社会開発調査部報告書

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DAR ES SALAAM CITY COMMISSION
THE UNITED REPUBLIC OF TANZANIA

THE STUDY ON THE SOLID WASTE MANAGEMENT FOR DAR ES SALAAM CITY

FINAL REPORT
VOLUME I

EXECUTIVE SUMMARY

SEPTEMBER 1997

KOKUSAI KOGYO CO., LTD.

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PREFACE

In response to the request from the Government of the United Republic of Tanzania, the Government of Japan decided to conduct the Study on the Solid Waste Management for Dar es Salaam City in the United Republic of Tanzania and entrusted the study to the Japan International Cooperation Agency (JICA).

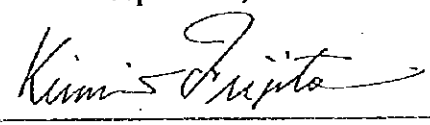
JICA sent to Tanzania a study tea headed by Mr. Susumu Shimura, KOKUSAI KOGYO CO., LTD., three times between February 1996 to August 1997.

The team held discussions with the officials concerned of the Government of Tanzania, and conducted filed surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the United Republic of Tanzania for their close cooperation extended to the team.

September, 1997



Kimio Fujita
President
Japan Internatinal Cooperation Agency

September 1997

Mr. Kimio Fujita
President
Japan International Cooperation Agency

Dear Mr. Fujita

Letter of Transmittal

We are pleased to submit to you the report on the study of Solid Waste Management for Dar es Salaam City in the United Republic of Tanzania.

This report contains the urban environment sanitation study, the solid waste management master plan until the year 2005 and the feasibility study on the first priority projects which cover 39 wards in Dar es Salaam.

The urban environment sanitation study identified the importance of solid waste management in various public services after assessing the present sanitary condition of Dar es Salaam.

The master plan comprises the forecast of future waste generation, planning framework with phased goals / targets / strategies, technical system and institutional system. Since the improvement of the institutional system is required to materialize the master plan and to establish a sustainable solid waste management system, eight items proposed on improvement of the institutional system, including establishing the independent solid waste management authority, were recommended.

The feasibility study was conducted on the first priority project consisting of improvement of refuse collection and transportation system, construction of the new Kunduchi disposal site, improvement of the maintenance workshop, etc. The project was evaluated from financial, economical, technical, social and environmental views. It found it would be feasible in all aspects.

Four pilot projects were conducted during the study. One of them, the enhancement of public awareness which was so called "Beautify Your City" campaign provoked response from many citizens.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs, the Ministry of Health and Welfare and the Environmental Agency. And in the United Republic of Tanzania, we also wish to express our deep gratitude to the Prime Minister's Office, Dar es Salaam City Commission, the Embassy of Japan and the JICA office in the United Republic of Tanzania.

Finally, we hope that this report will help to enhance the solid waste management and the urban environment sanitation in Dar es Salaam

Respectfully,

Susumu Shimura
Team Leader
The Study of the Solid Waste Management
for Dar es Salaam City in the United
Republic of Tanzania

Summary

1. Municipal Solid Waste Management Master Plan

1.1 Planning Frameworks

a. Goals

The principal goal of the Solid Waste Management Master Plan is ***to establish a proper management system for solid waste by the target year 2005 in Dar es Salaam City,*** this being the centre of the country's economic and industrial activities and where approximately 8% of the national population lives.

Through the establishment of a proper solid waste management system, ***the Plan aims at:***

- ***preservation of the environment and public health, and sustainable development of the city; and***
- ***promotion and growth of the Tanzanian economy through gaining foreign investment.***

b. Targets

In order to achieve the principle goal of the master plan, the targets for major technical system components for each phase are set up and tabulated in the table below.

Table: Targets for Establishment of Major Technical System Components

Components \ Phase	Present (1996)	Phase I (1997 - 1999)	Phase II (2000 - 2002)	Phase III (2003 - 2005)
1. Refuse Collection Rate				
Urban Area (UA)	90 %	100%	100%	100%
Semi-Urban Planned Area (SUPA)	17 %	30%	50%	70%
Semi-Urban Unplanned Area (SUUA)	0 %	4%	30%	50%
Rural Area (RA)	0 %	0%	0%	10%
2. Length Covered by Street Sweeping Service	34 km	50 km	100 km	100 km
3. Intermediate Treatment and Recycling	No treatment facilities other than pilot on-site compost and an incinerator for medical waste	Promotion of organised recycling	Promotion of organised recycling	Promotion of segregation at generation for recycling
Rate of Recycling				
From Generation Source	6.5 %	6.5 %	8.0 %	10.0 %
Total Recycling	7.3 %	7.3 %	8.8 %	10.6 %
4. Final Disposal				
Landfill Sites	Vingunguti	Vingunguti	Kunduchi	Kunduchi: Level 2 Ilala, Temeke
Sanitary Landfill Level	Open Dumping	Level 1[1]	Level 2[2]	Level 3[3]

[1] Level 1: controlled tipping method.
[2] Level 2: sanitary landfill without liner for leachate
[3] Level 3: sanitary landfill with liner for the prevention of leachate percolation into the ground

1.2 Outline of the Solid Waste Management Master Plan

The following table shows the outline of the Solid Waste Management Master Plan.

Table: Outline of the Solid Waste Management Master Plan

Components \ Phase	Present (1996)	Phase I (1997 - 1999)	Phase II (2000 - 2002)	Phase III (2003 - 2005)
1. Refuse Collection & Transportation				
Population in DSM	2,261,000	2,859,000	3,736,000	5,066,000
Population in the study area	2,030,000	2,455,000	3,066,000	3,966,000
Waste generation amount (t/d)	1,772	2,144	2,678	3,464
Collection rate of all waste	8 %	17 %	37 %	57 %
Collection rate of household waste	5 %	15 %	33 %	52 %
Waste collection amount (t/d)	143	362	1,001	1,960
Nos. of households served	23,604	85,640	235,298	479,609
Served population	101,500	368,250	1,011,780	2,062,320
Non served population	1,928,500	2,086,750	2,054,220	1,903,680
Collection system	Point & curb side collection	Point & curb side collection	UA: Curb side collection SUPA: Curb side collection and Point collection SUUA: Curb side collection and Point collection	UA: Curb side collection SUPA: Curb side collection and Point collection SUUA: Curb side collection and Point collection RA: Point collection
Major type of vehicles	Tipper Skip truck Tractor trailer	Tipper Skip truck Tractor trailer	UA: 6 ton tipper truck SUPA: 6 ton tipper truck and 8 ton skip trucks SUUA: 6 tons tipper truck and 8 tons skip trucks	UA: 4 ton compactor truck SUPA: 6 ton tipper truck and 8 ton skip trucks SUUA: 6 ton tipper truck and 8 ton skip trucks RA: 8 ton skip trucks
Transportation system	Direct haulage	Direct haulage	Direct haulage	Direct haulage
Executing organisations				
DCC	Cleansing unit, Health dept	Cleansing unit, Health dept	WM authority	WM authority
Private contractors	5 concessionaires	NA	NA	NA
Required main equipment				
6 ton tipper trucks	14	NA	50	66
8 ton skip trucks	1	NA	67	95
4 ton compactor truck	0	NA	0	10
8 m^3 skip with lids	0	NA	134	190
8 m^3 open skip	8	NA	536	760
No. of workers			317	455
DCC	40 (Aug.1996)	NA	152	132
Contractors	127 (Aug.1996)	NA	165	323
Unit cost				
DCC (USD/ton)	24.85 (1994)	NA	21.44 (excluding tipping fee)	17.33 (excluding tipping fee)
Private contractors (USD/ton)	13.14 (1994) (including dumping fee)	NA		
2. Street Sweeping				
Method of sweeping	Manual	Manual	Manual	Manual
Length of sealed regional road in DSM (km)	60.7	60.7	100	100
Length of served road (km)	32.8	50	100	100
Operator	Contractors	Contractors	Contractors	Contractors
Nos. of workers				
Private contractor	72	110	220	220
DCC	3	5	5	5
Contractors	69	105	215	215
Unit cost				
DCC (USD/ton)	Not available		This cost is included in the collection cost.	This cost is included in the collection cost.
Contractor (USD/ton)	Not available			
Main equipment	Manual	Manual	Manual work with litter boxes	Manual work with litter boxes
3. Intermediate treatment	•Community based pilot composting facilities •Simple incinerator for	• No requirement other than on-site & community based ones	• On-site composting	• On-site composting

Components \ Phase	Present (1996)	Phase I (1997 - 1999)	Phase II (2000 - 2002)	Phase III (2003 - 2005)
	infectious waste			
4. Recycling				
Recycling rate from generation	6.5 %	6.5 %	8.0 %	10.0 %
Overall recycling rate	7.3 %	7.3 %	8.8 %	10.8 %
Recycling system	• No organised recycling	• DCC needs to organise present recycling system	• Private sector centred system • DCC encourage to organise recycling activities	• Private sector centred system • DCC promotes the separate discharge of wastes for recycling
5. Final Disposal				
Method of operation	Open dumping	Level I	Level 2	Level 2 or 3
Final disposal site	Vingunguti	Vingunguti	Kunduchi	Level 2 for Kunduchi Level 3 for Ilala & Temeke
Transportation distance (km)	8.7	8.7	18	13 (average)
Operation by	DCC	DCC	WM authority	WM authority
Nos. of workers	11	11	34	85
Tipping fee (Tsh/ton)	800	800	3,600	6,100
Unit cost (USD/ton)	N.A	N.A	5.37	9.22
Main equipment	Bulldozer 1	Bulldozer 1	Bulldozer: 3 Excavator: 1 Tipper truck: 3 Pickup: 1	Bulldozer: 6 Excavator: 3 Tipper truck: 6 Pickup: 3
6. Maintenance & Repair				
Preventive Maintenance	Mwananyamala depot	Mwananyamala depot	Nyerere workshop	Nyerere workshop
Major repair	Mwananyamala depot	Mwananyamala depot	Private workshop	Private workshop
Operation by	E & M sec, Works Dept., DCC	E & M sec, Works Dept., DCC	WM Authority	WM Authority
Nos. of workers	17	17	65	98
7. Public Organisations Responsible on SWM				
Competent authorities	Health Dept., DCC Cleansing Sec.	Health Dept., DCC Cleansing Sec.	WM authority	WM authority
Operation by	1	10	WM authority 30	WM authority 50
Nos. of staff				
8. Financial Matters				
Unit SWM Cost (Tsh/ton)				
Revenue Source	• Tax • RCC collected by concessionaires	• Tax • RCC collected by concessionaires	• Tax • RCC collected by joint billing with water or • Special RCC collected by DCC	• Tax • RCC collected by joint billing with water or • Special RCC collected by DCC
Breakdown of Revenue				
Tax (M. Tsh)	296	548	1,165	1,868
RCC (M. Tsh)	not available	-	1,426	2,684
Total Revenue (M. Tsh)	not available	-	2,591	4,552
Total revenue per capita(Tsh)	not available	223	845	1,148
Total revenue per beneficiary (Tsh)	not available	1,488	2,561	2,207
SWM budget per capita (Tsh)	160	223	380	471
DCC Budget (M. Tsh.)	5,910	10,963	23,291	37,368
Tax Revenue (M. Tsh)	2,540	7,062	18,775	32,140
Subsidy (M. Tsh)	3,370	3,901	4,516	5,228
Tax Forecast Scenario	not available	Moderate	Moderate	Moderate
Share of SWM budget	5 %	5 %	5 %	5 %
Collection Rate of RCC	15 %	15 %	20 %	20 %
Tariff Level for RCC (Tsh/month/household)	150 or 900	150 or 900	1,250	1,250
9. Role of Private Org.				
SWM services privatised	• Parts of refuse collection • Street sweeping	• Parts of refuse collection • Street sweeping	• Parts of refuse collection • Street sweeping	• Parts of refuse collection • Street sweeping
Type of contract	Concession contract	Concession contract	Lump sum contract	Lump sum contract
10. Legislation	There are basic legislation but lack of enforcement	Consolidation of scattered legislation on SWM into a Sanitary Code	Enforcement of the Sanitary Code	Establishment of a law for waste minimisation and recycling
11. Public Cooperation	There are very little public education programmes and co-operation	Informing of proposed institutional, administrative and legislative changes on SWM	Conduct of active public education and cooperation campaigns	Promotion of waste minimisation and recycling campaigns
12. Medical SWM	• No clear classification of medical solid waste, • No discharger's responsibility, lack of laws, codes & enforcement	• Establishment of clear classification for medical SW and code of practice, • Infectious wastes shall be properly treated at generation	• Enforcement of strict segregation, separate collection, transportation and disposal system for infectious waste, • Examination of	• Establishment of thermal treatment of infectious waste with hazardous waste

Components \ Phase	Present (1996)	Phase I (1997 - 1999)	Phase II (2000 - 2002)	Phase III (2003 - 2005)
			thermal treatment of infectious waste with hazardous industrial SW	
13. Industrial SWM	• No clear classification of industrial solid waste • No discharger's responsibility, lack of laws, codes & enforcement	• Establishment of clear classification of industrial SW • Examination of HISW generation amount and its disposal methods	• Enforcement of proper disposal of hazardous industrial SW • Examination of thermal treatment of infectious waste with hazardous industrial SW	• Establishment of thermal treatment of infectious waste with hazardous waste

2. Feasibility Study for the First Priority Project

2.1 Outline of the First Priority Project

Table: First Priority Projects and Project Cost (Investment)

unit: million Tsh

Category	Contents of Projects	Type	1999-2003 Required Investment	1999-2003 *Required Grant of Total Investment
Improvement of Waste Collection, Transport and Disposal System	Improvement of Waste Collection and Transport *Procurement of refuse collection vehicles and skips, etc.*	Equip.	6,719	3,644
	Development of the New Kunduchi Disposal Site *Construction of a disposal site, procurement of sanitary landfill equipment*	Facil. Equip.	1,841 750	831 600
	Improvement of Street Sweeping *Procurement of equipment to collect street sweeping waste, etc.*	Equip.	69	23
	Improvement of the Nyerere Workshop *Procurement of machinery for repair of refuse collection vehicles and sanitary landfill equipment*	Facil. Equip.	42 297	42 297
	Improvement of Administrative System *Renovation of office facilities, procurement of educational equipment, etc.*	Facil. Equip.	29 165	29 123
Improvement of Night Soil Collection and Transport System	Improvement of Night Soil Collection and Transport *Procurement of cesspit empty trucks, etc.*	Equip.	786	655
Detailed Design and Supervision			1,070	624
Total			**11,768**	**6,868**

Note:
* The amount of required grant covers the investment required in 1999 which will play a role in a take-off project.

