Plate 6: PP "Improvement of the Moon Plain Landfill" (1/2)

Waste was dumped into the forest in Nuwara Eliya, having a serious impact on the natural environment. However, the site was in fact naturally and socially ideal for landfill operation. An attempt was, therefore, made to turn the site into a model sanitary landfill site because the waste amount that had already been dumped was still small.

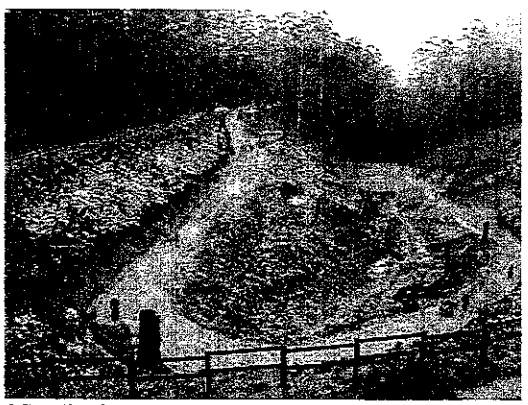
Site observation by the monitoring committee
The monitoring committee headed by a monk who is the representative of local residents visited the landfill site before the improvement.

Project explanation to local residents
Municipal staff talked to local residents at the temple. The monk of this temple is the chairman of the monitoring committee.

Access road before the improvement
This access road under the control of the Forest Department often became inaccessible due to waste when it rained.

Access road after the improvement
The improved access road has ensured that the municipal council can always carry waste to the landfill site even during heavy rains.

Waste dumped before the improvement
The waste dumped had a serious impact on many planted trees in the forest.

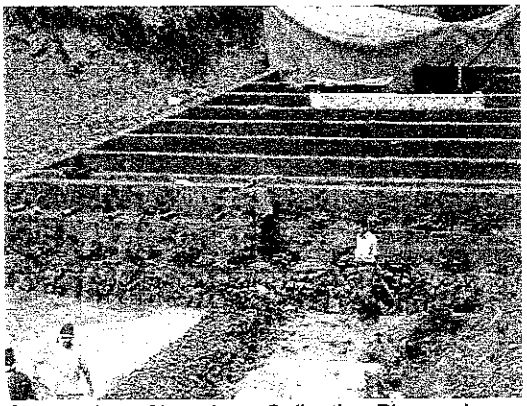


After the improvement
The waste dumped was shifted to the lowest area of the landfill site and covered with soil. The leachate collection pipe can be seen along the bottom of the valley.

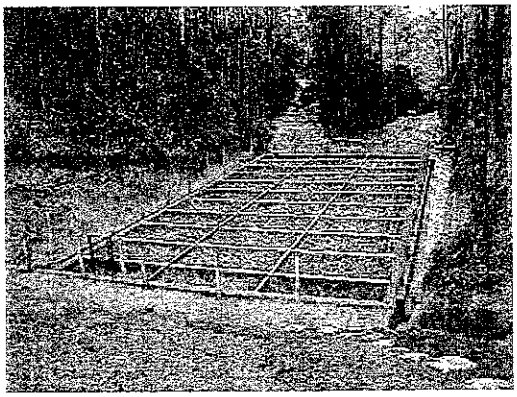
Plate 6: PP "Improvement of the Moon Plain Landfill" (2/2)

The key to secure the sustainability of the project is to minimize the O&M cost by using technologies appropriate to the local conditions. The landfill doesn't require any equipment using power by using gravity obtained by this steep topography.

Leachate collection pipe
Perforated reinforced concrete pipes were laid along the bottom of valley and it was covered with crushed stone. Leachate is collected and carried through the pipes.

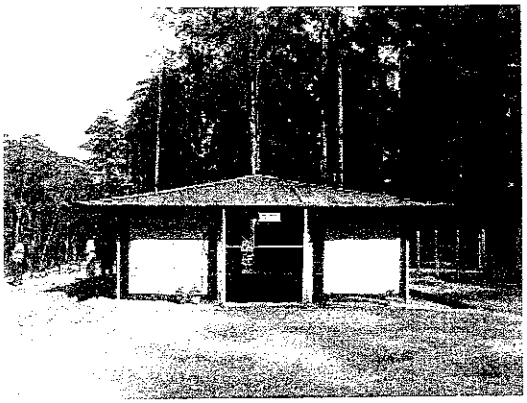


Connection of Leachate Collection Pipe and Leachate Treatment Tank
This tank receives leachate carried by the leachate collection pipes and water seepage pipes for treatment.



Leachate treatment tank
A leachate treatment pond using coconut fiber for treatment was constructed. After being treated, the effluent is discharged to a wetland located at the outlet side.

Gas ventilating facility
Methane Gas generated by discharged wasted is ventilated perforated oil barrel which is filled with crush stone.



Disposal Pit for Health Care Waste
No leachate is generated as all run-off water is intercepted with roofing and drains. The water contained in waste is solidified with cement. The pit is secured by fencing. If the pit gets full, a new pit will be dug and the roof will be shifted there.

A control house and an educational centre
Visitors can observe the entire landfill site from the educational centre and learn about the sanitary landfill.

Plate 7 : PP "Environmental Education Improvement" (1/2)

Recently in Sri Lanka, SWM has become a big burden that is beyond the capacity of LAs. Public cooperation is necessary to improve SWM. However, LAs do not have enough experience, the proper materials or the equipment to encourage people to cooperate.

Among the seven model towns, Chilaw, Matale, Nuwara Eliya and Badulla were very keen to educate their citizens. Hence, it was decided to carry out the environmental education improvement pilot project (EEIPP) in those four towns where they could expect good improvement. The main items of the EEIPP were as follows:

- Establishment of the environmental education centre (EEC)
- Procurement of educational equipment
- Production of environmental education materials using the equipment
- Trainers' training for the counterparts

The Environmental Education Centre (EEC)

The concept of the EEC was "to provide a space for citizens to learn about the environment with ease.

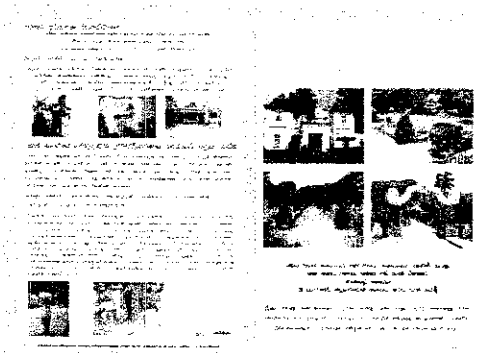
The EEC in Chilaw, the first centre among the four selected towns was established on the second floor of the municipal council building.

The EEC in Nuwara Eliya was established on the second floor of the public library. Many children visit the library to study/read after school.

The opening ceremony of the EEC in Matale on 18 September, 2003.

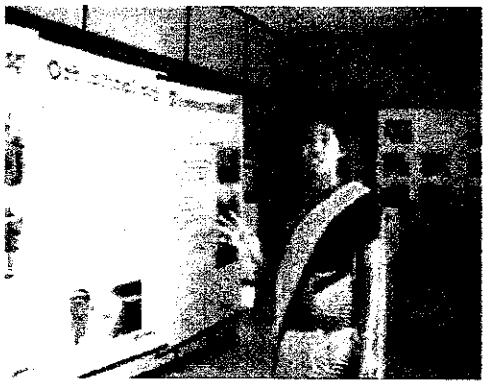
Environmental Education Materials

Environmental education materials were produced by the counterparts with support from the Study Team. The equipment provided, such as a laptop PC or digital camera, was utilised to produce educational materials.



Leaflet (Matale)

Topics such as the opening of the EEC, starting bell collection and promoting the traditional recycling system were dealt with in the educational leaflet and the leaflet distributed to a wide area range of citizens.



Banners (Chilaw)

The educational banners were movable so that they could be used for on-site education in schools or communities. Topics of banners: Explanation of the 3Rs (lower left) and example actions to reduce waste (lower right). To promote the 3Rs, the Study Team proposed "Aparade" in Shinhala ("Mottainai" in Japanese) as a slogan.

Plate 7 : PP "Environmental Education Improvement" (2/2)

The objective of the pilot project was to develop the capacities of the counterparts. Through the process of the pilot project, including the establishment of the EEC, training in equipment use, production of educational materials, etc., the counterparts' sense of ownership of the environmental education program was increased.

When the environmental education improvement pilot project (EEIPP) started, the counterparts needed much support from the Study Team, but now they are planning and taking action by themselves. They are willing to promote environmental education. Each town has developed original activities suitable to their areas.

Progress in Chilaw

In Chilaw the EEIPP started in February 2003 and is being carried out continuously by the Divisional Development Officer (DEO). The organisation of Chilaw Urban Council was fragile and their human resources limited. Chilaw was under the poorest conditions among the four towns for the EEIPP. However, now they are implementing the environmental education program by themselves with minimal input from the Study Team. This shows that the EEIPP can be successful in many other LAs.

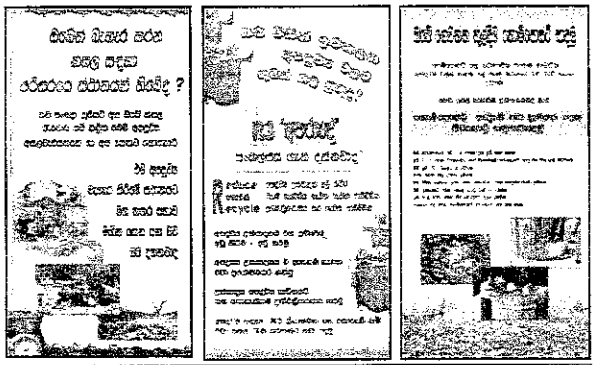
Educational activity for school children in the EEC on 28 March 2003

Cleaning up campaign (Sramadana) on 25 April 2003. Many the public people participated in the campaign to clean up road sides in their area.

Community activity as part of on-site education held on 28 May 2003.

Effectiveness in Capacity Development

Following Chilaw, Badulla, Nuwara Eliya and Matale started the EEIPP. The know-how obtained through the EEIPP in Chilaw was made good use of for the other towns, bringing good results and greater effectiveness.



Banners (Badulla)

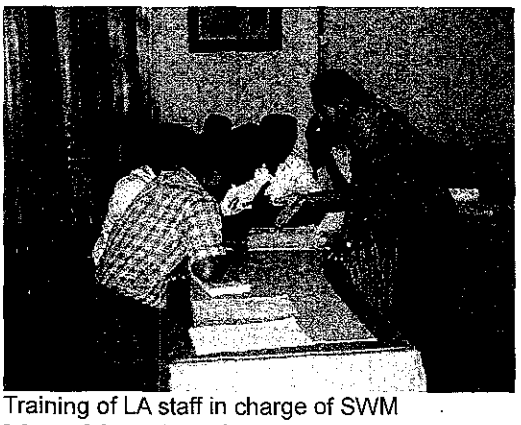
The counterparts prepared the educational banners by themselves. They came up with description of banners and took photos with a digital camera. Their design is much better than the draft idea prepared by the Study Team.

Presentation by counterparts (Badulla)

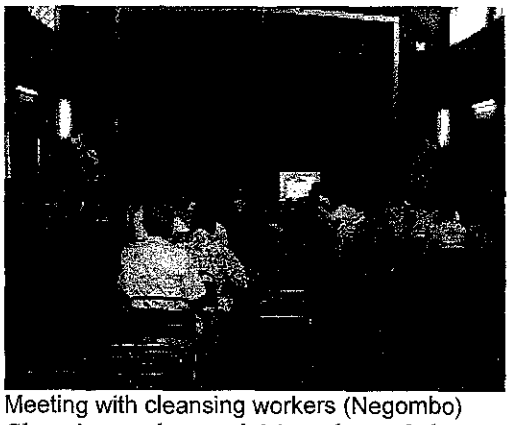
In the beginning, the counterparts were inexperienced in even how to use a keyboard. But in the end, they were able to give a presentation including many photos to the Study Team in order to explain the progress of the pilot projects.

