2.3.9 Industrial Waste Management

Interview studies were conducted with sufficient industries in all seven towns, as part of determining the waste stream for these towns. The results of these investigations are summarised here.

Industrial land use accounts for around 0.5-0.6% of the total urban/municipal area in most cases, with the figure for Chilaw being higher at 2% due to including shrimp/prawn farms in this category. It is also expected that the industrial land use percentage for Gampaha may be higher than this, due to there being many industries in the Yakkala area.

The industries surveyed cover a broad range of activities, including sawmills/timber processing (common in most towns), garment factories, rice/grinding mills, dessicated coconut mills, ice factories, boatyards, plastics manufacturing, shrimp/prawn farms, distillery and tobacco company.

Industrial waste generation as a percentage of MSW ranged from 1.4% in Kandy to 27% in Gampaha.

Most industries do not produce hazardous wastes, other than typical everyday items such as tubelights, paint tins, batteries, spray cans, etc. The few industries that do produce hazardous wastes do so in small quantities and include:

- Ceylon Tobacco Co, Kandy: some asbestos and chemical waste.
- Boatyards in Chilaw (2) and Negombo (1): some fibreglass waste
- Coil mill, Yakkala: some sulphur containing wastes.

Recycling is the most common waste management method in five towns, accounting for 46-73% of industrial wastes. In Kandy, recycling (31%) is the second most common method, while Nuwara Eliya has the lowest industrial waste recycling activity (14%). This is largely due to sawmill/timber waste comprising a large proportion (27-99%) of industrial waste generation, except in Nuwara Eliya where there are no timber related industries. Sawmill/timber waste comprises sawdust, woodchips and bark and is virtually 100% recyclable. Most sawmills and timber processing places either give away or sell these materials for use in mushroom growing or as fuel (recycling), or burn them on-site. A few places do compost bark on-site or directly haul some of these materials to landfill or illegally dump them.

Similarly, most waste from dessicated coconut mills and rice/grinding mills is highly recyclable, which explains the high proportion of industrial waste recycled in Gampaha and Badulla where sawmill waste generation is also relatively high.

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.

On-site disposal is also very common, with 26-39% of industrial wastes being disposed of by this means in six of seven towns. This is thought to be due to most of the industries who practise on-site disposal generating relatively little waste and having sufficiently large premises for this to be feasible.

Relatively little industrial waste is discharged for LA collection, ranging from 1-14% in six towns, while LA collection is only significant in Nuwara Eliya (44%). Only a few industries are involved in illegal dumping or direct haulage of their waste to the LA disposal site.

Overall, 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.

Table 2-18: Industrial Waste Management Summary in Seven Towns

Item	Negombo	Gampaha	Chilaw	Kandy	Matale	Nuwara Eliya	Badulla
Designated industrial areas (ha, %)	13.0ha (1998) 0.57%	Not known	2.7ha (ca. 1998) 2.0%	17ha (1999) 0.6%	4.6ha (1997) 0.5%	13.4ha 0.9%	4.7ha (1994) 0.5%
Number of Industries	139	33	25	26	10	7	28
Main Industry Types	Sawmills (10), garment (6), plastics manufacture (4), ice production (4), etc.	Garment (6), dessicated coconut mills (2), sawmills (13), other (12)	Shrimp/prawn farms (14), sawmills (5), boatyards (2), ice (2), garment, shoe packaging	CTC, garment (6), timber (7), concrete workshops (10), quarries (2) + many small metal work/ welding workshops	Sawmills (5), lime kilns (4), Diana Chocolate factory	Brewery (closed), Pedro Tea Estate (excluded), garment (2), eye-lashes manf. (2), plastics manf. (1)	Rice/grinding mills (16), timber (7), others (5)
Industries surveyed	Elsuma, sawmills (7), other (19)	Garment (6), coconut mills (2), sawmills (5), other (6)	Shrimp/prawn (2), sawmills (5), other (5)	CTC, garment (4), timber (7)	Sawmills (5), lime kiln (1), Chocolate factory	Garment (2), eyelashes (2), plastics (1)	Rice mills (2), timber (4), garment, distillery, lathe (2), engineering
Waste generation (T/d) (estimated for all industries based on survey data, as per notes)	10.48 Elsuma: 1.07 Sawmills: 2.82 Other: 6.59	14.23 Coconut mills: 7.11 Sawmills: 5.16 Garment: 0.55 Other: 1.41	1.08 Sawmills: 0.66 Prawn farms: 0.22 Other: 0.20	1.87 Timber: 1.16 CTC: 0.60 Garment: 0.11	1.83 Sawmills: 1.81 Diana Choc: 0.02	1.16 No breakdown	6.27 Rice mills: 3.53 Timber: 2.50 Other: 0.24
Ind. Waste/MSW	7.7%	26.5%	4.9%	1.4%	5.7%	4.0%	15.2%
Hazardous waste	Neil Marine Boatyard: fibreglass wastes	Coir mill: 55kg/mth of sulphur containing wastes	Boatyards: some fibreglass waste	CTC: some asbestos and chemical waste	None	None	None
Waste Stream Data:							
OSD	26.2%	38.2%	38.9%	32.1%	21.9%	28.9%	2.6%
Composting	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
LA Collection	13.1%	3.4%	13.9%	4.8%	1.1%	44.4%	0.6%
Recycling	57.7%	53.3%	46.3%	31.0%	63.4%	13.8%	73.2%
Illegal Dumping	1.6%	5.1%	1.9%	0.0%	0.0%	0.0%	8.5%
Direct Haulage	0.0%	0.0%	0.0%	32.1%	13.7%	12.9%	15.2%

Notes: ID = illegal dumping, OSD = on-site disposal, LA = local authority

1. **Negombo:** Stated industrial land use does not include Thalahena. **Elsuma** (750 workers): composting (garden/other) = 0.4%, LA collection = 96%, recycling = 3.6%, with recycling comprising one lorry load of cardboard/mth (~756kg), 400kg/mth of food/kitchen waste for animal feed and small quantities of metals. **Sawmills:** OSD = 2.7%, composting = 1.1%, recycling = 96.2%. **Other**: OSD = 40.5%, composting =1.8%, LA collection = 5.2%, recycling = 50%, illegal dumping = 2.6%. Significant quantities of recycled materials by various industries include 2000kg/mth of paper by the St Regis Packaging Factory (paper bag manufacture), 3,000kg/mth of textile/rubber waste and 240kg/mth of food/kitchen waste for animal feed by Viva Lanka Pvt Ltd (bag manufacturer), 3,000kg/mth of metals by Metro Industries (spare parts manufacture),

275kg/mth of metals, 100kg/mth of cardboard and 100kg/mth of polythene bags by Neil Marine Boatyard, 300kg/mth of leather and 45kg/mth of polythene bags by Belden Industry (gloves manufacture).

2. **Gampaha: Dessicated coconut mills:** One mill disposes most of its waste on-site, while recycling 300,000-375,000 coconut shells/mth and 27,000kg/mth of "polkurutu" (inner layer of coconut); the other desiccated coconut mill recycles 300,000 coconut shells/mth (used to make charcoal), 1,800kg/mth of polkurutu and 3,000 broken nuts/mth, with residual waste collected by the LA or disposed illegally to vacant land (OSD = 47.5%, LA collection = 2.5%, recycling = 39.9%, illegal dumping = 10.1%). **Sawmills**: OSD = 16.2%, recycling = 83.8%. **Garment factories**: OSD = 25.2%, LA collection = 38.2%, recycling = 36.7%, with recycling comprising 3,230kg/mth paper/cardboard waste, ~2,240kg/mth food/kitchen waste for animal feed, 300kg/mth metal and 215kg/mth plastics. **Other** = steel goods production (2), scrap metal recycling/steel goods manufacturing (1), plastics recycling/plastics goods manufacturing (1), bag production (1), ayurvedic medicine production (1), coir processing (1), quarries (2) and unspecified (3). Of these, all but one steel goods production facility, the two quarries and three unspecified industries were surveyed. OSD = 77.2%, LA collection = 7.2%, recycling = 15.6%, with recycling comprising mainly 2,025kg/mth of cardboard, 1,000kg/mth of coconut fibre, 100-150kg/mth broken glass and 130kg/mth metals.
3. **Chilaw:** Quoted land area = industrial (1.9ha) + prawn/shrimp farm (0.8ha). **Sawmills**: Recycling = 73.3%, OSD = 26.7%. **Prawn/shrimp farms**: Prima burns most of its waste on-site while recycling about 700 paper bags/month and some metal barrels; Furnishel Aqua Project takes most of its garbage off site to an unknown place (counted as illegal dumping) (OSD = 88.4%, recycling = 7.8%, ID = 3.8%). **Other:** LA collection = 74.8% (including boatyard waste), OSD = 20.1%, ID = 5.0% (boatyard waste).
4. **Matale: Lime kilns:** excluded from study as preliminary investigations found they produce very little waste with most of this being reused or disposed of on site. **Chocolate factory:** waste collected by LA. **Sawmills**: OSD = 22.1%, recycling = 64.2%, direct haulage = 13.7%.
5. **Kandy: CTC** (Ceylon Tobacco Company Ltd): direct hauls all of its garbage to Gohagoda landfill. **Garment factories**: LA collection = 78%, OSD = 22%. **Timber**: recycling = 50%, OSD = 50%.
6. **Nuwara Eliya:** Birdwear Interfashion usually burn most of their waste on-site in their own incinerator, while directly hauling about one tractor load per week to the NEMC disposal site and recycling 1,00kg/mth paper/cardboard, 210kg/mth plastic, 50kgmth metals and 600kg/mth textiles. Three other industries are involved in recycling. Winter World Garment Pvt Ltd recycles 1,000kg/mth of textiles; S.S. International Ltd (main eyelashes factory) recycles 450kg/mth of polythene and Robin Polypack Pvt Ltd recycles 1,500kg/mth of polythene.
7. **Badulla: Timber**: recycling = 79%, ID = 21%. **Rice/grinding mills**: recycling =72.9%, DH = 27.1%. **Other:** two lathe workshops largely recycle their waste (80kg/mth of metals); distillery recycles some waste materials – 17kg paper/cardboard, 667 bottles and 10 polysacks per month; garment factory and engineering company burn most of their waste on-site with all other waste being recycled - 3kg/mth of cardboard, 3kg/mth of metals and 350kg/mth of textiles by the garment factory and 12kg/mth paper and 200kg/mth of metals by the engineering company (OSD = 66.4%, LA collection = 15.5%, ID = 18.2%).

2.4 Social Situation

2.4.1 History of SWM

a. Under British Administration

Public health was one of the main concerns of local government bodies during the colonial era. Though undergoing several organizational changes, the local authorities continued to play a primary role in keeping the sanitary standard. In particular, the conservancy of latrines and cleansing work, called scavenging work at the time, were the main duties of local government bodies. Among these two works, the conservancy work was recognized as severer and essential[13]. 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 historical uniqueness of SWM in Sri Lanka lies in this fact that a large proportion of conservancy and cleansing workers in the LAs were secured through a large influx of immigrant labourers from the poverty driven areas in South India. According to the Jackson Commission Report in 1936, approximately 4,400 workers among 6,700 regular workers in the Municipal Councils and Urban Councils were Indian immigrant workers employed for the conservancy and cleansing works. They lived in the special quarter called labour line prepared by each municipality. Some of the Indian workers decided to stay in Sri Lanka without going back to India, although they had faced difficulties in lifting themselves up socially.

b. After Independence

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 lines which were notorious for unsanitary conditions even from the colonial period, Indian workers continued to work for municipal councils as cleansing workers. Even at present, many Tamil workers who are descendants of Indian immigrant workers are still working as cleansing works in the comparatively old councils. Like the labourers in the plantation sector, they faced the serious problem of non-citizenship after independence, which was to be finally solved as late as in 1986. Now they are employed at councils as Sri Lankan nationals.

[13] 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.

2.4.2 Social and Working Situation of Cleansing Workers

a. Municipal Cleansing Workers

The concentration of Indian Tamils in municipal cleansing works can be easily observed in many municipalities, although the actual figures differ from LA to LA due to the following reasons:

- Local authorities which have a long history, such as Kandy and Matale, had sufficient opportunity to receive a large number of immigrant Tamil labourers under the British administration. Therefore, a large number of the descendants of these workers are still working in these LAs.
- Cleansing works of the local authorities which are located near the metropolitan city, Colombo, have attracted urban poor people regardless of ethnicity. Therefore, the proportion of Sinhalese people has increased.

The municipal cleansing function highly depends on the existence of Indian Tamils even now, but Indian Tamils also do depend on this very occupation as an important job opportunity in cities. In fact, municipal cleansing works are sometimes the sole job opportunity for them. These works are taken up by one of the most pauperized and socially marginalized ethnic groups, Indian Tamils. This perspective is a prerequisite to understanding the social situation of municipal cleansing workers in Sri Lanka.

b. Socio-economic Situation of Municipal Cleansing Workers

Municipal cleansing workers, regardless of their ethnicities, are known as one of the most pauperized people in each town. Two types of employment status, namely permanent and casual workers, are widely observed in municipalities. The proportion of permanent to casual workers also differs from LA to LA, but approximately 20% of total workers are casual on the average. Casual workers' economic conditions and livelihood are known to be severer and more vulnerable since they are not entitled to most of the fringe benefits enjoyed by permanent workers such as paid holidays, medical leaves, a compensation scheme, a pension scheme, etc.

Even among municipal cleansing workers, the severe distress and poor living conditions of Tamil workers are outstanding. Most of them still live in the labour quarters called labour lines, which were originally built in the colonial period. The area where labour lines are located is widely known as one of the poorest areas within each municipal limit. Although the monthly wage level per cleansing worker has improved substantially from 2001[14] 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

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

such as municipal or private cleansing works and leather works. Tamil workers have been somehow marginalized from the mainstream of Sri Lankan society.

Houses in Mahaiyawa, a low income area where mainly Indian Tamils live together, in Kandy

c. Working Situation

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.

