorganization under the authority of the MLG would draw experienced technical management personnel, from existing sources such as the FCC and the MoHS. However, each transfer must also involve appropriate screening and approval by the FSWMC. In addition, approved transfers must be accomplished in a timely manner. An appropriate government mandate can help this process. Any position(s) open to the general public must go through a strict selection criteria implemented by the FSWMC. The only exception to this process could be the two individuals, the Waste Coordinator and the Unit Manager at the MoYS. Their inclusion was requested by the MoYS minister. To help the staffing process, a list of key individuals currently employed by the MoYS and the MoHS is attached in the APPENDIX: Table A-5. *Current EHD Staff at the Ministry of Health and*

Sanitation. The proposed transfers will also bring needed institutional experience in waste management to the FSWMC. Cost estimates for the FSWMC are indicated under Table 5-1. *Cost Estimates (First Year) for the Freetown Solid Waste Management Company.*

No budgetary provisions for office rents, utilities, and office equipment such as computers, printers, faxes etc., have been made under the proposed World Bank funding. It is recommended that the MLG provide these to the FSWMC at no cost, and at the start of operations. It is further recommended that this and other support, such as fees for the incorporation of the FSWMC, be agreed upon and documented before the World Bank funds are released. It is expected that within a few months after incorporation, the FSWMC will initiate user fee charges at the domestic and industrial houses. Such fees are based on the “polluter pays principle,” and may include residential waste fees, tipping fees for commercial users, (environmental) fee for business licenses, and increased property taxes and utility surcharges. In implementing these options, the poor can be protected through carefully designed cross-subsidies in user charges or taxes. At the same time, higher charges can be considered for high-income areas. User charges, including a refuse tax, a volumetric tariff, a tipping fee, business licenses, and grants, have the potential to raise considerable revenues.

The roles and responsibilities of various individuals of the FSWMC are synopsized below:

Director General (DG): The individual is the Chief Operating Officer for the FSWMC, reporting to its Board. In this position, the individual will provide administrative, technical, and operational and management oversight for all aspects of the SWM in Freetown. As the key spokesperson for the FSWMC, he/she will ensure adequate budgets, and coordinate policy decisions with all key players. The DG, through use of specialized consultants, at least during the first six months of its establishment, will also be responsible to ensure streamlining of various operations including procurement matters from the preparation of tender documents, bidding processing, bid evaluation of all contracts. At present, there is insufficient transparency related to public finances, and the general attitude towards fiscal discipline is not strong. For instance, the budget process is not yet transparent, and public access to government financial information is limited. The DG will place adequate pre-approval and checking processes, and set high standards for all of its operations.

The DG will be responsible for implementing the SWM program, provide policy development, systems and guidelines development. Included will be technical, budgetary and resource planning, oversight of management information systems, implementation monitoring, training and capacity building. The DG will provide oversight to its five Division Managers, as listed below.

- **Division Manger-Administration/Finance**—Key duties are management and oversight of the FSWMC’s personnel, budgeting, and security issues, and assisting the Director General (DG) in contractual issues, including potential participation of private sector. Other duties include development of human resource plan including in-service training programs. As a backbone of the operation, this Division Manager must establish close

working relationship, especially with the other Division Managers (listed below) to help optimize SWM system's performance.

- **Division Manager—Waste Collection** will be responsible for management of collection of household, market and commercial, industrial and hazardous wastes. This work will be accomplished through four Unit Managers, as indicated under Figure A-5. In addition, he/she will relate with the MoHS sewage collection and management to understand various nuisances. It is proposed that after the emergency cleanup, as mentioned earlier, the sewage function also be transferred to the FSWMC for better operational and management economies.
- **Division Manager—Waste Disposal/Landfills** will ensure environmental management through sound practices at the city's two landfills. He/She will also be responsible for planning, budgeting, and ensuring close coordination with other division managers.
- **Division Manager—Equipment and Workshop.** Key responsibilities include equipment management and mobilization and workshop management, identifying potential needs and close cooperation with all other managers.
- **Division Manager—Environmental Health, Safety and Public Relations.** Key responsibilities include: providing guidance and oversight for solid waste management in the areas of environmental health and safety to ensure legislative compliance. Health aspect work will be coordinated with the EHD/the MoHS. In addition, public relation activities, including public education and awareness will also be under this Division. This DM must also develop an environmental and social screening and assessment framework to assist executing entities in screening activities for likely social and environmental impacts, identifying documentation and preparation requirements, prioritizing activities, and—for activities triggering safeguard policies under the World Bank projects—preparation of necessary mitigation plans. Given the important role of women in solid wastes generation and management in Freetown, as everywhere else, the social screening must place appropriate focus on gender issues. The indicated approach will help undertake due diligence, avoid causing harm or exacerbating social tensions and ensure consistent treatment of social and environmental issues. In a likewise manner, the Division Manager must also be sensitive to changing environmental regulatory regimes and its compliance requirements.

5.0 Implementation Strategy

In Freetown, administration is one of the major weaknesses of solid waste management. Limited budgets, inability to raise revenues through user fees, municipal bonds, or other means, as well as poor organizational set up are also serious constraints to effectively implement and manage the SWM projects. Effective administrative and organizational systems on which the service ultimately depends are crucial to a sustainable SWM system. It is also important to make provisions for public feedback, and for input from related public organizations in planning, evaluation and upgrading of the system. Cost-recovery, defined earlier, contributes to sustainability, as is the role of private sector. Following the establishment of a sound institutional structure, it is possible to bring sustained improvements through labor-intensive, low-capital alternatives, and enabling administrative changes.

Rehabilitation of Freetown's solid waste management system will require implementation of emergency cleanup measures at the start, followed by implementation of short-term, two to four year SWM strategies. Subsequently, medium- to long-term, five to ten years' strategies should be developed. Along with the implementation of emergency cleanup measures, processes to establish the FSWMC should be initiated, with the aim that the FSWMC is operational at the end of the emergency cleanup.

Key emergency measures have been identified earlier. It is recommended that the MoYS, in view of the urgency of the situation, should take the lead in implementing these measures. However, for this, the ministry would require immediate infusion of additional temporary workers, especially low-level for street cleaning and garbage pickup; provision of shovels, rakes, containers and dust bins; funds to repair of damaged equipment; and some working capital for spare parts. Emergency cleanup will help temporarily remediate the existing situation. It needs to be followed up with sustainable measures to make Freetown, a clean city.

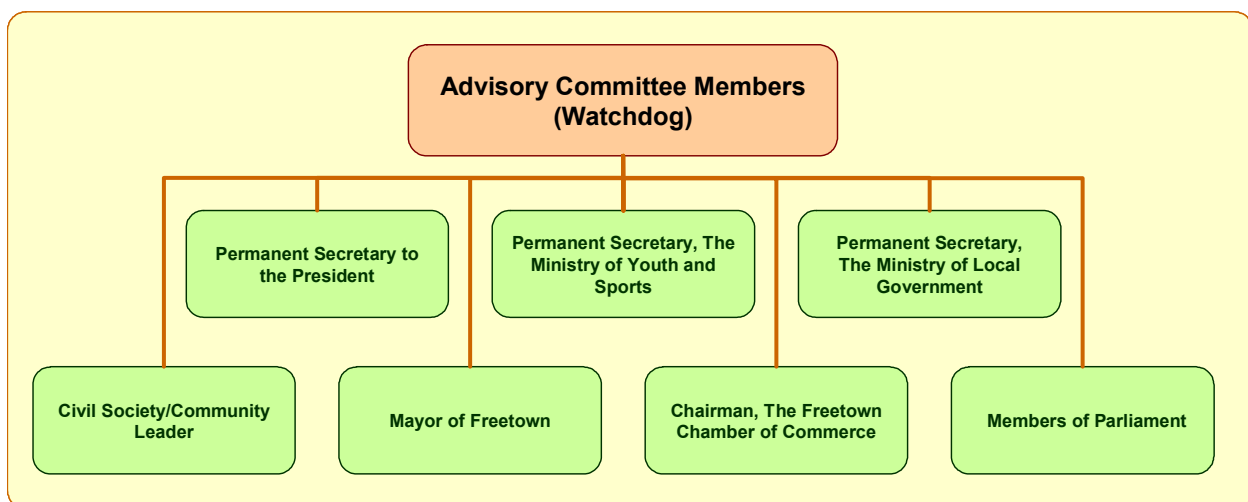


Figure 5-1. Proposed Advisory Committee Organizational Structure

For the short-term, up to four years, key specific measures have been identified. At the heart of the recommendations is the need to establish the FSWMC, and timely procurement of the needed equipment and other resources.