2.2 Evaluation of First Priority Projects

The first priority projects were divided into the following two components and evaluated.

i. Improvement project of refuse collection, transport and disposal system.

ii. Improvement project of night soil collection and transport system.

a. Improvement Project of Refuse Collection, Transport and Disposal System

Technical Evaluation

The technical evaluation concluded that the simplicity of the proposed technical system is very appropriate for the present level in Dar es Salaam. Although problems in vehicle and equipment maintenance are foreseen, they can be overcome by improvements in the proposed maintenance workshop.

Social Evaluation

The social evaluation concluded that the implementation of the proposed projects would generate various positive significantly intangible impacts such as improvements in public health and sanitary conditions, prevention of floods, promotion of foreign investment and tourism, increase in land value, etc.

Environmental Evaluation

The environmental evaluation concluded that the positive effects from the projects shall outnumber the negative impacts.

Financial Evaluation

In the financial evaluation, financial internal rate of returns (FIRR) for the 18 cases were calculated. As a result, if:

- all investment cost for 1999 is granted.
- the most probable scenario of increase of tax revenue is taken.
- refuse collection charge (RCC) is collected by either Dar es Salaam Water and Sewerage Authority (DAWASA) included in the water charges or the Dar es Salaam City Commission (DCC) directly.

1) In the case where RCC is collected by DAWASA with water charges, the project would be financially feasible because the FIRR is 24.70 %, exceeding the cut off rate of 11.6 %.
2) In the case where special RCC is collected by DCC, the FIRR is 10.24 %. Although this value is slightly lower than the cut off rate of 11.6 %, it can be made financially feasible by DCC making additional efforts such as collecting more taxes, increase collection rate of special RCC, etc.

Economic Evaluation

As a result the EIRR is calculated at 19.56 % which is almost equal to the cut off rate, i.e. 11.6 %. Therefore the implementation of the master plan will contribute to the national economy.

Overall Evaluation

The overall evaluation concluded that the execution of the Master Plan would be essential to maintain the basic level of urban environment sanitation and public health and to enable sustainable urban development for Dar es Salaam, at the same time it would be feasible technically, socially, environmentally, financially and economically.

b. Improvement project of night soil collection and transport system

The results indicate that the project would be unrealisable if the overall cost is subsidised by a loan, as it would incur a negative FIRR rate. However, the project would be financially feasible if the 1999 vehicle procurement cost is subsidised by a grant and if a collection fee of 10,500 Tsh/trip is imposed.

However, this was prepared in a very short period under limited conditions, and therefore the following issues should be reminded for implementation.

- The examination on the disposal capacity of night soil because it has not been investigated in this Study.
- Whether the proposed night soil collection charge is accepted has to be examined because it has not been done in this Study. However, it is expected that the magnitude of willingness to pay for night soil collection charge is larger than that for RCC because night soil is too difficult to be collected and dumped by themselves and the negative impacts created when it is not collected as much larger than refuse.

c. Conclusion of the Environmental Impact Assessment on the New Kunduchi Disposal Site

Based on the results of the initial environmental examination, surveys were conducted regarding the following environmental items in order to do the environmental impact assessment for the Kunduchi new disposal site construction project.

1) Economic activities
2) Traffic and public facilities
3) Public health
4) Waste
5) Hazards/Risks
6) Topography and geology
7) Groundwater
8) Hydrological situation
9) Flora and fauna
10) Landscape/aesthetics
11) Air pollution
12) Water pollution
13) Soil contamination
14) Noise and vibration
15) Offensive odour
16) Litter

The Environmental Impact Assessment matrix shows that the project will have various positive and negative impacts, although the latter will only be minor, except those regarding traffic (traffic jams, increase in traffic accidents and exhaust gas emissions). These negative impacts can be minimised through appropriate mitigation measures such as expanding the traffic lane in congested areas, strengthening traffic regulations, and improving collection vehicles. The result of the environmental impact assessment showed that all adverse impacts can be kept within the permissible level by adopting mitigation measures.

3. Recommendation

a. Implementation of the Master Plan

The basic goal of this master plan is "to establish a proper solid waste management system in Dar es Salaam City by 2005". The establishment of this management system shall attract foreign investment and consequently promote national economic development as well as preserve the urban environment and public health, and a sustainable development of the city.

The master plan is evaluated as feasible from technical, social, environmental, financial, and economic viewpoints. Therefore, DCC should implement this master plan based on the strategies proposed in this study with the cooperation of the central government

b. Improvement of Technical System

In order to realise the master plan, the technical system needs to be improved as follows.

- The most suitable collection system shall be adopted according to the characteristics of the areas. The collection system shall be either of the following depending on the accessibility to the collection points: (1) without primary collection: curb side collection by tipper trucks. (2) with primary collection: point collection by skip trucks.
- DCC needs to conduct the refuse collection services with as much cooperation from the private sector as possible, as its collection vehicles are very limited in number. Collection services should be extended to the following areas in their order of urbanisation starting from UA, SUPA, SUUA, and finally RA.
- Regarding maintenance of vehicles and any kind of heavy equipment necessary for solid waste management, Nyerere Workshop needs to be remodelled and at least the tools necessary to do preventive maintenance needs to be secured.
- To conduct recycling activities with construction and operation of associated facilities by public institutions, generally require additional funding. Therefore, although composting at waste generation sources shall be recommended, collective processing and recycling facilities shall neither be built nor operated. Construction and operation of these facilities shall be entrusted to the private sector. Reduction and resource recovery by 2005 shall be achieved by administratively (in a way which lessens financial burden) promoting recycling activities by dischargers and private companies including the informal sector.
- Taking into account the high unemployment rate and poor road surface conditions, street sweeping services should be done manually.
- The new Kunduchi disposal site should be developed and sanitary landfill operations should start by 2000 when Vingunguti disposal site becomes obsolete. Furthermore, disposal sites in both Ilala and Temeke districts shall be prepared and waste collected in these districts shall be disposed of at their respective disposal sites by sanitary landfilling.
- For the disposal site selection in both Ilala and Temeke districts, it is necessary to select disposal sites where construction and operation costs can be minimised as much as possible, adopting a method used by the study team to select the new Kunduchi disposal site.

- This study provided data regarding the quantity and composition of waste and the waste stream, which are the bases for proper solid waste management and waste stream. For the future re-examination of this plan, waste composition and quantity shall be surveyed regularly to accumulate basic data such as daily and seasonal fluctuation.
- By using the weighbridge installed at the Vinguguti disposal site, data on waste collection and disposal can be collected and analysed for the development of a more effective and sound collection and disposal system. This experience should be disseminated to the municipalities throughout Tanzania.

c. Improvement of Institutional System

The establishment of a strong and sound institutional system is most important to realise the master plan, making its technical system sustainable. Therefore, DCC needs to improve the institutional system by conducting the following to implement the priority projects (take-off projects) of the master plan.

- Integrate functions dispersed through the three departments (Health, Works and Planning) and establish an independent Waste Management Authority within DCC to assume all solid waste management responsibilities, including night soil collection. The Waste Management Authority shall be given the authority to independently conduct the administrative, operative and financial aspects of the services.
- Establish a Supervision and Monitoring Committee, an independent organisation to supervise and control the cleansing services provided by DCC and private contractors.
- Improve the city's tax collection capability and use city taxes as the main financial source for cleansing services by allocating a special fund for solid waste management.
- In order to establish the **"beneficiary-pay-principle"** in the future, the RCC system needs to be continued. However, the expenses of this system should not exceed the amount collected . Therefore, the joint billing of RCC with the water charge by DAWASA shall be considered. In case the adoption of this system is not possible due to some hindrance, DCC shall directly collect special RCCs.
- The type of contract shall be shifted from a concession contract system where collection services and RCC collection are consigned to private collectors, to the contracting out system in which DCC pays the contractor a service fee. To make the most of the private company's capabilities, clear policies and guidelines for the consignment of private companies for waste collection by the contracting out system should be formulated.
- Improve legislation relevant to solid waste management and incorporate them into the Sanitary Code.
- In view of the poor financial capabilities of DCC (service provider of cleansing) and the residents (beneficiaries), resident participation is very important for an efficient solid waste management system. DCC should, therefore, actively conduct promotional campaigns and educational programmes in order to gain their cooperation. Books and educational videos produced and used in the pilot project of this Study should be utilised effectively.

- Provide training for the people engaged in solid waste management and formulate a human resource development plan to improve their basic skills.

d. Financial Source

The funding for solid waste management shall mainly come from the special fund allocated from the city's taxes and the RCC. However, the financial analysis of the overall solid waste management project clearly states that even in the case of an optimistic revenue in which the income of the city and RCC is at its maximum (A-1-a), the project would still be infeasible, as the FIRR reaches only 2.32% when investment fund is all on loan.

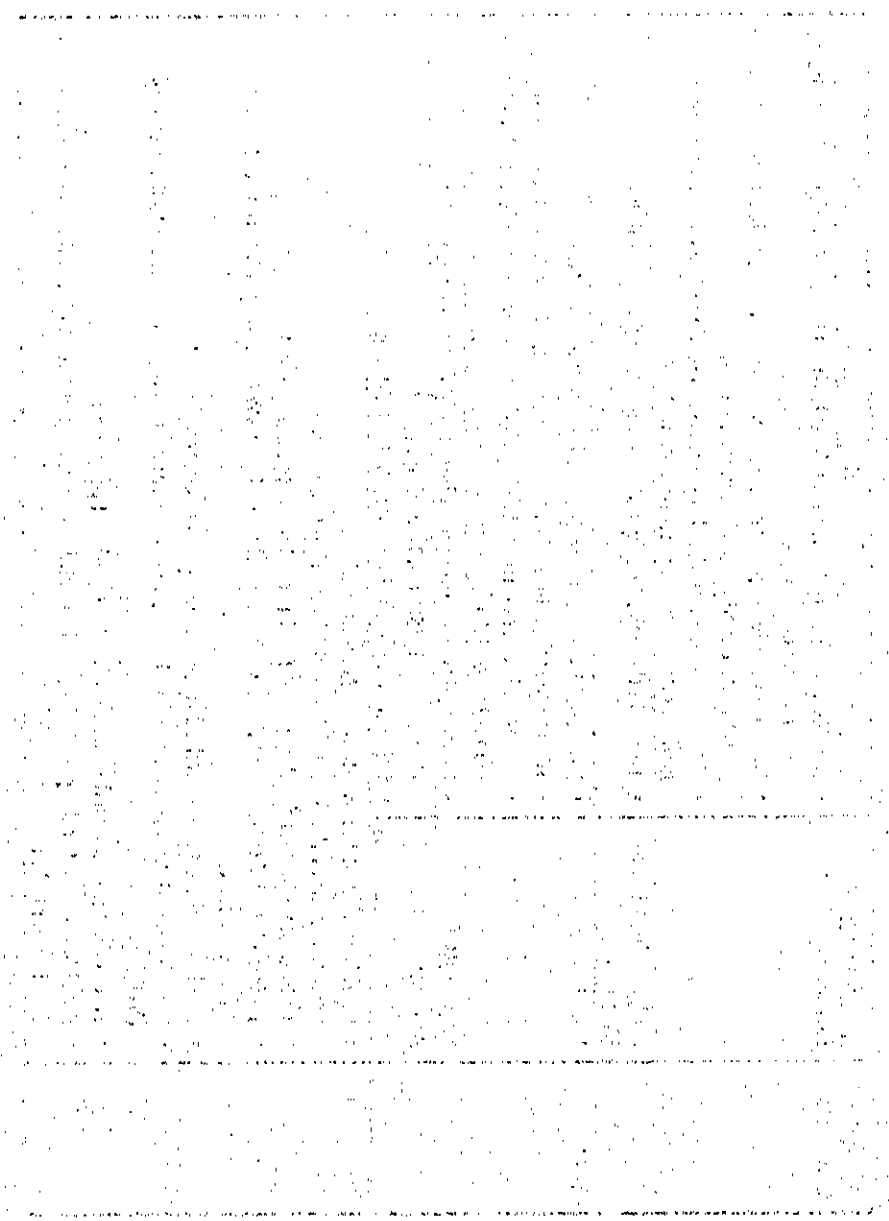
According to the results of the financial analysis, the funding for implementing the priority projects, the take-off projects of the master plan, scheduled for 1999 should be subsidised either by the central government or by bilateral or multilateral grant aid. Other than these priority projects, projects (i.e. vehicles and equipment replacement and facility expansion) necessary to realise the Master Plan shall be subsidised by the internal reserves from the special fund mentioned previously, RCC, tipping fees, etc.

The establishment of a sound financial system would firstly rely on accurate cost calculation for efficiently conducting operation, and secondly, restricting the use of collected RCC for reinvestments into solid waste management and its operation cost.

The following table shows the financial requirements to make the implementation of Master Plan and First Priority projects feasible.

Table: Financial Requirements for Master Plan

Category 1	Category 2	Requirements
City taxes	Revenue	• Service levy, petrol levy: to retain at least 50 % of annual growth rate based on performance in 1996. • Development levy, property tax, hotel levy: to retain at least 40 % of annual growth rate based on performance in 1996. • Business license, market levy, others: to retain at least 20 % of annual growth rate based on performance in 1996.
	Budget allocation to SWM works	• To retain the SWM budget allocation rate at 5.0 % until 2005.
RCC	Joint billing	• Household waste: the collection rate shall exceed 30 %. • Waste other than household waste: the collection rate shall exceed 70 %. • The actual revenue from RCC excluding cost and commission shall be less than 30 % of RCC.
	Special RCC	• Charge all wastes other than household and informal wastes
	Amount of RCC	• Household: 1,250 Tsh/household/month • Other than household waste: 20,000 Tsh/ton
Institution	• Establishment of the Waste Management Authority. • Establishment of the Supervision and Monitoring Committee. • To allocate a budget for the special fund for solid waste management. • To introduce RCC by joint billing with water charges by DAWASA or special RCC collected directly by DCC. • To change the contract method from a concession to contracting out. • Improve legislation relevant to solid waste management and incorporate them into the Sanitary Code. • To conduct promotional campaigns and educational programmes. • Provide training for the people engaged in solid waste management and formulate a human resource development plan.	