Plate 8: PP "Strengthening Management Capacity"

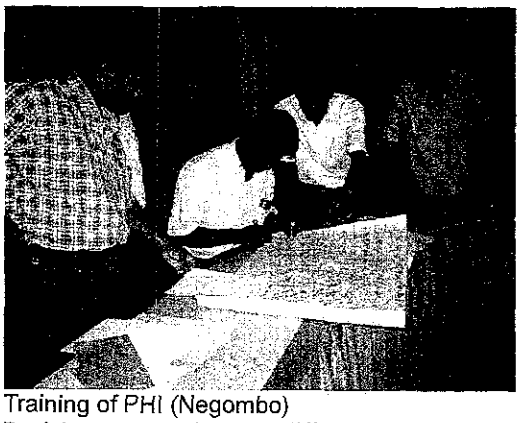
Appropriate SWM depends on the social condition because the waste amount, composition, and waste discharge pattern change with social change. LAs, therefore, always have to adjust the SWM system to fit the social condition. Strengthening the managerial capability of LAs' staff is therefore the most important task.



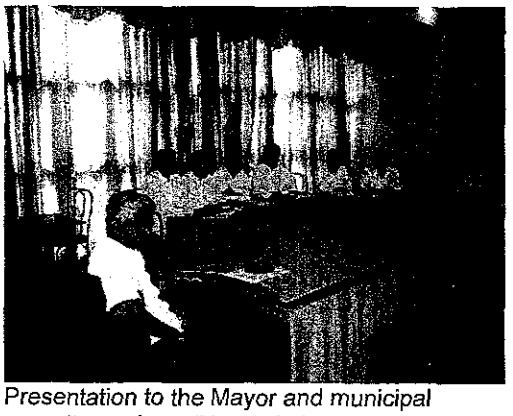
Training of LA staff in charge of SWM
Most of the trainees have never had SWM training. All of them appreciated the training.



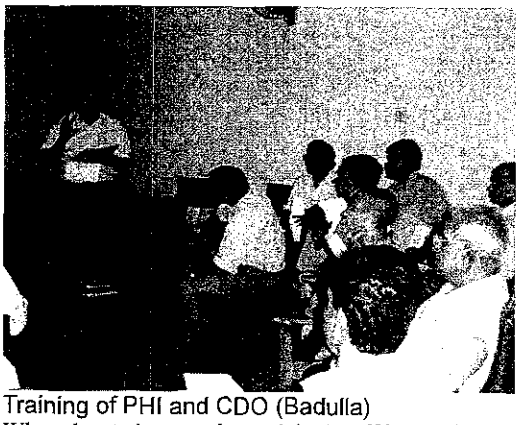
Meeting with cleansing workers (Negombo)
Cleansing workers and drivers learned about bell collection and some waste collection improvement measures to be executed.



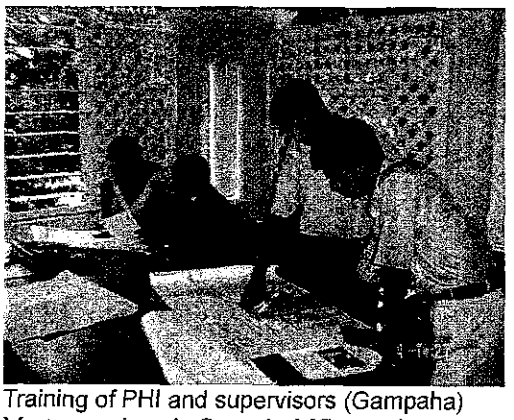
Training of PHI (Negombo)
Participants were given the different exercise by the group at the seminar. They presented their work after doing it.



Presentation to the Mayor and municipal council members (Negombo)
The bell collection method was explained to municipal council members to get their cooperation.



Training of PHI and CDO (Badulla)
When the study started, municipal staff knew almost nothing about SWM works. The training together with the implementation of the pilot project helped them to understand it.



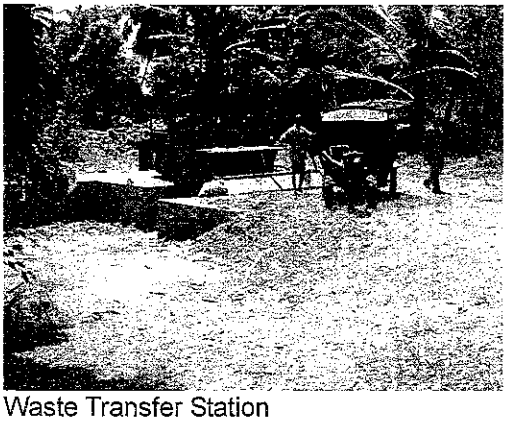
Training of PHI and supervisors (Gampaha)
Most supervisors in Gampaha MC are quite young and have little experience. They urgently need proper training.

Plate 9: PP "Waste Collection Improvement"

The project targeted improvement of the collection and transportation systems used to increase efficiency.

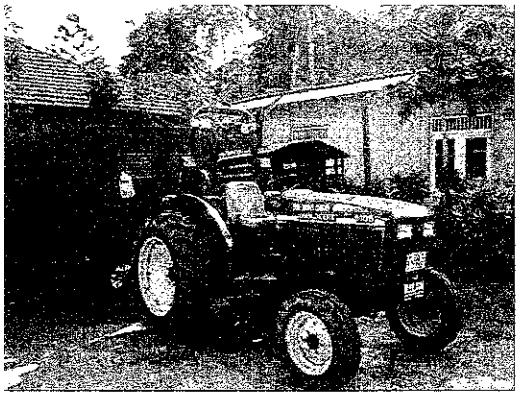
Before the improvement

Waste collected by a handcart and a handtractor were manually transferred to a trailer. This work was very inefficient, taking more than one hour and five people.



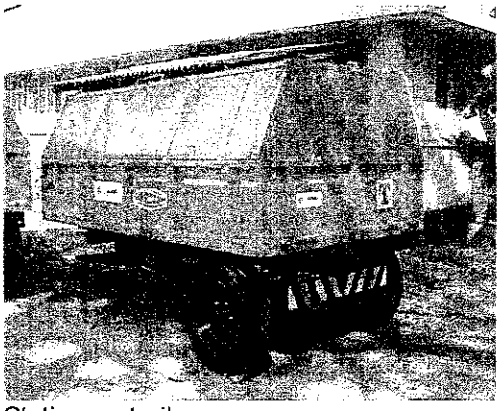
Waste Transfer Station

The transfer bay constructed enabled a trailer to park at the lower yard so that waste can be easily transferred.



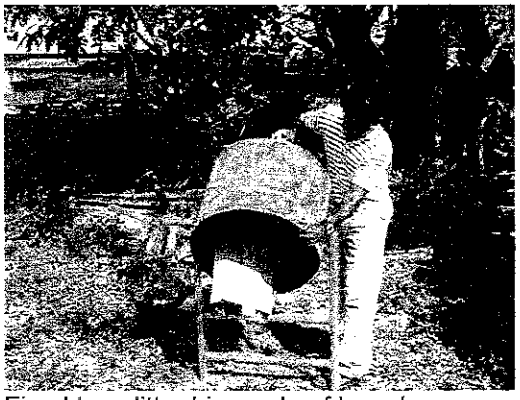
Tractor for bell collection

The tractor plays special music during the waste collection work to inform people that it is coming.



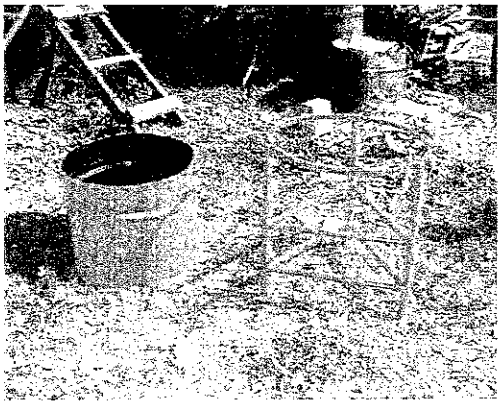
Stationary trailer

The stationary trailers provided were placed at markets and bus stations. After it is filled up with waste, it is carried to the landfill site for disposal by a tractor. Negombo MC purchased five trailers after realizing its effectiveness through the pilot project.



Fixed type litter bin made of barrel

These were installed at parks, etc. It is easy to discharge waste.



Movable type litter bin made of barrel

These should be carried to sites where many people gather temporarily such as Sunday markets.

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Abbreviations

ADB	Asian Development Bank
CBO	Community Based Organisation
CDA	Community Development Assistant
CDO	Community Development Officer
CEA	Central Environmental Authority
CPHI	Chief Health Inspector
DEO	Divisional Environmental Officer
DF/R	Draft Final Report
EEC	Environmental Education Centre
EIA	Environmental Impact Assessment
EPL	Environmental Protection License
EPR	Extensive Producers Responsibilities
F/R	Final Report
GMC	Gampaha Municipal Council
HABITAT	The United Nations Centre for Human Settlements
HCW	Health Care Waste
HDPE	High Density Polyethylene
HHCW	Hazardous HCW = clinical waste, body parts, placentas),
HHHCW	Highly HHCW = highly infectious wastes and sharps.
HWM	Hazardous Waste Management
IC/R	Inception Report
IEE	Initial Environmental Examination
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
KMC	Kandy Municipal Council
LA	Local Authority
LDPE	Low Density Polyethylene
LLDF	Local Loans and Development Fund
MC	Municipal Council
MCB	Badulla Municipal Council
M/M	Minutes of Meeting
MMC	Matale Municipal Council
MOENR	Ministry of Environment and Natural Resources
MOH	Medical Officer of Health
MOHAPCLG	Ministry of Home Affairs, Provincial Councils, Local Government
MOHNW	Ministry of Health, Nutrition and Welfare
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NEA	National Environmental Act
NEMC	Nuwara Eliya Municipal Council
NFPO	National Forum of People's Organisations
NGO	Non-Governmental Organisation
NIPHS	National Institute of Public Health and Science
NMC	Negombo Municipal Council
NSSWM	National Strategy for Solid Waste Management
NSWMSC	National Solid Waste Management Support Centre

O&M	Operation and Maintenance
PAA	Project Approving Agency
PC	Provincial Council
PHI	Public Health Inspector
PP	Polypropylene
P/R	Progress Report
PS	Pradeshiya Sabha
Rs	Rupees
SLILG	Sri Lankan Institute of Local Governance
S/W	Scope of Work
SWM	Solid Waste Management
UC	Urban Council
UCC	Urban Council of Chilaw
UDA	Urban Development Authority
3 Rs	Reduce, Reuse and Recycle

Chapter 1 Introduction

1.1 Background

In local towns in Sri Lanka, the problems related to health, sanitation and the environment caused by solid waste are getting more serious due to improper solid waste management (SWM). However, any improvement measures that incur a cost increase are too difficult to implement because the SWM expenditures in most local towns have overloaded the municipalities' budgets. Therefore, in terms of practicability and sustainability, the operation and maintenance (O&M) cost and the replacement cost of the improvement plans to be proposed must be affordable for the local governments. In order to satisfy the requirements, the proposed plans have to effectively utilise locally available materials, technologies, natural conditions, etc.

In addition, since SWM works are greatly influenced by the changes in social conditions, it is necessary that the SWM plans be flexible to adjust to the social changes and that the managerial capability of executing agencies is improved. A SWM manual, therefore, must be prepared.

Under these circumstances, the Government of Sri Lanka requested the Government of Japan to implement the Study in September 2000. In response to the request, the Government of Japan dispatched a Preparatory Study Team in September 2001 and the Team signed and exchanged the scope of work. JICA appointed Kokusai Kogyo Co., Ltd. as the consultant of the Study.