5.1 Financing Mechanisms

Solid waste management services account for high percentage of the municipal budgets. For instance, in Malaysia, an average of 50% of the municipal operating budget is spent on the management of municipal solid wastes, and of this, 70% is spent on collection. The following table provides a breakdown of the MSW management costs in developing countries. It can be used a general framework for proper finance planning.

Table 3-2 Breakdown of Solid Waste Management Costs--Typical Ranges*.

	Collection	Sweeping	
DisposalCapital			
Capital Costs	30 –40%	20 –30%	50 – 55%
Labor Costs	15-40%	50-70%	10-20%
Consumable & Maintenance.	30 – 45%	10-20%	30-35%

* Source: Cointreau-Levine, Sandra and Adrian Coad. 2000. "Guidance Pack. Private sector participation in municipal waste management." Swiss Center for Development Cooperation in Technology and Management, Vadianstrasse 42, CH-9000 St Gallen, Switzerland. Page 31

As can be seen from the above table, compared to collection, sweeping has a lower proportion of capital costs and a higher labor component, and that disposal requires proportionately more capital than collection or sweeping.

Financial issues primarily involve cost recovery and mobilization of resources. Options and mechanisms to implement these vary from country to country. As also indicated elsewhere in this report, cost recovery works on the principle of "user pays" and "polluter pays" principles. It has been effective in many developed and developing countries. For instance, cities in Indonesia have used cost recovery mechanisms for decades. Neighborhood leader manage pre-collection, with pushcarts going from door to door. Secondary collection from the neighborhood *transfer depots* is provided by the city administrations. Residents pay their neighborhood leader for both pre-collection and secondary collection, and the leader pays the city for removal of waste from the neighborhood transfer depot. Pre-collection of domestic solid waste, paid by residents in many developing countries is proving to be one means of developing financial sustainability, as well as obtaining public cooperation with waste collection systems.

For commercial and industrial waste collection, *direct user charges* are often used. For instance, the industry might be charged according to the number of containers taken away and emptied, or according to the weight of waste collected. Such charges can be collected with utility bills or separately. At present, Accra (Ghana); Ouagadougou (Burking Faso); Cotonou (Benin); and Bamako (Mali) are among the growing number of major cities in Africa to implement citywide cost recovery through direct user charges. The charges in Accra cover about 25% of total system costs and, in most of the city, are collected by special government bill collectors and deposited into segregated accounts dedicated to solid waste management. In Sedondi-Takoradi (Ghana) all businesses within the city pay an "environment tax" as part of the fee for their annual

business licenses. The receipts are used to help pay the costs of the city's sanitary landfill. Direct charges are not often used for collection of household wastes.

Experience in many locales have also shown that people are more willing to pay to private sector than the government for such services. This is because of the traditional bias of inefficiency and wasteful expenses on part of the government.

To recover costs, increasingly, the MSWM authorities in developing countries are levying fee for services provided. A levy is applied in several other forms: (a) direct fees based on waste volumes; (b) indirect fees derived from, for instance, property taxes; and (c) fees collected with payment of electric bills, or with water bills based on floor area and annual rental values of properties. Some of the approaches have been listed earlier. Cost recovery is also possible through the sale of recyclables and recovered resources. For example, in Accra (Ghana) a composting operation has been set up with German technical assistance. Solid waste and treated septage sludge is co-composted, and when properly marketed, is able to achieve full cost recovery.

Effective financial management also requires increasing access to sources of investment capital. For this, strengthening of cost accounting, budgeting and management information systems is also essential. However, it must be based on robust collection mechanisms. The poor can be protected through carefully designed cross-subsidies in user charges or taxes.

In the U.S., the President's Council on Environmental Quality (CEQ), 1997 indicates that over 3,400 communities in 37 states have instituted new variable pricing programs for household wastes. These programs take several forms. For example, *pre-paid* garbage bags or stickers to affix to bags can be required for collection or, collection fee can be based on the number and size of cans—a modification of this for Freetown can be charge on weight of broken bottles such as those from the Heinken Brewery--currently being disposed of the landfills at no cost. Such systems or their applicable modification are easy and inexpensive to implement. The can also provide a stable source of revenues for the collection service. Also, the U.S. experience has shown that education and recycling programs have been important contributing factors in the success of many variable pricing programs. It is recommended that selected communities where house-to-house garbage collection can be provided should consider implementing such programs, initially on a pilot basis. Successful implementation of variable pricing programs can dramatically reduced total quantities of wastes for collection. Perhaps increased recycling and reuse as well as changes in consumption and product purchasing habits have also helped reduce waste quantities for collection. Also, according to the CEQ, in the U.S., over 25% of all paper (41% including paper and paperboard) was recycled, as were 58% of all cans in 1997.

In some countries such as Indonesia, Korea, and others, a portion of services, such as collection, have been contracted out to private sector. Private sector participation can be in many forms including contracting out, franchises, and partnership arrangement. Often, private companies in these countries are also free to form joint ventures with foreign corporations to gain access to resources. In many developing countries, the most effective, efficient, and accountable system has evolved through a combination of government-run and privatized services.

For Freetown, user charges, as tipping fee, based on the volume of waste deposited for the area’s industries, hotels and institutions should be implemented upon establishment of the FSWMC. The practice is becoming increasingly common in many developing countries. For instance, Mexico’s SIMEPRODE—Monterrey Regional Processing and Disposal System, charges a tipping fee of \$34.50 at landfills. At present, the Freetown industry does not pay any fee for deposit of its wastes at the two landfills.

For households, on a gradual basis, user fee concept based on income levels or property taxes should be implemented. Unfortunately, using property tax as a base may be less effective--- currently, less than 30% of Freetown’s population is registered on the property tax assessment. Also, for the residential users, such fees should be gradually implemented, taking into account social considerations. From the field survey, it appears that economically better neighborhoods are willing and able to pay a monthly fee of Le 12,000 (approximately \$4.30). An earlier MoHS estimates show that such user charges, cesspit-servicing can annually generate over \$2M when fully implemented under sound collection and management practices.

5.2 Estimated Costs

Costs for emergency cleanup, and the first year are indicated in Tables 5-1.and 5-2 respectively. All costs have been projected in U.S. dollars.

Table 5-1. Cost Estimates, First Year, for the Freetown Solid Waste Management Company

Sr. No	Item/Type of Cost/ Number of Staff	First Yr. Costs (\$)	Remarks
A.	Equipment	350,000	
	Contingencies		See Table No. 5-2
B.	Labor: Management and Administrative Staff Salaries.		
1.	Director General		
2.	Division Managers		
3.	Unit Managers		
4.	Engineers/Technical Staff		
5.	Health/Inspectors		
6.	Senior Accountants		
7.	Senior Administrative Staff		
8.	Personnel Manager		
9.	Computer Technicians		
10.	Secretarial/Other Staff		
C.	Labor: Workshop/Field Staff	350,000	
1.	Workshop Manager		

Sr. No	Item/Type of Cost/ Number of Staff	First Yr. Costs (\$)	Remarks
2.	Drivers/Operators		
3.	Workshop Foreman		
4.	Welders		
5.	Sr. and Jr. Technicians .		
6.	Container Guards		
D.	Operation and Maintenance	50,000	
1.	Petrol and Diesel		
2.	Lubricants		
3.	Spare parts		
4.	Communication: Telephone etc.		
5.	Miscellaneous: Gloves/raincoats		
E.	Studies/Pilot Programs Etc.	200,000	Training/Recycling Pilot Projects.
1.	Consultants/Studies		
2.	Training Costs.		
3.	Public Education/Awareness.		Radio/TV announcements etc.
4.	Contingencies/total	See table 5-2	Includes official local travel costs etc.
	GRAND TOTAL	\$950,000	

For the first year, the Table 5-1 indicates the type of equipment that may be needed. The listed items are in addition to those mentioned for the emergency cleanup. The list has been developed in consultation with the MoYS, and the MoHS relevant staff. Combined with the existing equipment at the MoYS, the MoHS, and the equipment procured for the emergency cleanup, the quantities are considered adequate for the first few years of operation.

For the labor, no quantification of individual skills, by way of assigning the number of person(s) needed is shown in the above table. Based on further study, additional details can be provided for each year. It is recommended that the majority of field workers such as, sweepers, helpers, container guards, and others be hired under a carefully written and well-enforced competitive contract, such as with the NYMCOS. This can assure better work outputs. The O&M cost item shown in the Table 5-1, covers procurement of spare parts, petrol, diesel, lubricants and other items such as gloves, raincoats and nose masks.