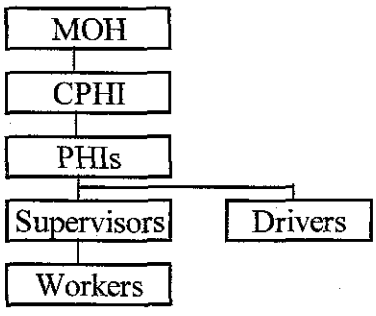

Figure 2-15: Typical Organizational Settings for SWM

MOHs have been recruited as state civil servants and all other staff members under CPHIs have been recruited at the provincial level since the establishment of provincial governments in 1987. However, before 1987, MOHs, CPHIs and PHIs were recruited at the central state level, but supervisors, drivers and workers were recruited at the LA level. Therefore, the recruitment system of supervisors, workers and drivers differed from LA to LA[15]. In general, however, most of the supervisors and drivers of collection vehicles are Sinhalese who were employed as such from the beginning, while the workers, most of whom are Tamils, have fewer opportunities to be promoted. In connection with the inefficiency of labour management widely observed in municipal solid waste management, the following points can be pointed out:

- Supervisors with insufficient experience in practical cleansing work have some difficulty in supervising workers properly.

[15] For example, supervisors, who are all Sinhala, in Gampaha were recruited politically in the previous regime. On the other, most of supervisors in Nuwara Eliya were promoted form workers.

- The hierarchical system without promotional opportunity for workers de-motivates workers, having a negative impact on their work ethics.

The results of the *Cleansing Workers Survey*[16] also reveal that the efficiency of cleansing works tends to depend on the capability of supervisors. It says that when difficulties relating to work arise, as many as 78% of workers talk to supervisors first, and only a few (13%) directly talk to PHIs and MOHs, illustrating the potential for supervisors to determine the work efficiency of cleansing workers[17].

The same survey asked for workers' suggestions on how to improve municipal cleansing works. Like many municipal officers, cleansing workers themselves think that an increase in labour force and equipment is most urgent, while obtaining citizens' cooperation is not. Having been employed as cleansing workers as their traditional occupation from the colonial period, workers themselves are tethered to the conventional idea that cleansing works are what they have to do and others do not get involved.

2.4.3 Awareness of Citizens on Waste Issues

2.4.3.1 General Picture of Present Collection System

a. Present Collection System

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 household questionnaire survey, the Public Opinion Survey for Households[18], 66% of the total sample households use the municipal collection service. As for the frequency of the collection service, 480 households (80% of the collection service users) receive the service more often than two to three times per week.

b. Present Problematic Situation

Citizens are frustrated with the waste scattered on the roads in their localities, although they receive frequent collection services. A main cause could be that there is no discharge rule suitable for each town. According to the survey, the absence of proper discharge rules incurs the following situations:

- Among people who discharge waste at the specified place for collection (344 households), daily discharge is most common. As many as 215 households discharge waste either daily or as soon as it is generated, though only 103 out of 344 households receive daily collection

[16] This survey was conducted among 216 cleansing workers, including 8 private cleansing workers in Kandy, in total at each seven municipality. The details are separately attached.

[17] In the worst case, the supervisors could be the source of inefficiency and sometimes even corruption. For example, supervisors receive some amount of money from workers and give them a paid off in return.

services. This means that quite a lot of people discharge waste, knowing that it will not be collected immediately. This inevitably results in the scattering of waste on many streets in Sri Lanka.

- 182 households[19] discharge their waste directly to the collection places without putting it in polythene or paper bags. This discharge habit of only 14% of respondents is enough to attribute to the unsanitary situation around the collection points.
- The lack of effective countermeasures to prevent waste scattering aggravates the problematic situation. Only 146 households (16% of the sample households) have discussed proper garbage discharge methods at the community level. Although a community based approach such as cleaning up around the collection points by users at each community is very effective in keeping common places clean, since waste problems are not considered as a problem of the community but of someone unknown to the community, no community-based measures have been taken yet.

2.4.3.2 Awareness of Citizens on Waste Issues

The awareness level of citizens on waste issues were also assessed through both the questionnaire survey and the series of focus group discussions at each town. The findings are summarized as follows.

- Almost all of the respondents understood the necessity of awareness programs focused on waste issues. Citizens appreciate room for improvement in waste management at each locality.
- The amount of WTP (willingness to pay) for improved solid waste management services can be interpreted as a yardstick to measure willingness to cooperate and improve the waste situation. The average amount is Rs.153 at most in Kandy, Rs.47 at least in Badulla, and Rs. 84 on average for all seven towns. Income-wise data shows Rs.57 in low income areas, Rs.88 in middle incomes area and Rs.107 in high income areas.
- As mentioned in the previous section, citizens are not used to discussing garbage problems and taking counter-measures at the community level.
- Some of the participants of group discussions strongly demand more collection bins and more frequent collection. The demand for further services with no effort from citizens implies that people have not recognized that they are also responsible for keeping their cities clean.

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[18] This survey was conducted among 930 households in total in each seven municipality. The details are separately attached.

[19] Effective numbers of responses are 1298 in this multi-answer question, and these 182 are equivalent to 14% of 1298 responses, and 20% of sample households.

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

2.4.4 Education on Waste

a. Ministry of Education

The Ministry of School Education has transferred the authority to develop a curriculum, syllabus and teachers' guideline for school education to the National Institute of Education (NIE) which is an institute under the direct control of the Ministry of School Education. The present school education system is as follows:

Table 2-19: School Education System in Sri Lanka

Education Level	Grade	Age
Primary Education	1～5	7～11
Junior Secondary Education	6～9	12～15
Senior Secondary Education	10 (Ordinary Level)	16
	11～12 (Advanced Level)	17～18
University	–	–

The NIE introduced environmental education into the curricula of primary and secondary school education in the late 1970s. The existing curriculum of primary school consists of four subjects: Language, Mathematics, Religion and Environment Related Activities. In the case of secondary school education, it is mentioned that teachers have to teach environmental topics through the main subjects such as Science, Social Science, Health Education, etc. Environmental education in primary and secondary schools puts emphasis on green issues. As for solid waste problems, the content of textbooks is insufficient. They just say "sweep your house and classroom" or "do not throw waste paper all around you and do not litter the roads or parks" without explaining why or giving more detailed information.

b. Ministry of Health, Nutrition and Welfare

Ministry of Health, Nutrition and Welfare dispatches most of qualified PHIs who are responsible for SWM in LA to LAs. Although the National Institute of Health Sciences, under the direct

control of the Ministry of Health, Nutrition and Welfare, has been operating an 18-month training course for PHIs, only 16 hours is allocated for SWM subject in this course and the contents are deficient.

In SWM subject, PHIs educate people mainly not to discharge wastes that collect water, such as coconut shells, tyres, tins or bottles, because the stagnant water inside such wastes breeds mosquitoes and causes dengue fever. However, PHIs teach people few on how to handle waste.

c. Central Environmental Authority (CEA)

CEA which is under the Ministry of Environment and Natural Resources dispatches the Divisional Environmental Officer (DEO) to District Secretariats, Divisional Secretariats or LAs in the whole country. The total number of DEOs is 361 as of September 2003.

Table 2-20: Allocation of DEOs

Attached office	Nos. of DEOs
District Office	25
Divisional Office	257
Municipal Council	20
Urban Council	33
CEA headquarter	19
Other branch/office	7
Total	361

The duty of DEOs is supervision of environmental licenses, collection, analysis and investigation of environmental data, reporting of environmental profiles and also awareness raising and education of people. The DEOs are conducting awareness activities such as environmental education for school children, and seminars or workshops for citizens.

A main activity of DEOs is the "Environmental Pioneer Brigades". The target group of the Environmental Pioneer Brigades is secondary school children up to grade 7 and volunteer students participate in this activity. The DEOs organise lectures, drawing competitions and speech contests for the children after school. The CEA aims to educate adults through the Environmental Pioneer Brigades' activities, i.e. the children disseminate environmental messages to their parents at home and events the children promote arouse citizens' interest in the environment.

At present, some 5,000 schools among 10,977 in total are participating in the EPB. However, the participation ratio is quite low when calculating the number of students.

In the case of Matale MC, only around 550 students from 10 schools are participating in the EPB among 18,000 students from 17 schools in total. The participation ratio is only 3%.

In addition, the Environmental Pioneer Brigades' activities emphasise green issues and they do not carry out any effective activities related to solid waste. They are doing some campaigns like the "Shramadane [20]" or "My Bag" campaigns. Those improve the situation temporally but do not generate any sustainability or attitudinal change of people.

d. Local Authority (LA)

Most of the LAs, the responsible body of SWM, concentrate on physical works such as the collection and final disposal of wastes and are not conscious of their duty to educate people for public cooperation. Hence, they are merely implementing awareness programs for citizens although public cooperation is necessary for the improvement of collection work, waste minimisation and the promotion of recycling.

The PHI, DEO and Community Development Officer (CDO) are potential resource persons for environmental education. However, they do not have a good understanding of SWM or have proper equipment and educational materials. Although many LAs hold Shramadane regularly, LAs approaches are not sufficient to encourage public cooperation. In many cases, only workers of LAs clean up the area without any participation from citizens.

e. NGO

At present, there are more than 300 NGOs in Sri Lanka. Most of them are dedicated to the protection of forest, wild animals or biodiversity. Some NGOs carry out projects for solid waste, such as separate collection or composting. However, many projects are not going well because NGOs' knowledge about SWM is poor and they lack logistical capacity and scientific understanding.

The lectures, leaflets, posters, etc. which NGOs prepare for environmental education are prepared without social consideration. In many cases they are far from the reality in the target area because they cover matters in developed countries.

f. School Education

Although it has been two decades since environmental education was incorporated into the primary and secondary school curricula, the effects such as attitudinal changes have not occurred to improve SWM. The reasons are 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 importance than changes in attitude and participatory action.

[20] : Cleaning campaign in Shinhala

There is no suitable textbook for environmental education while there are various ones for other subjects. Because of the lack of textbooks, the contents and quality of environmental education depend on teachers' capacity and thinking. However, teachers do not have the opportunity to receive training or obtain educational materials or data. This makes them less enthusiastic towards environmental education.

Furthermore, teachers and parents are reluctant to make children clean or pick up waste because normally there is a labour in each school and his social status is low. That social background makes the dissemination of environmental education difficult.

g. University

The universities in Sri Lanka offer SWM courses in the agriculture, engineering, and science and technology departments. Therefore, SWM professionals are limited to engineers. Students in the department of education, the future school teachers, do not have a chance to learn about solid waste although the importance of environmental education in primary and secondary school education is stressed.

2.4.5 Private Sector Participation

2.4.5.1 General Condition

Waste collection work in some areas in large cities such as Colombo and Kandy has been privatised since the late 90s. In addition, all waste collected in Colombo is disposed of at a private landfill site. 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.

The first reason is that privatisation is effective in overcoming the following current problems with the waste collection work done by LAs

- Very low work efficiency due to lack of LAs' managerial capability
- High absentee rate of employees due to many leaves with pay and medical leaves
- Severe corruption among employees
- Political intervention
- Repair work takes many days due to the long transaction procedure required for the procurement of spare parts

The second reason is that the current government has adopted the policy[21] 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. This has been increasing the necessity for LAs to deal with a greater amount of waste

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

with less people. Private sector participation is therefore being promoted as a main countermeasure. Waste collection work in some areas in Kotte and Negombo has been privatised since 2002, and Dehiwala Mt. Lavina and Manlagama have contracted the waste disposal work out to a private company.

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.

2.4.5.2 Collection and Transportation Work

There are two large local companies dealing with waste collection and transportation work and they are working mainly in highly densely populated towns such as Colombo. There are several small local companies which are doing waste collection and transportation work as well.

The specific characteristic of the waste collection work contracts used in Sri Lanka is to include road sweeping and drain cleaning. This is suitable for the situation in Sri Lanka because people often discharge waste onto roads and into drains. The majority of contracts used are lump sum contracts by collection zone and the term of contract is about 4 years. In Colombo, the MC is leasing its collection vehicles, which were donated by the Japanese Government, to contractors and a specified leasing fee is deducted from the payment. The drivers of the collection vehicles are all MC employees and the repair work is conducted at the Colombo MC's workshop. There is no municipal council other than Colombo MC which leases its own fleet.

Privatisation has often increased the total SWM expenditure because LAs are not able to dismiss employees which have become unnecessary due to privatisation. As a countermeasure to this, the contract adopted by Kotte MC obliges the contractor to use MC employees for execution of the contract work. This contract system where the MC pays their basic salary and the contractor pays their overtime started in 2002.

The contract system in accordance with the waste collection amount which is widely used in the world is not used in Sri Lanka.

The privatisation of waste collection services is well-evaluated because the private sector has been providing better services. However, attention and measures are needed for the following foreseeable problems.

- In many cases, privatisation increases the total SWM expenditure because LAs are not able to dismiss employees. Therefore, LAs should make efforts to reduce the collection cost by fully utilizing present resources and by improving the waste collection efficiency before the introduction of the private sector.

- The hard competition and the profit oriented policy would lead contractors to escape the payment for various levies such as social welfare charges for employees. This would deteriorate employment conditions.
- The lump sum contract gives priority to rich experience, the owning of resources, capital amount, etc. in the selection of contractors. This might reduce the number of potential contractors, which will reduce the tender competition and increase the tender price.

2.4.5.3 Landfill Disposal

There is only one private landfill site, the Blumendhal landfill site, owned by Burns Environmental and Technologies (PVT) Ltd. (BETL) located in Colombo in Sri Lanka. It receives a daily amount of about 800 tons of waste from Colombo, Dehiwala Mt. Lavina, Maharagama, etc. The tipping fee at the landfill site is 550 Rs per ton without tax and 660 Rs per ton with a 20% VAT.

