

3. ENHANCEMENT OF IMPLEMENTING ORGANIZATION

3.1 Proposed Structure of Implementing Organization

3.1.1 Project Components of the Feasibility Study

- (1) Innovation of Waste Collection System
- (2) Enhancement of Waste Transport System
- (3) Improvement of Waste Transfer System (Male' and Villingili)
- (4) Enhancement of Public Space Cleaning (Replacement of Equipment for Port Area Cleaning)
- (5) Environmental Improvement of Existing Thilafusi Island
- (6) Construction of New Landfill Site in Thilafusi Island
- (7) Promotion of Material Recycling

3.1.2 Arrangements of the SWM Service Functions in the Metropolitan Area

If the SWM service that consists of systems from collection, transfer, transport to final disposal is re-defined from the viewpoint of service content to clients, it can be said as follows.

The solid waste generated in Male' is broadly categorised by four kinds of waste, i.e. residential, commercial, business and construction waste. The responsible organization for each type of waste is defined in Table 3-1. The Municipality has responsibility for collection services of the residential waste and supervising & monitoring of waste collection & transportation of all the other types of waste except construction waste. Therefore, the waste construction plan dealt under this section shall be formulated with the residential waste.

Table 3-1. The Types of Waste and the Responsible Organization

The Types of Waste		Implementation Body		Supervision & Monitoring	
		Collection & Haulage	Transportation & Disposal	Collection & Haulage	Transportation & Disposal
Municipal Waste	Residential	The Municipality	MCPW	The Municipality	MCPW
	Commercial	Generator	MCPW	The Municipality	MCPW
Industrial Waste	Business	Industry	Generator	MCPW	The Municipality
		Market	Generator	MCPW	The Municipality
	Construction	Generator	MCPW	MCPW	MCPW

The collection plan is formulated only for the residential waste under the initiative of the Municipality.

The other types of waste, i.e. commercial and business waste shall be carried into the transfer station by the waste generators. The waste generators should have a responsibility of collection and hauling of their own waste, hence they can make a contract as to the delivery of collection service with private companies (include handcart) or with the Municipality. The system of the private collection services is in operation now. The collection services will provide the door to door collection.

Ministry of Construction and Public Works (MCPW) has responsibility for supervising and monitoring as to the construction waste. MCPW should monitor the large-scale development and construction plan. MCPW has to guide the suitable collection & hauling system to the contractors. The contractors have to submit the waste hauling plan before commencement of the construction work. And also, MCPW has responsibility for transportation and final disposal of all kinds of waste except the special waste.

3.1.3 Source of Revenue of the Project

Such an income that fills a necessary cost, for maintaining of the organization that takes charge of SWM is indispensable.

As a world wide pattern, cost of the SWM is borne by beneficiaries.

The most normal case provides for cost of municipal waste disposal with public finance expenditure on the one hand, primary revenue source of public finance comes from taxes including personal income tax on the other hand. Therefore it can be said that beneficiaries of SWM are taxpayers at the same time as far as municipal waste concerned.

Thereupon, the Study Team carried out a survey on the idea that the Government could allocate certain tax revenue to the powerful financial resources of the project. Then, it becomes clear that the Government of Maldives is fairly negative to the introduction of a new tax in general.

Incidentally, the tax that Government of Maldives at present introduces is only 4 of the export duty, import duty, banking transaction tax and tourism tax.

As a result, the method that imposes SWM charges directly to beneficiaries is studied.

By introduction of the Beneficiary Pay Principle, the SWM service being served upon free today should be turned to upon pay in the future.

3.1.4 Alternative Plan of Implementing Organizations

The Implementing Organizations shall execute the scope of undertakings as shown in the Table 3-1.

The Study Team studied framework of the implementing organization of the project by taking account of various aspects of circumstances as described under.

The basic requirements to the implementing organization are, generally speaking, capacity of the supply of adequate service and financial sustainability.

In this project, competence of collection of waste service charges is another fundamental requirement to the implementing organizations. Therefore, the organizations should pass these three criteria; (1) adequate service, (2) financial sustainability and (3) collection of charges on SWM.

The following three alternatives of the organization structures are to be studied.

- (A) Enhancement of existing organizations
- (B) Establishment of State Owned Enterprise (SOE)
- (C) Combination of Administrations and SOE

The Government of Maldives (the Ministry of Finance and Treasury) suggests its policy relates to the project as; (1) subsidy system would not be desirable, (2) MCPW would not be allowed to collect charges on the SWM. Alternative Plan A may not pass the criteria about mentioned criterion (3).

Although it may be a supreme plan because it is the smallest in terms of cost with same functionability among three alternatives, if MCPW could be able to collect charges on SWM.

Alternative Plan B, establishing implementing organization of a SOE, would be one of the candidates, because there are successful examples in similar sectors such as electricity, water supply and sewage. However, there still remain two difficult issues; less profitability of the SWM project in comparison with those of existing SOEs, and pre-secured land tenure of the landfill site which is reef of under development now to be land neatly in the future.

Alternative Plan C is able to supplement the said questions of Alternative Plan B to some degree. But there still remain some issues; (1) whether the collection of charges by the Municipality shall be carried out smoothly or not? (2) whether the co-ordination among administrations and SOE shall be carried out smoothly or not ?, and so on.

Emphasis should be put on the key role of Male' Municipality that could secure the agreement with residents in locating new type waste collection vehicles on the near of their houses.

As no critical difficulty seems to be brought in Alternative Plan C, the study team recommends the alternative as the most adequate organization plan among three Alternative Plans.

3.1.5 Strengthening of Implementing Organization

In the framework of the organization, the Male' Municipality, the MCPW and SOB, shall carry out SWM of Male' and vicinity, the role and main job of each organization shall be as described hereunder.

(1) Male' Municipality

a. Proposed Duty on the SWM

The Male' Municipality is not responsible for overall disposal of waste in principle. The Municipality shall play its role in collection of municipal waste definitely.

Those are;

- (1) Collection of municipal waste (residential waste, commercial waste)
- (2) Collection of charge on the SWM.
- (3) Enlightenment of citizens regarding reduction of waste discharge, reusing of waste materials and recycling of waste materials.

b. Proposed Assignment

Assignment that the Male' Municipality should implement in preparatory and implementation stages are as follows. Those are;

In Preparatory Stage:

- (1) to make a booklet on the new SWM plan of the Municipality to distribute it to citizens for the purpose of propaganda.
- (2) to form consensus with residents about set up of new type waste vehicles in the planned area.
- (3) to form consensus with citizens about Beneficially Pay Principle (introduction of charges on SWM)
- (4) to agree with MCPW in allocation of responsibilities on SWM and in amount of service charge that the Municipality shall be imposed by MCPW on disposal of wastes collected by the Municipality.

Implementation Stage:

- (1) to make waste collection plan
- (2) to arrange machines, vehicles and equipment for collection service.
- (3) to secure personnel required
- (4) to operate and to manage the waste collection system
- (5) to collect SWM charge on municipal waste collection
- (6) to maintain and to repair machines and equipment
- (7) to develop capacity of staffs and engineers thorough training of them
- (8) to enlighten citizens on SWM
- (9) to improve financial status of the organization

c. Establishment and Reinforcement of Organization

i) Establishment of New Organization

The Study Team proposed that Male' Municipality should establish a new organization to carry out the advanced new collection service.

Some staffs and workers of the Community Service Section of the Municipality should be made change from the section to be reorganized into another new organization, so that the waste collection corps can be devoted into the SWM services.

Necessary machines and equipment shall be newly procured.

Twelve vehicles shall be newly introduced to carry out proposed new collection service.

Depreciation for these machines and equipment shall be burdened by the expenditure budget of Male' Municipality.

ii) Major Jobs of New Organization

New organization shall;

- take the initiative to policy and regulations of the metropolitan area's SWM .
- tackle with the subject regarding reduction, reusing and recycling of wastes.
- offer the minimum collection service to all the households in Male'.
- impose SWM service charge to all beneficiaries on SWM of municipal waste.
- make various efforts to keep financial sustainability of the collection work.
- provide a high quality collection service upon full recovery cost charge.

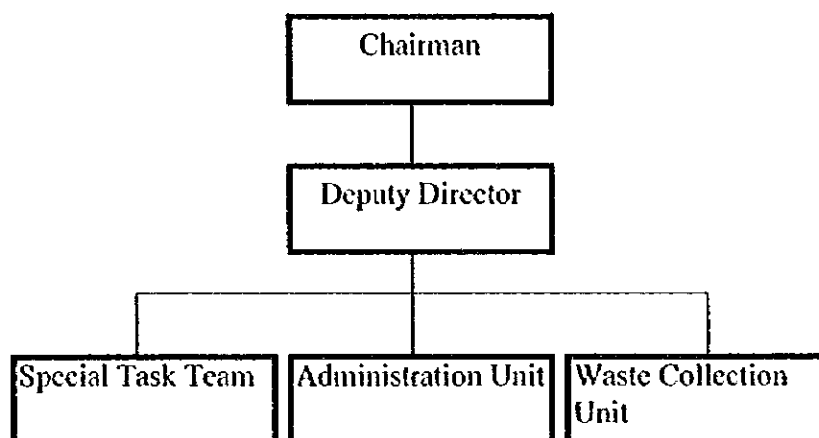
iii) Allocation of Personnel

Based on the estimation of manpower requirement of the project, 60 persons should be allocated in the jobs of the new organization. Those persons shall be organized based on the functional requirement as shown below.