1.2 Main Scope of the Study and the Study Area

1.2.1 Objectives of the Study

The study had the following five objectives.

1) To formulate an appropriate and practical solid waste management action plan for each model town described in the study area and study waste.
2) To jointly implement pilot projects in model towns aiming at the actual improvement of some aspects of SWM.
3) To prepare guidelines for local authorities (LAs) for improvement of SWM.
4) To prepare policy recommendations for the central government.
5) To transfer technologies to the counterpart personnel in the course of the Study

1.2.2 Study Area

The model towns targeted by the Study were Negombo, Chilaw, Gampaha, Kandy, Matale, Nuwara Eliya and Badulla. Based on the study results in the seven model towns, the SWM improvement plan for the country was formulated.

1.2.3 Outline of the Study

	Main Study Items	Study Contents
a.	**Formulation of Action Plans**	An action plan was prepared for each of the seven model towns. The Study coordinated with the relevant provincial governments as well.
b.	**Implementation of Pilot Projects**	The pilot project sites were selected from the above mentioned towns after the first study work in Sri Lanka.
c.	**Formulation of the SWM Guideline for Local Government**	It was formulated targeting all the local governments in Sri Lanka using the data collected in the first and second survey periods.
d.	**Formulation of the Policy Recommendation for the Central Government**	It was formulated targeting the central governmental organisations related to SWM administration

1.2.4 Solid Waste Covered Under the Study

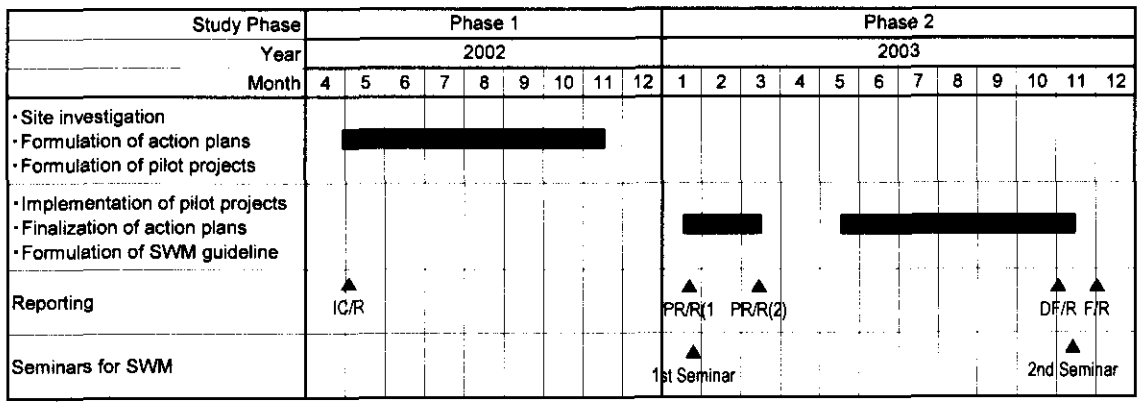
This study covered residential waste, business waste, public waste, medical waste and industrial waste. However, as for the study on industrial and medical waste, only policy suggestion was made. Although night soil was covered by the Study, only policy suggestions were made.

1.3 Study Schedule

The Study was executed according to the following two phases.

1st Phase (from May 2002 until Nov. 2002): Formulation of draft SWM action plans

2nd Phase (from Jan. 2003 until Nov. 2003): Implementation and operation of pilot projects



1.4 Policies of the Study

1) The operation and maintenance in SWM projects is more important than the investment for equipment procurement and facility construction because its required cost is very large. The priority was, therefore, placed on the capacity development of the relevant institution and staff to improve the present condition and to ensure the success of the project to be executed.

2) The local authority of each model town took the initiative in the formulation of the action plan with technical assistance from the Study team, and was responsible for it.

3) The pilot projects have to be continuously executed to achieve actual improvement. Therefore, the counterparts were requested to actively implement the projects with technical assistance from the Study team in order to improve the processes.

1.5 Implementation Plan of the Study

a. Member of the JICA Advisory Committee

The member of the JICA Advisory Committee was as follows.

Chairman Ph.D. Isamu Yokota University of Shizuoka

b. Members of the Study Team

The members of the Study team were as follows.

Assignment	Expert
Leader	Mr. Akira Doi
Deputy leader (1) / Final Disposal	Mr. Naofumi Sato
Collection, Transport, Resource Recovery	Dr. Sean Finnigan
Public participation, Social consideration	Ms. Misa Oishi
Environmental education	Ms. Tomomi Kitajima
Deputy leader (2) / Institutional Plan	Mr. Susumu Shimura
Financial analysis	Mr. Kozo Baba
Recycle, processing & treatment	Mr. Tamotsu Suzuki
Geological Survey and Facility Plan	Dr. Lei Peifeng
Equipment plan / Cost estimation	Mr. Hiroshi Fujita
Financial System Plan	Mr. Hachiro Ida
Waste amount & composition	Mr. Takeshi Nakano

c. Counterpart Organizations

The Ministry of Home Affairs, Provincial Councils, and Local Government (MOHAPCLG) was the counterpart agency and the coordinating body of the Study in the Sri Lankan side and the staff in MOHAPCLG and seven model towns worked as the counterparts of the Study.

d. Members of the Steering Committee

The Government of Sri Lanka established a Steering Committee consisting of representatives of the following organisations under the chairmanship of the secretary of Ministry. The Steering Committee held the meetings occasionally.

- Ministry of Policy Development & Implementation
- Ministry of Health, Nutrition & Welfare
- Ministry of Housing and Plantation Infrastructure
- Ministry of Environment & Natural Resources
- Ministry of Home Affairs, Provincial Councils & Local Government

1.6 Technical Transfer

a. Seminars and Workshops

SWM technical seminar:	(2 times each at 7 model towns and Colombo)	16 times
Workshop for the formulation of SWM By-law		3 times
Seminar on Picture Book for DEO (Training of Trainers)		2 times
Seminar on SWM for PHI course		4 times
Seminar on SWM for Local NGOs		1 time
Seminar on Social Aspect of SWM to University Students and Staff		1 time
Seminar on SWM for Politician and High Ranking Officers in Provinces:		6 times
Total		33 times

b. Training

Forty-five training sessions and lectures altogether were conducted.

c. Counterpart Training

The following two personnel received the training in Japan.

- Mr. Wijetunga, Additional Secretary, Ministry of Home Affair, Provincial Council and Local Government
- Mr. Namal Dhamika Dissanayake, Mechanical Engineer, Kandy Municipal Council

1.7 Reports

The list of final reports submitted to the Government of Sri Lanka by the Study team is as follows.

Reports	Language	No of Reports		
		JICA	Sri Lanka	Total
Action Plan for Model Towns				
for Badulla, Main Report	English and Shinhala	10	10	20
for Badulla, Supporting Report	English	10	5	15
for Chilaw, Main Report	English and Shinhala	10	10	20
for Chilaw, Supporting Report	English	10	5	15
for Gampaha, Main Report	English and Shinhala	10	10	20
for Gampaha, Supporting Report	English	10	5	15
for Kandy, Main Report	English and Shinhala	10	10	20
for Kandy, Supporting Report	English	10	5	15
for Matale, Main Report	English and Shinhala	10	10	20
for Matale, Supporting Report	English	10	5	15
for Negombo, Main Report	English and Shinhala	10	10	20
for Negombo, Supporting Report	English	10	5	15
for Nuwara Eliya, Main Report	English and Shinhala	10	10	20
for Nuwara Eliya, Supporting Report	English	10	5	15
Reports for the Central Government				
SWM Guideline for Local Governments	Guideline in English and Shinhala, Supporting data only in English	10	410	420
Summary	English	10	40	50
Main Report	English	10	40	50
Supporting Report	English	10	40	50

Chapter 2 Current Situation of Municipal SWM

2.1 Institutional and Organisational System

2.1.1 SWM Administration System

Local administration is executed by nine Provincial Councils (PCs) and a total of 311 local authorities (LAs) consisting of 18 Municipal Councils (MCs), 37 Urban Councils (UCs), and 256 Pradeshiya Sabhas (PSs) as of 2003. LAs are responsible for the execution of SWM works, while PCs' role in SWM administration is very limited as they are organisationally and financially weak due to their recent establishment in 1987.

Solid waste is categorized into the following three groups:

- Municipal solid waste (MSW);
- Health-care waste; and
- Hazardous waste.

Municipal solid waste and non-risk hazardous waste are the responsibility of LAs.

Although health-care waste is the responsibility of the medical institutions which discharge such waste, LAs deal with non-hazardous health-care waste.

The Ministry of Home Affairs, Provincial Councils and Local Government (MOHAPCLG) is responsible for the implementation of policies, plans and programmes in respect of Provincial Councils and Local Authorities. Under the Secretary, there is the Local Loans and Development Fund (LLDF) and the Sri Lanka Institute of Local Governance (SLILG).

The Ministry of Environment and Natural Resources (MOENR) is responsible for SWM planning and policy. The Central Environmental Authority (CEA) is a government agency appointed to work on the National Environment Act (NEA) within the MOENR; it is responsible for regulatory control and management.

The Ministry of Health, Nutrition and Welfare (MOHNW) is responsible for health-care waste management policy, monitoring and inspection on sanitary aspects. For the control and supervision of SWM, MOHNW assigns Medical Officers of Health (MOHs) and Public Health Inspectors (PHIs) to the LAs.

The Urban Development Authority (UDA) is a national agency responsible for urban development in the country under the UDA Act.

2.1.2 Legal System of SWM

Legislation relating to SWM is embodied in the NEA, which was enacted in 1980 and subsequently amended in 1988. The Act (including the amendment) provided for the

establishment of the CEA and defined the powers, functions and duties of it.

The government of Sri Lanka developed regulations for the Management of Hazardous Waste in 1996 and published "Guidelines for the Implementation of Hazardous Waste Management (HWM) Regulations" in 1999.

2.1.3 National Policy on SWM

The policies, strategies and legal provisions for SWM currently in place in Sri Lanka provide the necessary basis for action leading to effective and sustainable improvement in the sector. The NEA of 1980 provides the enabling legislation for the regulation and control of SWM activities; the National Strategy for Solid Waste Management (NSSWM) provides guidance for tackling the problem on several different fronts.

2.2 Financial Condition

a. Subsidy for LAs

Their dependence on the central government seems quite high; in 1998[1], the municipal councils' dependence rate was 24% and the urban councils' dependence rate was 46%. The fact that the dependence rate of six of the seven model towns on the subsidy exceeded 40% of LAs' budgets, which is based on data from 2001, shows a very high dependence. The number of public servants for LAs is decided at the national level and the amount of subsidy to LAs is determined based on their salaries. This system discourages LAs from reducing the salaries, which account for the largest part of their budgets.

b. Self-generated Revenue Sources for LAs

LAs' main revenue sources are assessment tax, rental income, trade licenses, etc. As for the assessment tax, the collection rate is relatively high; however the basic rates for assessment tax are generally too cheap. As for trade licenses, most LAs have been using very old tariff systems since long ago without any revision, which are no longer appropriate for the current social condition. Therefore, there is a high potential for an increase in revenue through the improvement of these revenue systems.

c. Financial Sources for Capital Investment Projects

LAs' budgets for capital investment are generally very small. This is due to not only few self financial sources but also the fact that development projects for LAs have historically been implemented by the central government. In addition, the fact that the budget for LLDF has greatly decreased since a few years ago has made it more difficult for LAs to execute projects by themselves.

[1] Source: Statistical Abstract 2000, Department of Census and Statistics, Ministry of Finance and Planning

d. LAs' Budget for SWM

LAs' SWM budgets are generally around 20% for urbanised towns and up to 50% of the total budget for local towns. However, most LAs do not understand or control the expenditure properly because it is generally included in the budget of the health department and/or the mechanical department.