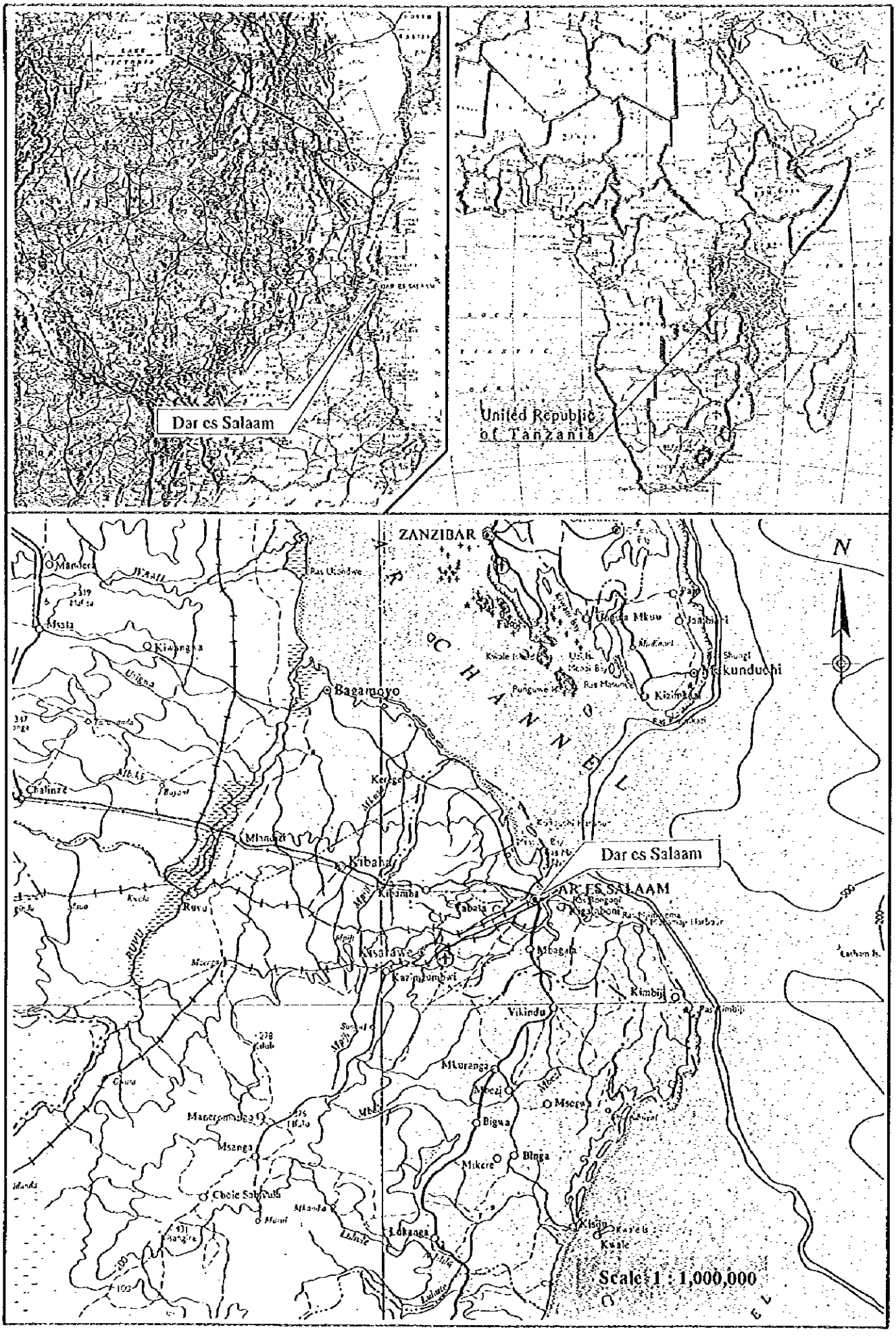
The Study on
The Solid Waste Management for
Dar es Salaam City

List of Volumes

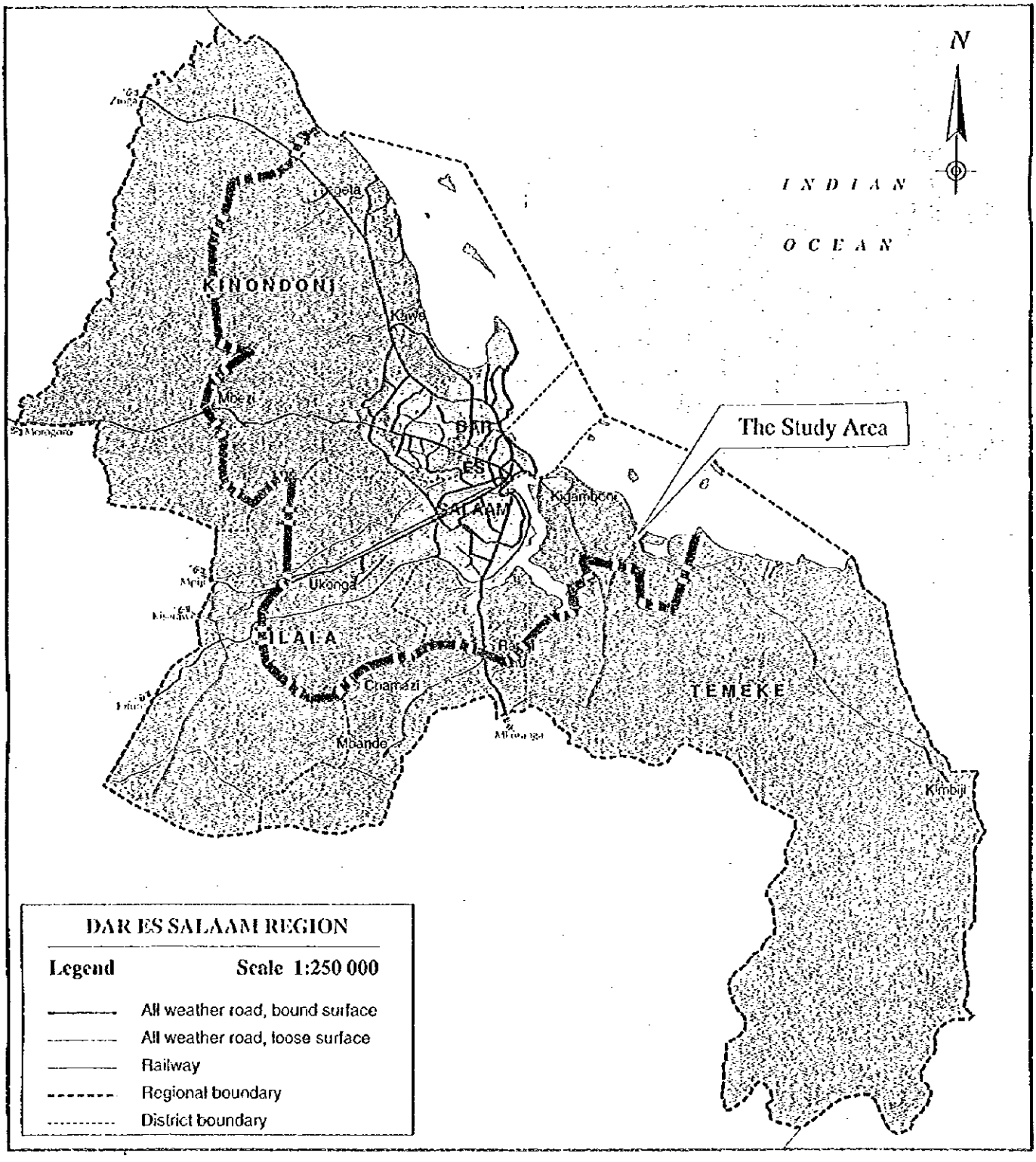
Volume I	Executive Summary
Volume II	Main Report for the Master Plan
Volume III	Main Report for the Feasibility Study
Volume IV	Annex
Volume V	Data Book

This is the Executive Summary.

In this report, the project cost is estimated using the February 1997 prices and at an exchange rate of 1US$ = 120.85 Japanese Yen = 597.8 Tanzanian Shilling



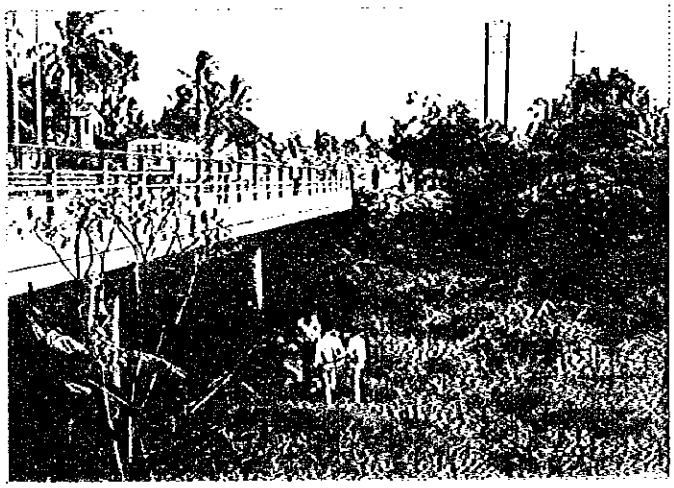
Map 1 : The Location Map of the Study Area



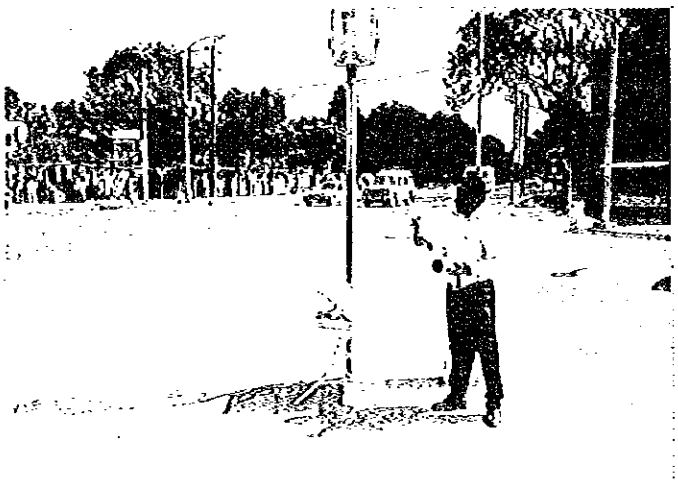
Map 2 : The Location Map of the Study Area

Plate 1 : Urban Environmental Surveys

A member of staff from UCLS is taking a water sample at Vingunguti.



Measuring the water quality of the Msimbazi River.



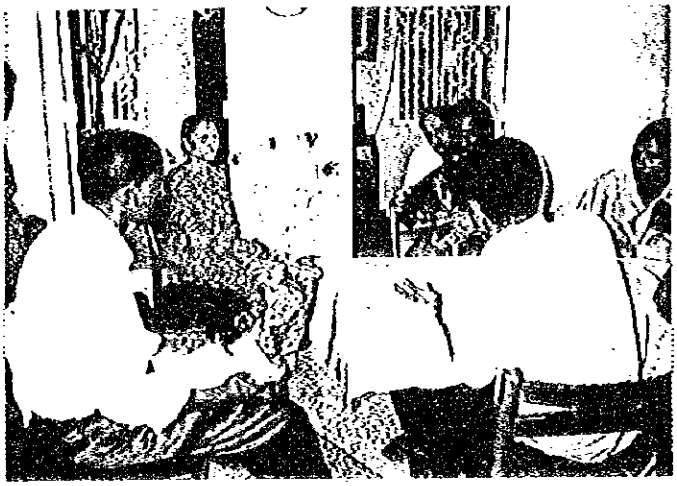
Taking the noise level at the intersection of Bagamoyo Road and Morocco Road.

Traffic volume survey being conducted.

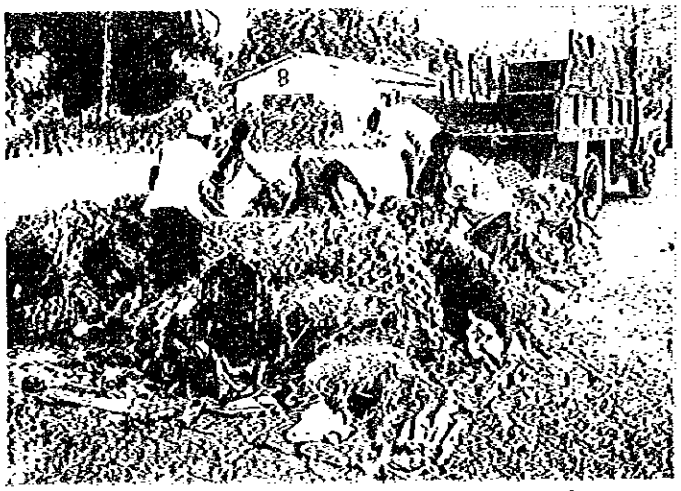
Measuring the air with a gas detection tube.

Taking a soil sample at Vingunguti for soil contamination analysis.

Plate 2 : Waste Amount and Composition Survey

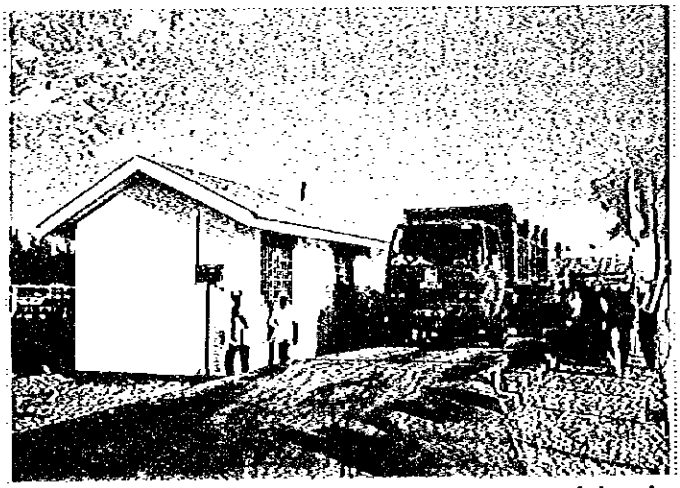


The Study Team explaining the Waste Amount and Composition Survey (WACS) to the residents of one of the sampling points in Upanga East

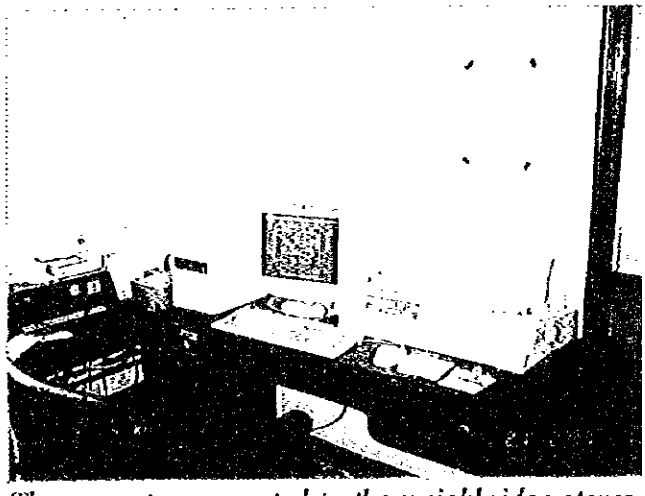


Samples of waste collected and brought to the waste composition analysis yard.