The Studies/Pilot—short term, low cost collection, transfer and disposal programs and others will also require competitive hiring of specialized consultants, development of pilot programs such as for recycling, and to provide training to the FSWMC staff, NGOs and others, as needed. Some training activities have been identified elsewhere.

Likewise, pilot programs for recycling can be initiated or existing ones, most of which currently are at rudimentary level, be strengthened. Freetown wastes offer significant recycling opportunities, especially for cans, footwear, and biodegradables for composting. Pilot programs can be useful to identify potential recycling constraints, helping the FSWMC to develop appropriate policy and other measures. In addition, under this category, specialized consultants can be hired to meet specific needs such as developing management information systems (MIS) for accounting, to provide independent oversight for an operation, and others.

The emergency cleanup is estimated to take three months from the date of start (Figure A-4: *Timeline*). It is anticipated that the additional equipment and other resources, as indicated under Table 3-2 are available at the time of the start up of the operation. As indicated earlier, these resources should be combined with those available at the MoHS and the SLRA. The MoHS and the SLRA should fully cooperate and assist in the effort at no cost to the MoYS.

While incentives can be built into the contractual agreement between the MoYS and the NYMCOS, labor charges paid to the new recruits must be in line with existing rates. A pre-plan detailing priority areas for cleanup, provision of tools such as rakes, spades, gloves, masks etc., appropriate arrangements at the two landfills to receive wastes and regular oversight including timely trouble shooting of the problems is recommended. In addition notification to the general public should be timely done to seek its cooperation and arouse sensitivities to relatively cleaner environment.

5.2.1 Summary of Various Cost Components

The following table summarizes various cost components under the project. It is followed by a description of each element listed.

Table 5-2 Summary of Cost Components

Sr. No.	Period	Equipment	Labor	O & M	Studies/Pilot Programs Etc.	Total Costs (\$).
1.	Emergency	650,000	50,000	10,000	Not recommended.	710,000
2.	Year 1	350,000	350,000	50,000	200,000	950,000
3.	Year 2	200,000	300,000	40,000	100,000	490,000
4.	Year 3	100,000	250,000	40,000	100,000	490,000
5.	Year 4	100,000	200,000	33,000	50,000	383,000
Contingency (10%)	N/A	140,000	115,000	17,000	55,000	327,000
Total	N/A	1,540,000	1,265,000	190,000	605,000	3,600,000

The above table summarizes the breakdown of various cost components under the proposed World Bank funding. The various amounts have been distributed in accordance with the anticipated need for the component. In addition, contingency to meet unknowns has been kept at 10% level. Various projections have been made for the emergency cleanup period of three months, and for short-term, up to 4-year operation, as funded by the Bank. Equipment,

labor, O&M and studies, pilot program and training have been identified elsewhere for the emergency period as well as for the first year of the operation.

5.3 Private Sector Participation

Private sector participation in the SWM in Freetown, at this time is nonexistent. At this stage, it is also not recommended, given the lack of competition, the lack of institutional capabilities to manage the operation, and high risks for the private entrepreneurs. However, micro- or small enterprises such as for recycling can be set up. For this, the FSWMC can help by way of technical assistance, and facilitating access to micro-credits. Nevertheless, various strategies should be designed with input from key stakeholders including community groups.

Stronger financial-footings of the FSWMC, as envisioned will also help in promoting private sector participation and in its ability to raise investment capital. Private investments—domestic or international, can also boost skills, transfer technology and latest management practices, and create links to marketing networks. While such investments in infrastructure boomed in many developing countries, unfortunately, it has not happened in Sierra Leone for various reasons, including the long domestic insurgency. The government can help by providing loan guarantees, devising private sector risk-loan guarantees, devising private sector risk-reduction strategies and other policy measures.

To further strengthen this aspect, the FSWMC must keep detailed accounting of all management and operation costs, including billing and contract management.

While private sector involvement is not a panacea for all the ills facing the Freetown's SWM system, its effective introduction elsewhere has shown superior results in similar climatic and economic levels. For instance, under a World Bank funded project, Conakry's solid waste collection improved from a low of 30% before 1998 to a current high of 85%, lowered the SWM costs to US\$4/ton for collection, transfer and disposal, covered all areas, and also created over 3,000 jobs in the city.

5.4 Community Mobilization, Marketing and Promotions

The public enjoys a pivotal role in waste management. Without the public conscious and collective decision to support, proposed improvements in the existing system cannot be sustained. For instance, for recycling, mobilizing household cooperation for community based recycling programs will be necessary to overcome a number of obstacles, particularly the need to convince individuals that the program is essential and relevant to them. It will require a change in public's attitude and behavior towards environmental consciousness, and recycling as an acceptable method of waste treatment. The FSWMC will have to devise and implement strategies to overcome such key constraints as laziness, and the lack of convenience, such as drop-off centers, or inadequate local facilities. Moreover, such strategies would also need to be publicized and marketed. In a number of developing countries, traditional marketing techniques such as poster, leaflets and newspaper advertisement have been successfully used. As an innovative approach, it is recommended that within a few months after its establishment, the FSWMC should conduct a road show in (greater) Freetown to educate the public in recycling

and the SWM. A road show can also provide the FSWMC, greater visibility and closer interaction with the residents.

For the any waste management strategy to succeed in the field, community buy-in is crucial. Public's awareness and attitudes to waste can affect the population's willingness to cooperate and participate in adequate waste management practices. For instance, general environmental awareness and information on health risks due to deficient solid waste management are important factors, which need to be continuously communicated to all sectors of the population. Participation of the population can include: carrying waste to a shared container, paying for waste management services, or as indicated above, by segregating waste to assist recycling activities.

In developing countries, there are several successful examples of continuous education and awareness to promote sustainable SWM. For instance, the regular "Green and Clean" campaigns to promote environmental awareness by the Metro Manila Women Balikatan Movement and Green Forum in Manila. Another example is the Environmental Pioneer Brigade Program in Sri Lanka where children are made aware of environmental problems, are shown how to manage the problems, or how to be preventative so that the problems do not occur?

It is therefore important to keep the community informed, and seek its cooperation. Implementing education and awareness strategies can significantly help to keep SWM systems sustainable.

5.5 Training

Building human resources is often the most critical—and one of the most difficult—aspect of building a new program such as effective SWM. Recently, like other services, managing solid waste has become a technically sophisticated municipal activity that requires regular formal or informal training programs to ensure that the workforce is aware of and comprehends the new management techniques available, and their adaptability to the indigenous management environment. In Freetown, this situation gains difficult dimensions, given the lack of adequate technical and management staff. Training could provide a useful tool to help meet these needs. Such training could be in the form of workshops, seminars and in-country classroom training.

For sustainable SWM, human resource development is very important especially for three strategically important groups, namely (i) key personnel in the national coordinating unit of the central government; (ii) operational managers of the selected local organization, in this case the FSWMC; and (iii) university and other higher educational institutions. Among these target groups, the strengthening of human resources in the national coordinating unit and in addition to the FSWMC, one or two selected local governments (such as the MLG, and the city staff) are the first priority. It is recommended that it is done in the short term, while support to higher educational institutions is a long-term program.

Unfortunately, due to financial constraints and low priorities afforded to this important aspect, little, if any, training has been provided to skilled, semi-skilled or unskilled waste management workers of the developing countries, It is strongly felt that proper formal or

informal training for the workforce would enhance the work efficiency and improve the situation that now exists in the developing countries.

The training program must relate to the types of waste, goals to be reached, and the means by which they will be reached. Training program should also be based on analysis of the existing situation and current legislation.

Training, being an important element of the SWM, many developing countries have developed specialized SWM training institutes. The oldest among these are the National Environmental Engineering Research Institute and the All India Institute of Hygiene and Public Health. Both of these are in India. In addition, many private corporations, NGOs and community groups are also provided SWM training in developing countries. For example, within the Hanoi, each worker must complete a training course every year in order to be eligible for promotion / increases in salary. For street sweepers and collectors the course focuses on workplace efficiency and personal safety / health. There are also courses for the mechanics and truck drivers that covers the machinery they operate or repair. The teaching style is classroom based with the aid of some written materials.

It is recommended that the FSWMC provide training in SWM to its key professional staff. In addition, the training should also be provided to the FSWMC's Board of Directors and selected stakeholders including privates sector participants. Specific training areas will however vary. These can be prioritized based on specific needs. A few items are suggested. These include training in: the roles and responsibilities of the FSWMC and local governments, monitoring and enforcement, targeted public awareness campaigns, organizing primary and secondary solid waste collection services, piloting recycling projects, assessing privatization options and cost recovery issues. Such training can be provided in Freetown, and conducted by experienced specialists, either local or expatriates.