It has had serious negative environmental impacts on the surrounding areas due to overfilling and insufficient environmental protection measures. BETL invested 600 million Rs in 2002 for the construction of a compost facility at the Blumendhal and Sedawatta sites in Colombo as a result of the renewal of the contract which obliges BETL to use more environmentally friendly technology. However, the roof of the primary fermentation storage constructed in Blumendhal has not been repaired since it collapsed due to strong wind in May 2003. At present, the waste which has been left for natural fermentation at the Blumendhal landfill site for a few months is being transferred to the plant at Sedawatta. It is sieved using three different sized trommel screens after fermentation by the windrow method. This production method is associated with the possibility of contamination by hazardous material in compost products. The monthly production amount is about 300 tons and the sale price is about 3 Rs per kilogram. The rejects are transported to the landfill site in Anamaduwa in the North Western Province.

This facility was often in the news for its environmental problems after the collapse of the roof in May 2003 because it completely turned into an open dump. Although it has been improved slightly due to the efforts by BETL with the central government's support, the condition has not reached a satisfactory level.

The Blumendhal landfill site is the sole large landfill site in operation within Colombo and its environs. Both the amount of waste received and the number of LAs that utilize the site are therefore increasing although it is seriously deteriorating the environment. The government has directed BETL to rectify the situation at the Blumendhal landfill site. However, only slight progress has been made due to little room for the technical improvement and lack of alternative

landfill sites. It is, therefore, one of the biggest environmental and social problems within Colombo and its environs.

Although the private landfill site causes serious problems in Sri Lanka, the government is promoting the policy of privatisation for landfill disposal. This is because the government and LAs have reached a dead lock on this issue, as neither the government nor the LAs are able to take effective actions due to too many difficulties in all aspects such as acquisition of land, building of social acceptance, acquisition of financial sources, technologies, etc.

In the case of private landfill sites, it is very difficult for clients or customers to oblige the contractor to satisfy environmental requirements despite paying a sufficient tipping fee because it often becomes a monopoly due to the difficulty of the business even for the private sector. In order to avoid such trouble, clients such as LAs have to greatly strengthen their contract and supervision capabilities. Privatisation without strengthening these capabilities is very risky.

2.4.6 Opposition against SWM Facilities

2.4.6.1 Overview

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. Some examples are listed below:

- In 2000, one of the NGOs, Public Interest Law Foundation, 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 August 2002, the court made the decision to first deal with 16 LAs and a summons against the16 LAs was served. The16 LAs included most of the model towns in the Study. Then the court directed LAs to implement the improvement measures in accordance with the plan prepared by the LAs and appoint a petitioner to monitor and supervise the LAs' progress.
- The sanitary landfill construction project in Hikkaduwa to be funded by the Australian grant scheme was cancelled in 2002 due to strong objection by local residents just before construction began.
- In Negombo in November 2002, local residents blocked the access road to the Kocchikade landfill site due to its existing negative environmental impacts.
- In Matale in July 2003, parents and school teachers protested a landfill disposal operation which was carried out next to the school. Matale MC then moved the landfill site to the proposed landfill site located in Raththota PS adjoining Matale MC. However, people in Peradeshiya Sabha protested by blocking the access road. Matale MC was then forced to look for small landfill sites for temporary use.

The following two things were identified in the opposition against landfill sites.

- 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.

2.4.6.2 Causes

Possible causes of the current protest are as follows:

a) Neither the administration nor the citizens fully understand the importance and the necessity of landfill disposal as a social system.

b) Most LAs neglect to take environmental protection measures for landfill disposal, which results in serious environmental hazards to the surrounding environment. It is, therefore, natural that LAs are strongly protested by the people and not able to get social acceptance for the new landfill site project.

c) Immediate improvement is always required due to a lack of a long term plan, which has caused the following problems.

- Decision making on projects is always politically driven. There is a lack of accountability and transparency to citizens in the various decision-making processes such as site selection, technology selection, etc.
- Social consideration and proper actions in the project preparation period have been in effect ignored. There has been almost no pre-explanation of the project, or compensation and provision of some benefits to local residents who will suffer some degree of negative impacts.
- Lack of financial sources for investment prevents LAs from implementing a facility which has sufficient environmental protection measures.
- There is strong local egoism among people, such as NIMBY[22] syndrome. People do not fully understand their social responsibility as a waste discharger.
- People do not understand proper sanitary landfill disposal due to a lack of sanitary landfills in Sri Lanka.

2.4.6.3 Importance of Building Social Acceptability

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

2.4.7 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.

[22] not in my back yard; someone who does not want a particular activity or building near their home although he/ she understand its necessity.

2.5 Condition of On-Going SWM Projects

a. Discharge and Storage

Academicians, NGOs, donor agencies, and LAs are not very interested in the discharge and storage system for waste. The few improvements of this system that have been made are as follows:

- Colombo MC has placed public waste bins along roads in inaccessible areas to encourage people living there to discharge waste in them.
- Sitawaka UC has placed 30 cm diameter hume concrete pipes along the roadside as communal waste bins. It carries out kerbside collection using these bins.

b. Collection and Transportation

The Indian government provided the Sri Lankan government with financial assistance to procure 1000 tractors in 2003. Under this programme, any public institution can apply for this scheme, may LAs applied tractors for SWM works.

c. 3 Rs (Reduce, Reuse, Recycle)

A considerable number of NGOs, LAs, etc. are promoting the use of "My Bags" to reduce the consumption of plastic shopping bags and the phrase "My Bag" has become a widely used expression. However, the usage of plastic bags is still rapidly increasing.

d. Processing and Treatment

Many NGOs and LAs are promoting home composting by providing compost barrels which are made of used metal drums, concrete, plastic, etc. In Badulla, an NGO with the assistance of Badulla MC is actively promoting Jeewa Kotu, which is a Sri Lankan traditional composting technology.

e. Final Disposal

The Hanwela project consisted of a sanitary landfill site and a compost plant, which were supposed to receive waste from 13 LAs including Colombo MC from 1998 to 2004. This was promoted by the Colombo Environmental Improvement Program (CEIP) and was supposed to be implemented by the Ministry of Housing and Infrastructure using a World Bank loan. The project of which the estimated cost was Rs. 12.5 million could not be implemented due to various problems although the tender was conducted.

2.6 Involved Organisations for SWM Projects

a. ADB

ADB has been providing LAs with funds for infrastructure projects as Urban Development Sector Loans through the Ministry of Housing and Infrastructure and some LAs have utilised this fund for SWM projects. However, UDA has been implementing facility construction projects for LAs in fact because most of LAs don't have this capability. In the 1st phase of the project, compost plants were constructed for Nuwara Eliya MC and Ratnapura MC and the landfill site in Anuradhapura was improved. In addition, some LAs procured waste collection equipment. However, the compost facilities in Nuwara Eliya were utilized for only 8 months and the improved landfill in Anuradhapura has never been used due to protest. The causes of failure of the compost plant in Nuwara Eliya were as follows:

- Poor planning such as too far from the town, poor technical design, etc.
- Ignorance of operation and maintenance.
- Lack of commitment by Nuwara Eliya MC due to being driven by other organisation.
- Lack of public participation

As for the 2nd phase of the programme, no SWM projects were applied by LAs. ADB is, therefore, reluctant about SWM projects.

b. HABITAT

The Sustainable City Programme conducted by HABITAT targets the development of the capacity of LAs. In this programme, the improvement of SWM is often focused on and improvements in in-organic recyclable waste, home composting, biogas treatment, etc. are often implemented in small scale. However, there are few projects which have been continued by LAs after the project is complete.

Chapter 3 Assessment of Current SWM System

3.1 Assessment

3.1.1 Assessment by SWM objective

The current SWM situation in LAs was assessed in terms of the following main objectives of SWM:

- Maintaining the sanitary condition
- Minimization of negative environmental and social impacts through the SWM process

a. Maintaining the sanitary condition

Maintaining the sanitary condition is the primary objective of SWM and this can be achieved by removing garbage discharged immediately from the living environment. However, waste scattering is dominant in most LAs and it causes the following sanitation problems:

- An increase in flies, mosquitoes and rats which carry communicable disease.
- The blockage of drains by garbage makes drain cleaning work difficult and causes not only an increase in the drain cleaning cost but also flooding.

In addition to insanitation, waste scattering indirectly causes the following problems:

- It affects the tourist industry by deteriorating the view.
- It affects the tourist industry because the crows which breed in garbage attack people.
- It encourages people to discard waste in roads and parks and leads to the deterioration of public morals.
- It causes the unintended death of animals because they eat indigestible waste.

Consequently, the current SWM situation in terms of sanitation is considered to be very poor.

b. Minimization of negative environmental and social impacts through the SWM process

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.

Although waste minimization is still actively practiced by traditional methods, the tendency of such activities to decline with economic development is one of the causes of the current increase in waste. Recycling and composting have not achieved significant effects although they are actively promoted. As a result, 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. The landfill problem is a serious social issue, which is often reported on in newspapers. 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. Under active 3 R conditions, the promotion of recycling targets mainly materials which are financially very difficult to be recycled.

Although the necessity of introducing a new separate collection system is still not so high due to the active implementation of the 3 Rs, the promotion of the 3 Rs is highly required. The fact that the 3 Rs is 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 3R activities could increase the waste discharge amount rapidly and greatly. The promotion of the 3Rs is, therefore, essential as a prevention measure. 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.

The following problems in understanding SWM among Sri Lankan people can be generally observed.

1) The worth and importance of traditional 3 R systems such as private recyclers, Jeewa Kotuwa, etc., which have been rooted into the society, have not been recognized as recycling systems. They want to introduce a new recycling system, which requires separate collection by LAs like LAs in developed countries do. This policy may cause the following two problems:

   - Disturbance to the traditional 3 R systems which are important sources of social capital for the society.
   - Replacement of the private recycling system with the LAs' recycling system is against the Sri Lankan national policy for the promotion of privatisation.

2) The amount of materials in waste which is financially feasibly to recycle is much less than that in developed countries. Many people do not understand that recyclable waste needs to be not only technically but also financially feasible.

3) Any recycling activity requires some degree of additional energy input for sorting, collecting, transporting, washing, reprocessing, etc. Recycling activities requiring too much energy input are, therefore, bad for the environment. However, this point is often ignored by people Sri Lanka.

4) Many people mistake the promotion of recycling to be a solution to waste scattering problems and the serious environmental impacts of landfill sites. The waste scattering problem is caused by the poor waste discharge and storage system, and the necessity of landfill site cannot be eliminated by any means in reality.

5) In most developed countries, various economic instruments have been employed in order to create economic incentives towards 3 R activities. This policy has widened the scale of recycling businesses. This fact is not well known in Sri Lanka. Examples of economic instruments employed in developed countries are as follows:

- Stringent legislative restrictions
- Waste collection charge systems
- Deposit systems
- Imposing all governmental organization to purchase recycled products
- Subsidy and tax discounts to private enterprises dealing with 3 R businesses
- Extensive Producers Responsibility (EPR)

b. Discharge and Storage

The scattering of waste prevails throughout the country. This is largely due to the fact that the existing waste discharge and storage systems are unsuitable to present social conditions. At present, 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. LAs that are going to construct communal garbage bins should be very careful in doing so as there have been many failed cases of this system.

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 Japan, the common waste collection frequency is two to three times per week and in other developed countries in Europe and the USA it is one to two times per week. Since the collection and transportation cost accounts for the largest portion of SWM expenditure, the target should be maintaining the town's sanitary conditions by the least collection frequency with public cooperation. LAs should provide citizens with only basic waste collection services, and provide special services such as door-to-door collection, daily collection, large amount collection, etc. only in return for a special charge.

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

This problem can be solved by establishing waste discharge rules as follows:

- LAs decide the waste discharge rules including the waste collection days, discharge manner, etc.
- The rules are fully publicised to all citizens and they are requested to comply with them.
- LAs carry out waste collection in accordance with the rules.

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. Therefore, it is difficult to cover even the operation and maintenance cost with the revenue from the sale of compost. The competitive price of compost is about Rs. 2 to 3 per kilogram.

2) The required landfill cost is very cheap, almost free, due to very weak legislative restrictions on the final disposal operation. Therefore, most LAs have selected the landfill method. This is also the reason why 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. This was due to the fact that the client of the project and the organisation responsible for the operation and maintenance were often different. Consensus building between them at the project formulation stage was insufficient.

4) The investment of many compost plants were borne by central governmental organisations. In this case, the organisations responsible for operation and maintenance, i.e. LAs, have no responsibility to pay back the loan. This is the main reason why LAs have easily accepted construction projects without deep consideration and have easily given up continuing their operation.

5) The demand for compost is quite limited. One cause is due to the few existing large farmers in Sri Lanka. Only tea estate companies can afford to purchase large amounts of compost.

There are few LAs which carry out separate collection for compost plants. However, the quality of compost is quite good due to the high percentage of organic waste, although the technology employed is very simple. Furthermore, because of the simple technology used, it was confirmed that to economically obtain the required quality of compost product highly depended on the responsible person's capability.

d.2 Bio-gas

There are still few bio-gas plants that are being practically used for the treatment of municipal solid waste in Sri Lanka. Although several pilot plants have been tried, most of them have stopped operating due to facility problems or operational 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 in Sri Lanka has not yet achieved a level for practical utilization.

d.3 Incineration of Health-Care Waste

We investigated the technology of crematoriums and incinerators for health care waste because their required technologies are similar. It was judged that the furnace technology in Sri Lanka was at a sufficient level because it is the same as the furnaces for producing tiles, which are commonly produced. However, the equipment for incineration employs imported technologies. As for operation and maintenance technology, the existing technology is sufficient for the operation of small incinerators such as those with a capacity of 5 tons per day. In conclusion, the existing technology for small incinerators such as for health care waste is quite sufficient. The only problem in the promotion of this technology is financial issues.

As for the operation of large-scale incinerators, a full training course is required.