Management function	: 6
Special task force function	: 8
Waste collection routine function	: 46
Total	: 60

iv) Organization Chart

Organization Chart of Waste Management Section of Male' Municipality



d. Work Plan

i) Service Plan

	Unit	1999	2000	2001	2002	2003
CLIENT NUMBER						
household	house	--	--	--	--	5701
institution/industry	unit	--	--	--	--	423
COLLECTION VOLUME						
household in Male'	t/y	--	--	--	--	23470
institution/business	t/y	--	--	--	--	10038
household in Villingili	t/y	--	--	--	--	949
institution/business	t/y	--	--	--	--	--
total	t/y	--	--	--	--	34456

ii) Performance Plan

(a) High-Performance Plan

(Unit: Million Rf/y, Rf/t)

	1999	2000	2001	2002	2003	(unit value)
					(Million Rf/y)	(Rf/t)
CHARGE						
Charge from household	-	-	-	-	8.547	350.0
Charge from business	-	-	-	-	3.513	350.0
Total	-	-	-	-	12.060	350.0
OM COST						
Collection cost	-	-	-	-	2.668	77.4
Disposal charge to SOE	-	-	-	-	8.097	235.0
Total	-	-	-	-	10.765	312.4
DEPRICIATION	-	-	-	-	1.931	56.0
SURPLUS						
Before depreciation	-	-	-	-	1.295	37.6
after depreciation	-	-	-	-	-0.636	-18.5

(b) Minimum-Performance Plan

(Unit: Million Rf/y, Rf/t)

	1999	2000	2001	2002	2003	(unit value)
					(Million Rf/y)	(Rf/t)
CHARGE						
Charge from household	-	-	-	-	7.692	315.0
Charge from business	-	-	-	-	3.162	315.0
Total	-	-	-	-	10.854	315.0
OM COST						
Collection cost	-	-	-	-	2.668	77.4
Disposal charge to SOE	-	-	-	-	8.097	235.0
Total	-	-	-	-	10.765	312.4
DEPRICIATION	-	-	-	-	1.931	56.0
SURPLUS						
Before depreciation	-	-	-	-	0.089	2.6
after depreciation	-	-	-	-	-1.842	-53.5

(2) State Owned Enterprise of SWM (SOE)

a. Proposed Duty on the SWM

SOE shall substitute for the common duty of MCPW on SWM and shall take charge of the part of the operation among the Ministry's scope of the SWM service.

SOE shall play its role definitely in the SWM of transportation and final disposal.

In other words, activities of SOE shall be;

- (1) SWM from reception, storage, transport, to final disposal of all waste, except hazardous and hospital waste.
- (2) collection of charges on SWM services mentioned above.
- (3) composting
- (4) treatment and disposal of special waste such as waste batteries and waste oil.

b. Proposed Assignment

Proposed assignment that SOE should implement in implementation stage are as follows.

- (1) arrangement of machines, vehicles, vessels and equipment for SWM service.
- (2) securing required personnel.
- (3) operation and management of machines, vehicles, vessels and equipment provided for SWM services of the SOE.
- (4) imposition of charges upon waste transportation and disposal to waste generators.
- (5) maintenance of machines, vehicles, vessels and equipment by outsourcing.
- (6) capacity development through training of staffs and engineers.
- (7) composting and free distribution of the compost.
- (8) treatment and disposal of special waste.
- (9) financial management of the organization.

c. Establishment and Reinforcement of Organization

i) Establishment of New Organization

To establish a state owned enterprise is identified as the matter that needs a political decision. Hence it is only possibly promoted during a government restructuring phase. The time when the restructuring phase takes place can not be foreseen at present because it might be concluded through the overall aspects of political needs accumulated in the government. In this connection, there is a very limited possibility that the new organization is established by the target year of 2003.

However, necessity of the new organization grows bigger as the waste volume increases in proportion to the expansion of the capital region. Therefore, it is still recommended to establish a new organization as early as possible. Before the establishment, the expected function to the new organization must be undertaken by MCPW and Male' Municipality according to the present task allocation.

ii) Procurement of Machines and Equipment

Necessary machines and equipment except barges shall be newly procured.

The truck scale, which is indispensable device for measuring of waste, shall be introduced for the first time at the transfer station.

Depreciation for these machines and equipment shall be burdened by the SOE account.

iii) Cost Saving by Outsourcing

Pretty large numbers of employees for maintenance works shall be saved through outsourcing of the works to WMS/MCPW; so that downsizing of the SOE shall be resulted.

iv) Allocation of Staffs and Workers

Based on the estimation of manpower requirement of the project, 103 persons excluding board members should be allocated to the enterprise. Those persons shall be organized based on the functional requirement as shown below.

Administration	:	3
Male' T/S	:	23
Vehicle transport operation	:	36
Ship transport operation	:	15
Final disposal	:	26
Total	:	103

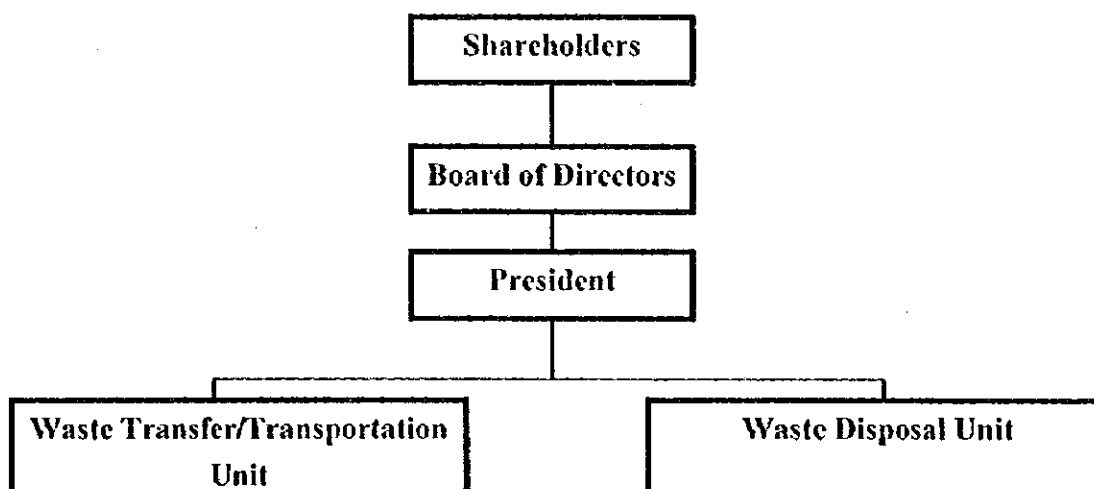
v) Board of Directors

MCPW shall appoint the president and directors of the enterprise.

Two outside directors shall be invited from MHAHE and Male' Municipality.

iv) Organization Chart

Organization Chart of Proposed SOE is as follows.



d. Business Plan

i) Service Plan

	(unit: t/y)				
	1999	2000	2001	2002	2003
DISPOSAL VOLUME OF WASTE					
solid waste in Male'	--	--	--	--	78219.5
solid waste in Villingili	--	--	--	--	949
solid waste at Thilafusi	--	--	--	--	10950
Total	--	--	--	--	90118.5

ii) Business Performance Plan

(a) High-Performance Plan

	1999	2000	2001	2002	2003 (unit value)	
					(Million Rf/y)	(Rf/t)
INCOME						
solid waste in Male'	--	--	--	--	18.382	235.0
solid waste in Villingili	--	--	--	--	0.223	235.0
solid waste at Thilafusi	--	--	--	--	0.164	15.0
total	--	--	--	--	18.769	208.266
OM COST						
transportation cost	--	--	--	--	9.197	102.1
disposal cost	--	--	--	--	1.495	16.6
total	--	--	--	--	10.692	118.6
DEPRICIATION	--	--	--	--	8.04	89.2
PROFIT						
profit before depreciation	--	--	--	--	8.077	89.6
profit after depreciation	--	--	--	--	0.037	0.4

(b) Minimum-Performance Plan

	1999	2000	2001	2002	2003 (unit value)	
					(Million Rf/y)	(Rf/t)
INCOME						
solid waste in Male'	-	-	-	-	10.560	135.0
solid waste in Villingili	-	-	-	-	0.128	135.0
solid waste at Thilafusi	-	-	-	-	0.164	15.0
total	-	-	-	-	10.852	120.4
OM COST						
transportation cost	-	-	-	-	9.197	102.1
disposal cost	-	-	-	-	1.495	16.6
total	-	-	-	-	10.692	118.6
DEPRICIATION	-	-	-	-	8.04	89.2
PROFIT						
profit before depreciation	-	-	-	-	0.160	1.8
profit after depreciation	-	-	-	-	-7.880	-87.4

(3) MCPW

a. Proposed Duty on the SWM

MCPW takes original responsibility to transport and disposal of municipal and industrial waste in principle. However MCPW shall trust whole operation of SWM with SOE. Therefore the duty that MCPW accomplishes alone shall be as proposed as follows.

- (1) Consensus formation of Beneficiary Pay Principle with potential clients
- (2) Development and construction of new final landfill site
- (3) Construction of new Male' Transfer Station

b. Proposed Assignment

MCPW should implement following works in preparatory and implementation stages.

Preparatory Stage:

- (1) construction of a new landfill site
- (2) establishment of SOE
- (3) formation of consensus on Beneficially Pay Principle with potential clients
- (4) agreement with Male' Municipality in allocation among each responsibilities on SWM and in amount of service charge that the Municipality shall be imposed by MCPW(or SOE) on disposal of waste collected by the Municipality.

Implementation Stage:

- (1) phase construction of New Landfill Site
- (2) large-scale maintenance and repair of machines and equipment of SOE
- (3) guidance to SOE
- (4) plan of construction for next landfill site
- (5) budgeting for the above construction

c. Restructuring of the Existing Organization

WMS of MCPW shall be moved to SOE. Therefore operational organization of SWM shall be no longer organized other than construction of landfill site in MCPW.

Yet, MCPW should supervise and support SOE properly. The Minister of MCPW shall be directly in charge of this matter.

The Minister shall assign appropriate officials to be organized in task forces, responding to the matters concerned.

d. Work Plan

The major tasks related to SWM of MCPW shall be construction of final landfill site and new Transfer Station and should supervise and support SOE properly.

Construction and depreciation on the constructed facilities in the plan period shall be as shown below

i) Construction and Depreciation

	(unit: Million Rf)	
	Construction	Annual Depreciation
(a) Construction cost in New Thilafusi		
(1) Construction of 50 years Life	90.529	1.811
(2) Construction of 35 years Life	4.910	0.140
(3) Construction of 30 years Life	2.017	0.067
Sub-Total	97.456	2.018
(b) Construction Cost in Male'		
(1) Construction of 50 years Life	-	-
(2) Construction of 35 years Life	16.586	0.474
(3) Construction of 30 years Life	9.158	0.305
Sub-Total	25.744	0.779
Total	123.200	2.797

ii) Depreciation

(unit: Million Rf)

Period	Annual Dep.	Accumulated Dep.
2003	2.797	2.797
2004-2033	2.797	83.918
2034-2038	2.425	96.041
2039-2052	1.811	123.200

3.2 Acquisition and Training of Personnel

3.2.1 Required Personnel for Operation of Improved SWM System

Generally, the number of operation staff increase as to waste amount increase, upgrading of the level of services and inefficient operation systems. However, it is possible to decrease the number of staff as the system is operated by the efficient system composed of good management, sufficient numbers of equipment and well trained personnel required for individual operation of waste collection, transfer, and disposal.