Training can bring improvements over time. However, overall SWM program's success will also rest on inducing necessary changes in the attitudes and behavior of the government officials, polluters and the general public.

5.6 Monitoring and Evaluation

Given the fact that a great number of actors are involved in the SWM, it is important to determine clearly who is doing what, and who should be responsible for what in the provision of SWM. Hence M&E is very important.

The FSWMC will be responsible for monitoring progress against agreed-upon performance indicators. Key elements of M & E may include maintenance of project information and management system to produce quarterly monitoring reports for the FSWMC's Board, the MLG, the Advisory Committee, as well as the donors, such as the World Bank. It is recommended that the FSWMC hires a specialized consultant to help meet the above needs, including helping prepare management and financial systems. Independent experts can also be contracted out for such activities as technical reviews—procurement reviews, environmental reviews etc., and assessment of stakeholder's satisfaction with the services provided by the FSWMC.

A sound independent monitoring and evaluation mechanism for the entire SWM operation is needed to assure objectivity and accuracy of the data. As indicated elsewhere in this report, this work can be contracted with a private consulting such as an MA.

5.7 Logical Framework

For the FSWMC to do an effective job, it should also set up key performance targets to measure its degree of success. Appropriate monitoring and careful evaluation should back these targets. They should cover all areas of its activities including administration, operational areas such as collection, transport and disposal, area coverage, especially the poor neighborhood and other criteria. As an incentive, for superior performance, bonuses can be given. Incentive is an important element for a superior work culture. Likewise, penalties should be implemented for poor performance. A Timeline *is proposed in Figure A-4: Timeline.*

5.8 Outstanding Issues

To establish SWM on sound footing, in addition to the interventions presented earlier, additional strategic interventions involving government, private sector and community initiative need to be undertaken by the FSWMC. Solid waste management is quite complex when viewed in its full scope, including all the links in the chain, such as transportation and disposal. Moreover, the cost of such service often exceeds by far the beneficiaries' capacity to pay and demands a judicious contribution from various sources of funding. Unlike urban areas in developed countries, Freetown, like many African cities has little or no tax base and suffers from tight financial constraints. In light of this, a number of issues need to be tackled to establish a sustainable SWM system. Also, likely outcomes will also depend on effective partnerships at all levels. These partnerships should involve local organizations such as area municipalities, citizenry, civil society groups, private firms and other actors including international donors. Experience in other countries has shown that the governments have also led effective partnerships. The FSWMC should look into these aspects for its relevance and long-term needs. While it is difficult to list every need, a few the key ones are as follows:

1. Government Directives, Mandates, and Acts of Parliament: These are needed for such items as: passing of an Act by the Sierra Leone's parliament to help approve the FSWCM, as a legal entity; an (expedited) return of loaned waste management equipment by the SLRA to the FSWMC; transfer of needed personnel (after screening by the FSWMC) from the Ministry of Health and Sanitation to the FSWMC; and elimination or minimization of import duties, taxes or custom fees for procurement of the SWM equipment. The last item is crucial to bringing state-of-the-art technologies such as an incinerator(s) for medical and toxic waste management, as well as IT equipment. Activities such as passing of an Act by the Parliament must proceed promptly to facilitate the timely incorporation of the FSWMC.

2. Policy and Legislative Support: Under this aspect, several areas will need priority attention. Included are: (i) government initiated measures to reduce private sector participation risks in SWM; (ii) waste management promotional instruments like pilot operations and demonstration projects, which must also include informal sector and community participation. Similarly, decentralization which can improve efficiencies, overcome shortcomings of the

existing system and bring broader political outlets to help create synergies and dynamisms need appropriate framework and policy support; (iii) technical standards and operational requirements for the design, siting and usage of containers as well as landfills and environmental, health and worker safety measures.

3. New Landfill Site: The existing two dumpsites pose serious health, environmental and socio-economic problems to area residents. The need to look for 1-2 landfills sites is pressing. Subsequently, the selected sites need to be developed as Sanitary Landfills in accordance with sound engineering and environmental principles. The current landfill capacity, in spite of incorporating the proposed improvements is very likely to be run out during the next 3-4 years. Identification, approval including through public hearing and developing a potential site is a costly and time-consuming operation. It is, therefore essential that the FSWMC initiate this process in the first year of its operation. The effort should involve the Environmental Division of the Ministry of Land and Development, the regional authorities, and the community.

4. Abandoned/Derelict Vehicles: No provision currently exists for removal and safe disposal of numerous these vehicles. These vehicles occupy valuable land and host to rodents and pests, in addition to being unsightly. Removal and environmental and economic disposal of these vehicles requires careful planning. At present, there are no steel reclamation facilities. Thus, among other measures, efforts should be made to arouse the interests of the local recycling community through technical and funding assistance.

5. Private Sector Participation: One of the key pillars of a long-term, sustainable system is provided by an active private sector which brings use of commercial principles in to the SWM system. At present, except for a few rudimentary initiatives, overall, given the high risks, there is no private sector participation in the SWM in Freetown. To minimize the risks, the government must provide effective policy and legislative support. In addition, legislative and policy support is also needed for environmental enforcement, cost recovery through user charges and others. In the long run, private sector participation in SWM has helped lower overall costs. The government should give high priority to this item and work closely with the FSWMC

6. Storm Drains and Regular Drains: Currently, many drains in the city are uncovered, encouraging illegal dumping of wastes. While the drains are under the SLRA, their cleaning will be the responsibility of the FSWMC, once it is established. Also, it is recommended that the SLRA take expedited action to all drains, including storm drains, starting with the congested areas. In addition insect spraying need to be done. As an outstanding issue, it will require inter-agency coordination for a well-planned synergistic approach (with the FSWMC) and appropriate budgeting.

7. Sewage Treatment Plant: A sewage treatment plant or system is essential for appropriate treatment of human excreta. Current system is based on the use of a polder and has run out of capacity. Consequently, existing system is unhealthy and poses serious environmental and health dangers especially to residents in the vicinity.

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APPENDIX A

Figure A-1. Ministry of Health and Sanitation Organizational Chart

Figure A-2. Organizational Chart Of Ministry Of Youth And Sports (MoYs)

Figure A-3. Key Characteristics Of Commonly Used Equipment

Figure A-4. Timeline

Table A-1. List of Current Waste Management Equipment at the MoYS

Table A-2. List of Current Waste Management Equipment at the MoHS

Table A-3. Workshop and Garaged Equipment Needing Significant Repairs or Replacement