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. Jeewa Kotu, in particular, is an excellent method because it is highly an aerobic system.

e. Final Disposal

e.1 Existing Landfill Sites

Among the more than 20 landfill sites we visited, there were no disposal sites with sanitary levels acceptable to the Study Team except in Gampaha. Most sites have very little remaining capacity and very strong opposition by residents in neighbouring areas due to the lack of consideration to environmental protection. The main causes can be attributed to the following:

- The root problem is the neglect of the landfill site and its operation by LAs. Most LAs spend very little expenditure on landfill operation, i.e. less than Rs. 50 per ton of waste, while proper operation is supposed to require more than Rs. 300 per ton. In addition, most LAs do not understand the absolute necessity of landfill disposal in SWM.
- Lack of understanding of a sanitary landfill site and its operation.
- Consideration to neighbouring residents, especially social consideration is significantly absent. This is due to a lack of understanding of the social cost incurred.

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.

e.2 New Landfill Sites

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.

In addition, because urbanised local authorities tend to control narrow areas, it is too difficult for them to acquire land for landfill sites within their area of jurisdiction. They have to acquire lands in neighbouring towns, which makes building social acceptance for landfill sites more 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 fact that the SWM budget accounts for 20% to 50% of the total municipal budget can be attributed to the following:

- A huge increase in SWM work due to an increase in waste amount and an increase in waste which is difficult to properly treat and dispose of.
- Neglecting to improve work efficiency because job creation is prioritised in SWM.
- LAs have no economic incentive to reduce SWM costs because their salary is granted by provincial councils.
- Lack of utilization of external resources such as public cooperation and the private sector.

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 cannot often maintain proper records of days worked to account for their salaries. This is due to the following:

- Too many cleansing workers to control their attendance properly.
- Too difficult to keep track of their attendance due to the site mode work.
- Few proper traffic means are provided for supervisors.

- Public servants including permanent cleansing workers have the right to take 45 days leave with pay annually in total, i.e. 21 days leave with pay and 24 days medical leave with pay per year. Many LAs do not keep their leave records properly.
- Existence of corruption among public servants.
- Cleansing workers health conditions are generally poor due to poor working conditions and poor living conditions.
- Very labour intensive mode of cleansing work

c. Education on Waste

Education on waste is scarcely provided for school children or adults. Although students who want it can receive some education on waste conducted as a part of extracurricular activities by a DEO officer, the number of these students is very few and the content of education is insufficient. There are neither proper educational materials nor proper information for teachers as it is a new subject.

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.

e. Complaints

The majority of complaints which LAs receive are for neglecting to collect waste and clean drains. Actually, both types of complaints are rooted in the waste issue. However, it is not always the case that the LAs neglect to perform waste collection services. Because the collection service presently provided is irregular, citizens discharge their waste at any time. Therefore, citizens sometimes discharge their waste even immediately after waste is collected and then they criticize the LA for failing to perform its services. In order to solve this problem, complying with a waste collection schedule is essential even if the waste collection frequency is reduced.

f. Political Intervention

Intervention in SWM works by municipal council members is often seen. The following are some examples of the problems it causes.

- They hinder LAs from keeping to the waste collection schedule by ordering the particular work directly.
- They order LAs to collect garden waste from particular residences free of charge, which is not supposed to be done.
- The employment of employees.

3.2 Problems LAs are Facing and the Causes

3.2.1 Common Problems

a) Widespread scattering of waste in the towns
b) Terrible conditions of landfill sites and little remaining capacity of existing landfill sites
c) Difficulty in establishing new landfill sites
d) Stagnation or failure of many compost and recycling projects
e) Huge SWM expenditure, approximately 20% to 50% of the LA's total budget
f) Difficulty in controlling many waste collection workers; approximately 30% to 50% of the LA's total employees
g) Very high absentee and leaving work rate; ranging from 10% to 20%
h) Many complaints from citizens
i) Lack of public cooperation
j) Political intervention

3.2.2 Main Causes

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

a. Insufficient understanding of the importance of SWM works

Although the SWM budget accounts for 20% to 50% of the total budget and SWM employees account for 30% to 50% of the total employees, LAs have not realized the importance of its work. Therefore, only a few LAs have an independent SWM department and the status of the section in charge of SWM works is generally low. Therefore, sufficient human resources are not allocated and sufficient authorities have not been granted, resulting in the inefficient operation.

b. Insufficient knowledge of SWM works

There is a lack of understanding of SWM as can be seen in neglect of the discharge and storage system, neglect of landfill sites, excessive expectations for recycling and composting, and neglect of an operation and maintenance plan. This makes it difficult for LAs to make the right decisions.

c. Difficulty in Acquisition of Land for Landfill Site

In order to facilitate getting acceptance for the establishment of SWM facilities from residents in the surrounding area, it should be sited within its own area of jurisdiction to establish the social justice. However, it is too difficult to do because:

- LAs' area of jurisdiction is too narrow
- SWM facilities are not identified in the town plan.

d. Lack of Social Consideration, Transparency, Accountability and Public Participation

It is very natural for local residents to protest SWM facilities because they more or less have a negative impact on the surrounding area. However, SWM facilities have to be constructed somewhere because they are essential for the society. Building social acceptability for SWM facilities is essential before the implementation of SWM projects. However, there are rarely efforts made by LAs to get the acceptance of local residents by fully explaining to them the necessity of the facilities, the reason for selecting the site, and scientific assurance of acceptable environmental impacts.

e. Lack of Cost Control, Future Planning and Public Relations due to Weak Organisation

Because LAs have been doing only maintenance work such as road maintenance rather that the implementation of development projects, they have neither the planning capability nor the cost control capability for services provided. This is one of the factors obstructing LAs from executing improvement projects by themselves.

f. Lack of utilization of the external resources

The majority of LAs tend deal with most issues with their own resources, i.e. human resources and equipment, without considering the utilization of external resources such as the involvement of citizens. Therefore, they are quick to solve problems by increasing the number of employees and making requests to provincial councils and donor agencies.

g. Lack of Waste Discharge Rules

The process in SWM which greatly requires public cooperation is waste discharge. In order to get public cooperation, the establishment of waste discharge rules and informing the public of them are essential. The current lack of public cooperation is due to the lack of such rules.

h. Lack of Social and Economic Consideration and Technology Oriented

Social and economic issues are very important in SWM because it is closely related to citizens' lives and many employees are involved. In developed countries, therefore, not only engineers but also experts in social issues, economics, education, and local governance actively participate in this subject. On the other hand, engineers are dominant in SWM in Sri Lanka resulting in a

technology oriented approach, while social and economic aspects, which are just as important in SWM as the technological aspect, have been ignored.

i. Shortage of Financial Sources

The financial capability of the LLDF scheme, which can be utilized for SWM projects as well as by LAs, has rapidly decreased since a few years ago and it is actually too difficult to get a loan from LLDF for projects. In addition, the incomes of LAs are too limited to do projects which require a large capital investment.

j. Poor Governance

Concerning the solid waste problems in Sri Lanka, the institutional causes are much more important than the technical ones. Therefore, the SWM problems cannot be improved only by technical improvement unless institutional improvement is executed as well. In other words, the governance quality of LAs is well reflected in the efficiency of SWM works. The improvement of governance is also very important for the improvement of SWM works.

k. Lack of Private Consultant Capability

Since certain governmental organisations have dealt with development projects, most LAs seldom have the experience of implementing projects. Therefore, not only LAs but also private consultants have lack of experience and capabilities to implement SWM projects.

l. Many Failure and Stagnant of Compost Projects and Recycling Projects

The main reason why LAs are practicing open dumping is because it is actually the cheapest means of disposing of waste regardless of regulations. The improvement of landfill sites will create an economic incentive for compost projects, recycling projects, etc. because the gap between their costs and landfill costs will become small. In other words, in order to promote composting and recycling which are environmentally better systems than open dumping, it is necessary to create an economic incentive for them by forcing LAs to spend sufficient expenditure for better landfill operation. This means that stringent enforcement of environmental standards for landfill site operation is the best method.

However, the present situation is headed in the opposite direction. The improvement of landfill sites is hardly considered, while compost and recycling projects are actively promoted. This is because for the time being LAs, NGOs, and communities are dealing with improvement measures which they can somehow manage on their own, leaving behind the landfill site problems which are too large for them to deal with.

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. However, Colombo and the neighbouring LAs are relatively lucky in terms of waste collection because they received hundreds of waste collection vehicles through Japanese Grant Aid in 1997 and 1999. Although waste scattering is dominant there, it is clear that it is not due to a shortage of collection capacity but rather the absence of proper waste discharge rules and a proper discharge and storage system.

The landfill problem is very serious in Colombo and the neighbouring towns. Colombo MC, Dehiwala Mt. Lavina MC and Mahalagama UC have contracted the final disposal work out to a private landfill site in Bloememdhal, which receives about 1000 tons of waste daily. The landfill site has serious negative impacts on the surrounding environment due to improper operation.

Chapter 4 Formulation of Pilot Projects

4.1 Concept of Pilot Projects

4.1.1 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

4.1.2 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.

4.1.3 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 MGTP 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 management plan they implement by themselves is able to take off.

4.1.4 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

4.1.4.1 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. Public cooperation was obtained by the following means.

- 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.

4.1.4.2 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.

4.1.4.3 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 including collection days.	→	Establishment of the rule
Informing the public of waste discharge rules including collection days	→	Publicity, education
Enforcement of waste discharge rules	→	Supervision, enforcement
Compliance with the waste collection schedule	→	Improvement of O & M

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

4.1.4.4 Improvement of final disposal

The present terrible landfill conditions can be temporarily improved quite 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.

4.1.4.5 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

4.2 Formulated Pilot Projects

4.2.1 Pilot Projects for the National Level

4.2.1.1 Formulation of model by-laws for local governments

The policy proposed in the National Strategy for SWM formulated by the Ministry of Environment and Natural Resources in 2000 has scarcely been practiced. In order to help put it into practice, by-laws used by local governments, which are responsible for the execution of the SWM, should be in compliance with the thought of the National Strategy. However, local governments do not have the capacity to prepare new by-laws for SWM in compliance with the National Strategy.

The objective of this pilot project is, therefore, to assist local governments in preparing the by-laws by providing a model by-law. The model by-law in line with the National Strategy will be jointly prepared by the Study Team and the Ministry of Home Affairs, Provincial Councils and Local Government.

4.2.1.2 Introduction of the Bell Collection system

Waste scattering in towns is dominant throughout all of Sri Lanka. This is because the common waste storage systems such as conventional communal garbage bins and plastic garbage bags recently getting popular are not able to prevent the scattering of waste by the many existing stray dogs, goats, cows, horses, monkeys and crows. In other word, they are not suitable for the present social condition. Curb side collection using plastic containers is not suitable either due to the high possibility of the plastic containers getting stolen.

Considering the present condition in local towns in Sri Lanka, the waste collection system that is the most suitable and widely applicable is the bell collection method. In the bell collection system, collection trucks play music to inform residents they are approaching. When they hear the music, the residents gather their household waste and take it directly to the collection workers. If this method functions, it will reduce the amount of scattered waste and waste heaps in towns, and eventually improve the efficiency of waste collection. It is highly likely that the bell collection system will be able to function in local towns because there is usually somebody in most houses and shops in the daytime in most local towns.

In this pilot project, the bell collection system will be implemented in seven model towns after the speaker units to play the music are installed in all waste collection trucks in order to determine its applicability to the other towns and to learn the appropriate usage method.

4.2.1.3 Production of picture books on waste for children

In order to promote waste education for children, a sub-textbook on waste will be produced. This has been found to be highly necessary because no such educational materials exist at present and the seriousness of waste problems will grow with the expected economic development. The Study Team, the Ministry of Environment and Natural Resource and the Central Environmental Agency will jointly produce this. The proposed number of copies is 100,000.

4.2.1.4 Trial lecture on SWM in PHI (Public Health Inspector) training course

PHIs are dealing with SWM in most local governments at present. The PHI training course of one and half years' duration is executed regularly at the National Institute of Public Health and Science. However, the programme on the SWM is very scanty because of the lack of education materials, lecturers, etc.

For the pilot project, the Study Team will hold a trial lecture for PHI course students using the draft SWM guideline for local governments to be prepared in the Study in order to determine its applicability and the points to be reviewed.

In addition, because the Study is examining the necessity of establishing the new training course for SWM inspectors, the findings through the execution of this trial will be reflected in the recommendation.

4.2.1.5 Lecture for university students and university staff on the social issues in SWM

Most of the SWM experts in Sri Lanka are engineers because only the agriculture department and/or the mechanical engineering department in universities deal with SWM. This situation has led to technology-oriented projects and has caused the failure of many SWM projects. Therefore, the Study Team will hold a lecture for university students and staff on waste focusing on

necessary socio-economic considerations in SWM in the universities by explaining various cases in Japan.

4.2.1.6 Seminar for interested NGOs on the findings obtained through the Study

Quite a number of environmental NGOs in Sri Lanka are keen to improve SWM. However, they have many problems and cases of failure in their activities because they do not have a scientific understanding of present SWM. Therefore, the Study Team will explain to them the scientific findings obtained through the Study and discuss the role of NGOs and their expected policies.

4.2.1.7 Seminar on SWM administration for decision making level staffs in PCs and LAs

Politicians and high-ranking officers are key persons in local governance due to the dominance of the top-down system in local governments. It is, therefore, necessary to ensure they have correct knowledge and understanding of SWM in order for the materialization of short-term improvement.

The Ministry of Home Affairs, Provincial Councils and Local Governments established the Sri Lankan Institute of Local Governance (SLILG) as their training institute in 1999. The pilot project aims to help SLILG in its activities to train them in SWM. The seminar targeting politicians and high-ranking officers in local governments will be held in five places.

4.2.2 Outline of Pilot Projects by Model Town

a. 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				●			●

b. Description of Each Component

b.1 Strengthening the Organisational Capacity

Strengthening the organisational capacity is very necessary because the present organizational condition where PHIs have dual tasks is very weak. Therefore, the following programmes will be executed in order to strengthen the present organisation.