The organisation and the numbers of staff in each work unit shown in Figure 3-1 is proposed to operate the improved SWM system taking into consideration of acquisition of capable staff, efficient work system and labour management. For the better management of operation of the system, the proposed organisation composed and divided into Administration, Special Task Team, Waste Collection, Waste Transfer and Transportation and Waste Disposal having the total number of 163 persons summarised in the following table.

Work Unit	Number of Required Staff (2003)
Administration	6
Special Task Team	8
Waste Collection	46
Waste Transfer and Transportation	78
Waste Disposal	25
Total	163

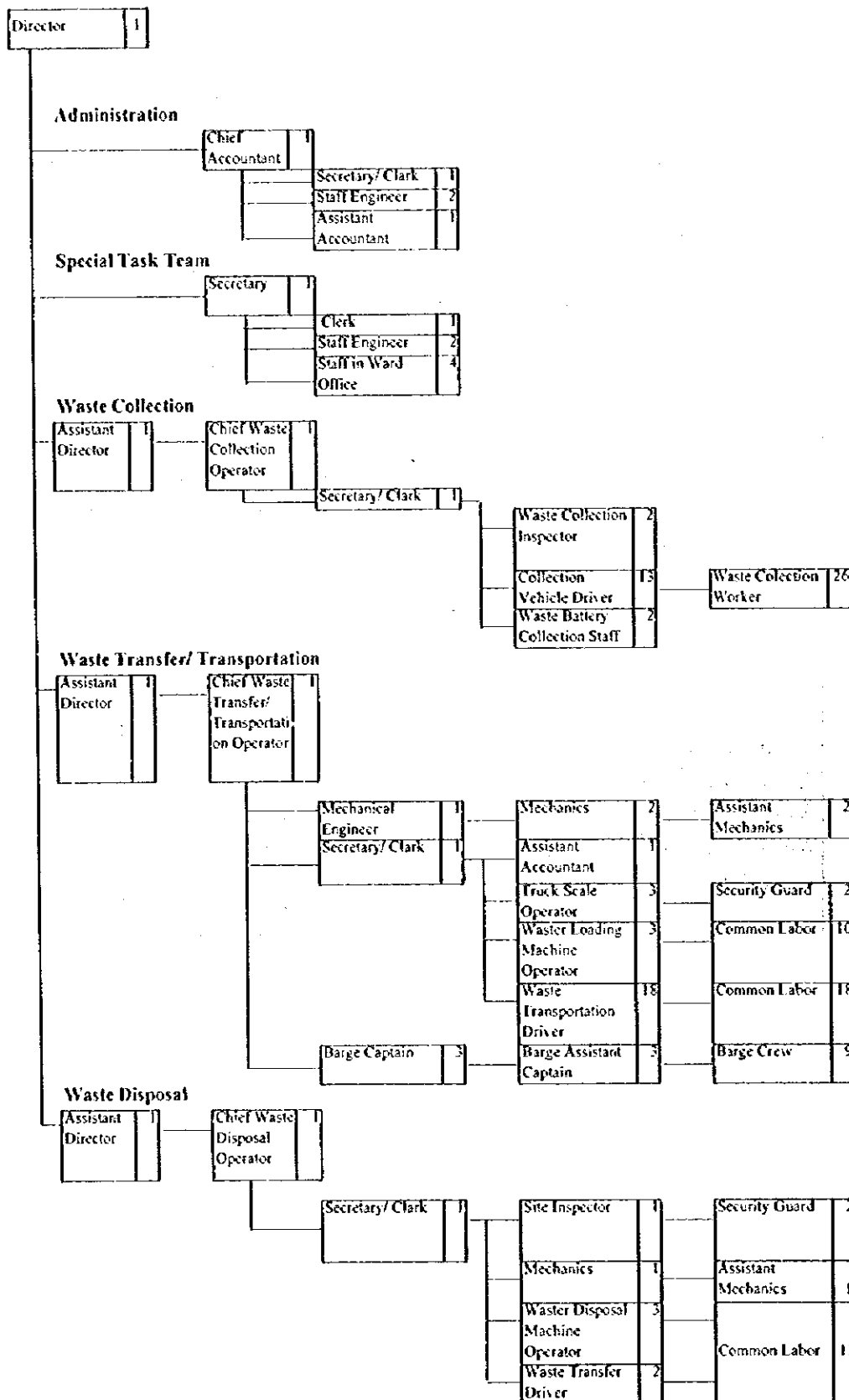


Figure 3-1 Organisation of Work Units for Operation of Improved SWM System (2003)

3.2.2 Work Responsibility of Individual Staff

Efficiency of work assigned to each staff increase when the staff understand his job clearly. The followings are the responsibilities allocated to each staff for operation of the improved SWM system.

Administration

Staff	Required Numbers of Staff	Responsibility
Deputy Director	1	All the responsibility for SWM activities in Male' including administration, formulation of policy, financing, operation, regulation, and all other activities necessary for establishment of effective and efficient SWM services for Male'.
Chief Accountant	1	Assists /Supports the deputy director and responsible for labour management of all the staff engaged in SWM services under the operation of the Administration Section Responsible for financial management of the SWM operation including budgeting, borrowing loan, waste charging and collection of waste charge.
Staff Engineer	2	Responsible for all engineering matters for planning, design, provisions of facilities and equipment, study & development of applicable technology and formulation of SWM policies in collaboration with the Directors.
Assistant Accountant	1	Assists /Supports the Chief Accountant and responsible for accounting of all the financial affairs of the Administration Section
Secretary/ Clerk	1	Assists /supports all the staff within the Administration Section to maintain efficient office work.

Special Task Team

Staff	Required Numbers of Staff	Responsibility
Secretary	1	Responsible for implementation of waste reduction/recycling programs by raising public awareness and participation through public campaign and education. Prepare comprehensive improvement plan for effective and efficient SWM operation. Reports status of the activities of the Section to the Director.
Staff Engineer	2	Responsible for study, preparation, coordination, implementation and monitoring of the SWM programs, i.e. public education, waste reduction and recycling programs in collaboration with the community groups and the SWM staff concerned. Provide marketing routes through collection of domestic & international information of reusable/ recyclable materials and assist to maintain the Buy-back Center
Clerk	1	Assists /supports all the staff within the Special Task Team to maintain efficient office work and implementation of the SWM programs. Responsible for keeping an account book within the Section.
Staff in Ward Office	4	Responsible for organising community groups to promote participation to the programs and for maintaining the links with the community groups. Responsible for implementation of the SWM programs by instructing/ guiding the community groups.

Waste Collection

Staff	Required Numbers of Staff	Responsibility
Assistant Director	1	All the responsibility for management and waste collection and transportation to the Transfer station. Assist/ Support the Deputy Director to perform effective and efficient SWM services for Male'. Report status of the activities to the Deputy Director. Responsible for labor management within the Waste Collection Section.
Chief Waste Collection Operator	1	Responsibility for performing waste collection, instructing the operational procedures, scheduling of drivers and collection workers and prepare daily record and reporting to the Deputy Director.
Waste Collection Inspector	2	Responsible for monitoring the performance of waste collection operation through inspection of the collection area and report to the Chief Waste Collection Operator.

Staff	Required Numbers of Staff	Responsibility
Secretary/ Clark	1	Assists /supports all the staff within the Waste Collection Section to maintain efficient office work and implementation of waste collection operation. Responsible for keeping an account book of the Section
Collection Vehicle Driver	13	Drives collection vehicle, checks the vehicle before and after operation, wash vehicle after operation and reports the result of operation and inspection to the Chief Waste Collection Operator
Waste Collection Worker	26	Loads solid waste from person carry waste and/or from communal collection points to the collection vehicle and sweeps waste droppings on the street.
Battery (dry cells) Collector	2	Collects dry cells from the storing places such as schools and any other place and bring in to the storage area in the Transfer Station.

Waste Transfer and Transportation

Staff	Required Numbers of Staff	Responsibility
Assistant Director	1	All the responsibility for management and operation for receiving, transferring, transporting wastes to the disposal site. Assist/ Support the Deputy Director to perform effective and efficient SWM services for Male'. Reporting the status of waste transfer and transporting operations to the Deputy Director. Responsible for labor management within the Section.
Mechanical Engineer	1	Responsible for maintaining all the vehicles, heavy machines and equipment provided for operation of the SWM services in Male. Prepares maintenance/ purchasing schedule to provide sufficient vehicles, machines and equipment provided for the SWM operation for Male'.
Chief Waste Transfer/ Transportation Operator	1	Responsible for performing waste transfer and transportation operation to the disposal site, instructs operational procedures for storage and transfer of wastes, scheduling of waste transportation drivers. Prepare daily record and report to the Deputy Director.
Secretary/ Clerk	1	Assists /supports all the staff within the Section to maintain efficient office work and implementation of waste transfer and transportation operation. Responsible for keeping an account book of the Section.

Staff	Required Numbers of Staff	Responsibility
Assistant Accountant	1	Responsible for settling the amount of chargeable carried-in waste and billing waste charge to the individuals/enterprises for waste transportation and disposal charges.
Truck Scale Operator	3	Operates truck scale to measure and records quantity and types of wastes, number plate of direct carried-in vehicles and directs the driver to the designated unloading area or container.
Mechanics	2	Responsible for repair and periodical maintenance of all the vehicles, machines and equipment provided for the SWM operation for Male'. Prepare maintenance work records and report to the Mechanical Engineer.
Assistant Mechanics	2	Assist the Mechanics for periodical maintenance of all the vehicles, machines and equipment provided for the SWM operation for Male'.
Waste Loading Machine Operator	3	Operates heavy machine for waste transfer and transportation, check condition of the machine before and after the operation and reports the result of operation and inspection to the Mechanics.
Waste Transportation Driver	18	Drives waste transportation vehicle, checks the vehicle before and after operation, wash vehicle after operation and reports the result of operation and inspection to the Mechanics.
Common Labour	28	Supports the waste transfer and transportation operation including control of vehicles entering/leaving from the Transfer Station, sweeping the droppings, washing the site and other auxiliary tasks to maintain cleanliness and sanitation of the Waste Transfer Station and surrounding area.
Security Guard	2	Inspects and monitor safety against strangers, robbers and so on to keep better security of the station.
Barge Captain	3	Responsible for operation and navigation of barge to and from the disposal site, check condition of the barge before and after the operation and prepare daily records of operation to report to the Mechanical Engineer.
Barge Assistant Captain	3	Assists Barge Captain for operation and navigation of barge and control Barge Crew.
Barge Crew	9	Works on come and leave alongside the quay. Clean and wash barge after operation of the day work.