Table A-4. Current Waste Management Staff at the MoYS

Table A-5. Current EHD Staff at the Ministry of Health and Sanitation

Table A-6. Workshop and Garaged Equipment Needing Repairs or Replacement

Table A-8. Contact List

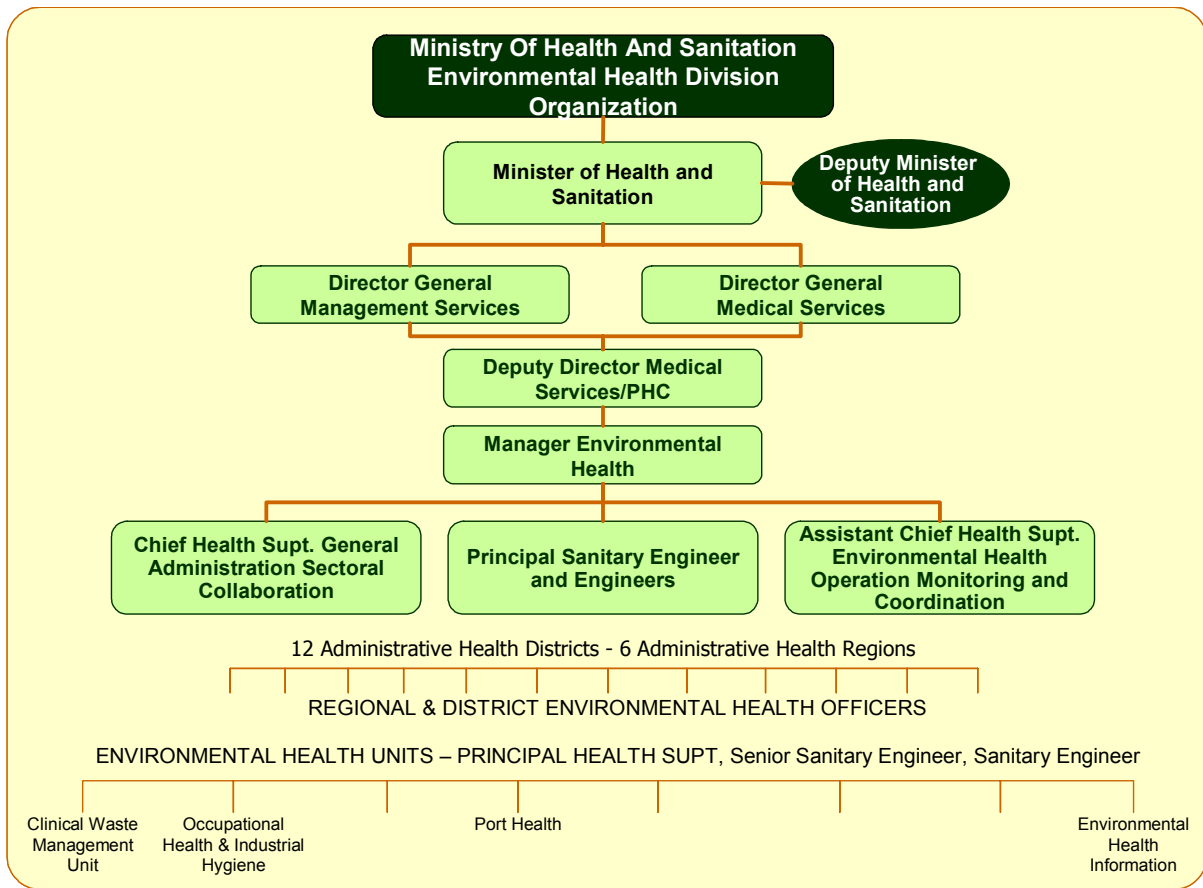


Figure A-1. Ministry of Health and Sanitation Organizational Chart

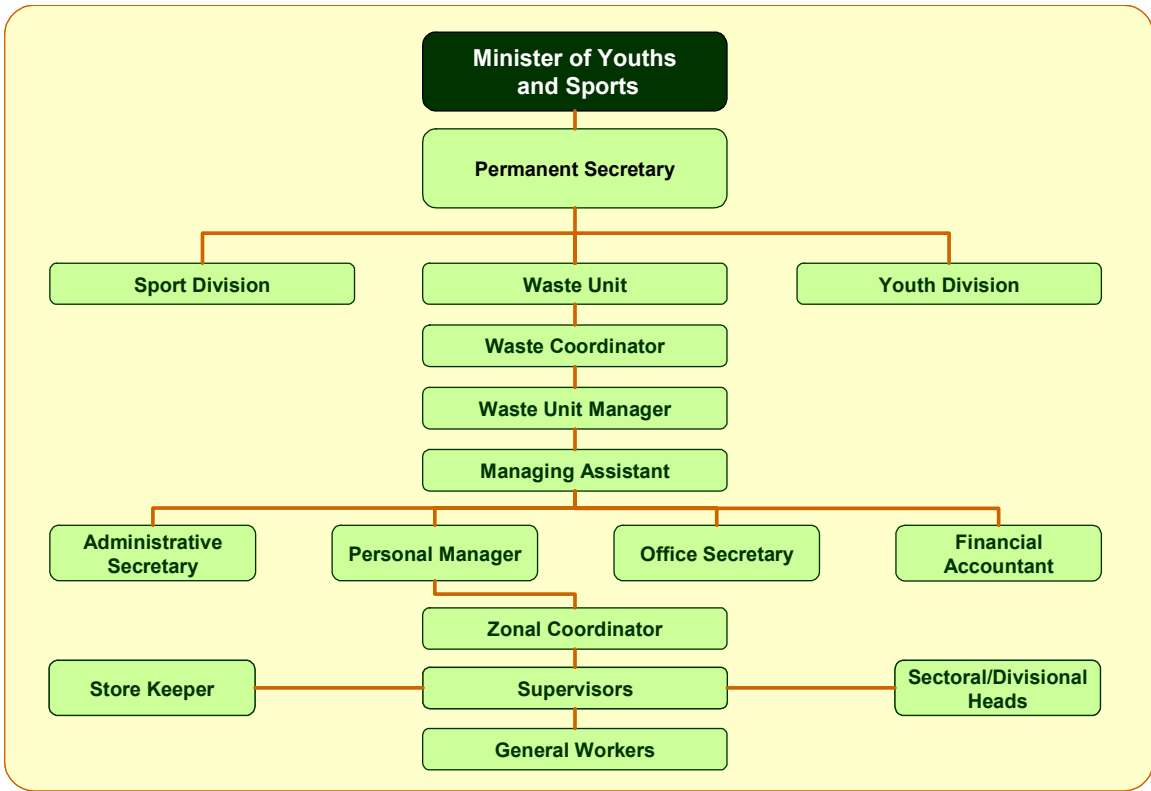


Figure A-2. Organizational Chart Of Ministry Of Youth And Sports (MoYs)

Wheelbarrows are commonly used. However, smaller wheelbarrows can be inefficient—their contents must be unloaded either by tipping or lifting by hand.

Handcarts and portable bins are useful and applicable for poor, congested neighborhoods and for short distances. A handcart can carry up to six portable bins or four small old oil drums. These can be lifted from the cart to discharge their contents directly into a larger vehicle or an area skip. Where handcarts are used for waste collection, it is often useful to engage a laborer at the skip transfer station to help lift full garbage bins and to keep the skip area clean. For poor neighborhoods and cramped conditions, use of portable bins is recommended for Freetown.

Animal-drawn Vehicles can also be useful. Their use is common in India. However, they have slow speeds and can be difficult to use in congested areas.

Tractors. Use of tractors for waste collection and transport is common. A tractor generally costs half as much as a Lorry. Also, in the long-term, tractor-trailer systems are most satisfactory and cheapest. A farm tractor with trailer (size 7m³) has a typical productivity of 8 tons/day and spare parts are usually 7-8% of capital costs – higher for certain specialized types of tractors. Use of ordinary tipper Lorries is also common. Advantages of both include: ready availability, ease of use, local maintenance and repair infrastructure (O&M can be carried out with other vehicles such as those of Public Works Department [PWD]), and each is suitable for other needs. Tractor-drawn, side-loading refuse trailers were used in Sierra Leone in 80s.

Trailers for refuse should have a low loading height—1.6 m is a recommended maximum. The capacity can be 8 cu. M. or more. Where spare land is available for transfer stations, one tractor can operate with three or four trailers. Trailers can be used for household refuse dumping, as well as for the transfer of refuse collected by handcarts. They can use the rear axles of worn-out Lorries and cars. A 3-4 m³ tipping trailer is commonly used.

Side- and Rear-end Loading Refuse Vehicles can only be used in city centers and upper income suburbs where good access and Western style housing standards allow their efficient use. Even where rear-end-loading vehicles are available and can be deployed, it is much more common to institute communal bulk bin systems. Containers sized for 1-2 m³, positioned at intervals along the roadside, have proven effective in many locales such as Lagos and Colombo, Sri Lanka. Outside the above areas, several variants of the communal bulk collection can be employed. Also, rear and side-loaders are commonly used collection vehicles for residential areas. These can be loaded automatically or by hand.

Skip Trucks or Refuse Vehicles (RV) Skip trucks are currently used in Freetown to carry garbage loaded skips to the landfills. An alternate to skip truck is a refuse vehicles (RVs) that can be used as static compactor. It can take up several set positions each day and being served by satellite teams of laborers who collect waste from inaccessible areas. Given the serious shortage of skip trucks, such a use is not feasible for Freetown. If incorporated into the system, they must be small because many Freetown streets are narrow and congested.

Rolonoff Vehicles. These vehicles are large, bulk containers, 27 m³, and are supervised by an attendant. Lagos (oil-rich Nigeria) uses these. Their use in Freetown may not be appropriate because roads are narrow and spare parts may be difficult to obtain. Also, maintenance of uncommon equipment always presents difficulties.