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

b.2 Promotion of Waste Minimization

Examples of measures taken are as follows:

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

b.3 Waste Collection Improvement

The majority of citizens maintain the old understanding that the waste they discharge on the road should be collected by waste collectors. This understanding has greatly affected the efficiency of waste collection work. The following improvement programmes will be integrally executed in order to improve waste collection efficiency together with reducing the amount of scattered waste.

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

b.4 Environmental Education

The following programmes will be executed:

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

e) Introduction and operation of school recycling

b.5 Improvement of existing landfill sites

- The adverse environmental impact of the existing landfill in Kandy on the surrounding area is mitigated.
- The existing landfill site in Nuwara Eliya is turned into a sanitary landfill site.

4.2.3 Initial Project Design Matrix of Pilot Project in Each Model Town

Initial PDM (Project Design Matrix) for Chilaw

Pilot Project Name: **Improvement of SWM for Chilaw**

Period: Implementation: from Jan. 2003 to Mar. 2003

Following up: from May 2003 to Sep. 2003

Target group: Urban Council employees and all citizens Date: Nov, 2002

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal The environmental sanitary condition in Chilaw is improved.	Complain from citizens to Urban Council decrease by50% by 2006.	Complain record	The central government won't change the policy of public health and environmental protection.
Project Purpose (a) Waste scattering decreases (b) Waste collection cost decreases	By August 2003, • The number of problem areas decreases by 30%. • The number of complains decrease by 30%.	Monthly SWM performance report	The number of population, shops, waste generation amount will not increase greatly.
Outputs a) Modified by-law enacts.	a) Municipal Council approves by-law.	Gazzet	The number of vehicles will not increase greatly.
b) Modified by-law is strictly enforced.	b) Environmental committee qualitatively evaluate.	Record of violence	
c) The management work is conducted in accordance with the SWM manual.	c) Filling rate of management note more than 70%.	Record	
d) The SWM monthly report is prepared and submitted to the environmental committee.	d) Submission of the report monthly.	Monthly SWM performance report	
e) SWM control board is utilized.	e) Data must be updated every week.	SWM control board	
f) Waste collection efficiency is improved.	f) The daily trip number increases.	Trip record	
g) Municipal Council staff produce education materials and conduct education activities by themselves.	g) Number of requesting technical support: less than 2 times/month	Support request record	
h) The education materials using the actual cases in Chilaw are produced.	Number of education material production : at least one	List of education material	
i) An environmental education center targeting citizens is established and operated.	h) Number of visitors : more than 300	Visitor record	
j) The environmental centre will also hold educational activities at sites such as communities and schools using the equipment and materials used at the centre.	i) Number of site education : more than twice/month	Site education record	
k) NGO's compost production is assisted by Urban Council	j) Sale of compost more than 200 kg/month	Accounting book	
Activities	**Inputs**		
2.1 Strengthening the Organisational Capacity a) Urban council is assisted to prepare the by-law for SWM based on the model by-law. b) Training on supervision works, SWM, public promotion, etc. is given to PHIs and supervisors. c) Necessary transportation means for supervision and public promotion activities are provided. d) SWM control board is produced and fixed. **2.2 Waste Collection Improvement** a) The bell collection and kerb side collection method are introduced. b) The stationary collection with trailers for markets, bus stations, etc. where many people gather are introduced. c) Waste transfer facilities are improved. d) Half barrel fixed type bins are installed in parks, etc. e) Half barrel movable bins are timely placed at events, festivals, Sunday bazaar, etc. f) Public litter bins to be provided Municipal Council to some of shops are taken care by them. **2.3 Hygiene Education** a) The promotion and education materials are produced. b) The Study Team will transfer the education material production know-how to municipal staff. c) An environmental education center is established. d) NGO of ORDE for the composting operation is assisted. e) The environmental centre execute the education at sites such as communities, schools by using the equipment and materials used at the center f) Beautification of Chilaw town is promoted by the public participation.	**JICA Study Team** **Manpower** • The Study Team member 5p **Technical assistance** • Training for PHIs & supervisors • Public education • On-the-job-training **Equipment and Material** **1) For supervision and education works** • SWM control board 1 no • Motorbike 2 nos • Helmets 2 nos **2) For waste collection improvement** • Speaker units for bell collection7 units • Modified handcart 5 units • 100l fixed type litter bins 20 nos • 100l movable type litter bins 20 nos • 30-40 litres litter bins 50 nos • Fabrication of waste transfer platform 2 unit • Closed type trailer for stationary waste transportation 3 nos **3) For environmental education** • Laptop computer 1 no • Projector 1 no • Screen 1 no • Digital camera 1 no • Colour printer 1 no • Education banner 10 nos • Leaflets 6,000 nos • Public notice board for waste discharge 50 plates • Refurbishing the office to the environmental education center 1 set	**Urban Council Chilaw** **Manpower** • PHI 2 p • Supervisor 6 p • Environmental Officer 1 p • Computer operator 1 p **Facilities** • To make the 2nd floor of town hall building for the environmental education centre	Trained staff will continue to work for the same tasks. **Pre-conditions** Municipal council doesn't oppose the pilot project.

Initial PDM for Negombo

Pilot Project Name: **Improvement of SWM for Negombo**

Period: Implementation: from Jan. 2003 to Mar. 2003

Following up: from May 2003 to Sep. 2003

Target group: Municipal Council employees and all citizens Date: Nov, 2002

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal The environmental sanitary condition in Negombo is improved.	Complain from citizens to Municipal Council decrease by50% by 2006.	Complain record	The central government won't change the policy of public health and environmental protection.
Project Purpose a) Waste scattering decreases b) Waste collection cost decreases	• The number of problem areas decreases by 30% • The number of complains decrease by 30%.	Qualitatively	The number of population, shops, waste generation amount will not increase greatly.
Outputs a) Modified by-law enacts.	a) Municipal Council will discuss it soon.	Gazzet	The number of vehicles will not increase greatly.
b) Modified by-law is strictly enforced.	b) By-law has not been approved yet.	Record of violence	
c) The management work is conducted in accordance with the SWM manual.	c) SWM manual has been referred by staff following the trainings.	Record	
d) The SWM monthly report is prepared and submitted to the environmental committee.	d) The monthly report hasn't been prepared.	Monthly SWM performance report	
e) SWM control board is utilized.	e) It has been used since Sep. 2003.	SWM control board	
f) Waste collection efficiency is improved.	f) The daily trip number is conatant.	Trip record	
Activities **2.1 Strengthening the Organisational Capacity** a) Environmental committee is established and works. b) Urban council is assisted to prepare the by-law for SWM based on the model by-law c) PHIs and supervisors are trained on supervision works, SWM, public promotion, etc. d) Necessary transportation means for supervision and public promotion activities are provided. e) SWM control board is produced and fixed. **2.2 Waste Collection Improvement** a) The bell collection and kerb side collection method are introduced. b) The stationary collection by using trailers in markets, bus stations, etc. where many people gather are introduced. c) Waste transfer facilities are improved. d) Half barrel fixed type bins are installed in parks, etc. e) Half barrel movable bins are timely placed at events, festivals, Sunday bazaar, etc. **2.3 Environmental Education** a) Leaflets showing waste discharge rule, etc. are produced and distributed.	**Inputs** **JICA Study Team** **Manpower** • The Study Team member 5p **Technical assistance** • Training for staff • Public education • On-the-job-training **Equipment, material and facilities** **1) For supervision and education works** • SWM control board 1 no • Motorbike 6 nos • Helmets 6 nos **2) For waste collection improvement** • Speaker units for bell collection16 u • Modified handcart 6 units • Fabrication of waste transfer platform 1 unit • Closed type trailer for stationary waste transportation 3 nos • 100l fixed type litter bins 20 nos • 100l movable type litter bins20 nos **3) For environmental education** • Leaflets 30,000 nos • Public notice board for waste discharge 50 plates	**Negombo Municipal Council** **Manpower** • PHI 3 p • Supervisor 17 p • Environmental Officer 1 p • Computer operator 1 p **Facilities** • Provision of the proper office space for the Study Team	Trained staff will continue to work for the same tasks. **Pre-conditions** Municipal council doesn't oppose the pilot project.

Initial PDM for Gampaha

Pilot Project Name: **Improvement of SWM for Gampaha**

Period: Implementation: from Jan. 2003 to Mar. 2003

Following up: from May 2003 to Sep. 2003

Target group: Municipal Council employees and all citizens Date: Nov, 2002

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal The environmental sanitary condition in Gampaha is improved.	Complain from citizens to Municipal Council decrease by 50% by 2006.	Complain record	The central government won't change the policy of public health and environmental protection.
Project Purpose a) Waste scattering decreases. b) Waste collection cost decreases.	By August 2003, • The number of problem areas decreases by 30%.	Monthly SWM performance report	The number of population, shops, waste generation amount will not increase greatly.
Outputs a) The waste transfer work efficiency is improved.	a) Number of worker for waste transfer	Working record	
b) The waste transfer yard is cleaned.	b) Visual check	Visual check	
c) More recyclable materials are recovered.	c) Amount materials recovered	Sales amount of recyclables	
d) Compost is produced by using food leftover.	d) Utilisation condition of compost barrels	Visual check	
Activities 2.1 Waste Collection Improvement a) The bell collection and kerb side collection method are introduced. b) A waste transfer yard is improved. **2.2 School Recycling** a) Stores for in-organic recyclables are constructed. b) Compost barrels are provided at schools. c) Floor beds are constructed. **2.3 Environmental Education** a) Environmental education banners are produced. b) Leaflets showing waste discharge rule, etc. are produced and distributed.	**Inputs** **JICA Study Team** **Manpower** • The Study Team member 5p **Technical assistance** • Public education **Equipment and Material** **1) For waste collection improvement** • Speaker units for bell collection 16 units • Fabrication of waste transfer platform1 uni • Closed type trailer for stationary waste transportation 2 nos **2) For school recycling** • Store for in-organic recyclables 6 nos • Compost barrel 12 nos • Brick for flower bed 9,600 nos **3) For environmental education** • Leaflets 6,000 nos • Education banner 10 nos	**Gampaha Municipal Council** **Manpower** • PHI 2 p • Supervisor 6 p • Environmental Officer 1 p • Computer operator 1 p **Facilities** • Provision of the proper office space for the Study Team • Provision of the proper yard for the waste transfer facility • Coordination with target schools	Trained staff will continue to work for the same tasks. **Pre-conditions** Municipal council doesn't oppose the pilot project. Schools don't oppose the pilot project.

Initial PDM for Matale

Pilot Project Name: **Improvement of SWM for Matale**

Period: Implementation: from May 2003 to Sep. 2003

Following up: in Oct 2003

Target group: Municipal Council employees and all citizens Date: Nov, 2002

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal The environmental sanitary condition in Matale is improved.	Complain from citizens to Municipal Council decrease by 50% by 2006.	Complain record	The central government won't change the policy of public health and environmental protection.
Project Purpose a) Waste scattering decreases b) Waste collection cost decreases	By August 2003, • The number of problem areas decreases by 30%. • The number of complain decrease by 30%.	Monthly SWM performance report	The number of population, shops, waste generation amount will not *increase greatly.*
Outputs a) Modified by-law enacts.	a) Municipal Council approves by-law.	Gazzet	The number of vehicles will not increase greatly.
b) Modified by-law is strictly enforced.	b) Environmental committee qualitatively evaluate.	Record of violence	
c) The management work is conducted in accordance with the SWM manual.	c) Filling rate of management note. more than 70%.	Record	
d) The SWM monthly report is prepared and submitted to the environmental committee.	d) Submission of the report monthly.	Monthly SWM performance report	
e) SWM control board is utilized.	e) Data must be updated every week.	SWM control board	
f) Waste collection efficiency is improved.	f) The daily trip number increases.	Trip record	
g) Municipal Council staff produces education materials and conduct education activities by themselves.	g) Number of requesting technical support less than 2 times/month	Support request record	
h) The education materials showing the actual cases in Matale are produced.	h) Number of education material production : at least one	List of education material	
i) An environmental education center targeting citizens is established and operated.	i) Number of visitors : more than 300	Visitor record	
j) The environmental centre will execute educational activities at sites such as communities and schools using the equipment and materials used at the centre.	*j) Number of site education :* more than twice/month	*Site education record*	
Activities	**Inputs**		
1. Strengthening the Organisational Capacity a) Urban council is assisted to prepare the by-law for SWM based on the model by-law. b) Training on supervision works, SWM, public promotion, etc. is given to PHIs and supervisors. c) Necessary transportation means for supervision and public promotion activities are provided. d) SWM control board is produced and fixed. **2. Waste Minimisation** a) Home composting is promoted. b) Private recyclers and middlemen are assisted. c) Minimization of food leftover is promoted. d) Minimisation of polyethylene shopping bags is promoted. **3. Waste Collection Improvement** a) The bell collection and kerb side collection method are introduced. b) The stationary collection with trailers for markets is introduced. c) A waste transfer facility is improved. d) Half barrel fixed type bins are installed in parks, etc. e) Half barrel movable bins are timely placed at events, festivals, Sunday bazaar, etc. f) Public litter bins to be provided Municipal Council to some of shops are taken care by them. **4. Acquisition of Landfill Site** a) Acquisition of new land for landfill development is investigated. b) The introduction of waste treatment technologies is examined if acquisition of new landfill site is too difficult or too expensive. **5. Environmental Education** a) The promotion and education materials are produced. b) The Study Team will transfer the education material production know-how to municipal staff. c) An environmental education center is established. d) Beautification town is promoted with the public participation.	**JICA Study Team** **Manpower** • The Study Team member 5 p **Technical assistance** • Training for PHIs & supervisors • Public education • On-the-job-training **Equipment, material and facilities** **1) For supervision and education works** • SWM control board 1 no • Motorbike 4 nos • Helmets 4 nos **2) For waste collection improvement** • Speaker units for bell collection 6 units • Modified handcart 10 units • 100l fixed type litter bins 20 nos • 100l movable type litter bins 20 nos • 30-40 litres litter bins 50 nos • Fabrication of waste transfer platform 1 unit • Closed type trailer for stationary waste transportation 2 nos **3) For environmental education** • Laptop computer 1 no • Projector 1 no • Screen 1 no • Digital camera 1 no • Colour printer 1 no • Education banner 10 nos • Leaflets 7,000 nos • Public notice board for waste discharge 50 plates • Building an environmental education center 1 set	**Matale Municipal Council** **Manpower** • PHI 2 p • Supervisor 3 p • Community Development Officer 12 p • Environmental Officer 1 p • Computer operator 1 p **Facilities** • To make the 2nd floor of town hall building for the environmental education centre	Trained staff will continue to work for the same tasks. **Pre-conditions** Municipal council doesn't oppose the pilot project.