Waste Disposal

Staff	Required Numbers of Staff	Responsibility
Assistant Director	1	All the responsibility for management and operation of waste disposal and expansion of disposal site. Assist/Support the Director to perform effective and efficient waste disposal operation. Report status of waste transfer and transporting operations to the Director. Responsible for labor management within the Section.
Chief Waste Disposal Operator	1	Responsible for performing waste disposal operation including the works to receive, separate, store, and dispose wastes at the disposal site by means of instructing the operational procedures, scheduling of disposal operation and prepare daily record to report to the Deputy Director.
Site Inspector	1	Assists the Chief Waste Disposal Operator to perform appropriate disposal operation. Record keeping of the carried-in wastes transported directly to the site by private operator. Responsible to inspect and monitor the performance of waste disposal operation and environmental influence and report to the Chief Waste Disposal Operator.
Secretary/ Clark	1	Assists /supports all the staff within the Waste Disposal Section to maintain efficient office work and implementation of the waste disposal operation. Responsible for keeping an account book of the Section.
Mechanics	1	Responsible for repair and periodical maintenance of all the machines, vehicles and equipment provided for waste disposal operation. Prepare maintenance work records and report to the Deputy Director.
Assistant Mechanics	1	Assist the Mechanics for periodical maintenance of all the machines, vehicles and equipment provided for waste disposal operation.
Waste Disposal Machine Operator	3	Operates waste heavy machine for waste disposal operation instructed by the Chief Waste Disposal Operator, check condition of the machine before and after operation and reports the result of operation and inspection to the Mechanics.
Waste Transfer Driver	2	Operates dump truck for transporting wastes from resort islands from the unloading quay to the disposal area. Operates micron trucks for transporting food wastes from barge to the composting area as required place to

Staff	Required Numbers of Staff	Responsibility
Common Labour	12	Supports waste disposal operation by assisting Chief Waste Disposal Operator and Waste Disposal Machine Operators. Labor work for production of compost using food waste and sawdust directed by the Assistant Director. Maintain cleanliness and sanitation along the access road and office area.
Security Guard	2	Lookout and patrol for safety against strangers, illegal dumping, robbers and so on to keep better security of the site.

3.2.3 Acquisition of Operation Staff

An acquisition of operation staff for initial set up shall be made through restructuring of the existing staff, recruiting the Maldivian citizens, expatriates from Sri Lanka and/or Bangladesh. Phased privatisation of unit work is another possibility to acquire the operation staff in future. The proposed posts and the numbers of staff are the standard staffing required for operation of the improved SWM services for Male' starting form 2003. It is preferable to acquire the staff as proposed however due to difficulties to acquire the managerial staff, some posts may be hold by the same person during the transition period.

Basically, the administration staff, engineers, chief operators, inspectors, accountants and secretary/clerk shall be acquired from the Maldivian citizens. Mechanics, heavy machine operators, truck drivers and common labour may be acquired from the expatriates from Sri Lanka, Bangladesh or from some other neighbouring countries. Following table shows the position of work and the available resources to be acquired for organising the operation staff for SWM services in Male' Municipality.

Position of Work	Resources
Managerial Staff	Administrator from the Maldivian citizen
Technical Staff	Engineer from the Maldivian citizen
Chief Operator and Inspection Staff	Engineer or technician from the Maldivian citizen
Secretary/ Clerk	Highschool graduate from the Maldivian citizen
Accountant Staff	Accountants from the Maldivian citizen
Mechanics	Engineer or technician from Sri Lanka
Heavy Machine Operator	Heavy machine operator from Sri Lanka or Bangladesh
Truck Driver	Truck driver from Sri Lanka or Bangladesh
Truck Assistant and Labor	Common labor from Bangladesh
Security Guard	Common labor from Bangladesh

3.2.4 Training of Operation Staff

The training shall be carried out by means of a series of training courses to develop human resources for the purpose to increase organisational, managerial and operational capabilities of the concerning bodies engaged in the SWM services.

The staff allocated in each task under this section need intensive training in 2002 before switch over and periodic training after commencement of new system in 2003 for the purpose to perform an individually and totally efficient work for better quality of services and conservation of the environment. The training courses will be divided broadly into the following groups of staff to develop human resources to acquire the capable staff for SWM services in Male' Municipality.

- Administration Staff
- Technical Staff
- Machine Operator, Driver and Common Labor Staff

(I) Training of Administration Staff

The training for the administration staff is conducted to acquire the management practices especially on the point of managerial standards for SWM services. The training courses will be available through workshop, seminar, training classes held by the Government for the administration officials and participation to the JICA group training courses for SWM and the other human resource development courses.

Followings are the training programs suggested for the administration staff including Director, deputy directors, assistant directors, engineers, and accountants.

Training Courses		Outline of the Training Course
Organisational Management	1.	Principles, process and functions of organisations & their management
	2.	Policy, Strategic and operational planning
	3.	Management Information System
	4.	Improving managers skill and effectiveness
Financial Management	1.	Accounting concepts and principles
	2.	Budget settling and monitoring
	3.	Basic financial forecasting
	4.	Basic financial and economic evaluation of the projects
	5.	Practising rating and setting tariff for waste charge

Training Courses	Outline of the Training Course	
Regulation of SWM	1.	Regulatory policies, monitoring methodology and system
	2.	Procedures for regulating private SWM operators
	3.	Procedures for handling hazardous & bulky wastes
Contract Management	1.	Government regulations of contractual procedures
	2.	Pre-contract procedures
	3.	Post-contract procedures and monitoring
Human Resource Development & Management	1.	Human resource development policies and planning
	2.	Methodology and appraisal for personnel functions, recruitment, promotion and appraisal
	3.	Methodology for improving individual performance
	4.	Occupational health arrangement

(2) Training of Technical Staff

The training of technical staff is made for obtaining the technical standards and criteria for practical operation of SWM services in addition to acquire basic managerial practices and standards. The training courses will be available through workshop, seminar, training classes held specifically for SWM through inviting the technical staff and chief operation staff engaged in SWM in the neighbouring countries.

Participation to the JICA training courses for SWM is effective for engineers and chief operators. The training course is opened in Tokyo and also opened in the Water and Environmental Project Training Centre, Jakarta, Indonesia. For the mechanics staff, participation to the training courses and practising at the Operation and Maintenance Training Centre in Colombo, Srilanka will be also effective measures.

The operation manuals prepared for basic operation for new systems by the Study will be the effective materials for training of operation staff. The manuals will be useful after studied thoroughly by the engineers, the lecturers, to make use of the training text.

Followings are the training programs suggested for the technical staff including engineers, chief operators and inspectors.

Training Courses	Outline of the Training Course	
Regulation of SWM	1.	Procedures for handling hazardous & bulky wastes
	2.	Procedures for transporting wastes to the Transfer Station & Thilafushi
	3.	Setting standards for environmental protection
Contract Management	1.	Control and monitoring progress of work
	2.	Control and monitoring performance of work
	3.	Control and monitoring labour management
Waste Collection, Transfer, Transportation, Waste Reduction, Waste Recovery and Recycling	1.	Planning and design of integrated SWM system, collection, transfer and transportation systems
	2.	Operational practices and management
	3.	Scheduling and staffing of daily and periodical works
	4.	Maintenance of vehicle, heavy machine and equipment
	5.	Methodology and practising of environmental protection
	6.	Methodology and practising of raising public awareness
	7.	Methodology and practising waste reduction programs
	8.	Methodology and practising materials recovery/recycling
	9.	Methodology and practising a link with recycling industries
Waste Disposal Storage of Recovered Materials	1.	Planning and design of integrated SWM system, collection, transfer and transportation systems
	2.	Operational practices and management
	3.	Scheduling and staffing of daily and periodical works
	4.	Maintenance of vehicle, heavy machine and equipment
	5.	Methodology and practising to prepare landfill site
	6.	Methodology and practising of sanitary landfill
	7.	Methodology and practising of storage of recovered materials and operation of composting facilities
	8.	Methodology and practising of environmental protection

(3) Training of Machine Operator, Driver and Common Labour Staff

Individual performance for accomplishing tasks

The training of field operation staff including machine operator, drivers and common labour shall be made through raising awareness to performance and responsibilities of task allocated to individual staff for accomplishing the task as directed and satisfactorily manner. Actual training will be made by the chief operator in work unit through periodical meeting and on-the-job training for daily work and specific works by the chief operators.

3.3 Involvement of Private Sectors

3.3.1 Establishment of Legal ground for PSI

Private sector involvement (PSI) may provide a solution to improve the delivery of solid waste services which are either too costly or of poor quality. World wide experience has demonstrated this. In this context, privatisation should be considered as a means to improve the quality of services, to enhance efficiency and reduce cost, and to mobilise private sector capital for capital investment. However, the private companies have not enough capabilities to carry out the SWM services at the present time in Male'. Therefore, the plan of SWM services has to consider under the initiative of the services by the Municipality and MCPW.

The solid waste generation source in Male' are by 4 types, i.e. residential, commercial, business & industrial and construction waste. The Municipality is responsible to the collection & hauling of residential waste and supervising & monitoring for collection & hauling of all other waste from private waste generation sources. And the Municipality make a collection plan to provide a minimum level services for residential waste in whole area. The collection service coverage ratio by the Municipality amount to 46 % of total waste amount generated in Male' except the amount of construction waste. The responsibility for collection and transportation of commercial and business waste that share 54 % of total waste belong to the generators. The Municipality is responsible for supervision and monitoring of wastes generated by the private sectors.

At the present, the private waste collection companies and the Municipality collect approximately 8.64-ton/day, (HHF 1.22-ton/day, Handcart 6.36-ton/day, the Municipality 1.06 ton/day), and collect service charge from the waste generators. The collection coverage ratio of the door to door collection services by the service providers has an amount for 15 % of the total generation amount of commercial and business wastes.

The new waste collection services by the Male Municipality provides the minimum level of services which was named "vehicle station – go round collection" and the collection is made for the waste carried by the residents. The existing collection service providers will be able to continue and increase the more contracts with the waste generators since the people who discharge wastes through the collection service providers still need the high quality door to door services.

Considering the introduction of PSI in future, the existing waste collection service by the private service providers must be regulated by the Male' SWM by-law include the stipulations at least by the following conditions.