Figure A-3. Key Characteristics Of Commonly Used Equipment

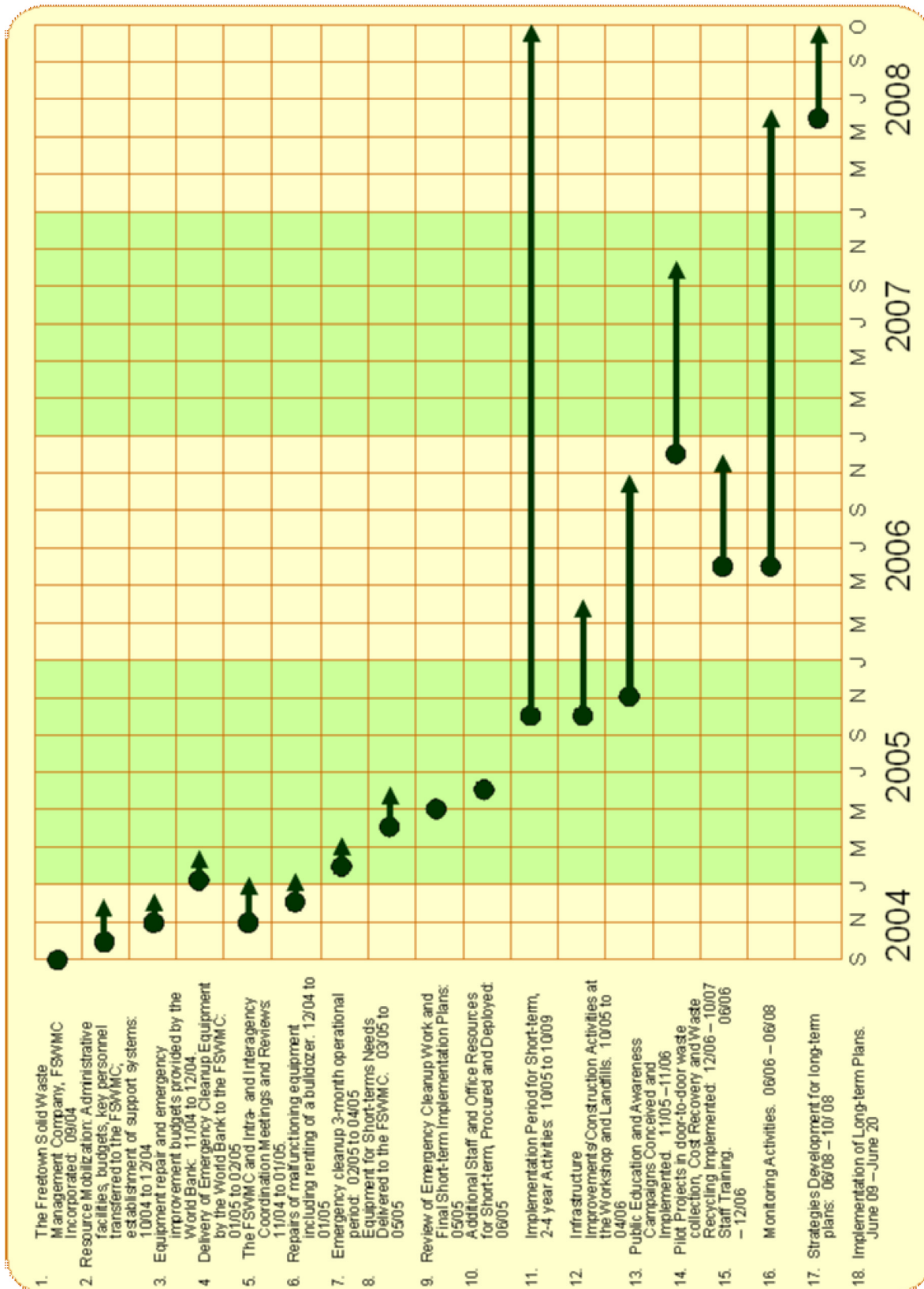


Figure A-4. Timeline

Table A-1. List of Current Equipment at the MoYS

Item	Quantity	Operational	Out of Operation
Tipper trucks	7	2	5
Skip truck	5	3	2
Front end loader	3	NIL	3
Generator 3KVA	1	1	NIL
Generator 15KVA	2	NIL	2
Utility vehicle	1	1	
Tire pumping machine	4	1	3
Gurloping metal plate cutter	1	NIL	1
Lathe machine	1	NIL	1
Pressure	2	1	1
Grinding drum	1	NIL	1
Power drill	3	1	2
Grinding stone	1	NIL	1
Steel cleaner	2	NIL	2
Grinding machine	2	NIL	2
Compressor (spraying)	3	NIL	3
Bulldozer	1	1	1
Low Bed prime mover	1	NIL	1

Table A-2. List of Current Waste Management Equipment

Serial No.	Item	Quantity	Specification
1	Skip Truck Mercedes Benz	12	9000kg Lifting Max 12 CM Capacity Engine- 6 Cylinders
2	Tipper Mercedes Benz		6-8 m ³ Tipper space Engine- 6 Cylinders Trans- Double axel GVW- 12-16 tons
3	Front End Loader Caterpillar	2	Engine- 4 or 6 Cylinders
4	Tractors/Caterpillars	12	D6
5	Monitoring vehicles	2	4WD
6	Breakdown vehicle	1	4WD
7	Motorbikes	5	-
8	Water bowzer		-
9	35 KVA generator	1	-
10	Air welding plant	1	-
11	Stream cleaner	1	-
12	Air compressor for inflating tires	1	-
13	Assorted mechanical tools	2 sets	6mm – 46mm
14	Tire removal equipment light and heavy duty	1 set	-
15	Electric cutter	1	-
16	Hand grounding marline heavy duty	1	-
17	Hand drilling machine heavy duty	1	-
18	Electric battery charger	1	6 – 24 volts
19	Container Dust Bins	3	Bedford or BMC Engine Type 6 Cylinders

Table A-3. Workshop and Garaged Equipment Needing Significant Repairs or Replacement

Item No.	Description	Quantity
1	Lathe Martine	1
2	Gellotine Plate Cutter	1
3	Standing Electrifier Drillers	2
4	35 KVA generator	1
5	Air compressor	1
6	Air welding plant	1
7	Can hoist	1
8	Electrifier tire removers	2
9	Stream cleaner	1
10	Electrifier cutter	1
11	Beam setter	1
12	Bailing machine	1
13	Weight bridge at Kingtom Landfill	1
14	Water bowzer Bedford	1

Table A-4. Current Waste Management Staff at the MoYS

Title	Quantity
Labor and General Workers	
Manager and Unit Manager	2
Sweeper	100
Container guards	50
Office cleaner	5
Landfill workers	30
Mobile team	50
Drivers	
Operator	5
Skip trucks/tipper drivers	12
Drivers	11
Mechanical	
Engineers/fitters	22
Auto Electricians	3
Mains Electrician	1
Fuel Distributors	2
Welders	6
Tyre repairers	3
Security	
Office/compound	20
Landfill security	10
Administration	
Ministry Coordinator	1
Unit Manager	2
Assistant Unit Manager	1
Administrative Secretary	1
Personnel Manager	1
Financial Accountant	1
Day and Night shift coordinators	2
Supervisors	25
Office Typist/Secretary	2
Store Keeper	2

Table A-5. Current EHD Staff at the Ministry of Health and Sanitation

No	Name	Designation	Functional Areas
1	Mr. M.S. Ibrahim	Chief Health Superintendent	Cline Town
2	Mr. T.J. Charles	Health Superintendent	EHD Worksyard
3	Mr. E.H. Georgestone	Senior Sanitary Engineer	EHD Worksyard
4	Mr. John Tommy	Sanitary Engineer	Medical Waste Cline Town
5	Mr. Yusif Dumbuya	Mechanical Engineer	EHD Worksyard
6	Mr. T.J. Koroma	Sanitary Engineer	Landfill & Cesspit Emptier Operations
7	Mr. E.B. Deen	Health Superintendent	EHD Worksyard
8	Mr. A.B.H. Kargbo	Health Superintendent	Medical Waste Cline Town
9	Mr. W.F. Martyn	Health Inspector	Medical Waste Cline Town
10	Mr. Tunde Taylor	Head Mechanic	EHD Worksyard
11	Mr. T.A. Belmoh	Account Clerk	EHD Worksyard
12	Mr. D.M. Sandi	Account Clerk	EHD Worksyard
13	Mr. Tamba Fayia	P.H. Aide	EHD Worksyard
14	Unisa S. Sesay	P.H. Aide	EHD Worksyard
15	Tamba Lebbie	P.H. Aide	EHD Worksyard
16	Mariama Jabbie	Clerk/Typist	EHD Worksyard
17	Nancy Edwin	Clerk/Typist	EHD Worksyard
18	Kadiatu Kamara	Receptionist	EHD Worksyard
19	Lahai Kowa	Mechanic	EHD Worksyard
20	Mr. Cole Store	Keeper	EHD Worksyard