Initial PDM for Kandy

Pilot Project Name: **Improvement of SWM for Kandy**

Period: Implementation: from May 2003 to Sep. 2003

Following up: in Oct 2003

Target group: Municipal Council employees and all citizens Date: Nov, 2002

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal The environmental sanitary condition in Kandy is improved.	Complain from citizens to Municipal Council decrease by 50% by 2006.	Complain record	The central government won't change the policy of public health and environmental protection.
Project Purpose a) The sanitary level of the landfill site and the environmental impacts by it decrease. b) Waste collection cost decreases.	By August 2003, • The number of problem areas decreases by 30%. • The number of complain decrease by 30%.	Monthly SWM performance report	The number of population, shops, waste generation amount will not increase geatly.
Outputs			
a) The waste collection efficiency is improved.	a) Daily trip record	Daily trip record	
b) Healthcare waste is separately collected.	b) Achievement: 100%	Waste incoming record	
c) The disposal pit for healthcare waste is separately constructed and healthcare waste is disposed of there.	c) Achievement: 100%	Monitoring check list	
d) Periodical monitoring is implemented.	d) Achievement: 100%	Monitoring check list	
e) The landfill site is sanitarily operated.	e) Number of failures: less than 3	Monitoring check list	
Activities **2.1 Waste collection improvement** a) The bell collection and kerb side collection method are introduced. **2.2 Improvement of the sanitary level of the landfill site** a) The existing landfill site is improved. b) The appropriate landfill operation method is transferred. c) The landfill monitoring committee is established.	**Inputs** **JICA Study Team** **Manpower** • The Study Team member 5p **Technical assistance** • On-the-job training **Equipment, material and facilities** **1) For waste collection improvement** • Speaker units for bell collection 19 units **2) For landfill improvement** • Improvement works of the existing landfill site 1 set	**Kandy Municipal Council** **Manpower** • PHI 2 p • Supervisor 1 p **Facilities** • Provision of the proper office space for the Study Team	Trained staff will continue to work for the same tasks. **Pre-conditions** Municipal council doesn't oppose the pilot project.

Initial PDM for Nuwara Eliya

Pilot Project Name: **Improvement of SWM for Nuwara Eliya**

Period: Implementation: from May 2003 to Sep. 2003

Following up: in Oct 2003

Target group: Municipal Council employees and all citizens Date: Nov, 2002

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal The environmental sanitary condition in Nuwara Eliya is improved.	Complain from citizens to Municipal Council decrease by 50% by 2006.	Complain record	The central government won't change the policy of public health and environmental protection.
Project Purpose a) Waste scattering decreases b) Waste collection cost decreases	By August 2003, • The number of problem areas decreases by 30%. • The number of complain decrease by 30%.	Monthly SWM performance report	The number of population, shops, waste generation amount will not increase greatly.
Outputs a) Modified by-law enacts.	a) Municipal Council approves by-law.	Gazzet	The number of vehicles will not increase greatly.
b) Modified by-law is strictly enforced.	b) Environmental committee qualitatively evaluate.	Record of violence	
c) The management work is conducted in accordance with the SWM manual.	c) Filling rate of management note. more than 70%.	Record	
d) The SWM monthly report is prepared and submitted to the environmental committee.	d) Submission of the report monthly.	Monthly SWM performance report	
e) SWM control board is utilized.	e) Data must be updated every week.	SWM control board	
f) Waste collection efficiency is improved.	f) The daily trip number increases.	Trip record	
g) Healthcare waste is separately collected.	g) Achievement rate: 100%	Waste incoming record	
h) Healthcare waste is disposed of at the separate disposal pit for healthcare waste.	h) Achievement rate: 100%	Monitoring check list	
i) Monitoring of the landfilling is periodically conducted.	i) Achievement rate: 100%	Monitoring check list	
j) Landfilling is sanitarily operated.	*j) Number of failures: less than 3*	*Monitoring check list*	
k) Municipal Council staff produce education materials and conduct education activities by themselves.	k) Number of requesting technical support less than 2 times/month	Support request record	
l) The education materials showing the actual cases in Nuwara Eliya are produced.	l) Number of education material production : at least one	List of education material	
m) An environmental education center targeting citizens is established and operated.	*m) Number of visitors : more than 300*	*Visitor record*	
n) The environmental centre will execute educational activities at sites such as communities and schools using the equipment and materials used at the centre.	n) Number of site education : more than twice/month	Site education record	
Activities **1. Strengthening the Organisational Capacity** a) Urban council is assisted to prepare the by-law for SWM based on the model by-law. b) Training on supervision works, SWM, public promotion, etc. are given to PHIs and supervisors. c) Necessary transportation means for supervision and public promotion activities are provided. d) SWM control board is produced and fixed. **2. Waste Minimisation** a) Home composting is promoted. b) Private recyclers and middlemen are assisted. c) Minimization of food leftover is promoted. d) Minimisation of polyethylene shopping bags is promoted. **3. Waste Collection Improvement** a) The bell collection and kerb side collection method are introduced. b) Healthcare waste is separately collected. **4. Landfill Improvement** a) The existing landfill site is improved. b) The sanitary landfill operation method is transferred. c) The monitoring committee for landfill operation is established. **5. Environmental Education** a) The promotion and education materials are produced. b) The Study Team will transfer the education material production know-how to municipal staff. c) An environmental education center is established. d) Beautification town is promoted with the public participation.	**Inputs** **JICA Study Team** **Manpower** • The Study Team member 5 p **Technical assistance** • Training for PHIs & supervisors • Public education • On-the-job-training **Equipment, material and facilities** **1) For supervision and education works** • SWM control board 1 no • Motorbike 5 nos • Helmets 5 nos **2) For waste collection improvement** • Speaker units for bell collection 6 units • Three wheeler 1 unit **3) For environmental education** • Laptop computer 1 no • Projector 1 no • Screen 1 no • Digital camera 1 no • Colour printer 1 no • Education banner 10 nos • Leaflets 6,000 nos • Poster 300 sheets • Sticker 3,000 sheets • Public notice board for waste discharge 50 plates • Building an environmental education center 1 set	**Nuwara Eliya Municipal Council** **Manpower** • PHI 5 p • Supervisor 3 p • Community Development Officer 1 p • Computer operator 1 p **Facilities** • To provide the proper office space for the environmental education centre	Trained staff will continue to work for the same tasks. **Pre-conditions** Municipal council doesn't oppose the pilot project.

Initial PDM for Badulla

Pilot Project Name: **Improvement of SWM for Badulla**

Period: Implementation: from May 2003 to Sep. 2003

Following up: in Oct 2003

Target group: Municipal Council employees and all citizens Date: March, 2003

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal The environmental sanitary condition in Badulla is improved.	Complain from citizens to Municipal Council decrease by 50% by 2006.	Complain record	The central government won't change the policy of public health and environmental protection.
Project Purpose a) Waste scattering decreases b) Waste collection cost decreases	By August 2003, ● The number of problem areas decreases by 30%. ● The number of complain decrease by 30%.	Monthly SWM performance report	The number of population, shops, waste generation amount will not increase greatly.
Outputs a) Modified by-law enacts.	a) Municipal Council approves by-law.	Gazzet	The number of vehicles will not increase greatly.
b) Modified by-law is strictly enforced.	b) Environmental committee qualitatively evaluate.	Record of violence	
c) The management work is conducted in accordance with the SWM manual.	C) Filling rate of management note. more than 70%.	Record	
d) The SWM monthly report is prepared and submitted to the environmental committee.	d) Submission of the report monthly.	Monthly SWM performance report	
e) SWM control board is utilized.	e) Data must be updated every week.	SWM control board	
f) Waste collection efficiency is improved.	f) The daily trip number increases.	Trip record	
g) Municipal Council staff produces education materials and conduct education activities by themselves.	g) Number of requesting technical support less than 2 times/month	Support request record	
h) The education materials showing the actual cases in Matale are produced.	h) Number of education material production : at least one	List of education material	
i) An environmental education center targeting citizens is established and operated.	i) Number of visitors : more than 300	Visitor record	
j) The environmental centre will execute educational activities at sites such as communities and schools using the equipment and materials used at the centre.	j) Number of site education : more than twice/month	Site education record	
Activities **1. Strengthening the Organisational Capacity** a) Urban council is assisted to prepare the by-law for SWM based on the model by-law. b) Training on supervision works, SWM, public promotion, etc. is given to PHIs and supervisors. c) Necessary transportation means for supervision and public promotion activities are provided. d) SWM control board is produced and fixed. **2. Waste Minimisation** a) Home composting is promoted. b) Private recyclers and middlemen are assisted. c) Minimization of food leftover is promoted. d) Minimisation of polyethylene shopping bags is promoted. **3. Waste Collection Improvement** a) The bell collection and kerb side collection method are introduced. b) The stationary collection with trailers for markets is introduced. c) A waste transfer facility is improved. d) Half barrel fixed type bins are installed in parks, etc. e) Half barrel movable bins are timely placed at events, festivals, Sunday bazaar, etc. f) Public litter bins to be provided Municipal Council to some of shops are taken care by them. **4. Acquisition of Landfill Site** a) Acquisition of new land for landfill development is investigated. b) The introduction of waste treatment technologies is examined if acquisition of new landfill site is too difficult or too expensive. **5. Environmental Education** a) The promotion and education materials are produced. b) The Study Team will transfer the education material production know-how to municipal staff. c) An environmental education center is established. d) Beautification town is promoted with the public participation.	**Inputs** **JICA Study Team** **Manpower** ● The Study Team member 5 p **Technical assistance** ● Training for PHIs & supervisors ● Public education ● On-the-job-training **Equipment, material and facilities** **1) For supervision and education works** ● SWM control board 1 no ● Motorbike 4 nos ● Helmets 4 nos **2) For waste collection improvement** ● Speaker units for bell collection 6 units ● Modified handcart 10 units ● 100l fixed type litter bins 20 nos ● 100l movable type litter bins 20 nos ● 30-40 litres litter bins 50 nos ● Fabrication of waste transfer platform 1 unit ● Closed type trailer for stationary waste transportation 2 nos **3) For environmental education** ● Laptop computer 1 no ● Projector 1 no ● Screen 1 no ● Digital camera 1 no ● Colour printer 1 no ● Education banner 10 nos ● Leaflets 7,000 nos ● Public notice board for waste discharge 50 plates ● Building an environmental education center 1 set	**Badulla Municipal Council** **Manpower** ● PHI 2 p ● Supervisor3 p ● Community Development Officer12 p ● Environmental Officer 1 p ● Computer operator 1 p **Facilities** ● To make the 2nd floor of town hall building for the environmental education centre	Trained staff will continue to work for the same tasks. **Pre-conditions** Municipal council doesn't oppose the pilot project.

4.3 Implementation

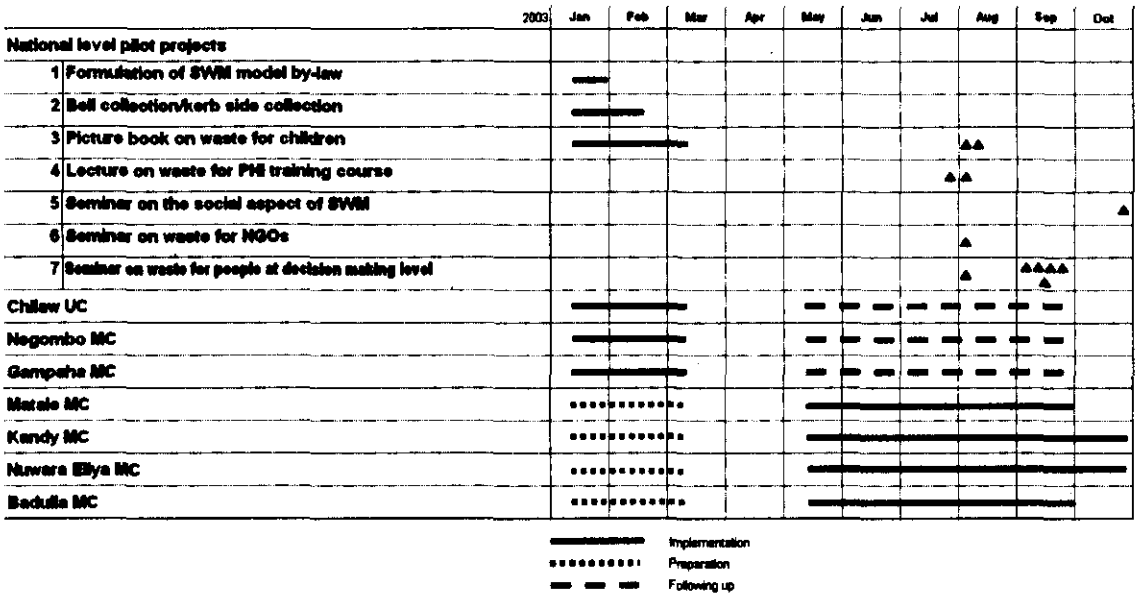
4.3.1 Actual Implementation Schedule

The actual implementation schedule of formulated pilot projects is shown below.

The pilot projects of three model towns, i.e. Chilaw, Negombo and Gampaha, were to be implemented between January and March, 2003.