The majority of the total SWM expenditure is for collection and transportation while very little is for final disposal. This is not only due to the LAs' ignorance of final disposal but also its high contribution to job creation and, in addition, its high subsidization by the Central government.

2.3 Outline of the Study Model Towns

The populations of the model towns range from 24,000 to 146,000. Most of them are main towns in rural regions and represent towns that are faced with waste problems. Table 1 shows the conditions in model towns as of Nov. 2002, befor the implementation of pilot projects.

Table 1: Main Index of the Seven Study Model Towns

Items	unit	**Chilaw**	**Negombo**	**Gampaha**	**Matale**
Type of LA		UC	MC	MC	MC
Province		North-central	Western	Western	Central
Population	p	24,100	146,000	57,400	36,300
Area	km^2	5.17	28.5	37.4	0.86
LA's total budget	Rs	31,695,000	98,814,000	36,791,000	61,303,500
SWM budget	Rs	10,936,000	20,607,000	10,010,000	12,085,660
Approved no. of LA employees	P	261	687	195	456
No. of SWM workers	P	77	184	72	132
Rate of SWM budget	%	35	21	27	20
Rate of SWM workers	%	30	28	36	29
SWM budget per capita	Rs	446	140	174	329
SWM system					
Collection system					
Handcart system	No	5	30	4	15
Two wheel tractor	No	2	1	6	3
Four wheel tractor	No	5	16	5	4
Compactor	No	0	0	0	2
Treatment system		The compost plant receives 90% of waste collected.	None	None	None
Final disposal system		Manual unsanitary landfill	The site is a sand mine; occasional soil cover; a rented bulldozer	Manual trench type sanitary landfill; rented tractor shovel	Riverside; unsanitary landfill

Items	unit	**Kandy**	**Nuwara Eliya**	**Badulla**
Type of LA		MC	MC	MC
Province		Central	Central	Uva
Population	p	110,000	27,800	41,000
Area	km^2	28.53	15.01	10.36
LA's total budget	Rs	269,915,000	72,975,000	57,861,000
SWM budget	Rs	52,851,300	13,795,000	7,717,000
Approved no. of LA employees	P	1,414 (excluding waster dept.)	402	249
No. of SWM workers	P	429	90	84
Rate of SWM budget	%	20	19	13
Rate of SWM workers	%	30	22	25
SWM budget per capita	Rs	476	489	187
SWM system				
Collection system				
Handcart system	No	70	23	5
Two wheel tractor	No	0	0	1
Four wheel tractor	No	14	6	3
Compactor	No	5	1	1
Treatment system		None	There is but no more operation	There is but no more operation
Final disposal system		Gohagoda landfill A bulldozer station	In the forest Unsanitary landfill	In the play ground Unsanitary landfill

2.4 Technical System

2.4.1 Waste Amount and Composition

2.4.1.1 Waste Composition

Table 2 show the physical composition data of the waste samples taken at the landfill sites in seven model towns.

Table 2: Physical Composition of Waste in Wet Base

Town	unit	Badulla	Chilaw	Gampaha	Kandy	Matale	Negombo	Nuwara Eliya
Physical composition								
Kitchen waste	%	64.3	36.6	57.3	58.2	61.3	45.6	71.6
Grass & wood	%	14.1	29.7	15.3	12.3	18.1	24.7	5.7
Paper	%	10.8	6.8	14.4	12.0	6.4	8.9	11.1
Textile	%	1.3	1.3	1.5	1.4	1.1	3.5	1.2
Soft plastic	%	3.1	3.1	6.5	7.3	3.9	4.0	5.4
Hard plastic	%	0.3	1.0	1.3	0.7	0.4	0.8	0.3
Leather & rubber	%	0.4	0.1	0.4	0.7	1.1	0.9	0.1
Metal	%	0.8	0.8	0.5	0.8	0.4	0.5	0.7
Glass	%	1.8	0.3	1.4	1.1	0.4	0.8	0.9
Ceramic & stone	%	2.8	12.1	1.2	5.1	6.6	8.4	2.6
Others	%	0.2	8.2	0.6	0.4	0.3	2.0	0.3
Total	%	100	100	100	100	100	100	100
Applicability								
Compostables	%	78.4	66.3	72.5	70.5	79.4	70.3	77.4
In-organic recyclables	%	18.2	13.3	25.4	23.3	12.6	18.4	19.7
Bulk density	kg/l	0.31	0.20	0.15	0.30	0.33	0.26	0.39

a. Compostable Ratio

Because the percentage of compostable contents in waste is very high, ranging from 70% to 80%, waste in local towns is suitable for compost in terms of waste quality.

b. In-organic Recyclables

1) The total percentage of in-organic recyclables including paper, textiles, plastics, metals and glass is rather small, ranging from 12% to 25%.

2) The percentages of hard plastics, metals and glass in particular, which can have relatively high profitability, are very low.

3) Most paper waste consists of used paper that had been reused or recycled.

4) As for the percentage of in-organic recyclables in waste, that in Gampaha located nearest to Colombo shows the highest of all model towns.

5) The above analysis suggests that there is a small amount of in-organic recyclables and that the 3 Rs are active.

c. Bulky Waste

Bulky waste such as furniture waste and electric appliances are scarcely disposed of at landfill sites. It is presumed that even parts of them are reused at present.

2.4.1.2 Waste Amount

a. Amount of Municipal Waste

The amounts of wastes at model towns are as follows.

Table 3: Waste Amounts by Model Town

Name of town	unit	Generation	Collection	Disposal
Badulla	T/D	41	21	21
Chilaw	T/D	22	12	11
Gampaha	T/D	54	11	9
Kandy	T/D	131	86	78
Matale	T/D	32	21	20
Negombo	T/D	136	56	54
Nuwara Eliya	T/D	29	18	17

b. Discharge Rates of Municipal Waste

Figure 1 shows that there are very large gaps between the waste generation rates and discharge rates. It implies the 3 Rs are being carried out very actively.

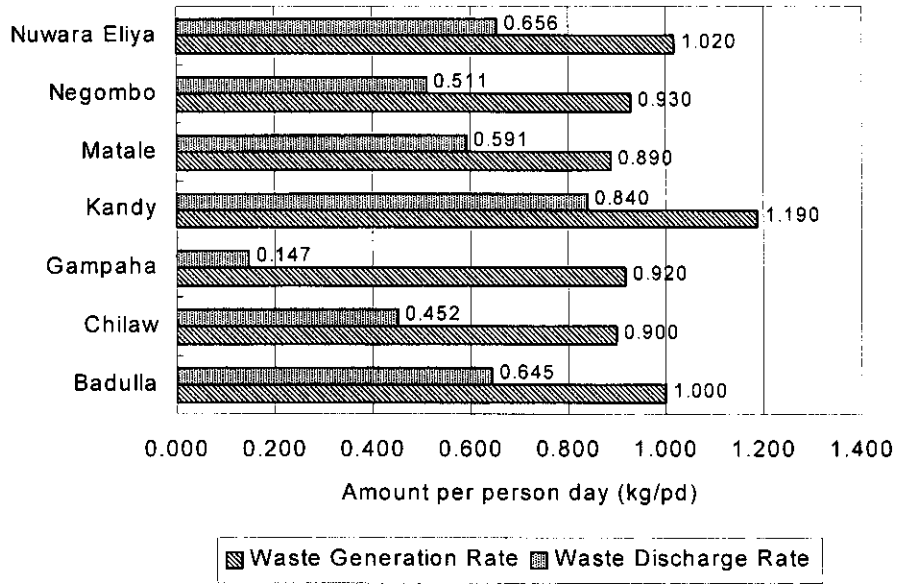


Figure 1: Waste Generation and Discharge Rates

c. Waste Discharge Rate Survey Results of Residential Wastes

Table 4 shows the waste discharge rate data for residential waste in Kandy and Matale.

Table 4: Waste Discharge Rate Survey Results of Residential Wastes

Category	unit	Kandy	Matale
High Income	kg/p/d	0.667	0.447
Middle Income	kg/p/d	0.466	0.413
Low Income	kg/p/d	0.368	0.407
Average	kg/p/d	0.502	0.422

Note: kg/p/d means kilogram/person/day

Richer people discharge more waste. This trend found in the survey fully complies with the principle of the waste discharge rate. However, the waste discharge rate of high income residences in Kandy, which is 1.8 times higher than that of low residences, has reached a similar range to that in developed countries.

2.4.1.3 Waste Stream

Figure 2 shows the typical waste stream in secondary cities in Sri Lanka.

Recycle at E in Figure 2 is divided into the following methods.

- Separate collection at generation sources such as recyclers and direct selling to shops.
- Recovery of recyclables during waste collection work
- Recovery of recyclables by waste pickers at landfill sites
- Recovery of kitchen waste for piggeries.

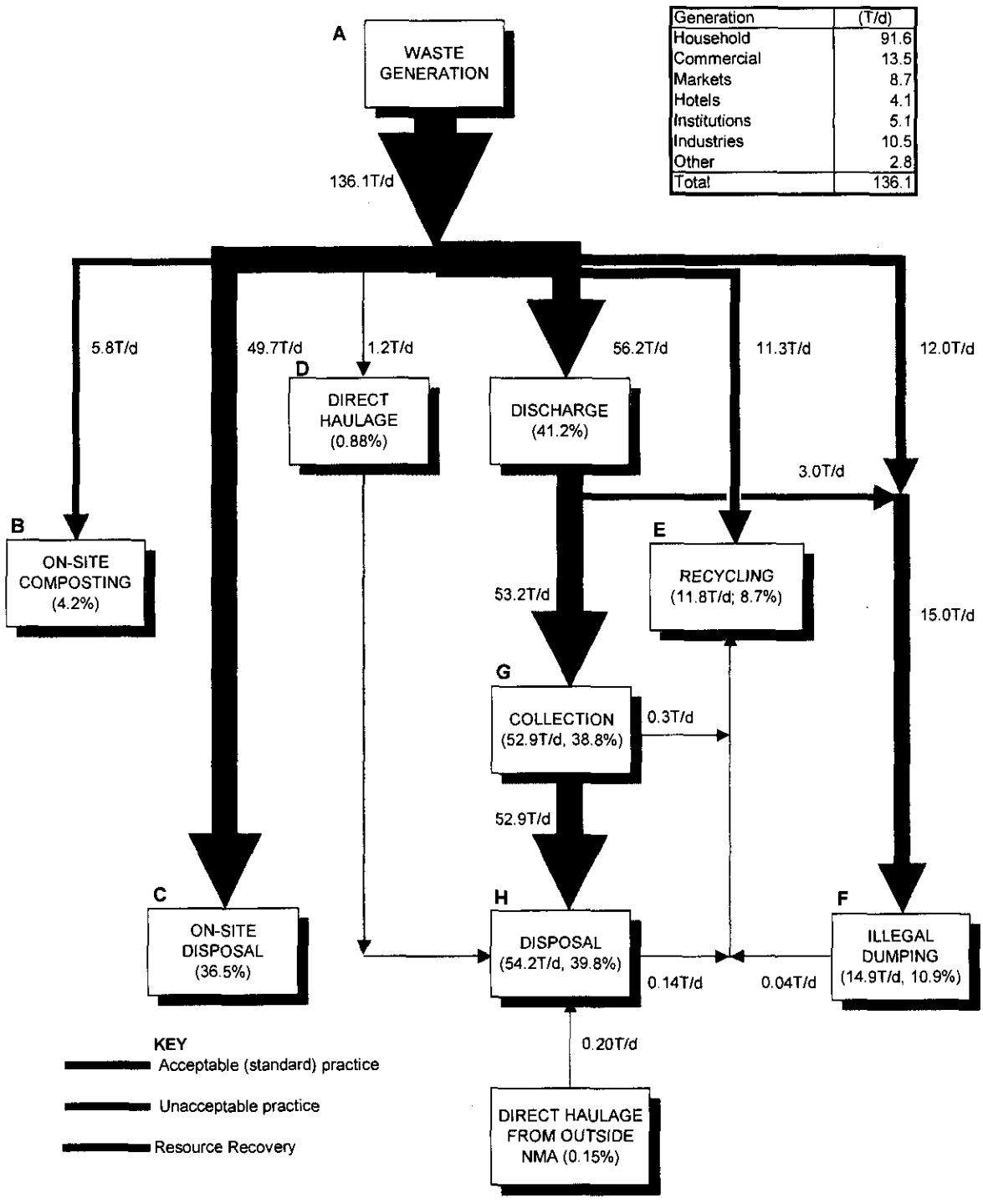
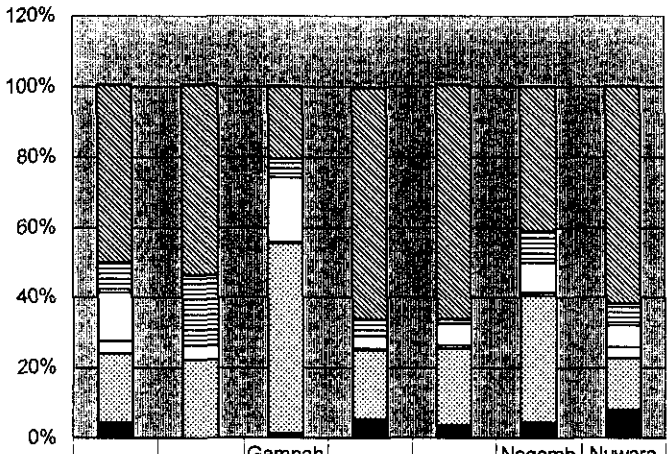