- Male' Municipality has primary duty for collection and disposal of the waste generated in the municipal area,

- No one can collect, dispose and charge the wastes generated in the municipal area except permitted by the Male Municipality,
- Male' Municipality can provide high quality collection services by the request of all parties upon full recovery cost charge.

The By-law suggested above allows any private person or companies can provide waste collection services by charging. In order to run the initial PSI, registration/permission of the service providers and monitoring of their activities will be required. The service provider have to run the business on the conditions permitted by the Municipality and the registration/permission will be nullified for the service providers do not comply with the conditions.

3.3.2 Preparatory Action for PSI

Introduction of PSI requires the preparatory actions and considerable time span for commencement. The major preparation actions to promote PSI include in the followings, which shall be prepared and executed prior to implementation of the improved SWM system in 2003.

- Capacity Building Programs,
- Restructuring of SWM organization,
- Registration of Male' by-law on SWM,
- Introduction of registration/permission system of private service providers for waste collection services,
- Establishment of monitoring system, etc.

4 FINANCIAL ARRANGEMENT

4.1 Fund Requirement for Priority Projects

(I) Initial Cost

Three options have been conceived for both collection vehicle fleet and transportation vehicles/equipment in Male'. Eventually, option 3 (vehicle station collection system) in the former and option 2 (compactor-truck system) in the latter were selected on account of their cost effectiveness.

Also, two proposals have been discussed regarding both reinforcement of seawalls in the existing Thilafushi island and the height of seawalls in the Thilafushi islands. Finally, the coral masonry protection system by the local company in the former and 4 m in the latter have been selected in consideration of various factors including cost.

The estimated initial cost of the priority projects is summarized as shown below:

(Unit: Rf. thousand)

Item	Amount
I. Transportation and Disposal	
1. Construction Cost in New Thilafushi	97,547
2. Construction Cost in Male'	25,742
3. Construction Cost in Villingili	2,525
3. Construction Cost in Existing Thilafushi	11,856
4. Procurement Cost in Male'	35,522
5. Procurement Cost in Thilafushi	9,386
6. Engineering Service	12,361
7. Physical Contingencies	13,767
Total	208,707
II. Collection	
1. Procurement Cost	9,055
2. Engineering Service	272
Total	9,327
III. Others (Public Space Cleaning Equipment)	
1. Procurement Cost	757
2. Engineering Service	23
Total	779
Grand Total	218,813

In calculating the engineering service cost it was assumed that it will be 8% of construction cost plus 3% of procurement cost. Physical contingencies were calculated on the assumption that it will be 10% of construction cost.

As the above table shows, the total initial cost comes to Rf. 218,813,000 or US\$ 18,670,000 or ¥ 2,427,107,000.

For more detailed breakdowns of the initial cost, refer to Table 15 in Supporting Report G.

(2) O & M Cost

(Unit: Rf. thousand)

Year	Collection	Transportation	Disposal	Administration	Sub-Total	Depreciation	Total
2003	2,910	9,065	1,495	618	14,088	14,369	28,457

As the above table shows, the operation and maintenance cost of priority projects is estimated to total Rf. 28,457 thousand from the target year of 2003 onward. In addition, Rf. 980 thousand in 2001 and Rf. 344 thousand in 2002 will be required for preparation of education video and texts to raise public awareness to SWM and for promotion of recycling industries and study for recycling technologies, respectively.

As regard the breakdown of the direct O & M cost, transportation tops others, accounting for 64.3% of total, followed by collection with 20.7%, disposal with 10.6% and administration with 4.4%. Also, it is to be noticed that the direct O & M cost and depreciation are of the same order in size.

For more details, refer to Table 16 in Supporting Report G.

(3) Implementation Schedule

The implementation schedule of the priority projects is proposed to be as follows:

Item	2000	2001	2002	2003	2004
Construction in New 'Thilafushi					
Construction in Male'					
Construction in Villingili					
Construction in Existing Thilafushi					
Procurement for Male' (Transport.)					
Procurement for Thilafushi (Disposal)					
Procurement for Male' (Collection)					
Procurement for Male' (Cleaning)					

4.2 Assumed Budget Allocation

(1) Cost-Bearers

Cost Items	Government	MCPW	MM	Beneficiaries
Initial Cost				
Grants	Yes	-	-	-
Loans	Yes	-	-	(Yes)*
Budget	Yes	-	-	-
O & M Cost				
Direct O & M Cost	-	-	-	Yes
Depreciation	-	Yes	Yes	-

Note: *=in case repayment cost is borne by beneficiaries.

As the above table shows, it is proposed that the central government basically bear the initial cost of the priority projects. If the initial cost is financed by grants of external countries, the fund is provided without repayment obligations to the government and the fund is allocated to suffice the initial cost. If it is financed by bond raising, domestic bank loans and/or external loans, it is proposed that the government take care of repayment. If the initial cost is allocated from the government revenues, it means that the central government uses the import duty, tourism tax, lease and rents of government property, etc. for this purpose.

The direct O & M cost is proposed to be borne by the beneficiaries. On the other hand, depreciation will be borne by MCPW and MM.

(2) Assumed Budget Allocation

In terms of the government/public expenditure and revenue budget, the following table can be made out of the preceding section.

Expenditure Budget	Revenue Budget
Initial Cost	Grants, Loans, Conventional Revenue Sources
Direct O & M Cost	Solid Waste Charge from Beneficiaries
Depreciation	Conventional Revenue Sources

As the above table shows, the expenditure budget of MCPW for the initial cost will be appropriated from the governmental revenue budget whose sources consist of foreign grants, new foreign/domestic loans and/or conventional governmental revenue sources such as tourism tax, lease and rent of governmental estate and import duty.

Likewise, the expenditure budget of MM and MCPW for the direct O & M cost to be required annually to collect, transport and dispose solid waste will be appropriated from the governmental/public revenue budget whose source will be solid waste charge imposed to beneficiaries. Regarding the expenditure budget of MM and MCPW for depreciation of SWM equipment and facilities, it will be allocated from the governmental/public revenue budget deriving from conventional governmental revenue sources such as tourism tax, lease and rent of governmental/public estate and import duty.

4.3 Proposed Cost Recovery from SWM Fee

(1) Target Level of Cost Recovery

a. Initial Cost

As mentioned in the master plan, the initial cost is proposed to be essentially taken care of by the central government, whether it be financed by grants, government revenues or loans.

From whichever financial resources the initial cost may be financed, the financing will take the form of appropriation from the government revenue budget to MCPW expenditure budget.

Therefore, it is worthwhile to get the perspective about the magnitude of the priority projects by comparing their initial cost with such budget.

(Unit: Rf. thousand)

Year	Government Revenue Budget	Initial Cost	Ratio (%)	MCPW Budget	Initial Cost	Ratio (%)
	A	B	C=B/A	D	E	F=E/D
Total*	7,342,000	218,813	3.0	422,482	218,813	51.8

Note: *=Total 2000 to 2002

The total amount of the initial cost of the priority projects is estimated at Rf. 216,523 thousand. It corresponds to 3.0% of the estimated cumulative total of the revenue budget of G.O.M for three years from the year 2000 to 2002 as the above table shows.

Also, as the table shows the estimated total amount of the initial cost of the priority projects corresponds to 51.8% of the estimated cumulative total of the expenditure budget of MCPW from 2000 to 2002.

It follows from the above that the initial cost is expected to take up more than half of the MCPW budget during the implementation period, although it will be small compared with the total government budget.

For more details, refer to Table 17 in Supporting Report G.

b. O & M Cost

The direct O & M cost will be entirely recovered through the introduction of solid waste charge from the beneficiaries, that is, houses (households) and establishments/institutions. Regarding depreciation of equipment and facilities

for collection, transportation and disposal of solid waste, and for port cleaning, it will be borne by MCPW (WMS) and MM.

Under the above conditions, the average monthly payment by the beneficiaries works out as follows:

Solid Waste Charge, 2003 to 2010 (monthly average per beneficiary)

Beneficiaries	Male'	Villingili
Houses	Rf.14,410x1.3%	Rf.9,691x0.5%
	x81.8%	x163.6%
	Rf.153	Rf.67
Establishments/ Institutions	Rf.1,292	Rf.1,292
	x81.8%	x81.8%
	Rf.1,057	Rf.1,057

During the period 2003 to 2010 in Male' a house with the average monthly income of Rf. 14,410 is proposed to pay Rf. 153 per month as solid waste charge, which accounts for 1.063% of its income, that is, 81.8% of 1.3%, its willingness to pay. In the same way, an establishment or institution will pay Rf. 1,057 per month on average as solid waste charge, that is, 81.8% of its willingness to pay.

During the same period in Villingili a house with the average monthly income of Rf. 9,691 is proposed to pay Rf. 67 per month as solid waste charge, which accounts for 0.818% of its income, that is, 163.6% of 0.5%, its willingness to pay. In the same way, an establishment or institution will pay Rf. 1,057 per month on average as solid waste charge, that is, 81.8% of its willingness to pay.

The ratio of domestic solid waste charge to willingness to pay in Villingili is assumed to be two times higher than in Male' to adjust the lower willingness to pay in Villingili.

For more details, refer to Table 18 in Supporting Report G.

Solid waste charge in terms of the price per unit weight will be structured as follows:

Solid Waste Charge, 2003 to 2010 (price per ton)

Beneficiaries	Male'	Villingili
Houses	Rf.81,468,000	Rf.3,904,000
	/225,826 tons	/14,199 tons
	Rf.361	Rf.275
Establishments /Institutions	Rf.42,121,000	-
	/493,334 tons	-
	Rf.85	-

It is expected that Rf. 81,468,000 will be collected from domestic beneficiaries as solid waste charge in Male' in 2003 to 2010. On the other hand, 225,826 tons of domestic solid waste is estimated to be generated in the Capital City in the same period. Therefore, domestic solid waste charge is calculated at Rf. 361 per ton. Likewise, Rf. 42,121,000 will be collected from non-domestic beneficiaries as solid waste charge, while 493,334 tons of non-domestic solid waste will be generated. As a result, non-domestic solid waste charge comes to Rf. 85 per ton.

Rf. 3,904,000 is expected to be collected from domestic beneficiaries as solid waste charge in Villingili in 2003 to 2010. On the other hand, 14,199 tons of domestic solid waste is estimated to generate in the island in the same period. Therefore, domestic solid waste charge is calculated at Rf. 275 per ton. There is not enough information to estimate non-domestic solid waste charge per ton.

