



**MINISTRY OF LOCAL DEVELOPMENT
HIS MAJESTY'S GOVERNMENT OF NEPAL**



**JAPAN INTERNATIONAL
COOPERATION AGENCY**

ACTION PLAN ON SOLID WASTE MANAGEMENT

September 2005



Lalitpur Sub-Metropolitan City

Action Plan on Solid Waste Management of Lalitpur Sub-Metropolitan City

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Abbreviations

<Organizations>

BKM	Bhaktapur Municipality
CDS	Community Development Section
HMG/N	His Majesty's Government of Nepal
JICA	Japan International Cooperation Agency
KMC	Kathmandu Metropolitan City
KRM	Kirtipur Municipality
LSMC	Lalitpur Sub-Metropolitan City
MOLD	Ministry of Local Development
MTM	Madhyapur Thimi Municipality
NGO	Non Governmental Organization
SWMS	Solid Waste Management Section (KMC)
SWMRMC	Solid Waste Management and Resource Mobilization Center
T/F	Task Force
TWG	Technical Working Group

<Metric Units>

g	Gram
g/L	Gram per liter
ha	Hectare
kg	Kilogram
kg/day	Kilogram per day
kg/d-capita	Kilogram per day per capita
km	Kilometre
km ²	Square Kilometer
L	Liter
mm	Millimeter
m ²	Square Meter
m ³	Cubic Meter
mg/L	Milligram per liter
m	Meter
oC	Centigrade
t	Ton
t/d	Ton per day

<Currency>

JPY	Japanese Yen
Rs	Nepalese Rupee
US\$	US Dollar

<Others>

A/P	Action Plan
BCC	Behavior Change Communication
CBO	Community Based Organization
CEO	Chief Executive Officer
CKV	Clean Kathmandu Valley
CSO	Civil Society Organization
FY	Fiscal Year

HH	Household
HRD	Human Resource Development
LF	Landfill
L/T	Long-term
LFS	Landfill site
OFP	Overall Facility Plan
OJT	On the Job Training
O & M	Operation and Maintenance
OVI	Objectively Verifiable Indicators
PSO	Private Sector Organization
PPP	Public-Private Partnership
S/T	Short-term
STV	secondary transportation vehicle
SW-C	Solid Waste Compost
SWM	Solid Waste Management
T/S	Transfer Station
UGR	unit generation rate
VDC	Village Development Committee
WPF	waste processing facility

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

Solid waste management (SWM) in The Kathmandu Valley faces great challenges not only in relation to the management system but also in gaining public awareness and participation of the people. In order to improve the current situations, His Majesty's Government of Nepal (HMG/N) and the Government of Japan have launched on a joint study titled "The Study on the Solid Waste Management for the Kathmandu Valley (the Study)" with the technical assistance of the Japan International Cooperation Agency (JICA). The Study commenced in January 2004 (Magh 2060¹) and ran for a total of 20 months until August 2005 (Bhadra 2062).

1.2 Objectives of the Study

The objectives of the Study were;

1. To formulate Action Plans (A/Ps) on solid waste management for five municipalities in the Kathmandu Valley, namely Kathmandu Metropolitan City (KMC), Lalitpur Sub-Metropolitan City (LSMC), Bhaktapur Municipality (BKM), Madhyapur Thimi Municipality (MTM), and Kirtipur Municipality (KRM), and
2. To pursue technology transfer regarding SWM for the Nepalese counterpart (C/P) personnel.

Through the formulation of the A/Ps, which aimed to strengthen management capability for the solid waste of each municipality and encourage public participation for solid waste management, the management ratios² of solid waste are expected to increase, toward the target year of 2015. In particular, capacity development of the Nepalese C/P personnel for planning and management of solid waste was carried out over the study period, which included the implementation of a series of pilot projects.

1.3 Study Area

The Study covered the jurisdiction of the five municipalities in the Kathmandu Valley, namely KMC, LSMC, BKM, MTM and KRM. In addition, "Okharpauwa" where a landfill site is proposed was also covered.

¹ Nepalese Year

² Management ratio is the ratio of "the quantity of waste" that is managed by waste generators or municipalities in the appropriate ways such as source reduction, recycling, appropriate collection, treatment and disposal after it has been generated from the sources to "the total quantity of generated waste".