Figure 2: Typical Waste Stream at Secondary Cities in Sri Lanka (Example of Negombo, 2002)

Table 5 shows the waste stream at each model town which identified by the Study.

Table 5: Waste Amounts by Final Destination

Town	unit	Generation	Home compost	Self disposal	Direct Haulage	Recycle	Illegal dumping	Landfill
Badulla	T/D	41	2	8	1	6	5	21
	%	100%	5%	20%	3%	14%	11%	51%
Chilaw	T/D	22	0	5	0	1	4	11
	%	100%	0%	22%	0%	4%	20%	50%
Gampaha	T/D	54	1	29	0	10	4	9
	%	100%	1%	54%	0%	18%	8%	16%
Kandy	T/D	131	7	26	1	5	18	78
	%	100%	5%	20%	0%	4%	13%	60%
Matale	T/D	32	1	7	0	2	2	20
	%	100%	4%	22%	1%	7%	7%	61%
Negombo	T/D	136	6	50	1	12	15	54
	%	100%	4%	37%	1%	9%	11%	40%
Nuwara Eliya	T/D	29	2	4	1	2	4	17
	%	100%	8%	15%	3%	7%	13%	58%



	Badulla	Chilaw	Gampaha	Kandy	Matale	Negombo	Nuwara Eliya
Collection	50%	54%	20%	66%	66%	41%	62%
Illegal dumping	8%	20%	6%	5%	1%	9%	6%
Recycle	14%	4%	18%	4%	7%	8%	7%
Direct Haulage	3%	0%	0%	0%	1%	1%	3%
Self disposal	20%	22%	54%	20%	22%	37%	15%
Home compost	5%	0%	1%	5%	4%	4%	8%

Figure 3: Waste Amount Ratio by Stream from Generation Sources

The waste stream implies the followings:

a) The differences between the waste generation amounts and the waste collection amounts are generally very large. The waste collection rate ranges from 50% to 65% and is very low in Gampaha (only 20%) in particular. This implies that the self disposal amount and recycle amount at generation sources are large and the 3Rs are active. In other words, a decline in the current 3R activity could rapidly and greatly increase the waste discharge amount. Promotion of the 3 Rs is, therefore, essential to prevent a rapid increase in waste amount.

b) Home composting is well performed in the inland area, ranging from 4% to 8%, while it can be further promoted at Negombo and Chilaw due to the present low performance.

c) The self-disposal rate is high, ranging from 15% to as much as 54%.

d) The recycling rate, ranging from 4% to 18%, is deemed very high, considering the fact that the percentage of in-organic recyclables in the waste generated is very low.

2.4.2 The 3 Rs (Reduce, Reuse, Recycle) at Generation Sources

2.4.2.1 Present System

The deposit system is widely used for soft drink bottles, beer bottles, local whisky bottles, and containers of local yoghurt. Their collection rates are very high because the deposit fees are generally is quite expensive.

Traditional recyclers, which are called "bothal paththara karaya" in Sinhala, have been working throughout the country since long ago. Because they have been well utilized by citizens, they have been rooted into a part of the social system. A large amount of recyclables are still recovered by them as valuable materials in return for money or some plastic products. The collection of recyclables at generation sources by recyclers is, therefore, very active and this is the most important recovery route of recyclables.

The items which recyclers generally collect are mainly paper such as newspapers, notebooks, cardboard, cans, bottles, and metal. These are sold to middle men after collection.

The public consciousness survey in the Study shows that 80% of households receives recyclers' visits. However, in towns which are more urbanized like Negombo, the recyclers' visiting rate is decreasing. The cause of decline of the recyclers' activity for residential waste with urbanization is mainly due to the increase in profitable recyclable waste which is discharged from industries and business entities. Recyclers are, therefore, busy collecting more these homogeneous wastes which can be recycled more easily than municipal waste. In such areas, the need to give an economic incentive for the recovery of recyclables from municipal waste and to establish a new separate collection system is increasing.

Waste collection workers often collect recyclable materials during waste collection work and sell it to middlemen. Although this practice is conducted widely in the country, the income from this is negligible, only enough for tea money for them.

Some recyclables are collected by waste pickers at landfill sites, although this amount is not so large because there are not many waste pickers at landfill sites in Sri Lanka.

Piggeries collect kitchen waste from some hotels and restaurants in some tourist towns.

2.4.3 Discharge and Storage

a. Main Systems Used

Current main systems used are classified into the following three types.

- Direct discharging onto roads
- Communal container
- Disposable bags

The appropriate discharge and storage system depends greatly on the waste composition, waste amount, town structure, waste discharge pattern, social condition, etc. However, the traditionally used waste bins which cannot prevent waste scattering by stray animals are still widely used and the usage of thin, flimsy polythene bags is increasing. Their own initiative toward the improvement of the discharge and storage system to fit to the current situation is scarcely seen. Therefore, most present discharge and storage systems are not suitable for the present social condition and cause the following problems:

- Deterioration of sanitary conditions and view
- An increase in street sweeping works and street sweeping workers
- An increase in waste collection works and collection workers

Consequently, the introduction of a proper discharge and storage system which fits the present social condition can greatly contribute to reducing the street sweeping cost and collection cost, and to improving the sanitary conditions and view.

2.4.4 Collection and Transportation

The average garbage collection service coverage is typically around 75-85% on a population basis, which is considered a quite satisfactory level under the present land use condition.

Garbage is commonly collected daily or every second day, with daily collection being popular for busy roads, commercial areas and high density residential areas. Some towns even operate a twice daily collection service in the city centre. Low frequency collection (once or twice per week) is typically carried out in areas with relatively few households, poor access, etc.

Handcarts are commonly used for primary garbage collection on a large scale in majority of towns. Tractors (hand tractors or tractor/trailers) are the most common vehicles used to collect garbage, although reconditioned compactors are favoured in some of towns for garbage collection.

Following collection, garbage is generally transported directly to final disposal except in few towns where there are processing/treatment.

Most LAs have an ageing vehicle collection fleet, resulting in frequent breakdowns. Many

repairs take a long time, due to poor workshop capacity, involved and slow approval procedures, etc. Most LAs do not have any systematic vehicle replacement plan.

The unit costs calculated above are high in many cases, indicating there is considerable potential for reducing handcart and collection vehicle unit costs by decreasing the number of labourers, increasing the number of daily trips, and improving the collection efficiency. Overall, both tractor/trailers and compactors are considered suitable for garbage collection in Sri Lanka, while the use of handcarts and hand tractors for garbage collection should be restricted to essential places only or for special tasks.

2.4.5 Processing and Treatment System

Most recycling processing and treatment operations focus on high value recyclables – metals, clean paper (old newspapers, periodicals, etc.), and broken glass – with the recycling system being well established and recovery rates being relatively high for these items, especially in the case of metals which is mainly exported to India. Plastics recycling is also relatively common but on a much smaller scale, being based on small-medium enterprises recycling mainly high value items - clean and sorted HDPE, LDPE and PP from industrial and commercial sources. The recycling of mixed, unwashed plastics (low value items) is much less common.

Whilst 70-90% of Sri Lankan MSW is organic, the amount of MSW currently being composted or processed into biogas is very small. Economic viability is the key issue, compounded by receiving mainly mixed MSW, difficulties in selling the resulting compost product, a lack of support from local and central government, and problems disposing of reject waste materials.

Overall, however the most important factor currently affecting the viability of MSW processing and treatment operations in Sri Lanka is that final disposal, via open dumping or landfilling, is virtually free in almost all local towns. This means that most LAs have no incentive to actively promote recycling or composting or biogas production from MSW. The exception is Colombo where they pay a tipping fee of 550Rs/tonne. If other LAs were to pay a similar fee, or even a much lower fee of say 150-200Rs/tonne, this would provide a big stimulus to the processing and treatment of MSW.

2.4.6 Final Disposal

2.4.6.1 Current condition of Final Disposal

There are few measures to mitigate environmental pollution at most of the existing landfill sites in Sri Lanka. This causes serious environmental effects on the surrounding areas. The current condition of existing landfill sites in Sri Lanka are as follows:

- The scales of existing landfill sites which cover an area of approximately 1-2 hectors are small and their life spans are very short.
- There is a lot of illegal dumping in forests and rivers because the LAs can dump the waste onto natural slopes without operation of heavy equipment. Most landfill sites owned by LAs are located very close to residential areas in the town.
- Septic sewage and medical waste are discharged without any treatment at most of the existing landfill sites.
- There is often public opposition to the existing landfill sites. For example, the residents living near the existing landfill sites blockaded the access road at Matale MC and Negombo MC in 2002 and 2003.
- Soil covering has not been carried out regularly. Most LAs carry out soil covering only when the residents near the landfill site complain about it.
- The staffs in charge of operation of landfill sites burn the discharged waste on purpose in order to extend the life span of the landfill sites. The resulting smoke has a serious environmental impact on the residents in the surrounding area.
- Generally, while the appropriate operation of a landfill site requires approximately 200-300 RS per ton of discharged waste, most LAs spend less than 50Rs per ton for the operation of existing landfill sites.

2.4.6.2 Management Organization of the Landfill

The LAs that operate the landfill sites are mainly responsible for managing them. Furthermore, the CEA or the monitoring committee consisting of Project Approving Agencies (PAA)[2] is responsible as the competent organization based on the following regulations to manage the operation of landfill sites done by LAs.

[2] Project Approving Agencies: The Gazette extra-ordinary No. 859/14 of 23 February 1995 (See reference "13 Environmental Law")

Table 6: Management Organization and Method of Landfill Site

Defined regulations for landfill site	Defined Projects	Management Structure & Method
Environmental Clearance	All kinds of project consisting of facilities that have an environmental impact such as noise, air pollution, odour, and water pollution. Landfill sites are also defined.	The CEA examines whether or not the project conforms to the environmental standards based on an outline of the facility plan and a site survey. During operation of the project, the CEA monitors the operation of it periodically.
IEE or IEA	New landfill site projects defined under "The National Environmental ACT published in the Gazettes (Extra-Ordinary) No. 772/22 of 24 June 1993 and No. 859/14 of 23 February 1995" (See reference "13 Environmental Law")	Project Approving Agencies and the CEA examine the project in accordance with IEE or EIA procedures. During operation of the project, a monitoring committee consisting of PPA conducts monitoring periodically.
Environmental Protection Licenses (EPL)	All kinds of facilities that discharge 3.0 m^3 of effluent per day	After the project is approved by the CEA in accordance with Environmental Clearance or IEE or EIA procedures, an EPL is issued.