Table A-6. Key Workshop and Garaged Equipment Needing Repairs or Replacement

Sr #	Item	Total #	Oper-ational	Out of Order	Requirements/Remarks
1	Bulldozer	1	None	None	Loaned in 2002 to SLRA: Not available to MoYS.
2	Skip Trucks	5	2	5	Operational trucks need new tires and extensive tune up; In-operational need spare parts.
Skips					Most are badly damaged
3	Front-end Loaders	3	None	3	Need major repairs
	Low-bed Prime Mover	1	None	1	
4	Generator 3KVA	1	1		Needs a tune up and replacement in the near future
5	Generator, 15 KVA	2	None	2	Urgently needed; blackouts necessitate work discontinuity.
6.	Utility Vehicle	1	1	None	Needs tune up.
7	Tire Pumping Machine	4	1	3	
8	Gurlop Metal Plate Cutter	1	None	1	
9	Lathe Machine	1	None	1	
10	Pressure Machine.	2	1	1	
11	Grinding Drum	1	None	1	
12	Power Drill	3	1	2	
13	Steel Cleaner	2	None	2	Can be Fixed
14	Grinding Stone	2	None	2	Can be Fixed
15	Steel Cleaner	2	None	2	
16	Grinding Machine	2	None	2	One can be Fixed
17	Compressor (Spraying)	3	None	3	
18	Lathe Martine	1	1	-	
19	Gellotine plate cutter	1	1	-	
20	Standing electrifier drillers	2	1	1	Can be Repaired
21	35 KVA generator	1			Needs Parts, Expensive to Repair
22	Air compressor	1	1		
23	Air welding plant	1	1		
24	Can hoist	1	0	1	to be repaired
25	Electrifier tire removers	1		2	out of order, can be repaired
26	Stream cleaner	1			

Sr #	Item	Total #	Oper-ational	Out of Order	Requirements/Remarks
27	Electrifier cutter	1	1	-	
28	Beam setter	1	1	-	
29	Bailing machine	1	1	-	
30	Weight bridge at Kingtom Landfill site	1	-	-	Out of order. Urgently Needed for charges from users fees
31	Water "Bowze" Bedford grounded	1	-	-	Grounded: expensive to fix.

Table A-8. Contact List

Serial #	Name	Title	Telephone/Email
A. SIERRA LEONE WATER COMPANY, P.M.B 42, TOWER HILL FREETOWN			
1.	Justin A. Musa	Director General/Engineer-in-chief	076-610-308 slwc@sierratel.sl
2.	Francis Moijue	Deputy Director General	076-610-558 fmoijue@hotmail.com
3.	Mary James	Development Planner/Deputy Director Admin.	076-660-250 jamesmaryus@yahoo.com
4.	Joseph Mahayei	Water Analyst	030-206-479 jdmahayei@hotmail.com
B. MINISTRY OF TRANSPORT AND COMMUNICATIONS, FREETOWN.			
5.	Hon' Dr. Prince Harding	Minister	Not available
6.	Dr. Shamsu Mustapha	Technical Coordinator – Transport Sector Project (TSP) Coordination and Monitoring Unit (CMU)/IDP, World Bank	030-234-692
7.	Franklin Bassir	Environmental Specialist and Coordinator and Monitoring Unit (CMU)/IDP, World Bank Transport Sector Project (TSP)	076-623-083 franklinbassir@yahoo.com
8.	Musa Randy Kabbia	Data Analyst Transport Sector Project (TSP) Coordinator and Monitoring Unit (CMU)/IDP, World Bank	(Office) 221 237 (Mobile) 030-216-658 kabayz@yahoo.com kabacmu@hotmail.com
9.	Albert Lappia	Project Officer, Sierra Leone Roads Authority	(Office): 220 579, 22 6565 (Cell): 076-688-323
10.	El-Hadj I. M. Kabbay	Director-General Sierra Leone Roads Authority	(Office): 222322 / 220587 (Cell): 076-602-183 slra_dg@sierratel.sl
11.	Farrma Tass Thorlu-Bangura	Financial Analyst Transport Sector Project (TSP) Coordination and Monitoring Unit (CMU)/IDP, World Bank	(Office): 223283 (Home): 272928 (Cell): 076-657-689 tasscmu@hotmail.com
C. MINISTRY OF YOUTH AND SPORTS, BISHOP HOUSE, NATIONAL STADIUM, BROOKFIELDS, FREETOWN			
12.	Hon. Dr. Dennis Bright	Minister OF Youth and Sports Ministry	241 640/241391 (Residence) 239 203 Cell: 076 609 444 ayobright1@yahoo.com
13.	Haroun Sankoh	Coordinator – Solid Waste	076-614-647
14.	Sultan Bangura	Welfare Officer, NYMCOS	076-631-737
15.	Abdul A. Ismail	Unit Manager	076-655-347 babyassan@yahoo.com
16.	Tunde Taylor	Chief Mechanical Engineer	076-697-890
17.	Gibrilla K. Bangura	Assistant Manager, Waste Mgmt. Unit	076-687-726
D. MINISTRY OF HEALTH AND SANITATION, CLINE TOWN, FREETOWN			
18.	Dr. Clifford W. Kamara	Director of Planning and Information Youyi Building, Freetown.	076-601-494 cwkamara@sierratel.sl cwkamara@hotmail.com
19.	John Tommy	National Medical Waste Manager	076-612-176 gladtom58@yahoo.com
20.	J.G.K. Lebbie	Port Health Officer	030-219-578
21.	Thomas Amara	Assistant Port Health Officer	076-635-065
22.	M.S. Ibrahim	Environmental Health Manager	076-629-349
23.	Tamba J. Charles	Health Superintendent In-charge of Liquid Waste Management	076-662-547
24.	M.K. Kpevai	Senior Health Superintendent, Western area, and	076 – 635 - 065

Serial #	Name	Title	Telephone/Email
		Unit Head Environment Inspection Unit	
E. MINISTRY OF LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT, YOUYI BUILDING, FREETOWN			
25.	Hon. Sidikie Brima	Minister	(Office): 225922 (Cell): 076-600-760
F. MINISTRY OF LANDS, COUNTRY PLANNING AND THE ENVIRONMENT, YOUYI BUILDING, FREETOWN			
26.	John Solomon Kamara	Principal Environment Officer Environment Protection Department	(Office): 240355 / 240367 (Cell): 076-668-697 jskamara@yahoo.com
G. CITY COUNCIL OF FREETOWN, 17 WALLACE JOHNSON STREET, FREETOWN			
27.	Henry Nathaniel Fergusson	Chairman, Committee of Management (Mayor)	(Office): 223636
28.	Akindele P. Williams	City Engineer	(Office): 225046/227885 (Cell): 076-640-905
H. MINISTRY OF FINANCE MINISTERIAL BUILDING, GEORGE STREET, FREETOWN			
29.	Sheku Tamu	Deputy Financial Secretary	(Office) 222211 Fax: 228472/225 826 Cell: 076 64 6057 (Res.) 233037
I. CABINET SECRETARIAT, LEONE HOUSE, 21/23 SIAKA STEVEN STREET, FREETOWN			
30.	Joseph P. K. Lamin	Secretary to the Cabinet Head of the Civil Service	(Office): 227891/222994 (Cell): 076-604-535
J. THE WORLD BANK, SIERRA LEONE COUNTRY OFFICE, AFRICANUS HOUSE, 13A HOWE STREET - FREETOWN			
31.	James Sackey	Country Manager	(Office): 227555/227488/228377/229138 (Cell): 076-607-854 jsackey@worldbank.org
K. INSTITUTE OF MARINE BIOLOGY AND OCEANOGRAPHY (IMBO), FOURAH BAY COLLEGE, UNIVERSITY OF SIERRA LEONE, MOUNT AUREOL, FREETOWN			
32.	Dr. Ernest T. Ndomahina, Ph.D.	Director/Marine Environmental Consultant	Office: 228580 Cell: 076-613-980 ernest_ndomahina@yahoo.co.uk
L. PRIVATE SECTOR			
1. SAWAB CONSTRUCTION COMPANY – 8 EAST STREET, FREETOWN			
33.	Hon. Kabba Kamara, MP	Manager/Director and Member of Parliament (MP)	076-633-889
2. POLYSYNTHETIC INDUSTRIES – 2 BETTS STREET, CLINE TOWN, FREETOWN			
34.	Ibrahim Jaffer	Owner/Recycling Industry for Plastic	Not Available
3. SIERRA LEONE BREWERY LIMITED, P.O. BOX 721			
35.	Ivan Carol	Managing Director	(Office): 263385/6/7/8 (Cell): 076-603-182 slbl@sierratel.sl carrol@hotmail.com carrol@heineken.com
36.	Victor H. O. Sawyer	Brewery Manager	(Office): 263385/6/7/8 slbl@sierratel.sl vicsandsaw@yahoo.com victorsawyer@heineken.com
4. ALTERNATIVE USE INTERNATIONAL LIMITED, 843 FINCHLY ROAD, LONDON			

Serial #	Name	Title	Telephone/Email
NW118NA, UK			
37.	Nicholas P Adams	Representative, Garbage Incinerator (for electricity production)	UK Mobile 07947 855137 SL Mobile 00232 76675141

TERMS OF REFERENCE FOR THE STUDY

Annex A: Terms of Reference and Scope of Services

SIERRA LEONE INFRASTRUCTURE DEVELOPMENT PROJECT

TERMS OF REFERENCE COMPONENT IDENTIFICATION URBAN WASTE MANAGEMENT

1.0 BACKGROUND

The Government of Sierra Leone through its Ministry of Transport and Communications (MOTC) Coordination and Monitoring Unit, wish to carry out a study on improving access to urban waste management services, as a subcomponent of the Infrastructure Development Project (IDP), currently under design. The study will be carried out with financial assistance through a PHRD Grant from the Japanese Government.