Waste composition analysis conducted at the yard ne the Vinguguti disposal site during WACS.



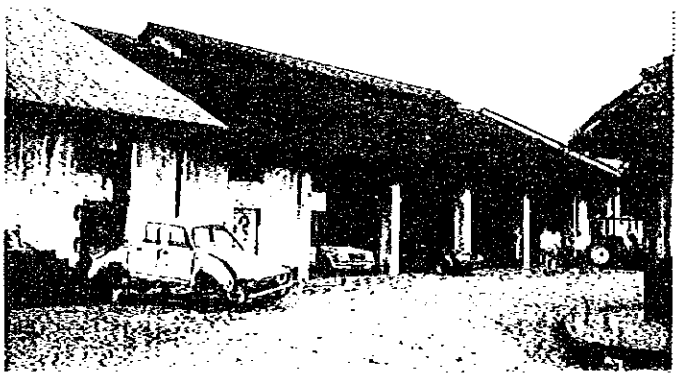
The amount of disposal waste was measured by the weighbridge installed at the corner of Nyerere Road and Vinguguti Road.



The computer connected to the weighbridge stores weighing data and provide us with various use information.

Plate 3 : Present Condition of Proposed Locations of SWM Facilities

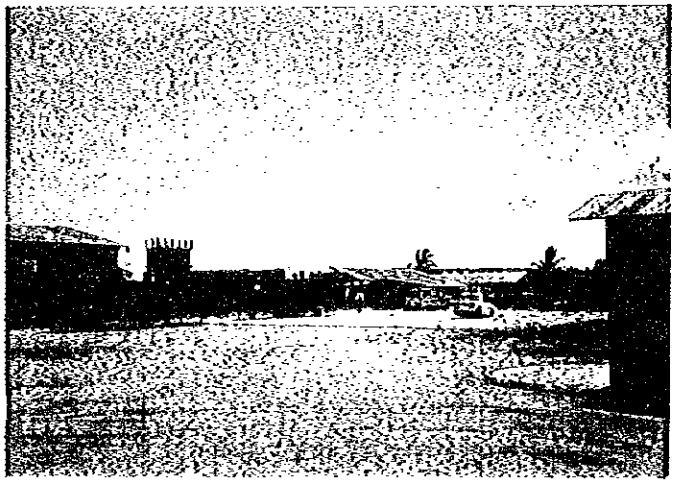
Present condition of the New Kunduchi Disposal Site (Kunduchi New MECCO Quarry, south side).



Nyerere workshop is to be improved as a central workshop.

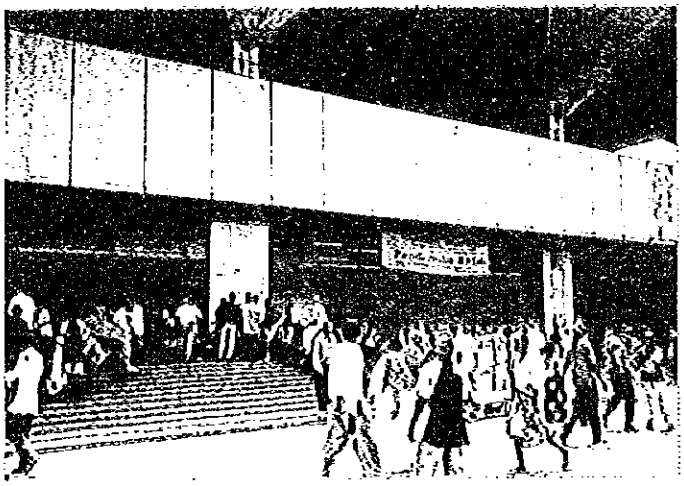
Mwananyamala depot is to be a motorpool for the Kinondoni district.

DRIMP depot is to be a motorpool for the Ilala district.



Temeke district office is to be a motorpool for Temeke district.

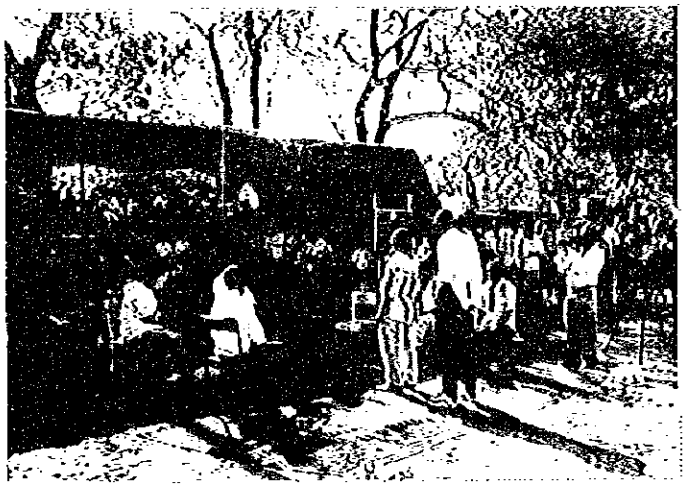
Plate 4 : Pilot Project The "Beautify Your City" Campaign (1)



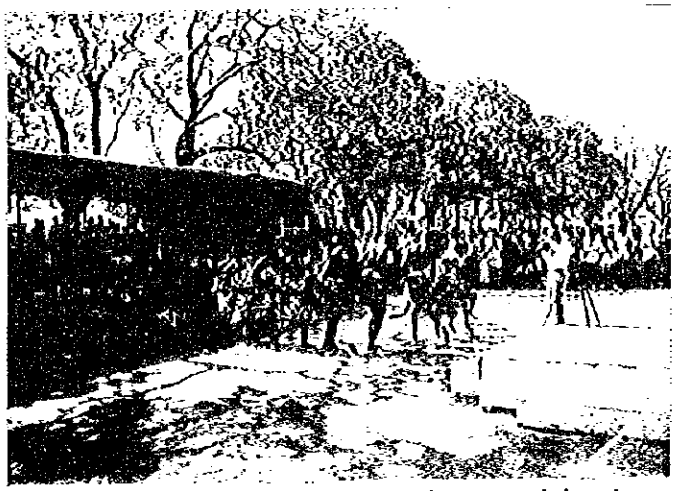
Banner showing "Beautify your city", the catchphrase for the campaign.

The "Beautify Your City" campaign, aiming at public education and awareness, was held during February, with most of the pilot project being conducted within this month. This was advertised in the mass media (television, newspapers) including some newspaper articles and using 16,000 stickers, 300 T-shirts, 20 street banners and a competition for the 100 best posters.

Program	Events
Public Awareness	Beautify DSM month
	10 km Race
Adult Education	Educational Cultural Show on SWM by the Tanzanian Culture Group
	Cinema Show on SWM
Primary School Education	Production of books for primary School Students about SWM
	Trial Lessons on SWM to Primary School students
	Seminar for Primary School Teachers
	Poster Competition

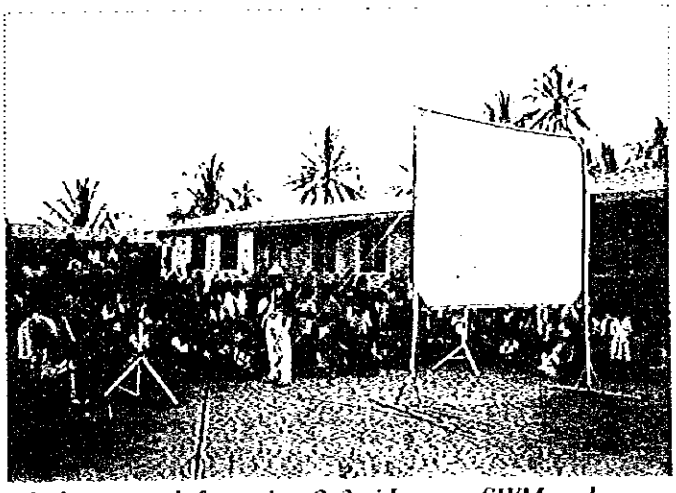


A drama containing many strong messages concerning SWM.



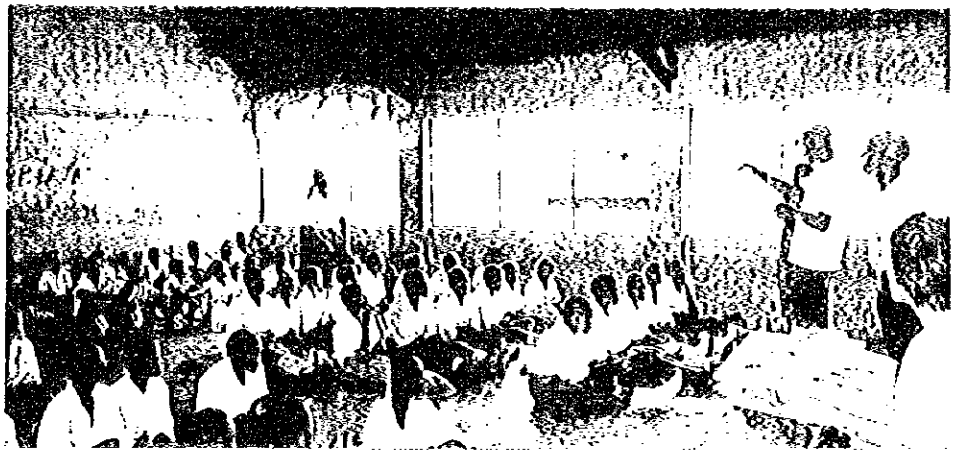
4 Cultural shows featuring songs, drama and dancing about SWM at various venues in DSM.

The culture show was prepared and performed by the Tanzanian Peoples' Defense Force Culture Group and featured dancing, singing and dramas.



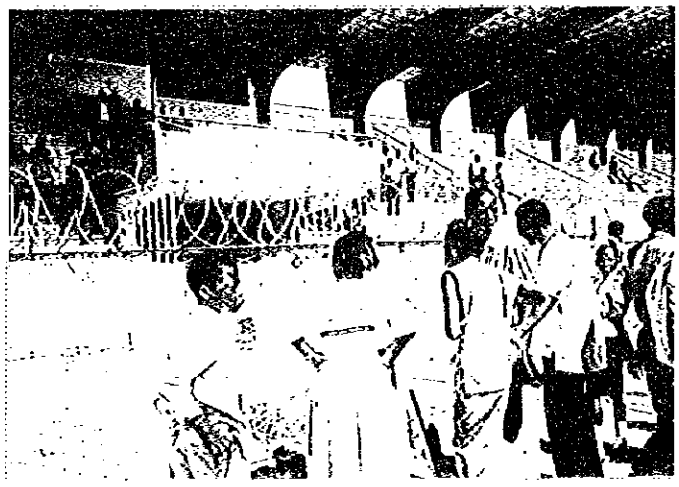
10 shows, each featuring 2-3 videos on SWM and environmental issues held at various venues in DSM in the evening.

Plate 5 : Pilot Project The "Beautify Your City" Campaign (2)

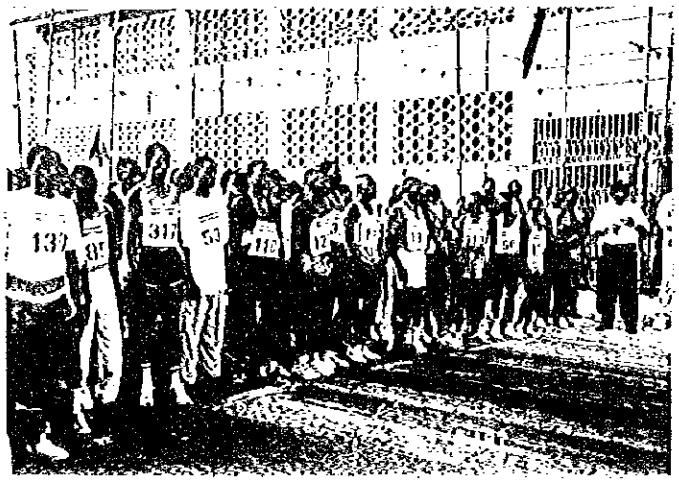


20,000 copies of a 28 pages book on SWM has been produced for Standard 4-7 primary school students in Swahili.
Trial Lessons on SWM were conducted with Standard 2 and Standard 5 classes at 6 primary schools in DSM.

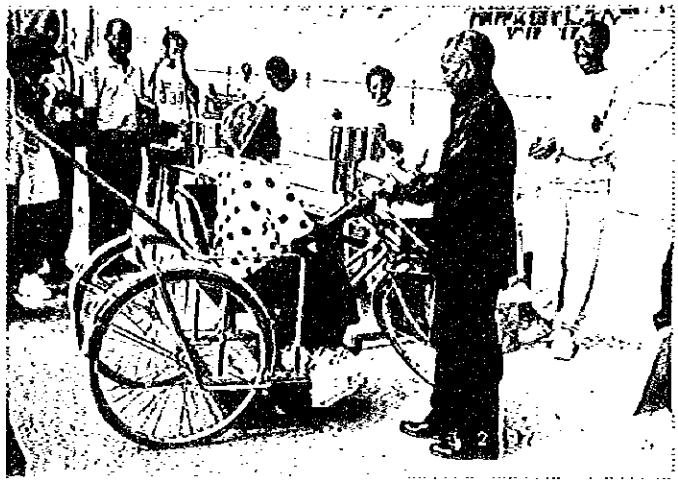
A seminar for 29 primary school teachers, District School Inspectors and District Academic Officers on SWM was held.



A poster competition was held on February 20 for all primary school students on the theme : "Beautify Your City".



An open 10 km race was held on March 2 for men, women and disabled people using tricycles. This was the closing event for the Beautify DSM month.



The winner of 10 km tricycle race is being awarded a prize by the Minister.