2.4.6.3 Permission for Landfill Operation

In order to operate a landfill, the project is required to obtain Environmental Clearance or IEE or EIA approval. Furthermore, if more than 3.0 m^3 of effluent per day is discharged at the landfill site, an Environmental Protection License is also required.

a. Environmental Clearance

Environmental Clearance is required for all projects which may have an environmental impact on the surrounding area including the landfill site. However, if the project is to be subjected to an IEE or EIA, Environmental Clearance is not required.

The CEA examines whether or not the noise, air pollution, odour and effluent generated by project facilities conform to general environmental standards based on an outline of the facility plan submitted by the project proponent and a site survey. Particular criteria for Environmental Clearance are not regulated; therefore, the CEA evaluates the project with the facility plan and site survey. However, Environmental Clearance for a landfill site project has never been conducted so far. All existing landfill sites in Sri Lanka are operated without Environmental Clearance; therefore, all of them are illegal dumping.

b. IEEs and EIAs

The regulation defines landfill site projects under "Schedule Part I" as follows:

Article 18: Disposal Waste

- Construction of any solid waste disposal facility having a capacity exceeding 100 tons per day.

- Construction of waste treatment plants treating toxic or hazardous waste.
- If a landfill site project has a capacity of less than 100 tons per day and is defined under another regulation in Part I-III, e.g. conversion of forests covering an area exceeding 1 hectare for use as a landfill site", the project is required to conduct an IEE or EIA

Except for the improvement of Nuwara Eliya Moon Plain landfill site carried in the JICA study, the only EIA conducted for a landfill site project so far was for the Hanwela landfill site project. However, the project was suspended and the construction has not implemented.

c. Environmental Protection License (EPL)

Projects defined under the National Environmental Regulation that have been granted Environmental Clearance or IEE or EIA approval by the CEA, are required to obtain an Environmental Protection License. The National Environmental (Protection and Quality) Regulation does not mention particular criteria regarding landfill site facilities. However, all kinds of facilities that discharge 3.0m^3 of effluent per day are subject to this regulation. As of October 2003, no local authority has obtained an Environmental Protection License regarding the operation of its landfill site except for the improvement of Nuwara Eliya Moon Plain landfill site carried out in the JICA study.

d. Approval of Existing Landfill Site

Some LAs have been dumping waste at existing landfill sites for many years before the mandate of Environmental Clearance and IEE or EIA. Most of the landfill sites have been generating leachate, which penetrates directly into the ground. If such an existing landfill site is to be improved, facilities on the surface of the landfill site, such as gas ventilation, fencing, covering soil and so on, can be installed easily. However, the installation of a new leachate collection facility below the existing discharged waste is always very difficult and is not practical because the installation costs are very high. Therefore, most of the improvement of existing landfill sites cannot conform to environmental standards and this is one of the reasons why improvement of existing landfill sites has not been implemented so far.

2.4.6.4 Guidelines for Landfill

The CEA has been preparing for the establishment of guidelines for landfill sites; however, as of October in 2003, they have not yet been mandated.

2.4.6.5 Knowledge and Training Concerning Sanitary Landfill Operation

a. Staffs of Local Authorities

Mainly PHIs are in charge of landfill operation as a part of their duties at most of the LAs. PHIs do not have enough knowledge regarding the operation of sanitary landfill, because they haven't

receive any training in sanitary landfill operation neither during the one and half years at the PHI training centre nor after being assigned to the LAs. This is why the staffs of LAs are not able to operate a sanitary landfill site.

b. CEA

Most of the staff members of the CEA, the competent authority of landfill site operation, have undergone some training or have visited sanitary landfill sites in foreign countries or developed countries. Therefore, they have some knowledge of sanitary landfill operation.

The CEA is responsible for managing the existing landfill sites in accordance with general environmental standards such as water quality standards. However, the CEA has been failing to carry out its duty, though it could have. This is mainly due to the following two reasons.

- *Inadequate management organization of landfill site*
- Lack of information on current conditions of existing landfill sites

c. Experts

Most of the experts of universities or research units are very keen on compost projects, recycling and technology for the collection of methane gas and so on as re-treatment systems. On the other hand, they are not so interested in sanitary landfill site operation as disposal technology.

d. Consultants

As a sanitary landfill project has never been implemented in Sri Lanka, there are few engineers who have experience in the planning or construction of a sanitary landfill site. Therefore, there is no consultant who is capable of planning a sanitary landfill site or designing its facilities.

2.4.6.6 Ongoing or New Landfill Site Projects

As October of 2003, there are no ongoing or new projects for a new sanitary landfill site or improvement of an existing landfill site except for this JICA project.

2.4.7 Street Sweeping

Most LAs currently undertake street cleaning and drain cleaning using handcarts and labours. However, as it is common for people to discharge their garbage at the roadside or into drains, cleansing workers tend to spend more of their time collecting garbage, rather than sweeping the streets or cleaning the drains. Dumping garbage into drains is undesirable for other reasons, as it may cause drain blockages, resulting in nuisance or health problems, (e.g. breeding sites for mosquitoes), as well as downstream environmental problems (e.g. polluting the river, lagoon or sea into which the drains flow).

In both cases, current discharge practices mean that there is no proper distinction between garbage collection, street sweeping and drain cleaning works, particularly for handcarts, these all being lumped into a single work category by LAs. Ideally, new waste discharge rules should be introduced, requiring people to discharge their garbage in a container according to a schedule and prohibiting the discharge of garbage at the roadside or into drains. Once these rules are established, this will reduce the amount of garbage deposited at the roadside or into drains, making the work of street sweepers and drain cleaners much easier.

2.4.8 Healthcare Waste Management

Interview surveys with (28) medical institutions in the seven study towns found:

1) Most HCW is made up of non-risk HCW (MSW), with hazardous HCW (HHCW) generation being relatively small, accounting for 9.1-13.8% of total HCW generation. HCW generation rates amount to 1.19-1.87kg/bed.day for non-risk HCW, 0.131-0.137kg/bed.day for HHCW and 0.060-0.085kg/bed.day for highly HHCW (HHHCW)[5].
2) None of the medical institutions surveyed are following the colour code garbage discharge system recommended by the Ministry of Health. However, most are segregating their non-risk HCW and HHCW at source and storing and disposing of them separately.
3) Most non-risk HCW is collected by the LA or a private contractor employed by LAs except for relatively small quantities of various materials that are reused (e.g. saline and penicillin bottles used as sample containers) or recycled (e.g. used plastic/glass/metal bottles/containers/tins, saline bottles, coconut shells). Some medical institutions dispose of some or all of their non-risk HCW on-site for a variety of reasons.
4) Inadequate collection and disposal of HHCW is a serious problem. Currently, most medical institutions dispose of such wastes by open burning and/or burial on-site, although some places discharge some or all of their HHCW with their non-risk HCW for collection. Even in places practicing on-site disposal of HHCW, their non-risk HCW often contains small amounts of HHCW, especially sharps.
5) Only five medical institutions surveyed have incinerators, four of which are used for HHCW treatment. All four either have some operational problems, are in poor condition or are relatively old. Three hospitals have autoclaves for the treatment of specimens and

[5] Non-risk HCW (= MSW), hazardous HCW (HHCW) = clinical waste, body parts, placentas), highly HHCW (HHHCW) = highly infectious wastes and sharps.
[7] According to the official documents of Kandy Municipal Council in 1933, that is one of the oldest municipalities in Sri Lanka, a largest portion of their annual expenditure was spent for the conservancy of latrines and scavenging together, with more to the conservancy of latrines than scavenging.

cultures prior to disposal, while some have needle burners for sterilising sharps before disposal.

2.4.9 Industrial Waste Management

Interview studies were conducted with a broad range of industries in all seven towns. This information suggests that, at least in the seven towns studied, industrial waste management is relatively healthy, with most wastes being recycled, while on-site disposal is also very common, illegal dumping is infrequent, and few industrial hazardous wastes are produced. These found:

1) Most industries do not produce hazardous wastes, other than typical everyday items such as tubelights, paint tins, batteries, spray cans, etc. The few industries producing hazardous wastes do so in small quantities.
2) Recycling is the most common waste management method in five towns, accounting for 46-73% of industrial wastes. This is largely due to sawmill/timber waste comprising a large proportion (27-99%) of industrial waste generation. Sawmill/timber waste comprises sawdust, woodchips and bark and is virtually 100% recyclable.
3) Some industries also recycle food/kitchen waste for animal feed, while a large range of inorganic materials are also recycled, including metals, broken glass, paper/cardboard, plastics/polythene, textiles, leather, rubber.
4) On-site disposal is also very common, with 26-39% of industrial wastes being disposed of by this means in six towns, mainly involving industries generating relatively little waste and having sufficiently large premises for this to be feasible.
5) Relatively little industrial waste is discharged for LA collection, ranging from 1-14% in six towns. Only a few industries are involved in illegal dumping or direct haulage of their waste to the LA disposal site.

2.5 Social Situation

2.5.1 History of SWM

Public health has been one of the main concerns of local government bodies since the colonial period. During the colonial period, the conservancy of latrines and cleansing work, called scavenging work, were the main duties of local government bodies. Among these two works, the conservancy work was recognized as severer and essential[7]. The conservancy of latrines is work which became inevitable with the introduction of bucket latrines under the British colonial regime. The bucket latrine was a type of latrine which stores all excrement into the buckets placed in the lower section below the latrine, and required a large number of conservancy workers to empty the buckets manually. The then British administration recruited these workers from South India.

The abolition of bucket latrines and the introduction of an improved toilet system liberated most

of the conservancy workers from the assigned work, and it is assumed that a large number of conservancy workers were converted into the cleansing workers. Living in the labour quarters called labour lines which were notorious for unsanitary conditions even from the colonial period, Indian workers continued to work for municipal councils as cleansing workers.

2.5.2 Social and Working Situation of Cleansing Workers

The uniqueness of SWM in Sri Lanka lies in the concentration of Indian Tamils in the municipal cleansing work, although the actual proportion of Tamil workers to Sinhalese workers differs from LA to LA. The severe socio-economic conditions of Tamil workers, living in the labour lines which were originally built in the colonial period, are outstanding even among municipal cleansing workers. Although the monthly wage level has improved substantially from 2001[8] reaching a level of more than Rs.5,000, unsanitary living conditions in the labour lines have not yet improved significantly. Moreover, it is still difficult for them to find jobs except in some "traditional" employment fields such as municipal or private cleansing works and leather works. Tamil workers have been somehow marginalized from the mainstream of Sri Lankan society.

SWM is usually taken care of under the health section of LAs. The MOH as the top of the health section supervises all the works under the health section. Beneath the MOH, the CPHI and PHIs look after SWM as one of their duties. In the field, cleansing workers are supervised by supervisors. In general, most of supervisors and drivers of collection vehicles are Sinhalese who were employed as such from the beginning without any experience in practical cleansing work. On the other hand, the workers, most of whom are Tamils, have fewer opportunities to be promoted and have, therefore, been de-motivated. Inappropriate supervision by inexperienced supervisors and the de-motivated working attitude of cleansing workers have resulted in the inefficiency of labour management widely observed in municipal solid waste management.

2.5.3 Awareness of Citizens on Waste Issues

In Sri Lanka, the common discharge methods rather differ from LA to LA. The most common method is to discharge waste at the specified place for collection, but self-disposal is also very common as the second method. According to a Public Opinion Survey for Households, 66% of the total sample households use the municipal collection service, and most of them receive the service as frequent as more than two to three times per week. Although citizens receive such a frequent collection service, they are frustrated with the waste scattered on the roads in their localities.