1.4 Target of the Study

In the Study, solid waste was broadly classified into four categories by generation source, i.e. 1) Municipal solid waste, 2) Industrial solid waste, 3) Medical solid waste, and 4) other solid waste including agricultural and construction waste.

The target solid waste of the Study was mainly municipal solid waste, non-hazardous waste that would be collected by the Municipality. However, the Study also made recommendations for industrial, medical and other solid wastes, but the management of night soil was not included in the Study.

1.5 Organization and Staffing of the Study

The Study established three implementation organizations on the Nepalese side, which are the Steering Committee (ST/C), Technical Working Group (TWG) and Task Force (T/F). The implementation organizations of the Study and their roles, tasks and members are shown in Figure 1.5-1 and Table 1.5-1, respectively.

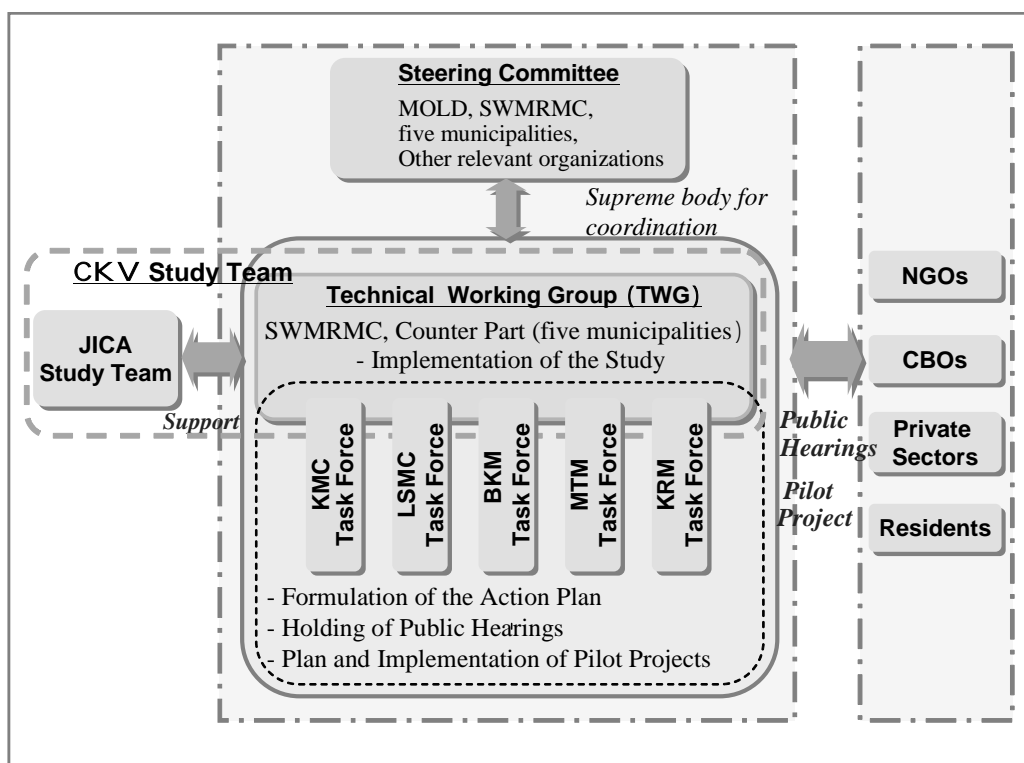


Figure 1.5-1 Implementation Organization of the Study

Source: JICA Study Team

Table 1.5-1 Roles, Tasks and Members of Organizations of the Study

Organization	Roles	Tasks	Members
ST/C	Coordination of relevant organizations	<ul style="list-style-type: none"> - To confirm the overall policies and progress of the Study - To confirm and approve the contents of the reports to be submitted to the Nepalese side by the JICA Study Team - To discuss and approve the contents of the action plan to be prepared during the Study and to make a commitment to implement the action plan as policy makers - To coordinate the concerned organizations for SWM in the Kathmandu Valley and exchange information and opinions between the organizations of central and local governments 	<ul style="list-style-type: none"> - Ministry of Local Development (MOLD) - SWMRMC - Five municipalities - Ministry of Environment, Science and Technology (MOEST) (formerly MOPE) - Ministry of Physical Planning and Works (MOPPW) - Ministry of Industry, Commerce and Supplies (MOICS) - Ministry of Education and Sports (MOES) - Ministry of Agriculture and Cooperative (MOAC) - Ministry of Health and Population (MOHP) - Members of TWG (as observers)
TWG (C/P)	Implementation of capacity development and technology transfer from the JICA Study Team	<ul style="list-style-type: none"> - To carry out the Study together with the JICA Study Team. - To prepare necessary documents and materials which are to be discussed at the ST/C - To organize and operate a T/F 	<ul style="list-style-type: none"> - MOLD - SWMRMC - Staff of KMC - Staff of LSMC - Staff of BKM - Staff of MTM - Staff of KRM
T/F	Coordination of opinions within the relevant departments, formulation of action plan, formulation and implementation of pilot projects	<ul style="list-style-type: none"> - To formulate an Action Plan of the municipality and conduct pilot projects under the support from the JICA Study Team. - To coordinate opinions among the relevant sections of each municipality - To carry out Public Hearings with an aim to collect opinions from the residents 	<ul style="list-style-type: none"> - Members of TWG - Planning relevant section - Environmental and Public Relations relevant sections - Community mobilization/development section - Financial section - NGOs/CBOs - Private sectors - Intellectuals

Source: JICA Study Team

1.6 Acronym and Slogan of the Study