Plate 6 : Pilot Project, Improvement of Refuse Collection System in Kariakoo

100 litter bins were installed along the Msimbazi Ro
for string litter. However, most of them became
collection points for municipal wastes.
One of the 3 skips placed in Kariakoo. Most of th
were always filled with refuse even though they
replaced every day.

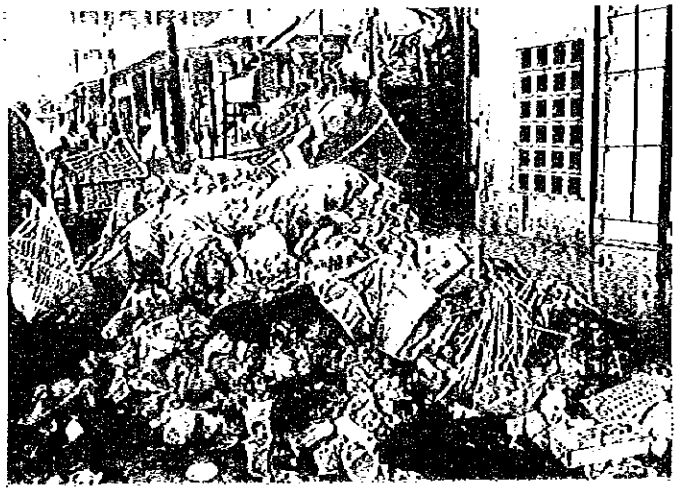
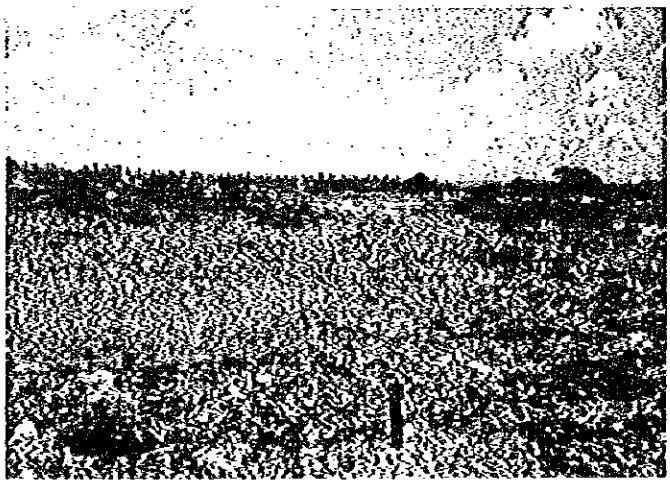


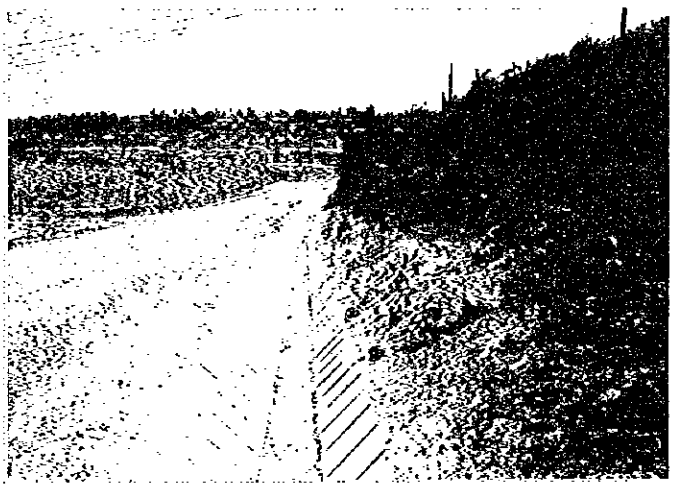
Plate 7 : Pilot Project, Improvement of the Vingunguti Disposal Site (1)

The condition of Vingunguti Disposal site before the improvement work.

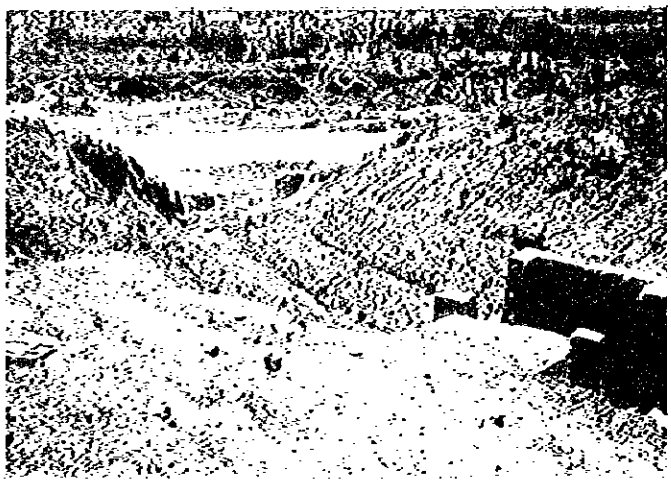
The condition of Vingunguti Disposal Site after the improvement work.



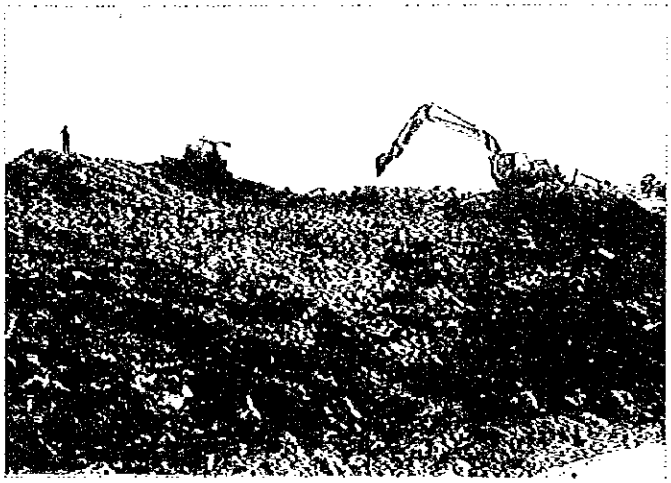
5 gas removable pipes were installed in the site.



Concrete surfaced side drain was constructed along the slope entrance to the disposal site.

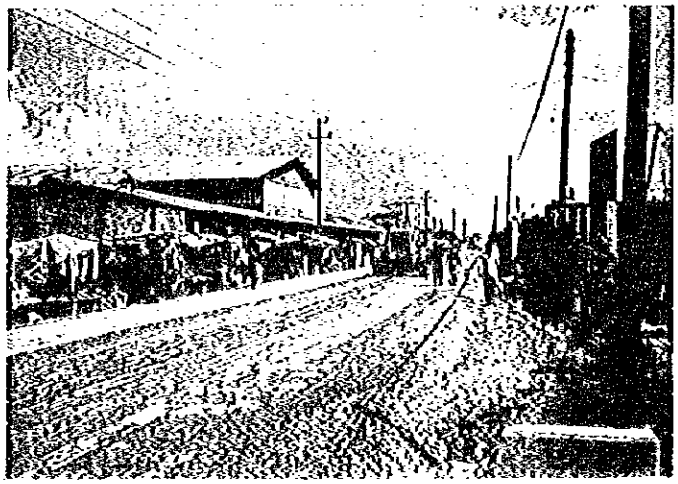


The outlet of side drain was protected by a stone gabion.



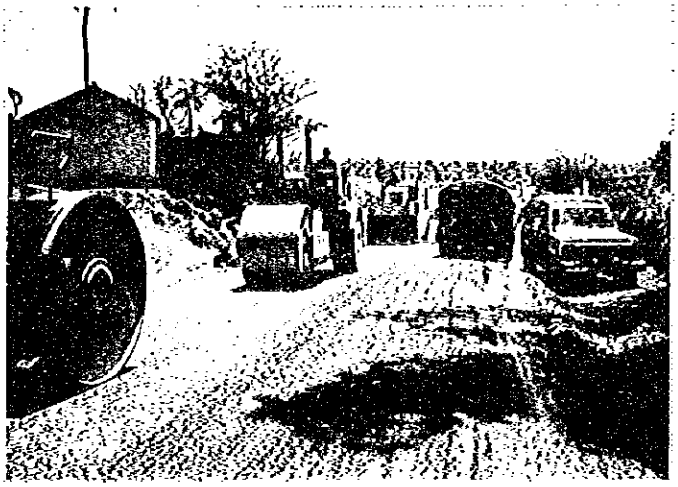
The landfill site was cleared and graded with a bulldozer and backhoe.

Plate 8 : Pilot Project, Improvement of the Vingunguti Disposal Site (2)

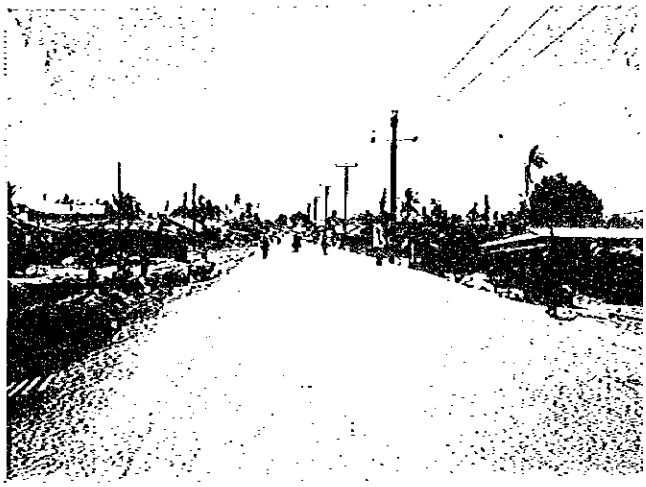


The access road from Nyerere Road to the landfill was paved.

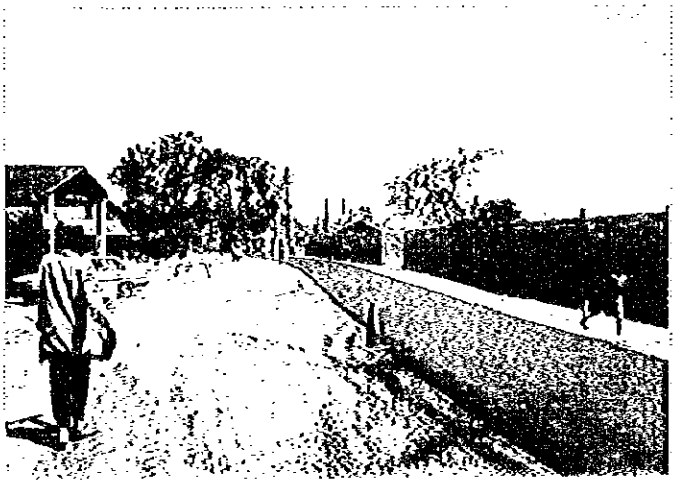
The condition of Vingunguti Road near Nyerere Roac



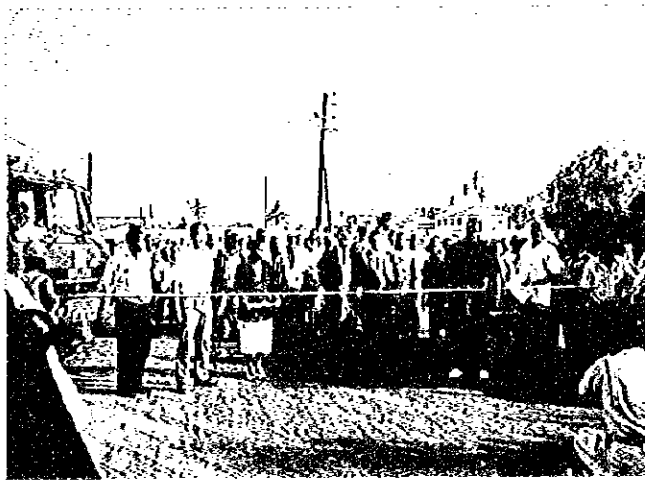
The access road near the disposal site being paved.



The condition of Vingunguti Road, in the midc section .



The road was paved on one lane.

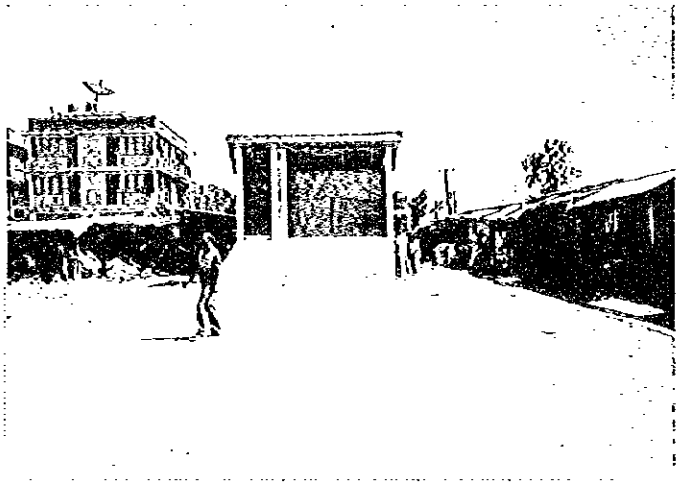


The opening ceremony of the Vingunguti Road to place on 21 March 97.

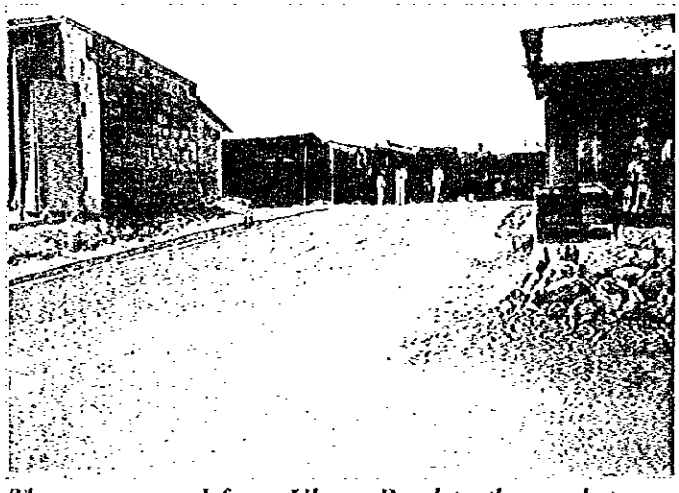
Plate 9 : Pilot Project, Improvement of Refuse Collection system in Bugurini

The centre square of the Bugurini Market was filled with plenty of refuse.