The pilot projects of four model towns, i.e. Matale, Kandy, Nuwara Eliya and Badulla, were to be implemented between May and October, 2003.

As for the pilot projects for the national level, some were to be implemented between January and March, and some were to be implemented between May and September, 2003.



4.3.2 List of Items Requiring JICA's Assistance for the Implementation of Pilot Projects

Table 4-1 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.

Table 4-1: List of Facilities and Equipment Provided by JICA for the Implementation of Pilot Projects

Item	Unit	National level		Chilaw (Jan-Feb 2003)		Negombo (Jan-Feb 2003)		Gampaha (Jan-Feb 2003)		Matale (May-Nov 2003)		Kandy (May-Nov 2003)		Nuwara Eliya (May-Nov 2003)		Badulla (May-Nov 2003)		Total		
		Qty.	Total (JPY)	Qty.	Total (JPY)	Qty.	Total (JPY)	Qty.	Total (JPY)	Qty.	Total (JPY)	Qty.	Total (JPY)	Qty.	Total (JPY)	Qty.	Total (JPY)	Qty.	Unit	Total (JPY)
1.National level																				
1-1.The first seminar explaining the study findings (7 towns)	LS	1	¥199,400															1	LS	¥199,400
1-2.The second seminar explaining the study findings (7 towns)	LS	1	¥680,600															1	LS	¥680,600
1-3.Seminar for officer and council members in local governments(6 towns)	LS	1	¥847,000															1	LS	¥847,000
1-4. Workshop for teaching manual for the sub-textbook	time	1	¥260,000															1	time	¥260,000
1-5.6. Seminar for environmental NGOs	time	1	¥136,000															1	time	¥136,000
1-6. Lecture on solid was management to PHI	time	1	¥40,000															1	time	¥40,000
1-7.Seminar at universities	times	3	¥120,000															3	times	¥120,000
1-8. Employment of a lawyer to assist the model by law	LS	1	¥548,000															1	LS	¥548,000
1-9.Production of sub-textbook on waste for kids	books	100,000	¥3,348,675															100,000	books	¥3,348,675
1-10.Production of teaching manual for the sub-textbook	books	10,000	¥24,354															10,000	books	¥24,354
2. Procurement of equipment																				
2-1.SWM control board	nos.			1	¥1,335	1	¥1,335	1	¥1,335	1	¥16,574			1	¥16,574	1	¥16,574	6	nos.	¥53,726
2-2.Education panel	nos.			10	¥7,823	10	¥86,930	10	¥7,823	10	¥86,930			10	¥86,930	10	¥86,930	60	nos.	¥403,366
2-3.Leaflets	nos.			6,000	¥52,472	30,000	¥262,358	6,000	¥52,472	7,000	¥84,000			6,000	¥72,000	6,000	¥72,000	61,000	nos.	¥595,303
2-4..Public notice board for waste discharge rule	nos.			50	¥1,661	50	¥83,025			100	¥221,000			100	¥221,000	100	¥221,000	400	nos.	¥747,686
2-5.Motorbike with helmet	nos.			2	¥52,470	6	¥314,820			4	¥184,560			5	¥243,200	5	¥243,200	22	nos.	¥1,848,250
2-6.Modified handcart	nos.			5	¥15,070	10	¥150,700			6	¥83,820					6	¥83,820	27	nos.	¥333,410
2-7.100 litre barrel fixed type litter bins	nos.			20	¥3,219	20	¥84,380			20	¥55,860					20	¥55,860	80	nos.	¥179,359
2-8.100 litre barrel movable type litter bins	nos.			20	¥1,712	20	¥34,240			20	¥30,740					20	¥30,740	80	nos.	¥97,432
2-9.40-50 litre prastic liter bins for school recycling	nos.			50	¥679					40	¥42,200					50	¥52,750	140	nos.	¥95,628
2-10.Fabrication of waste transfer platform	nos.			2	¥137,000	1	¥137,000			1	¥39,116					3	¥117,348	7	nos.	¥430,464
2-11.Closed type trailer for stationary waste transportation	nos.			3	¥180,840	3	¥542,520	2	¥180,840	2	¥334,010					3	¥501,015	13	nos.	¥1,739,225
2-12.Three wheeler for collecting healthcare waste	nos.													1	¥249,555			1	nos.	¥249,555
2-13.Lap top computer	nos.			1	¥319,347					1	¥294,196			1	¥294,196	1	¥294,196	4	nos.	¥1,201,935
2-14..Projector	nos.			1	¥369,900					1	¥342,900			1	¥342,900	1	¥342,900	4	nos.	¥1,398,600
2-15..Screen	nos.			1	¥41,100					1	¥14,959			1	¥14,959	1	¥14,959	4	nos.	¥85,977
2-16.Digital camera	nos.			1	¥39,900					1	¥36,830			1	¥36,830	1	¥36,830	4	nos.	¥150,290
2-17.Color printer	nos.			1	¥11,097					1	¥10,287			1	¥10,287	1	¥10,287	4	nos.	¥41,958
2-18.Megahorn	nos.			1	¥12,700			1	¥12,700	1	¥12,700			1	¥12,700	1	¥12,700	5	nos.	¥63,500
2-19.Amplifer for bell collection system	nos.			7	¥84,941	16	¥217,008	10	¥135,630	6	¥81,378	19	¥257,897	5	¥67,815	5	¥67,815	68	nos.	¥922,284
2-20. Bulldozer (USD68,873.11 Rate:June 2003 1USD=\119.05)	ea													1	¥8,199,344			1	no.	¥8,199,344
3.Construction, Building and Survery																				
3-1.Construction of a waste transfer station	LS							1	¥452,000									1	LS	¥452,000
3-2.Refurbishing the office room to the environmental education centre	LS			1	¥137,000													1	LS	¥137,000
3-3.Promotion of School Recycling	LS							1	¥445,000									1	LS	¥445,000
3-1.Building the environmental education centre(Matale)	LS									1	¥3,273,855							1	LS	¥3,273,855
3-2.Establishment of the environmental education center(NE)	LS													1	¥698,572			1	LS	¥698,572
3-3.Establishment of the environmental educationcenter(Beddula)	LS															1	¥419,143	1	LS	¥419,143
3-4.Improvement of Gohagoda landfill site	LS											1	¥12,015,510					1	LS	¥12,015,510
3-5.Improvement of Moon plain landfill site	LS													1	¥18,012,006			1	LS	¥18,012,006
3-6.Geological survey	LS									1	¥381,039					1	¥381,039	2	LS	¥762,078
3-7.Topographic survey	LS									1	¥508,052					1	¥508,052	2	LS	¥1,016,104
Total			¥6,204,029		¥1,480,164		¥1,904,317		¥1,287,799	1	¥6,154,926		¥12,273,207		¥26,588,788	1	¥3,579,078			¥61,472,287

Note: The amounts in the above table is based on the budget.

Chapter 5 Implementation of Pilot Projects

5.1 Bell Collection System (Waste Collection Improvement)

a. Rationale

Current waste discharge and storage is characterised by:

- A lack of public cooperation with many people discharging garbage in any container or none, at any time and any place, resulting in lots of garbage discharged at the roadside, or at public collection points, causing waste scattering and creating mini-dumps.
- Many animals (goats, dogs, cows, crows, etc.) search for food amongst the garbage, further scattering waste and creating poor sanitary conditions.
- Many public garbage bins are poorly designed, being difficult to empty.

In addition, collection and transportation is inefficient and unreliable, characterised by many handcarts and collection points, double handling and long loading times, frequent vehicle breakdowns and long delays for repairs, making it difficult for LAs to keep to scheduled garbage collection times, routes and frequencies.

These observations suggest that establishment of a proper garbage discharge and storage system is vital, while the efficiency of collection and transportation must also be increased. Increased public participation is considered the key to achieve these aims, with the vast majority of the public, businesses and institutions being willing to cooperate in improved SWM according to surveys conducted during this study. Increased public participation will also help to maintain SWM costs at similar levels to now, whilst improving performance.

Considering this situation, the introduction of a new waste discharge rule and a new "bell collection" system are considered the most suitable and widely applicable means of addressing these issues.

b. Objectives

The main objectives of the bell collection pilot project are:

- To keep the town clean with the minimum resource input by LAs, through increasing public participation.
- To improve the current garbage discharge and storage system.
- To increase public awareness and cooperation.
- To reduce the amount of waste scattering and garbage piles in local towns.
- To improve garbage collection and transportation efficiency, through reducing double handling and making garbage loading much easier.

c. Description

The bell collection system requires people to discharge their garbage in some form of containers (bags, dustbins, polysacks, etc.) in accordance with a "waste discharge rule" and a specified collection schedule.

The new waste discharge rule is based on the concept of minimising the time between garbage discharge and collection. Under this rule, people should not discard their garbage at the roadside, in public bins, in drains, public spaces, waterbodies, etc. Instead, they should keep their garbage within their premises until the specified collection days, bringing their garbage directly out to the collection vehicle when they hear special music being played or, if they are not going to be at home, placing it at the kerbside in a closed container before the specified collection time. Normally, there is somebody in most houses, shops and other premises during the daytime in local Sri Lankan towns, which is one reason why this system was selected for trial.

For this system to work, both the public and local authority must play their part, the public following the rules and the local authority collecting garbage on time and to schedule.

The bell collection system was implemented in all seven model towns during January-September 2003. Special bell collection music was composed by a Japanese music teacher, a JOCV volunteer who teaches music at the Mahaweli National College of Education. Bell collection hardware comprised a locally assembled amplifier and speaker system, which was specially modified to play the bell collection music only.

This involved the following steps:

c.1 Initial Meetings and Consultation:

- Initial meeting of the Study Team with senior LA SWM staff (e.g. Commissioner, MOH, PHIs) to discuss the proposed pilot project and plan what has to be done, by who and by when.
- Initial meeting with SWM supervisors, drivers and labourers to inform them about the proposed pilot project and to seek their ideas and comments.
- Meeting with Council members to inform them about the proposed pilot project and ask for their support in implementing the bell collection system.

c.2 Preparation:

- Preparation of a waste discharge rule by the LA, with assistance from the Study team.
- Selection of bell collection areas and preparation of a collection schedule, specifying the collection day(s), time and frequency. Generally the time was selected as a fairly broad period (e.g. between 8-10am) or before a certain cutoff time (e.g. before 10am) to make it easier for LAs to keep to this schedule. The Study team also stressed the importance of selecting the appropriate collection frequency for different trial areas. Although many areas

are used to daily collection and many people desire this, it is not generally necessary. A maximum frequency of two-three times per week is adequate in most circumstances.

- Discussion on how to publicise the new waste discharge rule and bell collection system.
- Design and production of relevant publicity material (e.g. leaflet design and printing, noticeboard design, production and selection of locations for installation, text and taped message for loudspeaker announcement, etc.).
- Installation of the speaker/amplifier system on collection vehicles in an appropriate place so as to protect it from vibration, water, vandalism and theft. As the speaker/amplifier system is powered by a 12V battery, installation required different arrangements for different vehicles:
  - Hand tractor (no battery): purchase and installation of a 12V battery and establishment of a recharging system (i.e. purchase of battery recharger or overnight charging)
  - Tractor (12V battery): connection to the main switch.
  - Compactor (often 2 x 12V batteries): connection to one of the two batteries.
- Training relevant SWM staff (drivers, labourers) on how to run the bell collection system, including operation of the speaker/amplifier system and responding to any questions from the public.

c.3 Introduction and Operation:

- Conduct of publicity in selected areas: e.g. doing loudspeaker announcements, distributing leaflets by house to house visits or other means, installing noticeboards, conducting community meetings, asking priests to announce at Mass, etc.).
- Start of bell collection in selected areas.
- Ongoing operation and monitoring: responding to inquiries and complaints from the public, discussing progress with PHIs, supervisors, drivers and labourers, etc.

c.4 Unique Features

Chilaw and Negombo both introduced formal means of improving LA-public communication as part of the bell collection system, namely community animator and street committee systems.

Chilaw's animator system is based on individual communities selecting someone from their community to act as a voluntary animator, who will be responsible for informing the Council of the community's SWM related complaints, while in turn the Council may ask them to pass on information to their communities. Negombo's system involves the formation of street committees, who select 1-2 people on the committee to be their representatives, these people playing a similar role as the Chilaw animators.