(2) Fee Collection System

It is proposed that the regular bill collection system be adopted towards the houses, while the on the spot payment system be applied to the establishments/institutions.

a. Houses

The uniform rate under the regular bill collection system is recommended to be chosen. That is to say, every house concerned will pay the same amount of solid waste charge per month. This is because SWM is by nature a public good benefited equally by people, and also because it is easier to implement than other methods.

As mentioned already in the preceding section, a house in Male' will pay Rf. 153 per month as solid waste charge, accounting for 1.063% of the average monthly house income in 2003 to 2010. In the same way, a house in Villingili will pay Rf. 67 per month as solid waste charge, accounting for 0.818% of the average monthly house income in the same period.

There are three ways to collect solid waste charge. One is to collect it together with the electricity or water charge. In this alternative Maldives Electricity Board (MEB) or MWSA will be involved. The second is that Male' Municipality will do it. The third is that the charge will be incorporated in the price of solid waste bags to be sold to households.

The second alternative is in procedure more complicated than the first one. The third is problematic in terms of environmental impact. Therefore, the first choice is recommended to be adopted.

b. Establishments/Institutions

Establishments/institutions differ widely in size and functions/activities, and, therefore, in the volume and kinds of solid waste they generate. Consequently, the on the spot payment system will be more appropriate for them.

Under the system they bring solid waste to the transfer station by themselves. Then the authorities (MM or a corporation under it) weigh the solid waste there and collect the charge according to the weight. The tariff will be different between the construction-related waste and other industrial waste. There are two alternatives in the way the charge is collected. One is the collection of cash, and the other is the collection of coupons issued and sold by the authorities.

As already mentioned in the preceding section, establishments/institutions will pay Rf. 85 per ton on average in Male' in 2003 to 2010.

c. Solid Waste from Vicinities

Solid waste from the airport island, resort islands and inhabited islands are brought to Thilafushi island and disposed there.

Disposal charge will be basically imposed on it. The airport island will pay a fixed amount of charge, Rf. 2,281 per month in 2003 to 2010. A resort island will monthly pay a fixed charge, Rf. 398 in the same period. The charge will be the same for all the resorts concerned. Inhabited islands will be exempted from payment because the volume of solid waste brought there by them is very little compared with other islands.

(3) Allocation and Disbursement of Fee

a. Budgetary Arrangement in MM

Revenue Budget of MM in Period i		Expenditure Budget of MM in Period i	
Revenue from Solid Waste Chg.	mmR1i	Collection of Solid Waste	mmX1i
Revenues from Other Sources	mmR2i	Depreciation of Collection Equipment	mmX2i

MM will take responsibility for collection of solid waste.

The solid waste charge is collected from houses and establishments/institutions in a given period. It will be sufficient to cover the O & M (collection, transportation, disposal and administration) cost in that period. Out of the revenue from the charge, a portion proportionate to collection cost will be allocated to MM. It is mmR1i in the above table. mmR1i will be appropriated for mmX1i.

A part of the revenues from other sources such as the transfer from the central government and rent (mmR2i) will be appropriated to cater for depreciation of collection equipment (mmX2i).

In accordance with the above-mentioned concept, the revenue and expenditure budget centering on the priority projects will be formulated in 2003 to 2010 as follows:

(Unit: Rf. thousand)

Revenue Budget of MM in 2003-2010		Expenditure Budget of MM in 2003-2010	
Revenue from Solid Waste Chg.	26,098	Collection of Solid Waste	23,280
Revenues from Other Sources	15,944	Depreciation of Collection Equipment	14,488

Revenues from other sources, Rf. 15,944 thousand in the above table accounts for 7.30% of the estimated cumulative MM budget 2002 to 2010. Currently, 8.3% of MM budget is estimated to be allocated for SWM on average.

b. Budgetary Arrangement in MCPW (WMS)

Revenue Budget of MCPW in Period i		Expenditure Budget of MCPW in Period I	
Revenue from Solid Waste Charge	mcR1i	Transportation, Disposal & Administration of Solid Waste	mcX1i
Revenues from Other Sources	mcR2i	Depreciation of Transport., Disposal & Cleaning Equipment and Facilities	mcX2i

MCPW will be responsible for transportation, disposal and administration of solid waste.

The solid waste charge is collected from houses and establishments/institutions in a given period. It will be sufficient to cover the O & M (collection, transportation, disposal and administration) cost in that period. Out of the revenue from the charge, a portion proportionate to transportation, disposal and administration cost will be allocated to MCPW (WMS). It is mcR1i in the above table. mcR1i will be appropriated for mcX1i.

A part of the central government revenues other than the above one, such as import duty, tourism tax and lease and rents of government property (mcR2i) will be appropriated to cater for depreciation of transportation, disposal and port cleaning equipment and facilities (mcX2i).

In accordance with the above-mentioned concept, the revenue and expenditure budget centering on the priority projects will be formulated in 2003 to 2010 as follows:

(Unit: Rf. thousand)

Revenue Budget of MCPW in 2003-2010		Expenditure Budget of MCPW in 2003-2010	
Revenue from Solid Waste Charge	106,126	Transportation, Disposal & Administration of Solid Waste	94,665
Revenues from Other Sources	106,903	Depreciation of Transport., Disposal & Cleaning Equipment and Facilities	100,464

Revenues from other sources, Rf. 106,903 thousand in the above table accounts for 6.49% of the estimated cumulative MCPW budget 2002 to 2010. Currently, 7.0% of MCPW budget is allocated to WMS on average.

Refer to Tables 16 and 18 in Supporting Report G.

4.4 Financial Plan

Financial statements were projected for the Male' and Vicinities Priority Projects so that the authorities concerned may proceed with the projects in a financially sustainable manner.

To reach the stage where such statements can be prepared, a lot of projections and estimations have to be made.

First of all, cost and revenue have to be estimated in the years to come up to the target year of 2010.

Regarding cost estimation, it is shown in detail in Tables 15 and 16 in Supporting Report G. In section 4.1 there is an overall description on it. To allocate depreciation in the years to come depreciation periods must be fixed for facilities and equipment to be constructed/installed.

The detail on the periods is summarized as follows:

Item	Yards and the Like	Other Civil Engineering Works	Buildings	Construction Vehicles	Other Construction Equipment
Depreciation Periods	30	50	35	5	10

As regard the estimation of revenue and budget allocations, the overall explanation is added hereunder.

(I) Estimation of Revenue and Allocations from Public Budget

Domestic Customers

Item	Male' and Vicinities Project			
	Male'		Villingili	
	2003	2010	2003	2010
Population	77,097	88,822	3,587	9,106
No. of Houses (Theoretical)	5,384	6,203	317	806
Income (Rf./m/house)	12,971	15,874	8,724	10,675
Payment for SWM as % of Income	1.3%x 81.8%	1.3%x 81.8%	0.5%x 163.6%	0.5%x 163.6%
Revenue (Rf. 000)	8,466	11,936	258	802

Population in Male' and Villingili was projected based on the official data prepared by MPHRE and Maldives Housing and Urban Development Authority. Population was theoretically converted into the number of houses through the average number of people in a house. Monthly income per house was estimated based on the results of socio-economic questionnaire surveys. It was assumed to grow in parallel with the growth of

per capita income. The growth of per capita income was projected from the estimated growths of population and the economy. Payment for SWM was determined in such a way that the ultimately calculated revenue might cover the O & M cost. In the above table, 1.3% and 0.5% are the willingness to pay for SWM in the respective two areas. Finally, the number of houses, income and payment for SWM were multiplied to arrive at revenue.

Non-Domestic Customers

Item	Male' and Vicinities Project			
	Male'		Villingiti	
	2003	2010	2003	2010
No. of Establish./ Institutions	404	465	19	48
Payment for SWM (Rf.)	1,163x 81.8%	1,423x 81.8%	1,163x 81.8%	1,423x 81.8%
Revenue (Rf. 000)	4,381	6,170	206	637

The number of establishments/institutions was projected to grow in parallel with the growth of population. The willingness to pay for SWM was assumed to go up in parallel with the growth of per capita income. Payment for SWM was determined in such a way that the ultimately calculated revenue might cover the O & M cost. In the above table, Rf. 1,163 and 1,423 are the willingness to pay for SWM in the respective years. Finally, the number of establishments/institutions was multiplied by payment for SWM to arrive at revenue.

In estimating the number of establishments/institutions in Villingiti, the ratio of the number of establishments/institutions to population in Male' was used.

Allocation from Public Budget

Item	Male' and Vicinities Project	
	2003	2010
MCPW Budget Estimates (Rf. 000)	162,468	252,756
Allocation Ratio	6.49%	6.49%
Allocations	10,544	16,404
MM Budget Estimates (Rf. 000)	21,710	33,345
Allocation Ratio	7.30%	7.30%
Allocations	1,584	2,434

The future magnitude of the expenditure budget of MCPW was estimated by employing regression analysis on the assumption that it is correlated with GDP. The same method was employed to estimate the future expenditure budget of MM. The analysis and the results are shown in Table 9 in Supporting Report G. The ratios to be allocated for SWM were determined in such a way that the allocated amount might cover depreciation. In the case of MCPW the ratio came to 6.49%. For MM it is 7.30%. It is to

be reminded that currently MCPW and MM are estimated to appropriate 7.0% and 8.3% for SWM.

For overall preconditions for the projection of financial statements and its results, refer to 5.4 Evaluation on Financial Sustainability.

5 PROJECT EVALUATION

5.1 Evaluation on Technical Effectiveness

Evaluation of component projects is conducted from two points of view, namely technical achievement and technical adaptability. The former is to assess if the performance of adopted technique achieves the objectives of the master plan well in comparison with current operation. The latter is to assess if Maldivian staff and foreign workers in charge can adapt to the proposed technical measures and equipment well. Seven components are thus evaluated hereunder in Table 5-1.