Frustrated citizens appreciate the need to improve the waste situation. However, unfortunately they have not clearly realized the fact that peoples' participation is becoming tremendously

[8] Wages of all government employees were increased Rs. 2,200.

important to improve the status quo, and fail to depict how they can take part in improving the present situation. In addition, it became known that the waste scattering, and therefore citizens' frustration, is ascribed to the lack of discharge rules. Under these circumstances, presenting a clear picture of public cooperation, including establishing discharge rules, to citizens by LAs is highly expected. Once clearly instructed on how to cooperate in municipal cleansing works to improve the present state, citizens are highly likely to take an active part in it. The possibility and level of citizens' cooperation were assessed through one of the pilot projects, *Bell Collection*, introduced in all seven municipalities.

2.5.4 Education on Waste

a. School Education

The environmental education was introduced into the curricula of primary and secondary schools in the late 1970s. The content of textbooks which give few detailed information about solid waste is insufficient because the current education emphasis on green issues. The deficiency of the present structure for environmental education in school is as follows:

- School teachers do not have a good understanding of environmental education
- There are no proper educational materials for environmental education
- Paper exam results are more important than changes in attitude and participatory action.

b. Non-formal Education

The Ministry of Health, Nutrition and Welfare dispatches PHIs and the Central Environmental Authority does DEOs (Divisional Environmental Officers) to LAs. The PHI and DEO are in charge of environmental education on waste at the local level. However, most LAs, the responsible bodies of SWM, are not conscious of their duty to educate people for public cooperation and, as a result, do nothing to encourage it.

On the other hand, NGOs carry out projects for solid waste, such as separate collection or composting. However, their knowledge about SWM is poor and they lack logistical capacity and scientific understanding. As a result, they are not educating people properly. Hence, many projects done by NGOs are not going well.

2.5.5 Private Sector Involvement

Waste collection work in some of large cities has been privatised since the late 90s. The trend of privatisation of SWM works has been rapidly extended to other towns, particularly since 2002. There seem to be three main reasons for this.

- Improvement of the work efficiency.
- The current government has adopted the policy[10] to reduce the number of public servants in response to the strong recommendation by international organizations. This policy change in SWM works means a change of importance from one of job creation to that of efficiency.
- The third reason is that LAs are financially incapable of implementing projects due to insufficient revenue and poor capacity of local funds. They, therefore, have to rely on the private sector's financial capability.

The specific characteristic of the waste collection work contracts used in Sri Lanka is to include road sweeping and drain cleaning. The privatisation of waste collection services is well-evaluated because the private sector has been providing better services.

There is only one private landfill site, the Blumendhal landfill site located in Colombo in Sri Lanka. It receives a daily amount of about 800 tons of waste from Colombo and its environs. The tipping fee at the landfill site is 550 Rs per ton. It has had serious negative environmental impacts on the surrounding areas due to overfilling and insufficient environmental protection measures.

2.5.6 Opposition Against SWM Facilities

The opposition against landfill sites is a serious social issue in Sri Lanka, since there have been quite a number of opposition cases against both present and proposed landfill sites. For example, one of the NGOs filed lawsuits against CEA and all LAs for their improper operation and maintenance of final disposal sites. The court case has been in progress. In addition, neighbourhoods of the landfill sites blocked the access roads to the landfill sites in some towns.

However, the local resident protest against landfill projects in Sri Lanka is not particularly stronger than that in other countries. Similar protest often occurs in Sri Lanka not only against landfill projects but also against various projects such as roads, dams, sewerage, etc. This fact implies that the present project preparation method in Sri Lanka does not take the necessary social measures to build consensus and to get neighbourhood acceptance, which are always the most important issues for SWM projects.

Little effort is made to build social acceptability during the project formulation and

[10] Management circular No.16 issued in October 2002

implementation stage in Sri Lanka while LAs in developed countries ordinarily spend 5 to 10 years in doing so. This lack of effort to build social acceptability is a vital mistake in the SWM facility project because its implementation absolutely requires social acceptance which is very difficult to get.

Recently in particular, people's opinions are rapidly getting diverse due to the progress of democratisation and people's awareness raising. This trend has weakened the power of politicians and somewhat strengthened people's opinion. Therefore, there has been a great increase in the need for public participation in the decision making on the project in order to empower the project.

2.5.7 Waste Picking at Landfill Sites

There are few waste pickers who collect recyclable materials for a living in landfill sites in Sri Lanka except near Colombo. Therefore, the waste picker problem which is always one of the biggest social issues associated with SWM works cannot be seen in Sri Lanka. There are mainly two reasons for this:

- There are not many recyclable materials coming into landfill sites because the traditional 3Rs are still carried out quite actively.
- Few people can mentally accept to do this kind of work due to the strong prejudice against waste.

However, based on our observation during the study period of more than one year, we feel that the number of waste pickers at the landfill site is increasing. According to the forecast, the increase in the number of supermarkets and fast food restaurants, which is the current trend, will increase the packaging waste and increase the recyclable materials contained in the packaging waste. This might increase the number of waste pickers at landfill sites. Therefore, there is a need for special attention and prompt actions concerning the waste picker issue, in addition to an increasing necessity for measures to reverse this trend through promotion of the 3 Rs at generation sources.

Chapter 3 Assessment of Current SWM System

3.1 Assessment

3.1.1 Assessment by SWM objective

Maintaining the sanitary condition which is the primary objective of SWM can be achieved by removing garbage discharged immediately from the living environment. However, waste scattering is dominant in most LAs and it causes the various sanitation problems. Consequently, the current SWM situation in terms of sanitation is considered to be very poor.

Minimizing the negative environmental and social impacts through the SWM process is the secondary objective of SWM. This can be achieved by carrying out the appropriate treatment and disposal of waste such as waste minimization activities, recycling, composting, incineration, sanitary landfilling, etc. Most waste comes into landfill sites without any treatment and the improper landfilling is a great nuisance to the surrounding residents due to a lack of environmental protection measures. Consequently, the current SWM situation in terms of the minimization of negative environmental and social impacts is considered to be very poor as well.

3.1.2 Assessment by SWM System Components

a. The 3Rs

Public awareness of waste is judged to be very high because the traditional 3 R systems which have been rooted into the society are still active. In particular, reduction and reuse activities are still very active so the waste discharged contains a small percentage of in-organic recyclables. However, they are very troublesome at present because materials such as thin polyethylene bags which are difficult to be treated by the traditional 3 R methods are rapidly increasing. This is one of the main reasons why most people tend to expect too much for the additional recycling.

The necessity of introducing a new separate collection system is still not so high due to the active implementation of reduction and reuse activities. However, the fact that these are being actively carried out implies that the potential amount of waste to be discharged is large. The Study shows that there are large gaps between the waste generation amounts and the actual waste discharge amounts in most LAs. This implies that a decline in reduction and reuse activities could increase the waste discharge amount rapidly and greatly. The promotion of the 3Rs is, therefore, essential as a prevention measure even at present. In fact, the need to introduce the separate collection of in-organic recyclables is increasing in highly urbanised towns due to the change in waste composition with the rapid change in social conditions.

Under active 3 R conditions, the promotion of recycling has to targets mainly materials which are financially very difficult to be recycled.

b. Discharge and Storage

Communal garbage bins made of blocks or concrete and plastic bags are commonly used, and waste is often directly discharged onto the roads. However, these systems do nothing to prevent stray animals such as goats, cows, dogs, crows, etc. which exist in most local towns from scavenging through the waste. Another cause of waste scattering is the increase in very light waste such as polyethylene bags.

As for communal garbage bins, some LAs are going to remove them, while other LAs are planning to construct them. As for plastic containers for waste, this system is not so suitable because they are commonly stolen requiring a certain cost for purchasing. This means the present social conditions make it quite difficult to select an appropriate discharge and storage system.

Although the current improper waste discharge and storage system is a main cause of waste scattering, this fact has been neither understood by people nor studied by SWM experts. Therefore, no improvement efforts have been made since long ago.

c. Collection and Transportation

c.1 Excessive Collection Service

Most LAs are targeting the provision of daily waste collection services which they believe is good. However, they should understand it too difficult to do due to the great increase in waste. In developed countries, the daily waste collection has been given up and the common waste collection frequency is one to three times per week. Overly frequent waste collection in most LAs discourages public cooperation and causes collection work to be inefficient. Handcart collection, in particular, has very low efficiency and discourages public cooperation, and it should therefore be reduced gradually.

c.2 Absence of Appropriate Waste Discharge, Storage and Collection System

LAs receive many complaints from citizens about the failure of waste collection in particular. Looking at the causes, it is true that LAs often neglect to collect waste. However, there are also cases where people discharge waste immediately after waste is collected. This is because citizens do not know when waste is collected due to irregular operation, which has led citizens to discharge their waste at the improper time

d. Processing and Treatment

d.1 Composting

Quite a number of compost plants have stopped operating or suffer from financial difficulties. The causes can be attributed to the following:

1) Because the prices of materials competing with compost such as chemical fertilizers,

poultry manure, cow dung mixed with hay, etc. are very cheap, the price of compost must be cheap as well.

2) The landfill cost spent is very cheap, almost free, due to very weak legislative restrictions on the final disposal operation. Therefore, most LAs do not pay a tipping fee to compost plants for their waste.
3) The operation and maintenance system was almost ignored in the planning stage.
4) The demand for compost is quite limited. One cause is due to the few existing large farmers. Only tea estate companies can afford to purchase large amounts of compost.

d.2 Bio-gas

Although several bio-gas pilot plants have been tried, most of them have stopped operating due to facility problems, operational problems and/or financial problems.

Considering the fact that there is no bio-gas plant that has continuously received and treated municipal waste for a few years, it is judged that the bio-gas technology for municipal solid waste in Sri Lanka has not yet achieved a level for practical utilization.

d.3 Incineration of Health-Care Waste

The furnace technology for healthcare waste in Sri Lanka is at a sufficient level. However, the equipment for incineration employs imported technologies.

d.4 Home Compost

NGOs are actively promoting home composting, which can be divided into two methods: using compost barrels made of steal, plastic or concrete and Jeewa Kotu, the Sri Lankan traditional composting method. Home composting should be promoted because it is a very appropriate technology for local towns.

e. Final Disposal

e.1 Existing Landfill Sites

As of Sep. 2003, there were no disposal sites with acceptable sanitary levels in Sri Lanka. Most sites are terrible condition and has serious negative impacts on the surrounding environment due to improper operation. Because the establishment of appropriate final disposal is essential to making the town development sustainable, this is one of the top priority issues which the central government, LAs and citizens have to seriously tackle together.

People generally strongly hate landfill sites because most landfill sites in Sri Lanka cause a serious nuisance due to the open dumping operation. In addition, the fact that they do not have the chance to see a sanitary landfill site as they do not exist in the country makes building consensus for the establishment of a new landfill site difficult.

Considering this difficult situation, the construction of new landfill sites is judged to be beyond the LAs' present capabilities. They lack the capability for development projects because they have been doing only maintenance work for so long. They are insufficient in all aspects such as human resources, technologies, financial sources for the investment, financial sources for operation and maintenance, the consensus building method, etc. The improvement of landfill sites must require institutional improvement and various supports by the central government.

3.1.3 Assessment of Non-Technical System

a. Financial System

The SWM budget accounts for 20% to 50% of the total municipal budget. Although the SWM budget is the largest budget in most LAs, few LAs deal with it independently. Most LAs do not have a proper accounting system to control SWM expenditure.

b. Labour Control

Many cleansing workers take many leaves and, in addition, they do not work hard during working hours. However, most LAs often cannot maintain proper records of days worked to account for their salaries.

c. Education on Waste

Education on waste is scarcely provided for school children or adults. There is prejudice against waste related works among Sri Lankan people. The role of education is, therefore, very important so that the society as a whole can tackle waste issues and public cooperation is encouraged.

d. Public Cooperation

Lack of public cooperation is always pointed out as one of the problems by LAs, although many citizens have expressed their willingness to cooperate with LAs in SWM in the public consciousness survey. The main cause of this is the fact that LAs have not informed citizens specifically how to cooperate with LAs. First, LAs have to clearly identify their responsibility and the citizens' responsibility and then inform the citizens through education. This has to be done before we make a judgement on whether citizens really cooperate with LAs.