Table 5-1: Bell Collection System Details

Item	Negombo	Gampaha	Chilaw	Kandy	Matale	Nuwara Eliya	Badulla
Speaker/amplifier units:							
- No supplied	16	10 (+4)	7	17	6	5	5
- No installed	13	8	5	7	1	1	5
- No repaired (Jan-Sep 03)	13	1	2	0	1	0	2
- No working (@10 Oct 03)	12	7	4	7	1	1	3
Publicity provided:							
- Leaflets	30,000	6,000	6,000	N/a	7,000	6,000	6,000
- Public noticeboards	50	0	50	N/a	100	100	100
Publicity used (@10 Oct 03):							
- Leaflets	5,000	About 5,000	1,500	N/a	2,000	1,000	2,500
- Public noticeboards	50	N/a	34	N/a	40	<100	38
Starting date	7 March	Early March	1 April	11 July	28 August	18 August	29 July
Initial Pilot areas	45 streets within Negombo	Selected areas in Gampaha and Yakkala	All areas	Parts of Peradeniya, Mahaiyawa, Aruppola, Deiyanewela	Kotuwegedera, Hulangamuwa, Dodandeniya	Town centre	Badulupitiya area
Publicity	Loudspeaker, leaflets, notice-boards, Church/ temple, community meetings	Loudspeaker, leaflets, playing the music	Loudspeaker, leaflets, noticeboards, Church, community meetings	Leaflets, community meetings (2), some house to house visits, playing the music	Loudspeaker, leaflets, noticeboards, CDA house to house visits	Leaflets, noticeboards	Loudspeaker, noticeboards, leaflets, CDA house to house visits, "kade" (local shop)
Unique Features	Street committees	None	Animators	None	None	Used only in the town centre.	Display on wall of "kade" (local shop)
Public Response	Very good	Fair – good	Good	Fair	Good	Good	Very good
Future Expansion	Planned	Planned	Not relevant	Dodanwella, Wattapuluwa, Mawilmada	Muslim Town, Rattota Rd, Mandandawela	Not planned.	Extend to cover 4 of 5 zones by 30 Sep
Problems	LA not keeping to collection schedule or not playing music; many S/A problems	LA not keeping to collection schedule; some S/A problems	LA not keeping to collection schedule; some S/A problems	LA not keeping to collection schedule; many people go to work early and discharge their waste as before.	None (too early to say)	Bell collection is only suitable for the town centre	None
Effect on collection time	Small decrease	No change	Small decrease	Increased	No change	Decreased	Decreased
Effect on discharge amount	Increased	Increased	Increased	Increased	No change	No change	Increased
No of public bins removed	About 30-40	None	None (planned)	None (planned)	None (planned)	None	43 of 68 bins
Reduction in no of handcarts	Some	None	Some	None	None	None	None
Reduction in collection freq.	Some areas	None	None	None	None	None	None
Reduction in no of labourers/vehicle	None	None	None	None	None	None	None
Decrease in no of garbage piles / scattered waste	Some	None	Some	Some (less garbage in drains)	Too early to say	None	Dramatic decrease

Note: S/A = speaker/amplifier; N/a = not applicable

d. Assessment

d.1 Public Response and LA Performance

Initial feedback from the bell collection pilot project has been encouraging, with the vast majority of the public approving of and supporting the bell collection system within a very short time of it being introduced (i.e. 1-2 weeks). This implies that people want this system, even though it is more inconvenient for them than their former garbage discharge practices, indicating that the perceived benefits which are related to "improved community cleanliness" must be worth the extra effort involved.

The bell collection system also seems to be a good way of introducing kerbside collection. It has been observed that within a few weeks of running the bell collection system, many people are putting their garbage out at the kerbside for collection in the morning and then coming to collect their garbage container when they hear the music coming. Even when the "bell" has not been working, people have continued to follow such improved practices.

The bell collection system has also raised the expectations of the public concerning LA SWM performance, while highlighting the ability of LAs to keep to the collection schedule. Failure of the LAs to do so has been identified as the main problem to date, primarily due to vehicle breakdowns and speaker/amplifier problems. If the collection vehicle doesn't come, or the music isn't played, people seem much quicker to complain about this to the LA than previously. For example, in Negombo when the bell collection virtually stopped for some time due to speaker/amplifier problems, many people were very upset and the LA received many complaints, including about 20-30 telegrams to the Mayor.

The bell collection has also increased the LA's commitment to providing a regular collection service, for several reasons including the good public response and increased public complaints should they not keep to the collection schedule. This has led many LAs to discuss and address some long standing issues so as to improve their ability to provide a reliable collection service. Examples include:

- Purchase of new collection vehicles (Badulla (2), Gampaha (4?), Chilaw (1 requested for 2003/04)).
- Fitting speaker/amplifier systems to more vehicles than were used in the bell collection trial, with additional speaker/amplifier units being kept as spares to cover vehicle breakdowns and speaker/amplifier failure respectively.
- Considering the use of manual "school" bells for installation on trailers to provide temporary cover for broken amplifiers (Negombo).

- Improving the vehicle repair and maintenance system, so as to reduce vehicle downtime, including the establishment of a stock of essential vehicle spare parts (e.g. tyres, tubes, starter motors, compactor clutch plates, etc.).

Overall, the awareness of LA personnel concerning their abilities and limitations in providing good SWM services is considered to have significantly increased. LAs are also very keen to expand the bell collection service on a wider scale, indicating their support for this system.

Collection workers (drivers and labourers) also widely support the system. It has made loading much easier for them and their "customers" (the public) are happier. In some towns, labourers have commented that collection is now slower as they are going house to house and sometimes have to wait for people to bring their garbage out from their houses to the vehicle.

One problem has been a general lack of interest shown by many elected Council members in the bell collection system and most of the other pilot projects. Generally, once they see and get a basic understanding of what the pilot projects involve, they are very supportive. Some Council members have even complained when the LA has not kept to the collection schedule or played the music. The main problem is getting their attention and initial interest, with relatively few Council members coming to meetings designed for this purpose. However, this aspect is also very important for the long term sustainability of new ideas like the bell collection, as politics has a very powerful influence in Sri Lanka. If support can be gained for such new ideas from a good cross-section of politicians, particularly from the two main parties, the chances of long term sustainability will be greatly enhanced.

d.2 Speaker/Amplifier Problems

There have been quite a lot of speaker/amplifier problems, particularly in Negombo, with approximately 18 out of 70 supplied units having been repaired over the period Jan-Sep 2003. Most of these problems have been caused by excessive vibration or water damage (e.g. direct rainwater entry, splashing off road, washing during servicing). Feedback from the LA tractor drivers and workshop staff on how these problems might be solved has been passed on to the speaker/amplifier manufacturer. In all cases, the manufacturer has repaired the amplifiers and some improvements have already been made (e.g. modifying the amplifier so that no internal battery (2 x AA) needed). A bell collection manual has also been prepared covering installation, operation and maintenance of the speaker/amplifier system which addresses all these issues. The manufacturer is planning to develop a new improved version which he will market to interested LAs.

d.3 Publicity

The format of publicity leaflets has gradually evolved during this project from relatively wordy, long productions that covered many aspects of SWM to short and attractive leaflets focusing on

the bell collection system, with LAs taking a much greater role in leaflet preparation, design and production. This change was partly due to time constraints during the Jan-Mar pilot project phase and also to experience gained during this first stage of introducing the bell collection system.

Whilst leaflet distribution and community meetings have been useful, curiosity as to what the "new music" is for, has also been an important, informal publicity method. "Playing the music" is clearly the cheapest form of publicity and seems to work. Hence, in the future when bell collection is introduced to new areas and resources for publicity/awareness are limited, it may be worthwhile starting with just playing the music, allowing some time to assess peoples' response and then following up with formal publicity/awareness in areas where the response is poor.

Feedback from Chilaw and Negombo on the first batch of noticeboards (Jan-Mar 2003) has largely been negative. They consider the noticeboards to be too small in size and with too many words, making them difficult to read. In addition, they are not eyecatching or visually attractive, being done in black lettering on a white background, while the writing is fading in locations exposed to sunlight. Most noticeboards were fixed to permanent structures (e.g. walls), with approval sought from the appropriate person at each place to fix the noticeboards there. In some cases, the same people were asked to look after the board. This is a good approach, as some noticeboards disappeared in Negombo. This initial feedback was passed on to other LAs in designing and producing the second batch of noticeboards (May-Sep 03), resulting in a much better product. However, it is questionable whether the noticeboards are really needed. An alternative and possibly better approach, may be to display a simple notice at the many "kade"(small shops) present on almost every street. These are an important form of "social capital", visited by many people in the area each day and hence a useful means of communicating with the community. This approach would also be cheaper and more flexible, as the notices can be updated relatively easily.

Public enthusiasm for both the community animator and street committee system in Chilaw and Negombo respectively has been high. Some of the Chilaw animators have taken a very active role in SWM issues, including writing letters to people in their area who discharge their waste improperly and then copying these letters to the Council for action. Some Negombo street committee representatives have also been active, complaining vigorously by way of phone calls and visits to the PHI and Mayor and telegrams when the bell collection system has not been functioning properly, as described previously. In both cases, these formal SWM communication channels have increased public awareness and expectations and made the LAs more accountable. However, whilst the LAs have been good at initiating these communication systems, they have yet to be set up properly, particularly in the case of Negombo, while response to community representatives' complaints has often been slow, or non-existent. Both these factors have tended to discourage both animators and street committee representatives and make them more frustrated

with the LA than previously. These issues need to be addressed so that both the animator and street committee systems can function properly and all parties involved are aware of their roles and responsibilities. As it involves a lot of work to set up new systems like this, an alternative approach could be to utilise existing community groups (e.g. Funeral Assistant Societies) for this purpose.

d.4 Summary

In summary, the bell collection system:

- Improves city cleanliness, reducing the number of garbage piles and waste scattering.
- Improves public cooperation by clearly showing the public how to discharge their garbage, even though this is more inconvenient for them than their former practices
- Seems to be a good means of introducing kerbside collection.
- Raises public expectations towards SWM and increases their willingness to complain.
- Highlights LA's ability or lack of it to keep to the garbage collection schedule.
- Increases LA's commitment to providing a reliable garbage collection service.
- Makes LA cleansing workers' (labourers, street sweepers, etc.) jobs easier.
- Encourages the LA to educate people due to the quick, positive response to the bell collection.
- Teaches the LA the importance of planning and following a logical sequence of works to achieve certain goals/objectives and of having contingency plans in place to deal with problems.

d.5 Possible Future Developments

It is important that as this system becomes well established, LAs should consider how to run the bell collection with minimum resource input from them and maximum public participation, this being one of the key objectives. Practically, this could involve the following steps:

- Reducing the collection frequency.
- Removing unnecessary public concrete bins.
- Reducing the number of labourers per collection vehicle.
- Reducing the number of handcarts collecting garbage, using them in essential places only.
- Replacing handcart collection with a designated handcart street sweeping and drain cleaning service.
- Increasing work performance targets for street sweeping and drain cleaning (i.e. km/worker.day) and/or reduction of street sweeping and drain cleaning frequencies.

These points have been emphasised to all LA SWM staff.

5.2 Landfill Improvement

a. Rationale

There are two main issues concerning the current landfill site conditions in Sri Lanka. One is how to mitigate the environmental pollution that is caused by existing landfill sites and the other is how to establish new sanitary landfill sites.

Mitigation of environmental pollution, the first issue, is urgently needed at most of the existing landfill sites. However, the necessity of mitigation has not been recognized because the investment for the improvement of existing landfill sites does not produce any output. Furthermore, as improvement technologies are not known to the relative authorities in charge of solid waste management, few improvement projects of existing landfill sites have been implemented. Therefore, showing the effect of the improvement of an existing landfill site through a pilot project is very useful not only for the transfer of technology but also for raising awareness of the necessity of mitigation

The establishment of new sanitary landfill sites, the second issue, is also necessary. However, as there is no sanitary landfill site in Sri Lanka so far, people have not realized this need. Therefore, they have a strong prejudice against landfill sites operated by local authorities, which causes strong public opposition to landfill sites. In addition, the relative authorities in charge of solid waste management are not able to account for the idea of a sanitary landfill site because they have no knowledge based on actual experience. A pilot project which establishes a new sanitary landfill site is very useful in terms of not only the improvement of the existing landfill site run by the local authority but also the introduction of the idea of the sanitary landfill site to the people and relative authorities in Sri Lanka.

In order to mitigate the environmental pollution of the existing landfill site and establish a new sanitary landfill, the two pilot projects, i.e. the improvement of Gohagoda landfill site and the construction of the sanitary landfill site at Nuwara Eliya, were implemented in this study.

b. Objective

The objectives of pilot projects include the following four items:

- To introduce the mitigation technology for environmental pollution at the existing landfill site
- To introduce the structure of sanitary landfill site facilities
- To transfer the appropriate method for sanitary landfill operation

- To establish the necessary public consideration and monitoring system for operation of the sanitary landfill site

The improvement of Gohagoda landfill site in Kandy was implemented as the pilot project to introduce the mitigation technology for environmental pollution at the existing landfill site. The lift-up type landfill method was applied for the improvement of the landfill site

The establishment of the new sanitary landfill site at Moon Plain in Nuwara Eliya was implemented as the other pilot project. Moon Plan was an existing landfill site where Nuwara Eliya Municipal Council had discharged waste for three years before the pilot project. The study team found the Moon Plain landfill site to be excellent for the establishment of the new sanitary landfill site because of the small amount of waste discharged, the fact that there were no existing neighbourhoods surrounding the landfill site and the very favourable valley topography with very low permeable ground. The valley type landfill method was applied for the establishment of the new landfill site. During the pilot projects, the counterparts from Kandy Municipal Council and Nuwara Eliya Council were involved in the supervision of construction in order to transfer the method for construction of the sanitary landfill site.

After the completion of the improvement constructions, technical transfer, such as compression of discharged waste and soil covering, was conducted with the bulldozers donated to Nuwara Eliya Municipal Council and Kandy Municipal Council by JICA.

Improving the facilities at the landfill site is easy with investment. However, maintaining sustainable maintenance and operation is always very difficult. A monitoring committee was established in order to maintain sustainable maintenance and operation at the improved and established landfill sites. The monitoring committee holds meetings periodically and makes the monitoring results available to the public.

c. Description

The "valley type landfill" method applied for the improvement of the Moon Plain landfill site in Nuwara Eliya and the "lift up type landfill" method applied for the improvement of the Gohagoda landfill site in Kandy are described as follows:

5.2.1 Pilot project of improvement at Kandy Gohagoda Landfill Site

The objective of project is to introduce the mitigation technology for environmental pollution at exiting landfill site and to introduce the structure of facilities of sanitary landfill site

a. Location of the Gohagoda Landfill Site

The Gohagoda dumping site is located approximately 7 km away from the city centre, out of the Kandy Municipal Council limits. Further, the site is located within the limits of Harispaththuwa Pradeshiya Sabha (Local Authority) 200 m away from the Peradeniya – Katugasthota Main Road

near the Village Gohagoda. The total land area own by the Kandy Municipal council is around 12 Hectares while nearly 2.5 hectares is active filling area. The Gohagoda site has been used since 1970's and remaining capacity is limited to active filling area.

b. Landfill facility at Gohagoda Landfill Site

b.1 Conceptual design of the landfill facility, extent capacity and life span

shows Condition of Gohagoda Landfill Site before Pilot Project, while , and show the conceptual design of the improved Gohagoda Landfill Site.

The extended capacity of Gohagoda improved site is 2-3 years.