Table 5-1 Evaluation on Technical Effectiveness

Component Project	Technical Achievement	Technical Adaptability
1 Waste Collection System	<ul style="list-style-type: none"> • 100% coverage of collection service is conserved • Time duration is shortened while the waste is exposed to the open air 	<ul style="list-style-type: none"> • Manipulation of press-type truck is not more difficult than micro-bin
2 Waste Transport System	<ul style="list-style-type: none"> • Timely transport of collected waste is secured • Dispersion of offensive odor and waste itself is reduced by adoption of press-type truck that confines waste inside the body 	<ul style="list-style-type: none"> • Manipulation of press-type truck is a bit more difficult than dump truck, however, not as difficult as foreign workers can not master
3 Waste Transfer System	<ul style="list-style-type: none"> • Segregation of waste is secured to promote material recover and effective landfill • Vilingili deposit site is conspicuously improved in physical structure and equipment allocation • Waste volume is measured as part of routine which gives fundamental information for management 	<ul style="list-style-type: none"> • Reloading method is succeeded from the current operation • Complex function of new transfer station allows that administration & Operation are conducted more efficiently than ever

Component Project	Technical Achievement	Technical Adaptability
4 Port Area Cleaning	<ul style="list-style-type: none"> • Mobilization measure for cleaning crew is improved that leads to better efficiency and cleaner port 	<ul style="list-style-type: none"> • Operation on the sea surface becomes easier because motor boat can be operated by only one person; it was handled by two rowers and a cox so far
5 Improvement of Existing Thilafushi	<ul style="list-style-type: none"> • Stability of the coast is improved in case permanent seawall is adopted • Emission of waster pollution load stays within existing level 	<ul style="list-style-type: none"> • Even if a stone built seawall is adopted, Maldivian has enough experience in construction and maintenance
6 Construction of New Landfill Site	<ul style="list-style-type: none"> • Stability of the coast is improved • Emission of waster pollution load is reduced from existing level by aeration in the retention ditch and confinement effect by sheet pile wall 	<ul style="list-style-type: none"> • Stone built seawall can be adapted to with no major difficulty • Sheet pile wall might exceed Maldivian experience, however, it can be commissioned to ordinary contractors of neighboring countries
7 Material Recycling	<ul style="list-style-type: none"> • It contributes to create a possible productive usage of waste and consequently reduces landfill volume that saves the life of final disposal site 	<ul style="list-style-type: none"> • Practice of compost making was once trained in this study and the foreign workers engaged in are found adaptable to the practice

5.2 Evaluation on Social Acceptability

5.2.1 New SWM System

Most of the people are always sensitive against change of the system and refuse to accept the new system as long as the system is not beneficial to individual person even though the system is beneficial to the society. The improved SWM system contains several new sub-systems to improve effectiveness and efficiency in place of the existing system. Those major discussion topics among the people concerned and the society of Male' include environmental protection measures, establishment of state enterprise, height of finishing level of landfill, and for forth in the long term plan. The discussion topics with regard to social acceptability in the priority projects will be 1) Implementation of Waste Reduction and Recovery/Recycling Programs, 2) New Waste Collection System, and 3) Collection of Waste Charge which are evaluated in the following sections.

5.2.2 Implementation of Waste Reduction and Recovery/Recycling Programs

Waste reduction, resource recovery and recycling programs are set at the top of hierarchy in SWM aiming at the environmental conservation in the end. The programs are not easy to attain the targeted results without participation of all the bodies composing the society. The public awareness survey conducted by the Study Team in July, 1998 shows the bright side to this issue. More than 80 % of the respondents are interested in recycling of wastes and almost all the respondents answered to participate in waste separation at the generation sources. From the aspects, waste reduction as well as waste segregation will be also accepted by the residents. Accordingly, the remaining key issue of the programs will be establishment of marketing routes through a link with foreign recycling markets and the market information will be collected periodically from now on by the SWM service staff for promotion of the programs.

5.2.3 New Waste Collection System

Likewise the view mentioned in waste recycling programs, the residents in Male' were co-operative to the interview survey and interested in participation of public services. About 62% of the respondents bring waste to the micro bin station or to the Transfer Station and 38 % of respondents discharge wastes through collection services.

The collection vehicle, manually loaded compactor, will park at the centre of the service area two times in a day in the morning and evening for two hours respectively. Then the collection vehicle goes slowly around the designated service area with a melody for notice during the time rest of the day. This is so-called as bell collection. For most of the residents living distant from existing fixed containers, the new system, what is called "vehicle station - go round collection system", will become more convenient since the vehicle station is located not as far as 250 m in radius from each house.

It may cause of decrease of the numbers of collection services for those residents who are now having door-to-door collection services by individual contractors. Though the new system is not adopting a door to door services, it is prospected that the residents who prefer higher level of collection service can chose it by contracting with the private service provider at their cost. Thus the new collection system is defined as that provides minimum level of services in Male'

5.2.4 Collection of Waste Charge

As prescribed, the public awareness shows that about 38 % of the respondents discharge wastes through collection service providers. The average fee paid by them reach at 164 Rfs per month or 1.5 % of average monthly income of one house populated with 14 person. Interview of willingness to pay for waste charge indicates 149 Rfs. from the residents and 683 Rfs from the business establishments in average rate per month respectively. As long as the waste charge rate is set at more or less the rate of the willingness to pay, to adopt collection of waste charge will be accepted by the people having collection service at present.

Accordingly, the discussion shall be addressed for the promotion of solid waste charge system particularly among those who are discharging wastes by themselves, who share approximately 62 % of the respondent. The world wide concepts accepted in the field of the environmental conservation, the Polluters Pay Principle (PPP), shall be discussed among these groups of the people to raise awareness that individual person have to support the environmental conservation projects otherwise the project will fail and lose their benefits as well.

5.3 Evaluation on Economic Benefit

(1) Basic Concept

There are various kinds of economic benefits resulting from the implementation of the SWM priority projects. People concerned will be freed from unpleasant sight and odour of solid waste not only around their houses, but also in the public spaces. Also, they may have little chance of contracting the diseases related to unsanitary environmental conditions such as diarrhoea, dysentery and skin diseases. In short, the projects will contribute to keeping the living environment clean and pleasant.

The problem is how to express those benefits in quantitative terms. Fortunately, the JICA study team conducted the socio-economic survey towards the houses and establishments/institutions in Male' and vicinities, in which it asked them the willingness to pay for SWM. This willingness to pay can appropriately be regarded to reflect the economic values they attach to the projects.

Thus, the willingness to pay per house multiplied by the number of houses concerned plus the willingness to pay per establishment/institution multiplied by the number of establishments/institutions concerned in a certain year after project implementation can be considered the benefits in that year.

What cannot be ignored is that there is a benefit peculiar to the project: reclamation of the Thilafushi island by using the solid waste to be disposed there. Thus, the cumulative area to have been reclaimed up to a certain year during project implementation will be multiplied by rent per unit area to arrive at the benefit in that year.

The first and second types of benefits will be added together in each year during the project life period. This way, the benefit stream will be prepared.

On the other hand, the initial cost and the O & M cost will be converted into economic costs and are distributed over years. In this manner, cost streams will be made.

Using the cost and benefit streams, economic analysis will be conducted. From the resultant values of economic criteria, the feasibility of the projects will be evaluated.

Economic analysis was carried out for the Male' and Vicinities Priority Projects.

(2) Overall Conditions/Assumptions

- i Opportunity cost of capital will be 10%.
- ii. Project life will be 20 years from the start of project implementation.
- iii. Bill collection efficiency in connection with solid waste charge will be 95%.

- iv. The monthly rent of land plot in the new Thilafushi island will be Rf. 30 per square meter. This is based on the existing land/room rent in Male' and Villingili. (On average it is around Rf. 100/m³ in Male' and around Rf.34/m³ in Villingili.) Also, two thirds of the island will be used for renting.
- v. The standard conversion factor in the Maldives is calculated at 0.9038 based on the imports/exports and import/export duty from 1994 to 1996. It will be applied to initial cost of local goods. The conversion factor for skilled labor was assumed as 1.2 as it is scarce in the Maldives. As a result, it was revealed that the overall conversion factor to capital cost was very near to 1.

(3) Economic Analysis and Evaluation of the Results

Based on the foregoing investigations, cost benefit streams were worked out as shown below:

Male' and Vicinities Project

NPV (Rf. thousand)	B/C	EIRR (%)
17,191	1.08	12.4

Sensitivity analysis was performed to see how EIRR would be affected under unfavourable circumstances.

Case 1 assumes that both capital cost and O and M cost be by 20% higher than the base case. In Case 2 both capital cost and O & M cost will be by 10% higher and at the same time benefits will be by 10% less than the base case. In Case 3 the benefits will be by 20% less than the base case.

The results of sensitivity analysis are shown below:

Results of Sensitivity Analysis

Item	Base Case	Case 1	Case 2	Case 3
Comparison with Base Case	-	Capital Cost: +20% O & M cost: +20%	Capital Cost: +10% O & M cost: +10% Benefits : - 10%	Benefits: -20%
EIRR (%)	12.4	6.6	6.0	5.2

It follows from the above that the priority projects are judged to be economically feasible. However, as the results of sensitivity analysis show, the projects will lose its viability under the most unfavourable conditions conceived.

5.4 Evaluation on Financial Sustainability

In preparing the projected financial statements, the following overall conditions/assumptions were set up.

(1) Overall Conditions/Assumptions

- i. Project life will be 20 years from the start of project implementation.
- ii. No tax will be imposed on the surplus of SWM operations.
- iii. Bill collection efficiency in connection with solid waste charge will be 95%.
- iv. The ratios of solid waste charge to the willingness to pay for SWM and the ratios of budgetary allocations to SWM from 2011 onward will be as follows:

Item	Male'	Villingili
Ratios of solid waste charge to willingness to pay	65.8% (81.8%)	131.6% (163.6%)

Item	MCPW	MM
Ratios of budgetary allocation	5.22% (6.49%)	5.87% (7.30%)

Note: Figures in parentheses are for 2003 (2001) to 2010.

(2) Projection of Financial Statements

Financial statements for the Male' and Vicinities Priority Projects, consisting of income statement, fund statement and balance sheet are shown in Tables 20 in Supporting Report G.

The following table summarizes what those statements convey.

Male' and Vicinities Priority Projects

Management Indices	Profit Rate	Working Capital to Revenue Ratio	Profit to Total Capital Ratio
Formula	Profit/Revenue x 100	Working Capital/Revenue x 100	Profit/Total Capital x 100
Value	11.8%	49.9%	1.7%

The tables show that SWM authorities will have a reasonable extent of profit or surplus to cushion unpredictable financial disturbances, a thick reserve of working capital to prepare for replacement of facilities/equipment and a nominal profit to the total capital invested in the years to come.

5.5 Evaluation on Environmental Preservation

The most significant irreversible long term environmental effect as the direct consequence to the implementation of the project is identified as the very alteration of the ecosystem of the project area (Tilafushi-2) from a saline aquatic ecosystem to a land based terrestrial ecosystem and the resultant elimination of immobile marine biota, in particular coral life, and their habitat in the reef-flat area subjected to this ecological alteration (Tilafushi-2). Still the effect is minimized, if not entirely eliminated, with the selection of ecologically most degraded reef-flat area as the project area.