3.2 Problems LAs are Facing and the Causes

3.2.1 Common Problems

1) Widespread scattering of waste in the towns
2) Terrible conditions of landfill sites and little remaining capacity of existing landfill sites
3) Difficulty in establishing new landfill sites
4) Stagnation or failure of many compost and recycling projects
5) Huge SWM expenditure, approximately 20% to 50% of the LA's total budget
6) Difficulty in controlling many waste collection workers; approximately 30% to 50% of the LA's total employees
7) Very high absentee and leaving work rate; ranging from 10% to 20%
8) Many complaints from citizens
9) Lack of public cooperation
10) Political intervention

3.2.2 Main Causes

The following factors LAs generally have are main causes of problems.

1) Insufficient understanding of the importance of SWM works
2) Insufficient knowledge of SWM works
3) Difficulty in Acquisition of Land for Landfill Site
4) Lack of Social Consideration, Transparency, Accountability and Public Participation
5) Lack of Cost Control, Future Planning and Public Relations due to Weak Organisation
6) Lack of utilization of the external resources
7) Lack of Waste Discharge Rules
8) Lack of Social and Economic Consideration and Technology Oriented
9) Shortage of Financial Sources
10) Poor Governance

3.3 SWM Situation in Colombo Capital Area

Colombo and its environs have been urbanised, which has led to an increase in waste and a complex waste composition. This has made the SWM work too difficult for LAs to execute due to the increase in SWM works. The waste problems in the Colombo capital area are much more serious than that in secondary towns.

Chapter 4 Pilot Projects

4.1 Formulation of Pilot Projects

4.1.1 Concept

a. Objectives

The objectives of the pilot projects implemented in the seven model towns were as follows:

1) Actual improvement of the current SWM system by the improvement of the process
2) Capacity building of counterpart staff and institutions
3) Improvement and finalization of the action plan after better understanding of SWM through practice
4) Obtaining valuable lessons through the implementation of pilot projects to expand pilot projects to other LAs

b. Approach

The Study team adopted the following approaches to achieve the objectives:

a) The high priority improvement activities identified in Action Plan were selected as pilot projects.
b) The Study team provided the counterparts with only technical guidance in the initial stage and technical support during the implementation.
c) Pilot projects employed only locally available materials, equipment and human resources so that they can be expanded to other LAs.
d) The pilot projects have to be continued even after the pilot project implementation period because they target actual improvement. Therefore, the Study team only provided them with technical assistance and financial assistance for the investment, not in the operation and maintenance cost.
e) The pilot projects placed importance on "non-technical" issues such as economic aspects, social aspects, public cooperation, etc. because the major cause of project failure in past SWM projects was a policy oriented too much on technology.
f) The transfer of technologies and the development of the counterparts' capacities through the joint implementation of the pilot projects.
g) The results of similar pilot projects can be different depending on their backgrounds. These results are very valuable lessons, which should be reflected in the SWM Guideline for Local Governments. Therefore, similar projects were formulated in plural

municipal councils that have different backgrounds.

h) After the counterparts deeply understand the management plan through the experience of the joint implementation of the pilot projects, they improve the management plan by themselves in order to empower the plan.

c. General Scenario of SWM Improvement in Secondary Cities

The study promoted the following scenario as the general improvement strategy for SWM.

1) To keep the town clean with the minimum expenditure by improving waste collection efficiency through public cooperation and technical improvement.

2) The money saved by the collection improvement is used for the improvement of landfill disposal operation.

The basic improvement policy in the action plant for each town is in accordance with the above scenario. The pilot projects of each town were formulated and implemented in line with the actual improvement scenario to develop the counterparts' capacities so that the action plan they implement by themselves is able to take off.

d. Concrete Targets for Pilot Projects

The following four targets were set:

a) Examination of the possibility of public cooperation in SWM

b) Raising awareness about waste issues

c) Improvement of waste collection

d) Improvement of final disposal

d.1 Examination of the Possibility of Public Cooperation in SWM

Most of the LAs pointed out lack of public cooperation in SWM as one of the problems they faced, while in the public consciousness survey more than 90% of respondents expressed their willingness to cooperate. Since public cooperation is a key factor in the improvement of SWM, whether it can be obtained is one of the most important factors in the formulation of the improvement plan. Examining the possibility of public cooperation was, therefore, targeted.

The part in which public cooperation can contribute to SWM is mainly before the discharging of waste. The following means were executed to get public cooperation.

- The most widely applicable waste discharge and collection system, the combination of bell collection and curb side collection, was introduced.
- LAs clearly defined their responsibilities and the citizens' responsibilities and then asked citizens for their cooperation.

d.2 Raising People's Awareness about Waste Issues

The main objective of the national level pilot projects was to examine how to enlighten various people on waste issues. People responsible for local governance and SWM works, teachers, academicians, school children, and NGOs were enlightened by various different means which seemed suitable for them in order to raise awareness in Sri Lanka on waste issues. In addition, their needs, the information they need to be given, and the appropriate forms of education were studied through the implementation.

d.3 Improvement of Waste Collection

The following measures were conducted in order to reduce the waste collection work with the minimum input.

- Promotion of the 3 Rs
- Introduction of the combined system of bell collection and curb side collection
- Measures to prevent waste from scattering

Through the implementation of these measures, the counterparts were to learn the following things:

- Waste problems have to be improved step by step. For example, the immediate introduction of separate collection is too difficult. Executing the collection work in accordance with the collection schedule with public participation is the first step for the improvement.
- Investment only is insufficient for even one step of the improvement to succeed. The following various actions also need to be taken at the same time:
  - Establishment of waste discharge rules and collection days.
    → Establishment of the rule
  - Informing the public of waste discharge rules and collection days
    → Publicity, education
  - Enforcement of waste discharge rules
    → Supervision, enforcement
  - Compliance with the waste collection schedule
    → Improvement of O & M

The capacity building was conducted through the implementation of a series of "non-technical" works consisting of institutional arrangement, publicity, public education, supervision, enforcement, etc. during the process of introducing bell / curb side collection.

d.4 Improvement of Final Disposal

The present terrible landfill conditions can be temporarily and partially improved rather easily with the input of financial resources because it is technically not so difficult. However, it is too difficult to force LAs to maintain landfills in good condition for a long time because of a lack of incentive due to the weak enforcement of environmental regulations. In order to cope with this problem, a monitoring committee involving public participation, which is expected to force LAs to operate landfills properly, was introduced to examine its applicability.

e. Systems for Public Participation in SWM

The following systems for public participation were introduced to ensure good SWM.

- A street committee system and a community animator system for the collection area: for waste collection
- A monitoring committee system: for sanitary landfills

4.1.2 Formulated Pilot Projects

a. Pilot Projects for the National Level

1) Formulation of model by-laws for local governments
2) Introduction of the Bell Collection system
3) Production of picture books on waste for children
4) Trial lecture on SWM in PHI (Public Health Inspector) training course
5) Lecture for university students and university staff on the social issues in SWM
6) Seminar for interested NGOs on the findings obtained through the Study
7) Seminar on SWM administration for decision making level staffs in PCs and LAs

b. Pilot Projects for Model Town

b.1 Components of Pilot Projects by Model Town

Name of LA	Chilaw	Negombo	Gampaha	Matale	Kandy	Nuwara Eliya	Badulla
Capacity strengthening	●	●		●		●	●
Waste minimisation				●		●	●
Waste collection improvement	●	●	●	●	●	●	●
Environmental education	●		●	●		●	●
Landfill improvement				●			●

1) Capacity strengthening programme

- Preparation of SWM by-laws for the model towns based on a model by-law, taking the local characteristics and policy into account
- Training of PHI and supervisors in supervision works, solid waste management, public promotion, supporting private recyclers, etc.
- Provision of necessary items such as a SWM control board and motorbikes for supervision and public promotion activities
- Assistance to LAs for the improvement and finalization of the SWM action plan

2) Promotion of waste minimisation programme

- Promotion of home composting by the compost pit method, compost barrel method, and Jeewa Kotu method
- Giving support to recyclers, recycle middlemen, etc. who are social capital in SWM
- Reduction of food waste
- Reduction of polyethylene shopping bags

3) Waste collection improvement programme

- Establishment of proper waste discharge and collection rules
- Introduction of bell collection (pilot project at the national level)
- Promotion of a combination of bell collection and kerb side collection.
- Proper distribution of various types of litter bins based on conditions
- Taking proper counter measures suitable to each public container
- Introduction of stationary collection by trailers for markets, bus stations, etc. where many people gather

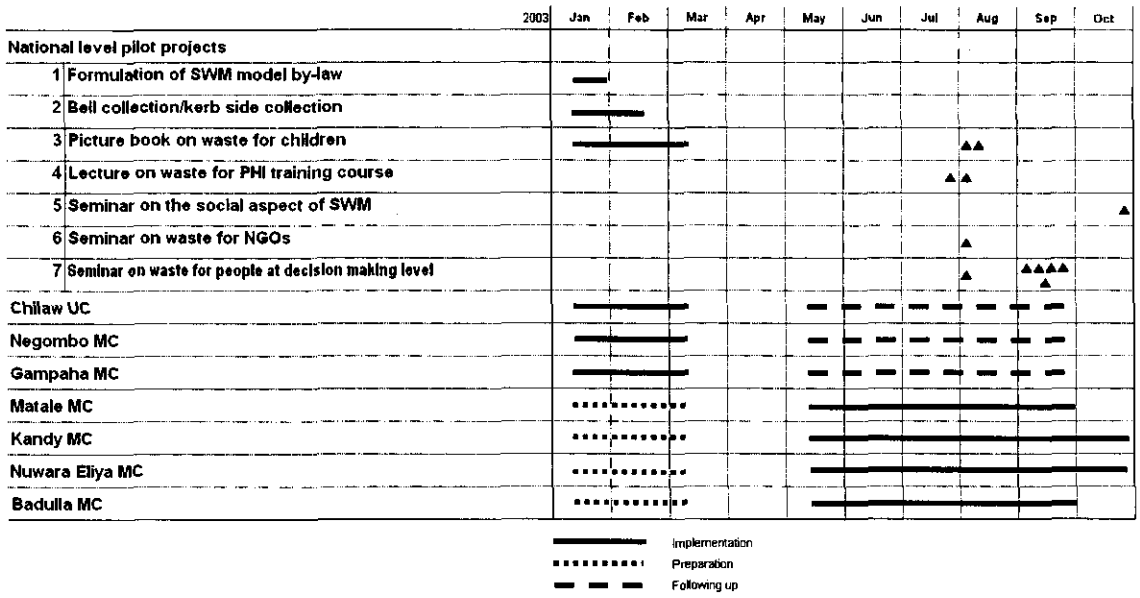
4) Environmental education programme

- Assistance of the educational material production know-how to municipal staff with the provision of necessary equipment
- Establishment and operation of a centre for educating people on environmental issues
- Establishment and operation of an on-site environmental education capability
- Operation of public awareness activities on the environment.
- Introduction and operation of school recycling

5) Landfill improvement programme

Construction of necessary facilities, provision of necessary landfill equipment, technical transfer of sanitary landfill operation method and social consideration activities.

b.2 Actual Implementation Schedule



4.1.3 List of Facilities and Equipment Provided by JICA

Table 7 shows the list of facilities and equipment provided by JICA for the implementation of pilot projects. The amounts shown in the list are based on the budget.