The Sierra Leone cities are unable to cope with the deteriorating urban infrastructure, unacceptable level of service delivered by their departments and their weak financial disposition. The IDA-financed FIR project (P002433) provided specific equipment for enhancing collection and disposal of waste in Freetown. However, during the disturbances and the subsequent civil war, nearly all the equipment procured for solid waste management was either diverted to other uses or vandalized. Refuse collection in Freetown, particularly in the low-income communities targeted by FIR project, are currently in a poorer condition than at the beginning of the project. Before the civil war, Freetown had in place a solid waste collection system, established through a bilateral agreement with the German Government. The German team left at the end of the assignment in 1995, and the contract for the local private sectors refuse collectors lapsed after the coup. Refuse collection situation in Sierra Leone remains a serious issue that needs to be addressed.

As an emergency measure, the IDA financed Transport Sector Project (TSP) financed a solid waste collection program for Freetown, Bo and Kenema designed mainly to generate employment, through local contracts. Makeni, the capital city of the Northern Province (Kabala), was not included at that time due to the problem of inaccessibility. The program was implemented by the Sierra Leon Roads Authority (SLRA). Although relatively successful, these service contracts ended in March 2002, and the Ministry of Health and Sanitation continues to be responsible for the management and sustenance of refuse collection and disposal in the country.

This assignment will be carried out under the overall supervision of the Coordinating and Monitoring Unit (CMU) of the Ministry of Transport and Communications (MOTC).

2.0 OBJECTIVE

The objective of this assignment is to recommend an urban waste management component for the city of Freetown, which shall investigate components addressing urban waste management and industrial and toxic waste management – where management is understood to include collection, treatment, disposal and overall management of waste management activities.

3.0 SCOPE OF SERVICES

The consultant shall work closely with the Freetown City Council, the Ministry of Health and Sanitation, Municipalities, donors and other stakeholders in the sector to carry out the following tasks:

1. Analysis of the Situation

Solid Waste Management

The consultant shall review the recent and existing solid waste collection and disposal practices and programs as well as past and planned projects to improve solid waste management in the city of Freetown. Current regulations shall also be reviewed, in addition to community participation in waste management activities including current levels of payments for services.

The efficiency (equipment base, staff collection rates. Etc.) of the private company currently responsible for garbage collection shall be assessed in connection with the estimated domestic waste generation and types of waste produced in the different neighbourhoods of the city.

Industrial and Toxic Waste Management

The consultant shall identify the major producers of industrial and toxic wastes (both solid and liquid), including health facilities, as well as the types and volumes of waste produced and the current treatment and disposal practices. A review will be made of existing discharge requirements/regulations for wastes and for disposal of other wastes.

2. Technical Options

Solid Waste Management

Options for collection, treatment and disposal of the waste will be reviewed. The consultant shall also review the conditions of existing designated disposal sites and assess the need for improvements in management or for new management arrangements in the next 10 to 15 years. The positive and negative environmental impact should be taken into consideration.

Proposals will be made on options for door to door collection, primary collection, use of containers etc. for each neighbourhood based on the volumes of waste generated, the willingness to pay for collection of garbage (information from the sanitation survey), access etc. Recommendations will be made on the types (and numbers) of equipment required for collection of waste from the different sites.

Industrial and Toxic Waste Management

The consultant shall, as appropriate, propose pretreatment/treatment of industrial effluents or solid wastes in order for them to comply with the regulations and good practice. The possibility

of treating certain types of waste with domestic wastewater/sludge will also be considered. Where regulations do not exist, the consultant shall propose detailed TORs for these to be prepared for the major waste streams.

3. Proposals for Improvements in Institutional and Financing Arrangements

Solid Waste Management

Proposal shall be made on the possible financing mechanisms for the different types of collection services and for management of the disposal site(s).

The need for additional private sector (and NGO) involvement for collection, treatment and disposal of waste shall be considered, as well as the needs for community mobilization, marketing and promotion activities.

Industrial and Toxic Waste Management

The consultant shall make recommendations on the personnel, budgetary and equipment requirements in order to better control industrial waste discharges and their impact on the environment. The consultant will also propose mechanisms by which industries may pay for any services they receive for treatment and disposal of their wastes.

4. Implementation Strategy

Solid Waste Management and Industrial and Toxic Waste Management

Describe project components and propose an implementation strategy and investment plan that will result in improved services for the city. The solutions shall be applicable to the conditions of the moment, while the implementation time frame shall be for a 4 years and 10 years plan, taking account of constraints to implementation and the need to identify quick-win initial initiatives. The strategy shall also include provision for ongoing planning and development of services during the plan period.

The description of the project components shall include, but not necessarily limited to: (i) estimated cost and timing; (ii) institutional arrangements for subcomponent implementation and monitoring, including coordination with other projects; (iii) draft subcomponent logical framework, including performance targets and indicators; (iv) outstanding issues and potential covenants and conditionalities to include in the project proposal document.

4.0 REPORT AND OTHER DELIVERABLES

The Consultant shall prepare and submit the following reports (all in English) to the Client and IDA.

Draft Component Design Report: 2 copies of Draft Final Report, inclusive of all outputs from Tasks 1 & 2, to be submitted to the CMU and 2 copies of the same to IDA, 5 weeks after signature of the contract. The consultant shall present this report with a verbal briefing.

Final Component Design Report: 2 copies of Final Report in hard copy and in diskettes to be submitted to CMU and 2 copies to IDA not later than 1 week after receiving comments from the CMU and IDA.

All the Reports shall include an executive summary.

To facilitate IDA and CMU review, all the Reports shall be transmitted electronically, as well as in hard copy.

All documents shall be prepared in accordance to the World Bank Guidelines. Two (2) copies of each of the reports shall be submitted by the Consultant directly to the International Development Association (IDA) for the attention of:

**The Task Team Leader,
FTTR, Africa Region,
1818 H Street, N.W.
Washington D.C. 204333
Fax (202) 473-4048**

5.0 EXTENT OF THE SERVICES

Total key staff inputs required is estimated at one and half (1.5) man-months. The Draft Final Report shall be presented and discussed in-country with CMU.

The duration of the assignment is estimated at 2 months, including mobilization period following signature of contract. The Consultant shall have at a minimum the following qualifications.

Urban Waste Management Specialist: Graduate qualifications in sanitation engineering or related field from a recognized institution. Proven experience of not less than 15 years in urban waste and industrial and toxic waste management planning and implementation. Proven knowledge and familiarity with environmental, social and cost recovery issues associated with urban waste management. Experience in the region and Sierra Leone preferred.

The consultant shall be fluent (written, spoken and reading) in the contract language, English. The consultant shall also be fully computer literate.

6.0 FORM OF CONTRACT FOR THE SERVICES

The services are to be provided under a standard IDA contract for small assignment by lump sum payments. Twenty (20) percent payment will be due upon signing of contract, Fifty (50) percent at delivery of the Draft Component Report and the balance will be due upon submittal of the Final Component Design Report, duly finalized to accommodate IDA and SALWACO/CMU comments.

7.0 DATA, LOCAL SERVICES AND FACILITIES TO BE PROVIDED BY THE GOVERNMENT

Government will arrange for cooperation with Government ministries, departments and other agencies required for carrying out the work, liaison as necessary for this purpose, and will give the Consultant full access to all information required for the completion of the studies.