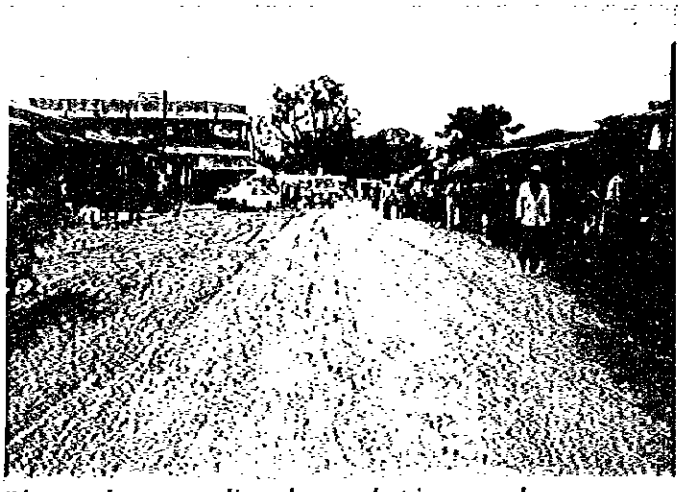
Leachate was stagnant and methane gas was emitted.



The centre square completely transformed after all the wastes and leachate were removed.



The access road from Uhuru Road to the market was constructed after two shops, blocking access, were demolished.



The road surrounding the market improved.

The road surrounding the market improved.

The Study on the Solid Waste Management for Dar es Salaam City

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Glossary

Concession contract	A contract system in which the contractor which is entrusted refuse collection and transportation work in a certain area are granted the right to collect RCC from its beneficiaries.
Contracting out	A contract system in which the client make payment to the contractor in return for performing refuse collection and transportation work.
Concessionaire	The contractor that works in the concession contract.
Special RCC	A refuse collection charge which is applied to all wastes other than household and informal wastes and also applied to bulky waste collection, door to door collection, garden waste collection and any other refuse where collection costs are generally more expensive than for household waste. DCC collects Special RCC in this report.
Informal waste	Waste generated through the activities which do not reflect the statistic data.

List of Abbreviations

CBO	Community Based Organisation
CCF	Consumption Conversion Factor
DAWASA	Dar es Salaam Water and Sewerage Authority
DCC	Dar es Salaam City Council or Dar es Salaam City Commission
DSM	Dar es Salaam
DSSD	Dar es Salaam Sewerage and Sanitation Department of the City Council
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
FIRR	Financial Internal Rate of Return
F/R	Final Report
F/S	Feasibility Study
HISW	Hazardous Industrial Solid Waste
GDP	Gross Domestic Product
IEE	Initial Environmental Examination
ISW	Industrial Solid Waste
ISWM	Industrial Solid Waste Management
JICA	Japan International Cooperation Agency
MEM	Ministry of Energy and Minerals
M/P	Master Plan
MSW	Medical Solid Waste
MSWM	Municipal Solid Waste Management
NEMC	National Environment Management Council
NGO	Non-Governmental Organisation
NUWA	National Urban Water Authority
O & M	Operation and Maintenance
POS	Public Opinion Survey
RA	Rural Area
RCC	Refuse Collection Rate
SCF	Standard Conversion Factor
SDP	Sustainable Dar es Salaam Project
SKAT	Swiss Centre for Technology and Management
SUPA	Semi-urban Planned Developed Area
SUUA	Semi-urban Unplanned Developed Area
SW	Solid Waste
S/W	Scope of Works
SWM	Solid Waste Management
Tsh	Tanzanian Shilling
UA	Urban Area
UES	Urban Environment Sanitation
USD	United States Dollar
WACS	Waste Amount and Composition Survey
WHO	World Health Organisation
WMA	Waste Management Authority

1 Chapter 1 Outline of the Study

1.1 Background

The city of Dar es Salaam is the centre for the industrial, commercial and administrative activities of Tanzania, and has a population of about 2.26 million. Due to rapid population growth and lack of adequate infrastructure improvement schemes, the urban environmental condition is deteriorating rapidly.

To solve this problem, the Government of Tanzania formulated the national environmental action plan with the assistance of the World Bank in June 1994. Although the plan proposes the improvement strategy of the urban environment sanitation, concrete countermeasures have not been proposed yet.

The present solid waste management system of the city only collects about 8.1 % of the total waste generation amount, 1,772 tons per day, due mainly to insufficient and decrepit equipment. Uncollected refuse are mostly stockpiled in vacant lands near residential areas, thereby deteriorating the sanitary conditions of the town and exposing the area to dangers of fire. The living environment of neighbouring areas of the existing disposal site is also affected by the insanitary disposal operations.

Consequently, the enhancement of the sanitary conditions of the urban environment, especially through the reinforcement of the cleansing services to cope with the increase in solid waste generation, and the formulation of a master plan are urgently required.

Under such circumstances, the Government of Tanzania officially made a request to the Government of Japan to implement the study on the solid waste management (SWM) for Dar es Salaam City in the Republic of Tanzania.

In response to this request, the Japan International Co-operation Agency (JICA), the official agency responsible for the implementation of the technical co-operation programs of the Government of Japan, conducted the Scope of Work for the Study with the DCC of the Government of Tanzania. Kokusai Kogyo Co., Ltd. carried out the Study.

1.2 Objectives and Scope of the Study

1.2.1 Objectives of the Study

The objectives of the Study were as follows.

- To identify the urban environment sanitation issues after assessing the environmental conditions of Dar es Salaam City
- To formulate a master plan for the improvement of solid waste management based on the assessment of the urban environment
- To conduct a feasibility study on the first priority project based on the master plan
- To carry out solid waste management technology transfer by conducting the study

1.2.2 The Study Area

The Study Area covers thirty nine (39) wards of the fifty two wards under the jurisdiction of the Dar es Salaam City Commission as shown in the Location Map of the Study Area, representing an area of 439.9 km^2 out of the total of 1,350 km^2 in the Dar es Salaam (DSM) region.

1.2.3 Study Wastes

This study covered household wastes, market wastes, commercial wastes, institutional wastes and street sweeping wastes. As far as industrial and hospital wastes are concerned, a rapid diagnosis was carried out based on existing information and data, and the general recommendations for the improvement in the management of such wastes in Dar es Salaam City is proposed in the master plan.

1.3 Basic Policy of the Study

For the successful execution of the Study, the Study Team established the basic policy regarding the following points:

a. Utilisation of Local Consultants

Considering the eminent characteristics of an SWM study, it was very important to pursue technology transfer to not only Tanzanian counterpart personnel but also local consultants in the course of the Study. Especially, the works which need to be done continuously even after the Study should be conducted by local consultants under the supervision of the Study Team; i.e. POS, UES, environmental impact studies of a final disposal site, etc.. Therefore, Tanzanian consultants and professional were utilized to successfully conduct the Study within a limited period, to make a master plan compatible with local conditions and to pursue technological transfer.

b. Joint Study

In order to conduct the Study successfully, the Study team proposed the joint implementation of the study and asked cooperation and active participation of the Tanzanian side. Especially, to smoothly conduct the Study, the Tanzanian side was requested to make political and administrative decisions regarding the following aspects:

- localization of a future disposal site.
- selection of the optimum technical system.
- selection of the first priority projects.
- determination of the plan for organisational and institutional system improvements.

c. Workable Plan and Appropriate Technology

The Study Team formulated the most workable and implementable SWM plan for DSM city in close co-operation with the Tanzanian counterparts. Furthermore, in light of the financial limitation of the DCC, the Study Team developed the most appropriate technology for both technical and institutional systems for SWM in the area. The study

and the plan were formulated, especially, to present and support a self-sustainable SWM for the DSM City.

1.4 Key Assumptions

Key Assumptions used in the Study are as follows;

a. Socio-econimic Conditions

Items	Unit	Descriptions			
		1996	1999	2002	2005
1. Population					
Population in DSM	persons	2,261,000	2,859,000	3,736,000	5,066,000
Population of the Study Area	persons	2,030,000	2,455,000	3,066,000	3,966,000
Annual Growth Rate	%/year	7.2	7.2	7.2	7.2
2. Economy					
GDP	mill. Tsh	1,830,072	2,118,537	2,452,471	2,839,042
Annual Increase Rate of GDP in Real Term	%	5.0	5.0	5.0	5.0
Future Budget Scale of the DCC	mill. Tsh	5,910	8,708	12,978	20,290
Income Level of the Citizens	Tsh/month	90,000	104,200	120,600	139,600
Currency Exchange Rate		1 US$ = 597.8 Tsh = 120.85 Japanese Yen			
Inflation Rate	%	10.0	10.0	10.0	10.0

b. Waste amount and Composition

Items	Unit	1996	1999	2002	2005
1. Waste Amount					
1-1 Waste Generation Rates					
Household Waste	kg/cap/d	0.698	0.698	0.698	0.698
Commercial Waste	kg/cap/d	0.013	0.023	0.032	0.039
Institutional Waste	kg/cap/d	0.005	0.005	0.005	0.005
Market Waste	kg/cap/d	0.017	0.027	0.035	0.042
Street Sweeping Waste	kg/km/d	40.390	40.390	40.390	40.390
Informal Waste	kg/cap/d	0.139	0.119	0.102	0.088
1-2 Collection Rate of Household Waste	%	5	15	33	52
1-3 Growth Rate of Household Waste Generation		0	0	0	0
2. Waste Composition Forecast					
Kitchen Waste	%	45.03	43	42	42
Paper	%	4.07	5	7	8
Textile	%	1.10	1	1	1
Plastic	%	2.01	3	4	5
Grass	%	25.11	24	23	22
Leather and Rubber	%	0.71	1	1	1
Metal	%	1.65	2	2	2
Glass	%	2.90	3	3	3
Soil and Ceramics	%	0.33	1	1	1
Others	%	17.09	17	16	15
Total	%	100.00	100	100	100

c. Life Span of Equipment and Facilities

	Life Span (years)	Salvage value (%)
Container	5	0
Truck and Heavy Equipment	7	10
Machinery	15	0
Buildings	30	0

Note: The life span of civil works and facilities other than buildings for the disposal site depends on the period of its operation.

d. Executing Bodies and Financial Sources

Item \ Year	1997 Study time	2002 F/S Phase	2005 M/P Phase
1. Responsible Body	Cleansing unit, Health dept.	Waste Management Authority	Waste Management Authority
2. Operation System of Collection Service			
UA	Concessionaires	DCC (contractors)	DCC (contractors)
SUPA	DCC and concessionaires	DCC (direct & contractors)	DCC (contractors)
SUUA	DCC and concessionaires	DCC (direct)	DCC (direct & contractors)
RA	No service	Self Disposal	DCC (DCC direct)
3. Operation System of Disposal Sites			
• Vinguguti	DCC direct	Closed	Closed
• Kunduchi	-	DCC direct	Kinondoni Municipality
• Ilala	-	-	Ilala Municipality
• Temeke	-	-	Temeke Municipality
4. Contract System	Concession	Tender by ward Lump sum contract	Tender by ward Lump sum contract
5. RCC	collected by concessionaires	Alternative 1 Joint-billing with water supply Alternative 2 Special RCC collected by DCC	Alternative 1 Joint-billing with water supply Alternative 2 Special RCC collected by DCC
6. Financial Sources	DCC's service area: DCC's budget Contractor's service area: RCC collected by concessionnaires	Whole area: Special fund from city taxes and RCC or special RCC	Whole area: Special fund from city taxes and RCC or special RCC

1.5 Work Processes of the Study

The Study commenced in March 1996 based on the Scope of Work (S/W) signed between the Tanzanian Government and JICA in October 1995 and ended in September 1997.

This Study consisted of the following three phases.

Phase I (Mar. - Aug. 1996): Assessment of urban environment sanitation of DSM

Phase II (May - Nov. 1996): Formulation of the Solid Waste Management Master Plan

Phase III (Dec. - Aug. 1997): Feasibility Study for the First priority Project proposed in the Master Plan

1.6 Members of the Study Team

The JICA Study Team consisted of the members listed below.

Expert	Assignment
Susumu SHIMURA	Team Leader & Solid Waste Management Plan
Akira DOI	Urban Environment Sanitation (1) & Collection and Transport Plan
Jacob Skovgaard Pedersen	Intermediate Treatment Plan
Precha CHUNTAKORN	Analysis of Solid Waste Composition
Takeshi TOMIYASU	Final Disposal Plan & Facility Design
Luiz Edmundo Costa Leite	Organisational and Institutional Development Plan
Takehiko OGAWA	Financial and Economic Analysis
Sean Matthew Finnigan	Environmental Impact Assessment & Urban Environment Sanitation (2)
Hatsue MAEDA	Social Considerations & Public Education
Tomomi ABE	Administrative Co-ordinator

2 Current Situation of Municipal SWM

2.1 Profile of the Study Area

a. Profile of the City of DSM

The City of Dar es Salaam (DSM) is the capital of Tanzania and the centre of the country's economic and industrial activities. The population of the city in 1996 was 2.26 million which is about 8% of the national population. Although considered best in the country, the infrastructure (road networks, telecommunication, drainage system, etc.) of the city is very poor.

The city of DSM is divided into 3 administrative districts, namely Kinondoni District, Ilala district and Temeke District and consists of 52 wards.

The climate is tropical and the annual rainfall averages just over 1000 mm in two seasons; the rainy season during November and May, and dry season between June and October.

The fiscal year of the DSM city is the same as calendar year, i.e. from January to December. The revenue of the city budget in 1996 was very limited; only 5,900 million Tsh. in total which is equivalent to only 2,620 Tsh. (4.4 US$) per capita.

b. Classification of the Study Area

The Study area has various characteristics, varying according to location (ward). Based on this the study area was classified by wards into urban (UA), semi-urban planned developed (SUPA), semi-urban unplanned developed (SUUA) and rural area (RA), each area having different characteristics in terms of solid waste management. Thirty-nine (39) wards in the study area were classified as shown in Table 2-1 and in Figure 2-1 in accordance with these categories. This Study used this classification for the formulation of the SWM Master Plan.