Silt screen is adopted as the most significant direct mitigation system of the project. This is both intended at mitigating the dispersal of dredged material to the surrounding reefs thereby potentially affecting the coral life and as well the marine water quality and also at conserving valuable landfill cover material. Its proper and continued use is essential and be ensured by the implementing agency (Project Initiator), the MCPW (Ministry of Construction and Public Works). All other impacts by the project are considered as insignificant.

Monitoring of leachate cum seawater quality and overall ecological status of the coral life in and around the project area (Tilafushi-2) on a regular basis is identified as the basic environmental monitoring requirement. The responsible agency for the monitoring of leachate cum seawater quality, twice times a year, be the PHL (Public Health Laboratory) of the MOH (Ministry of Health). The corresponding responsible agency for monitoring the status of coral life on an annual basis be the MRS (Marine Research Section) of the MOFA (Ministry of Fisheries and Agriculture). These agencies shall earmark their own budget to conduct their monitoring work independently.

The proposed tentative locations of landfill leachate and sea water quality monitoring are shown in Figure 5-1.

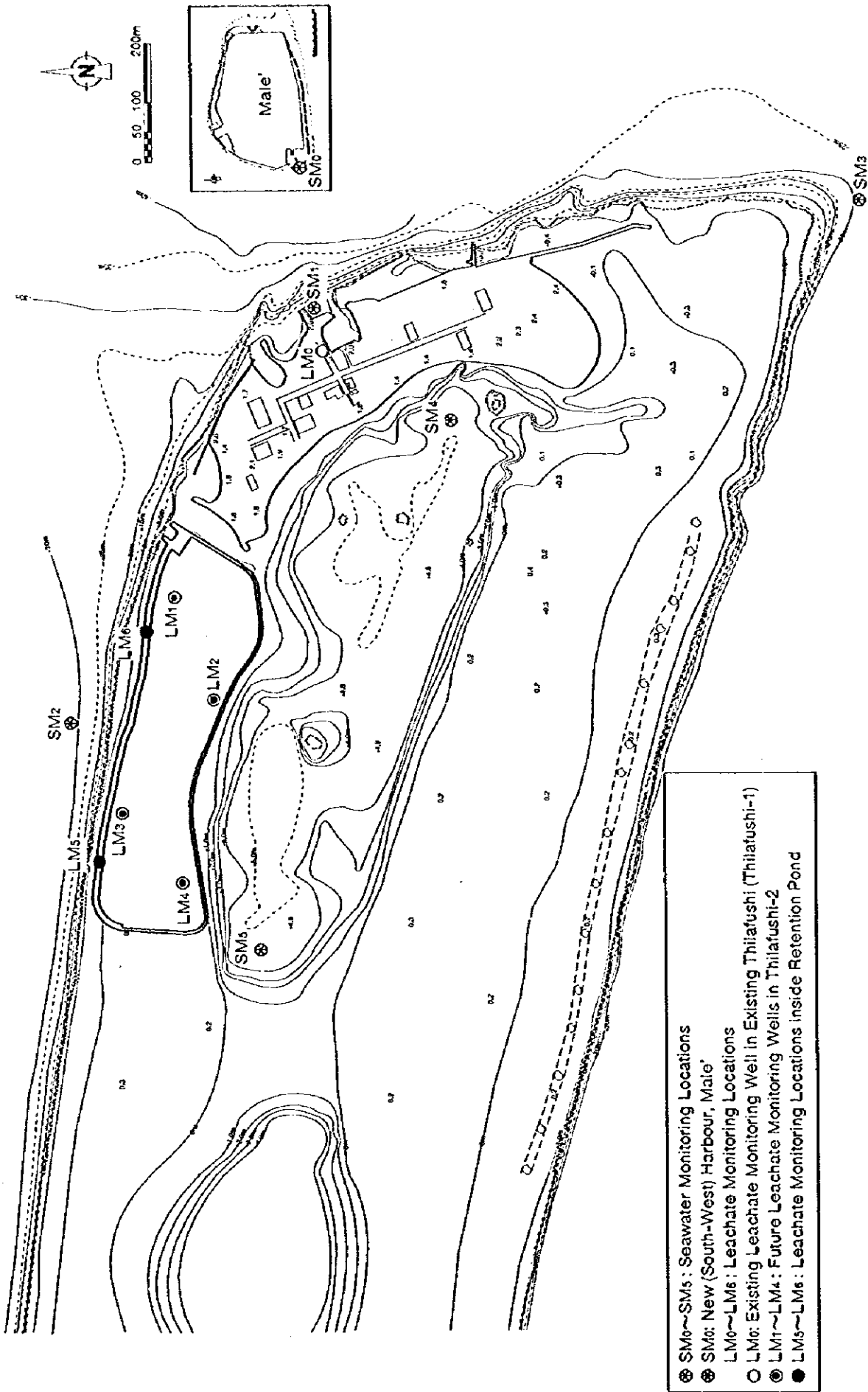


Figure S-1 Landfill Leachate and Seawater Quality Monitoring Locations

6. CONCLUSION AND RECOMMENDATION

6.1 Project Implementation

6.1.1 Packaging of Components

Seven component projects are classified and packaged for the convenience of implementation in accordance with the nature of the projects. Most of the components are recognized as environmental projects through the improvement of SWM except the project, Improvement of Existing Thilafushi Island. Improvement of existing Thilafushi is really an environmental project to prevent the drifting of waste from the eroded coast, however, it has at the same time a different aspect due to the current situation of land use in the island.

Finished landfill site is mostly rented to business enterprises and some of them have already started their regular activities or building works here and there in the rented blocs. In this situation, the project (Improvement of Existing Thilafushi Island) has the similar meanings to the seawall project in Male' Island which intends to secure the land firmly and to protect the business activities and real estates on it. This trend becomes much clearer when the landfill operation ceases in the island. Possible space for landfill is being exhausted in several months between the temporary channel in the north and the planned site for slip-way in the south.

The situation gives the project (Improvement of Existing Thilafushi Island) a unique status among the whole component projects discussed. The other six components are genuine environmental and SWM projects. Therefore the whole components are packaged into the following two groups.

- (1) Package 1:
1. Innovation of waste collection system
 2. Enhancement of waste transport system
 3. Improvement of waste transfer system
 4. Enhancement of port area cleaning
 5. Construction of new landfill site
 6. Promotion of material recycling

- (2) Package 2: Environmental improvement of existing Thilafushi Island

6.1.2 Implementation Schedule

The component projects are on the other hand classified by the form of implementation into the following three categories.

- a. Construction only
- b. Procurement only
- c. Construction & procurement

Individual components correspond to the above mentioned categories as shown below.

Table 6-1. Categorized Contents of Component Projects

Component Project	Form of Implementation	
	Construction	Procurement
Package 1		
1. Innovation of waste collection system		€
2. Enhancement of waste transport system		€
3. Improvement of waste transfer system	€	€
4. Enhancement of port area cleaning		€
5. Construction of new landfill site	€	€
6. Promotion of material recycling		€
Package 2:		
Environmental improvement of existing Thilafushi Island	€	

Note 1: € symbolizes the project contains the portion implemented in the form described in the top column.

Note 2: Preparation of the facility for the component of recycling requires construction scheme, however, the cost estimates is contained in the component of new landfill site.

Implementation of the package 1 needs a certain lead time for the preparation of investment fund because of large amount requirement. The earliest case of implementation schedule is shown in Table 6-2.

Table 6-2. Implementation Schedule of Priority Projects

Item	2000	2001	2002	2003
Innovation of Waste Collection System			■	
Enhancement of Waste Transport System			■	
Improvement of Waste Transfer System			■	
Construction of Male' Transfer Station		■	■	
Construction of Villingili Depot			■	
Enhancement of Port Area Cleaning		■		
Construction of New Landfill Site	■	■	■	
Promotion of Material Recycling		■	■	
Environmental Improvement of Existing Thilafushi Islan	■	■	■	

As for the package 2, the fund requirement ranges about Rf 12 to 35 million according to the option of specifications. These figures correspond to 10 to 30 % of estimated annual budget of MCPW. In case the project is extended in several years of implementation, the burden of investment comes down to a few per-cent of multi-year budget. This magnitude of additional expenditure is considered to stay within a extent of political adjustment on the budget of MCPW or the whole government. The time of implementation can be determined flexibly after the location of SWM is shifted to Thilafushi 2. Therefore the definite implementation schedule is not presented here.

The target year of component project was determined as "in and around 2003" as part of the Scope of Work, which was agreed by both Government of Maldives and Japan on December 17, 1997. Considering the fact that the remaining lifetime of the new sanitary landfill site is only one year after completion, it seems too short comparing with the scale of the project. This is caused by too close target year from present and the time toward the target year is mostly spent for the construction of the landfill site. It was not possible to change the target year in this study because it exceeded the capability of the Study Team.

On the other hand, Maldivian side expressed its hope for longer lifetime of the new sanitary landfill site. It seems difficult to extend the project period because the extension requires inevitable rise of construction cost. In case the priorities of component projects and the total fund requirement are adjusted within a possible level of investment, the extension of lifetime can be discussed in the successive stage of project implementation.

6.2 Waste Reduction and Recycling

As an important means of achieving sustainable means of solid waste management, waste reduction and recycling shall be promoted. In this respect, the basic step is the promotion of waste segregation at source by residents and other business entities.

In particular, recycling of non-perishable and essentially non-biodegradable materials like metal cans, glass bottles and plastic products shall be promoted both as means of resources conservation and optimal utilization of the capacity of final solid waste landfill disposal system.

Moreover, composting as the means of both producing fertilizer and reducing perishable waste requiring land filling is recommended to be introduced in Thilafushi.

6.3 Enhanced Awareness in Solid Waste Management (SWM)

Enhancement of public awareness of solid waste generators, residents and other entities, is very important in soliciting their due co-operation in achieving waste reduction and recycling. To this end public campaign and education by Male' Municipality is recommended to be initiated.

It is further noted that the solid waste management awareness need to be improved in the Ministry of Construction and Public Works (MCPW). In particular, the notion of treating solid waste simply as land reclamation material shall be abandoned. This is very important in realizing sanitarly and environmentally acceptable means of final solid waste disposal, with due consideration to the hazardous nature of leachate and flammable gas generated underground of a landfill system.

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