Table 2-1: Classification of the Study Area

Area	District	Ward
1. Urban Area (UA)	Ilala	Kariakoo, Kisutu, Kivukoni, Mchafukoge, Upanga East, Upanga West
2. Semi-Urban Planned Developed Area (SUPA)	Ilala	Gerezani, Ilala, Jangwani, Mchikichini, Tabata
	Kinondoni	Kawe, Kinondoni, Magomeni, Msasani, Mwananyamala
	Temeke	Kurasini, Miburani, Temeke 14
3. Semi-Urban Unplanned Developed Area (SUUA)	Ilala	Buguruni, Kipawa, Vingunguti
	Kinondoni	Kigogo, Mabibo, Makurumula, Manzese, Mzimuni, Ndugumbi, Tandale
	Temeke	Keko, Mbagala, Mtoni, Yombo Vituka
4. Rural Area (RA)	Ilala	Ukonga
	Kinondoni	Goba, Kunduchi, Ubungo
	Temeke	Kigamboni, Vijibweni

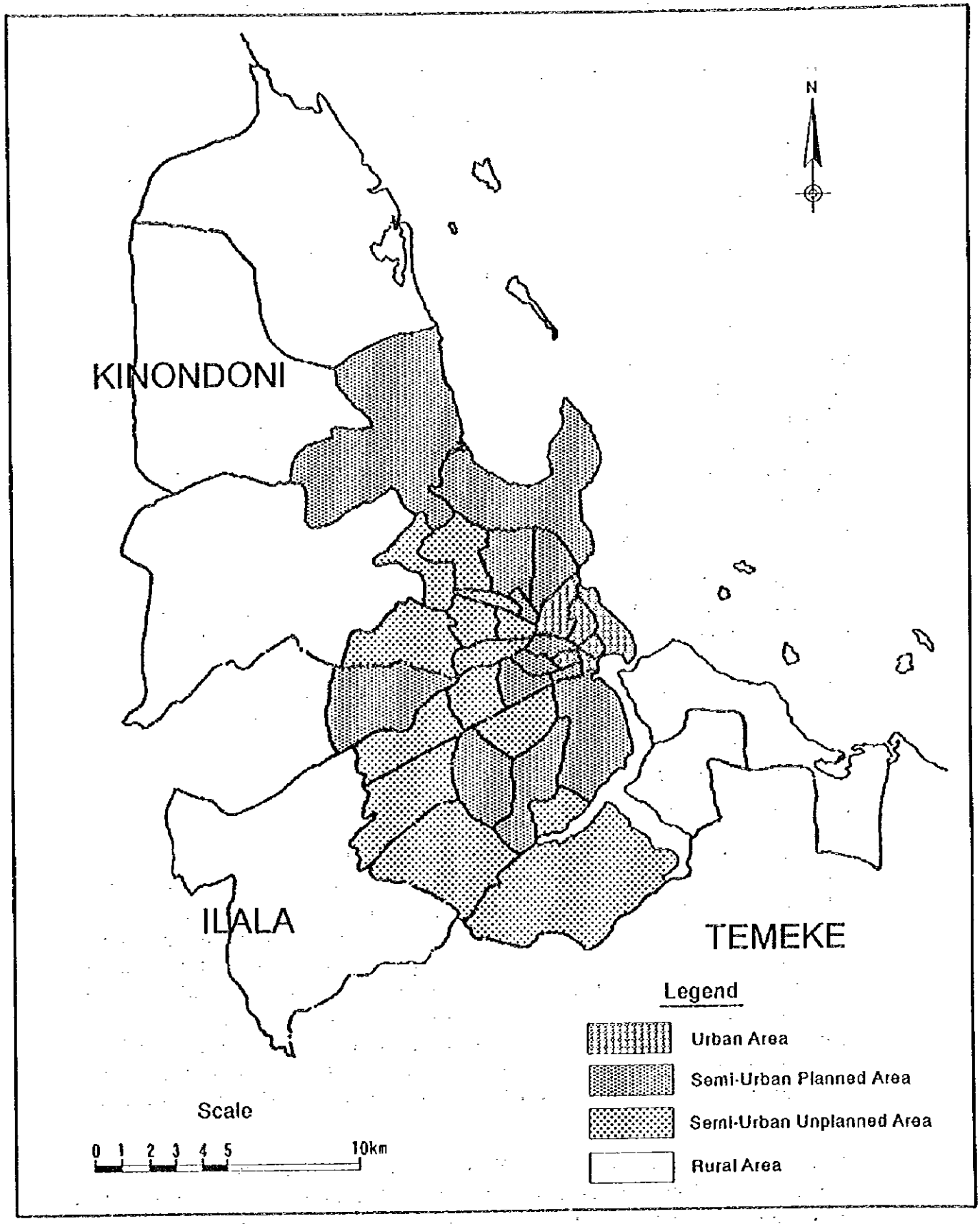

Figure 2-1: Area Classification Map of the Study Area

2.2 Assessment of the Current Urban Environment Sanitation

2.2.1 Current Urban Environmental Sanitation

Financial and human resources in Dar es Salaam City are extremely limited. Considering the vast administrative service needs to be provided with these limited resources, to apportion more resources solely on the improvement of the solid waste treatment service can not be justified from the administrative and citizens' viewpoint. Therefore, in order to assess the position of solid waste management service in the urban environment sanitation sector, this study conducted an assessment of the current urban environment sanitation. The result of this survey is summarised below.

a. Water Supply

The current condition of water supply was assessed to be extremely poor. The percentage of households having a tap in the house is only 22% and 60% of the citizen rely on public or neighbours' taps. The other 20% rely on a water source of unassured quality such as water vendors, wells, and streams. The average consumption of water is only 50 litre per person per day. It is extremely low compared with that of Japan where 250 litre of water per day is consumed.

b. Domestic Liquid Waste Management

Regarding night soil treatment, sewerage service rate is very low (only 5%) as only facilities constructed during the colonial period are in use now. However, the percentage of households without a toilet is estimated to be low (5%). This is because the total percentage of people using septic tanks, pit latrines, and cesspits, etc. is high (90%). Even though on-site treatment of night soil has reached a certain standard, the pit latrines and cesspits are considered to be the cause of groundwater contamination. This situation needs to be solved. Collection capacity and treatment condition of night soil is not satisfactory.

c. Solid Waste Management

Regarding waste treatment, the percentage of households receiving refuse collection service is only 8.1%. This percentage is too low for DSM, considering its degree of urbanisation and population density, etc. Current living conditions in DSM do not allow many people to dispose of their waste in a sanitary manner by themselves. However, the majority of people are forced to practice self-disposal of waste due to there being no waste collection services. In this regard, waste collection services are very different from other urban environment sanitation services such as water supply and sewerage system. More than 80% of households have access to a water supply and 95% of households have some kind of on-site facilities for night soil. On the other hand, 80-90% of households are forced to practice self-disposal of waste due to the lack of refuse collection services.

Although the primary objective of SWM is the immediate removal of waste from contact with the human population, the present waste collection rate is less than 10%. In addition, the current waste disposal site is located close to residential areas and the facilities are not operated in a sanitary manner at all. Therefore, the people living close to the disposal site are likely to be exposed to health risks.

d. Rainwater drainage

Although rainwater drainage facilities do not have a direct effect over the sanitary condition, they are closely related and this is most apparent during the rainy season. Frequent flooding in the rainy season is the cause of surface and underground water contamination as it washes away night soil from pit latrines. Furthermore, overflowing night soil from pit latrines is beyond the collection capacity of the 15 night soil collection vehicles owned by the city and in some cases it is not collected for two months.

Improvement of rainwater drainage canal is being encouraged by enhancing the quality of side ditches following road transformation projects carried out under Japan's aid and community based projects supervised by Sustainable Dar es Salaam Project (SDP). However these efforts are being hindered by people dumping waste in side ditches in areas such as Kariakoo, etc. where waste collection services are not provided. This causes blockage of the drains and flooding accelerates road deterioration in addition to sanitary problems in rainy season.

e. Road

Although road conditions do not have a direct effect over the sanitary condition, it is extremely poor. In addition to the fact that this contributes to air pollution caused by dust, etc., it hinders the efficiency of other public services, especially the waste collection and cesspit emptying services. Moreover, 50% of the citizens in Dar es Salaam are living in areas that have developed without any planning so that the roads in most of these districts are not laid out in a way that collection vehicles can gain access.

f. Market

Maintaining hygiene in the markets is essential because markets are focal points for food retail in DSM. In addition, markets are particularly vulnerable to inadequate waste collection services because they produce a large amount of organic wastes which attract flies, rats, mosquitoes, etc. Therefore, immediate removal of waste from markets is absolutely essential. However, the sanitary condition of 20 markets which the city is managing directly is bad and especially the condition of Tandale, Tandika and Buguruni markets are extremely poor.

Sanitary problems of the market can not be solved by improvement of waste treatment alone as bad maintenance of sewerage system and rainwater drainage is also a major cause. Improvement of waste collection system is the most effective short term improvement. At present, dump trucks are used for the collection of market waste. In order to reduce the time wasted in loading waste, wheel loaders are used. In this system, waste is collected when a certain amount of waste is accumulated since cost can be reduced to its minimum by raising the operation rate of a wheel loader. Therefore, frequency of waste collection from markets is once every week or two weeks and in the worst case, waste is not collected for more than a month. From the survey conducted in 20 markets, there was a strong request for reintroducing the conventional container truck system.

2.2.2 Identification of the Importance of SWM in UES

In order to assess the urban environment sanitation (UES) condition of Dar es Salaam, quantitative surveys such as water quality, air quality, noise, vibration, traffic and soil contamination surveys were conducted. In addition, the current conditions of public services related to the UES were investigated based on existing data. Using these results and taking the results of Public Opinion Survey (POS) into account, the current condition of UES is assessed as described previously and the importance of SWM in the UES was identified. The main conclusions are as follows.

- Since all public service for the UES are closely interrelated, it is necessary to improve all public services in a balanced way to improve the UES.
- Looking at the current conditions of public services, improvement of water supply should be given first priority followed by improvement of SWM. In fact, improvement of SWM will result in a higher quality of other public services, e.g. reduced flooding due to fewer blocked drains; reduced water pollution of surface and groundwater; increased road life by decreasing submergence; reduced outbreak of diseases by curtailing the number of flies, mosquitoes, rats, etc. and making markets more hygienic.
- The improvement of SWM is strongly demanded by the public according to the POS results which showed that lack of SWM is seen as a serious problem, being ranked second in order of priority for improvement.

2.3 Field Surveys

a. Field Surveys

In order to sufficiently understand the current situation of SWM in DSM, the following field surveys were conducted.

- Waste amount and composition survey.
- Public opinion survey.
- Topographical and environmental survey for the assessment of the Vinguguti disposal site.
- Survey on present industrial solid waste management.
- Survey on present medical solid waste management.
- Compost market survey.
- Time & motion survey.
- Survey on illegal dumping.
- Survey on scavengers.
- Maintenance of vehicle and equipment.
- Installation and operation of a weighbridge.

b. Waste Amount and Composition Survey

The present generation rates of wastes in DSM derived from the field surveys are presented in the table below.

Table 2-2: Waste Generation Rates in DSM in 1996

Type of Wastes	Sub-category	Unit	WAGR
Household Waste		g/cap/d	698
Commercial Waste	Restaurants	g/restaurant/d	37,450
	Others	g/shop/d	906
	Guest houses	g/guest house/d	405
	Hotels	g/hotel/d	744
Institutional Waste		g/worker/d	172
Market Waste	Retail shops	g/shop/d	3,120
	Wholesale shops	g/shop/d	5,360
Street Sweeping Waste		g/km/d	40,390

The present composition of wastes in DSM derived from the field surveys are presented in Table 2-3.

Table 2-3: Waste Composition in 1996

	Components	Household	Commercial		Institution	Market	Street
			Restaurant	Others			
Physical composition	Kitchen	42.0 %	93.4 %	0.8 %	9..2 %	59.6 %	23.0 %
	Paper	3.1 %	1.9 %	71.6 %	71.5 %	3.2 %	17.5 %
	Textile	1.2 %	1.2 %	2.5 %	2.6 %	0.5 %	1.3 %
	Plastic	2.2 %	1.7 %	8.4 %	6.1 %	0.9 %	6.4 %
	Grass & Wood	25.3 %	0.8 %	1.5 %	0.9 %	27.2 %	19.0 %
	Leather & Rubber	0.9 %	0.0 %	0.5 %	0.0 %	0.0 %	2.4 %
	Metal	2.0 %	0.5 %	5.3%	4.1 %	0.1 %	2.5 %
	Glass	3.5 %	0.6 %	0.0 %	3.3 %	0.3 %	1.0 %
	Ceramic & Stone	0.4 %	0.0 %	0.5 %	0.7 %	0.2 %	0.9 %
	Others	19.4 %	0.0 %	8.9 %	1.7 %	8.2 %	26.1 %
	Total	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %
Apparent Specific Gravity		0.39	0.64	0.03	0.05	0.23	0.22
Moisture Content		31.05 %	55.16 %	22.11 %	8.78 %	53.12 %	15.51 %

2.4 Current Situation of Municipal SWM

Based on the results obtained by the field surveys, the current situation of SWM in DSM is summarised and presented in Table 3-7.

The current waste stream is estimated based on the results of field surveys, and is presented in Figure 2-2.

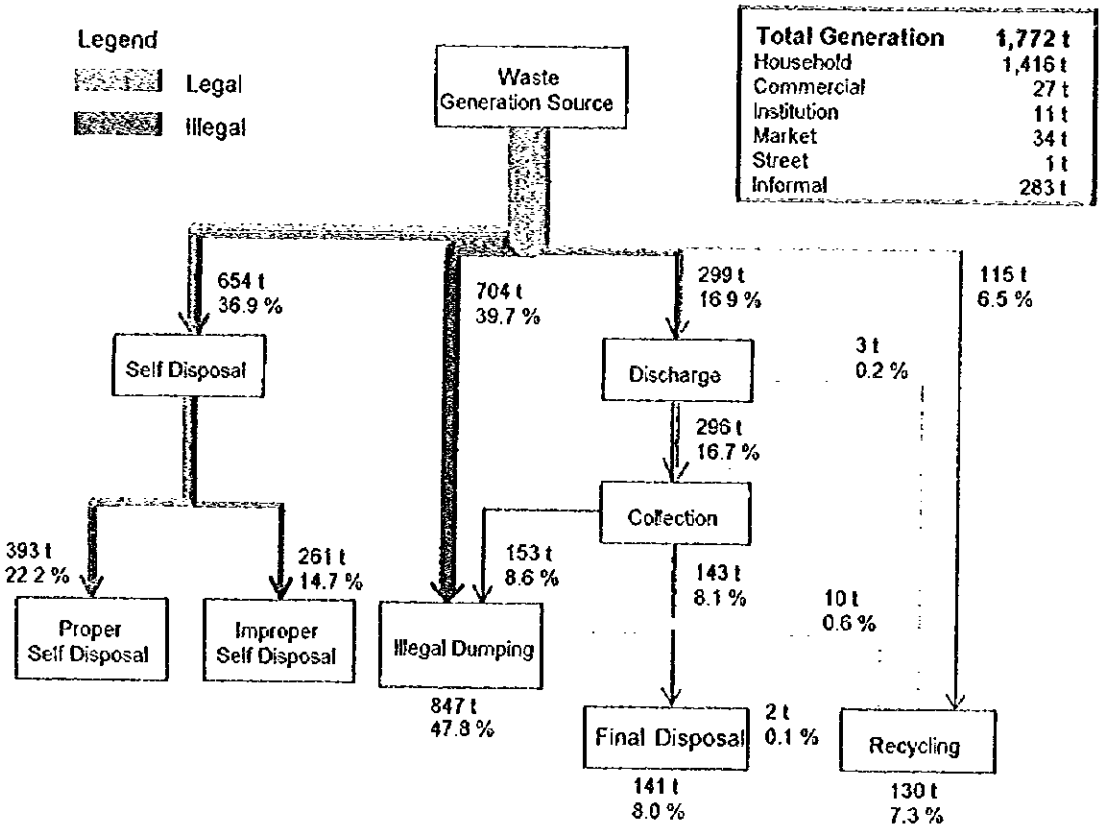

Figure 2-2: Current Waste Stream (1996)

2.5 Evaluation of Current Municipal SWM

The evaluation of the current municipal SWM in DSM is summarised below.

a. Technical System

The present SWM technical system in DSM is the simplest system, composed only of collection and transportation of waste with several 7 to 8 tonne tipper trucks and landfilling, without any major intermediate treatment or recycling systems. The first priority objective of SWM is always to maintain sanitary conditions in the city by immediately removing waste generated from the human living space. The present waste collection rate in DSM is however only 8.1% of the total waste generation. Therefore, the first priority of the SWM in DSM should be given to the improvement of present collection, transportation and final disposal systems.

Some of the causes for the present low waste collection rate are lack of equipment and decrepit equipment, lack of spare parts and fuel. While the population in DSM has increased by 1.6 times, the average daily waste generation rate per capita has increased by 1.85 times from 377 g/cap/day to 698 g/cap/day between 1989-96. The only equipment procured during this period was six compactor trucks donated in 1991 by the Italian government. However, most of these were out of order within six months of their arrival due to their unsuitability for use in DSM.

The number of waste collection trucks operated by the DCC in February 1997 was approximately ten 8-tonne tipper trucks all donated in 1987 by the Japanese government. The fact that about 10 out of 33 trucks (30 tipper trucks and 3 skip trucks), still work after nine years implies that these trucks are appropriate for the inferior road conditions in DSM. Further the existing skills and technology for vehicle/equipment maintenance and repair have reached a satisfactory level.

The accumulation of market waste, caused by the irregular collection, is a critical problem. Presently, a wheel loader is used for loading market waste as all 3 skip trucks donated in 1987 are now not working. This is due to excessive use as the number of trips made by skip trucks was about 3 times greater than for tipper trucks and they were in a very bad condition nine years after arrival. It was not because the skip trucks were inappropriate for the conditions in DSM.

Few environmental protection measures are being taken at the Vinguguti landfill site even though it is located very close to a densely populated residential area. Therefore, many residents are being forced to suffer from odour and vector (flies, mosquitoes, rats) problems produced by the landfill and also pollution (e.g. vibration, noise and dust) caused by refuse trucks. As the bulldozer at the landfill site is seldom working due to lack of fuel, even the spreading work of waste is not being carried out properly. This produces difficulties for refuse collection trucks when discharging waste at the landfill site.

The reserve volume of the landfill site as of 1st July 1996 was approximately 160,000 m^3, only enough for 1-2 more years. Therefore, to acquire land to develop a new disposal site is an urgent issue because the World Bank, due to associated environmental problems, has rejected financing for the expansion of the existing landfill site.

Although recycling activities in DSM are not formally organised, the estimated recycling waste amount is about 130 t/d, which constitutes 7.3 % of total waste generation. This figure is deemed to be large and shows that the present recycling activity is in fact active, considering the composition of recyclable wastes is only 12 %. However, the rapid growth in the waste generation amount observed during the last seven years implies that there is a necessity to commence promotion of recycling activities as a control measure for further waste generation.

Recently the demand for street sweeping works has increased greatly with the improvement of the road network. However, the capacity and organisation related to street sweeping works has not kept pace with the road improvements. It is necessary to improve the street sweeping system to maintain roads and also associated drainage and sewerage systems.

b. Institutional System

The institutional system of the solid waste management sector in Dar es Salaam city is very weak and outdated. This situation has been identified in previous reports and a great emphasis has been placed on its restructuring. Presently, this institutional system is in a transition phase with the private sector assuming a more important role, due mainly to the complete failure of the DCC solid waste management system to carry out its duties.

This transitional situation is also due to changes in the higher levels of the municipal government. It is now struggling through an important administrative and political transition, following the disbandment of the City Council by the Prime Minister and its replacement with a temporary City Commission, that is running the administrative and operational needs of Dar es Salaam. These dramatic changes were not part of any planned process but the government's response to what was perceived to be a crisis.

Although, the involvement of the private sector in solid waste management is increasing, its participation is not framed within a clear set of regulatory and control guidelines under a sound and stable policy. Instead, private sector involvement to date has been subject to misunderstandings and setbacks, but at least some service is being provided to areas of the city, which were either very poorly serviced before or not serviced at all.

The level of human resources in this institutional system is very limited, in terms of knowledge of solid waste management and public administration in general, as frequently is the case in most African nations, not to say in many other developing countries.

The final result of this situation is an institutional system in shambles and a very poor provision of SWM services throughout the city.

It should be noted that many studies have been done by foreign aid agencies in order to improve the performance of the solid waste management sector in Dar es Salaam. None, however, have given a clear and strong emphasis on building an adequate and reliable institutional system able to cope with the complexities, constraints and barriers of the situation found in Dar es Salaam.

This issue is being addressed now, since it has been understood that without a strong and sound institutional model any technical improvements will not be sustainable in the long term.

2.6 Significant Changes on SWM in DSM City after the Establishment of DSM City Commission

2.6.1 Significant Changes

Since the commencement of the study (March 1996), SWM in DSM city has changed significantly especially since June 28, 1996 when the Prime Minister dissolved the old DCC (Dar es Salaam City Council) and transferred its powers and functions to the present DCC (Dar es Salaam City Commission) due to the failure of the former to fulfil its responsibility regarding provision of SWM, etc. Taking into consideration the situation up to August 1996, the SWM master plan (draft) for DSM city was formulated in the IT/R. However, from August 1996 to February 1997 further significant changes on SWM in DSM city have occurred as described below.

a. Contract Method and Refuse Collection Charge (RCC)

In July 1997 the present DCC expanded its concessionnaire operation areas from 5 wards to 25 wards out of 39 wards in the study area. The method of the contract with private enterprises is called a concession. In the concession contract the contractors are granted the rights to collect RCC from customers by themselves for their operation.

Although the number of private refuse collection companies was increased from one to five in July 1996, with expansion of private collection areas, one of them had stopped its operation before February 1997. In addition, the area serviced by Multinet which has been working since 1994 was reduced from 10 to 5 wards, which is exactly the same number of wards they had until July 1996. According to the data measured by the Vingunguti weighbridge between 11 and 28 February 1997, the average daily amount of waste disposed by 3 private companies was only 6 tonnes. Therefore, the increase in the waste collection amount achieved by the expansion plan of private refuse collection service was found to be only 6 tonnes/day, equivalent to 4 % of the total refuse collection amount.

The latest RCC (refuse collection charge) collection rates of the two main concessionaires, Multinet and Mazingira, is very low as shown in the table below. As a result of the extremely low collection rate in Kariakoo and the neighbouring 4 wards, Multinet withdrew its services from these five wards in November 1996 after four months. The situation of Mazingira, which is presently providing services only to the commercial sector on a point to point basis, is much worse than Multinet. In fact, the latest information from the Vingunguti dumping site showed that Mazingira disposed only 26.3 tons (2.4 tonnes/day) of wastes by 15 trips over a 11 day period from February 11 to February 21, which represents serious failures to fulfil the demands of the concessionaire contract.

Table 2-4: Latest RCC Collection Rates of Multinet and Mazingira

Concessionaire	Invoiced Amount (Tsh.)	Paid Amount (Tsh.)	RCC Collection Rate (%)
Multinet	169,397,200	40,699,731	24.0
Mazingira	50,932,250	2,499,500	4.9

Source: Multinet and Mazingira Operational Reports
Note: The Multinet data is based on three-months operation from October to December 1996 for 5 wards in UA for which they still maintain the concession contract in February 1997. The Mazingira data is based on three-months operation from August to October 1996 for 5 wards in SUPA.

b Revenue Generation Efforts by the Present DCC

Significant increases in revenue generation have been achieved since the transfer of the city administration to the new DCC. The table below shows changes in DCC's revenues in 1995 (actual), 1996 (forecast) and 1997 (budget). Although in 1996 the subsidy from the central government was smaller than that of the previous year, the tax revenue of DCC skyrocketed from Tsh. 1.0 billion in 1995 to Tsh. 2.5 billion in 1996. The major contributors to this increase are improvement in the collection of the development levy and property tax. This fact shows that the new DCC has been making efforts to increase their income and has succeeded.

It is projected in the 1997 budget that the tax revenue will further drastically increase due mainly to further improvement of collection of development levy, property tax and the newly introduced city service levy.

Table 2-5: Changes in DCC's Revenues from 1995 to 1997

Revenue Sources	1995 (Actual) (Million Tsh.)	1996 (Provisional) (Million Tsh.)	1997 (Budget) (Million Tsh.)	1996 Growth Rate (%)	1997 Growth Rate (%)
Development Levy	140.5	556.6	2,500.0	396.2	449.2
Property Tax	60.1	559.5	2,800.0	931.0	500.5
Petrol Levy	100.0	0.0	0.0	0.0	0.0
Service Levy	191.4	353.1	5,000.0	184.5	1416.0
Hotel Levy	80.5	113.7	158.9	141.2	139.8
Business Licenses	137.5	473.1	542.7	344.1	114.7
Market Dues	26.2	165.9	73.0	633.2	44.0
Total/Average for 7 Major Revenue Sources	**736.2**	**2,221.9**	**11,074.6**	**301.8**	**498.0**
Income from All City Tax	**1,016**	**2,540**	**11,831**	**250.0**	**465.8**
Income from Central Gov.	**4,972**	**3,370**	**7,894**	**67.8**	**234.2**
Total DCC's Revenues	**6,076**	**5,919**	**19,846**	**97.4**	**335.3**

Source: DCC's Budget Abstract for 1995 and 1996, and DCC's 1997 Budget

c. Dissolution of NUWA and Establishment of DAWASA

On 25th February 1997, the Minister for Water announced the formal dissolution of NUWA (National Urban Water Authority), and that the new established DAWASA (Dar es Salaam Water and Sewerage Authority) will take over all of its activities in DSM city and in the coastal region.

The dissolution of NUWA is due to:

i. failure to supply the present water demand.
ii. unacceptable water losses.
iii. ineffective billing and poor revenue collection.
iv. absence of distribution network mapping.
v. inability to identify its customers.

DAWASA will also incorporate DSSD (Dar es Salaam Sewerage and Sanitation Department) which is under the DCC, and it will operate as a parastatal organisation under the Ministry of Water. While the board of directors will prepare the organisation structure and rules/regulations to govern the functions of DAWASA, the professional/technical side is directed by the central government to:

i. educate the public on water conservation;
ii. promptly take legal action against defaulters;
iii. carry out a house survey to identify DAWASA's customers;
iv. eliminate illegal water connections.

2.6.2 Conclusions obtained from the Significant Changes

Based on the above mentioned facts the Study Team concluded the following modifications should be necessary on the planning frameworks of the M/P.

i. It is impossible to achieve RCC collection rates of 80 % for Area A (UA/SUPA) and 60 % for Area B (SUUA/RA) which were assumed in the IT/R. Since the majority of the citizens are not willing or can not afford to pay for the refuse collection services, the expansion of the refuse collection service

area by means of direct billing of RCC by private concessionaires is not feasible.

ii. To achieve substantial RCC collection rates, a compulsory payment system is needed. It is proposed to apply a joint billing system for RCC with water/sewerage fees of the newly established DAWASA.

iii. If the joint billing is not feasible due to certain impediments, DCC shall collect RCC for commercial waste collection when business licenses are applied for and for special services such as door to door collection services to the high income households. The reason why RCC is not charged on the domestic waste collection is because the collection cost of the RCC should not exceed the value collected per client.

iv. In both proposals ii and iii above, the revenue collected through the RCC is not sufficient to cover the whole SWM costs. Since DCC increased city taxes revenues significantly, from the perspective of a tax payer, DCC is requested to provide better public services (including cleansing services) to the citizens. Therefore, DCC needs to provide a special fund for cleansing services from their tax revenue sources.

v. It is recommended that the present concession system (in which a concessionaire must collect RCC) should be replaced with the contracting out of services in which DCC would pay the contractor for the work done according to the contract.

vi. In the IT/R refuse collection services in Area A was planned to be provided by the private concessionaires while the services in Area B were to be done by the DCC in co-operation with NGOs/CBOs. However, due to the difficulty of expanding collection services by the concessionaires, the Team concluded the refuse collection services in Area A shall be provided by the DCC by contracting out its operation to private contractors. The priority of the service expansion is in the order of UA, SUPA, SUUA and RA in accordance with the degree of urbanisation. Meanwhile the provision of the primary collection by NGOs/CBOs using skips, which will be installed at accessible points for skip trucks, will not be necessary and it is to be done by each waste discharger, i.e. by public co-operation. The pilot project indicated that public co-operation for primary refuse collection using skips can be obtained if refuse collection services are sufficiently provided.

vii. It has been demonstrated that the expansion of refuse collection service areas by involving the private sector is difficult because private concessionaires can not collect sufficient revenue from RCC for the operation of their concession area to be financially sustainable. Consequently, the Team concludes the most important issues for the establishment of sustainable SWM in DSM city is to strengthen the capability of the DCC. In concrete terms, the following aspects shall be given priority.

- Reinforcement of the operational capability by the improvement of equipment and facilities and development of human resources.
- Establishment of financial sources by the DCC increasing its revenue generation efforts (such as city taxes, RCC, etc.)