Based on the discussions of the TWG members, the Study adopted the acronym “CKV” which stands for “Clean Kathmandu Valley” to make the Study easier to promote and to be identifiable by relevant organizations and residents of the Kathmandu Valley as part of the public relations activities.

The Study also put up a slogan, “Sapha Sahar Hamro Rahar” in Nepalese, which means “clean city is our desire”.

Both the acronym and slogan have been spreading gradually by relevant organizations.

CHAPTER 2 CONDITIONS OF MUNICIPAL SOLID WASTE MANAGEMENT OF LALITPUR SUB-METROPOLITAN CITY

2.1 Outline of Lalitpur Sub-Metropolitan City

Lalitpur Sub-Metropolitan City (LSMC) was originally established in 1918 and finally upgraded to sub-metropolitan city in 1995. The municipality has a long history with its foundation in the third century, and is famous for “Patan” as old name even in these days with abundant fine historical art and culture.

The population of LSMC was less than 120,000 according to the census of 1991, whereas the 2001 census shows more than 160,000. The population growth rate of the city is higher than the national figure. The city, which covers an area of about 15 km², is administratively divided into 22 wards. Out of these 22 wards, 11 are located inside the historical area and the remaining 11 wards are located in new areas.

Other social features of LSMC are noted below:

- The bustling economic activities generate a lot of employment opportunities, but at the same time access to higher education results in the late entry of the population in employment. The proportion of economically active population in the city decreased from 62% of the total population to 42% in 1991. The decline has not been the result of a decline in participation rate of the population in the economic activities, but as a result of the change in the definition of economically active population.
- Household survey in 1993 for the town profile revealed that the largest proportion of households have an annual income ranging between Rs 50,000 to 100,000. Households with less than Rs 25,000 income constitute about 12% and those in the highest income group with more than Rs 200,000 account for 4%.
- The household survey in 1993 showed about 70% of the households own their own house; whereas the other households are living in rented houses.
- Agricultural land use is predominant, which account for about 45% of the total city area. Residential use, including for commercial and service use, follows with about 35% of the city area.

2.2 Waste Generation and Stream

(1) Waste Quantity

TWG members of LSMC summarized the current situation of waste quantity as follows.

The quantity of household waste produced per day is estimated as 90-100 tones. The waste production rate is estimated as 0.4 kg/day-capita.

The first waste quantity survey in the dry season at the generation sources in LSMC took samples from 20 households, six commercials and two points from the street. The result is shown in Table 2.2-1. More than 1 liter of waste with 160 to 210 g/L of bulk density is generated per capita day on average.

**Table 2.2-1 Result of Daily Waste Generation Quantity Survey of Households
(LSMC: Dry Season)**

Income Level	Weekdays			Weekend		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
High	276	1.3	212	284	1.7	167
Middle	247	1.2	206	249	1.3	192
Low	117	0.7	167	190	1.1	172
Average	222	1.1	202	243	1.3	187

Source: JICA Study Team

From commercial areas, it was observed that 3.5 to 10 kg/day was generated from surveyed restaurants with 210 to 580 g/L of bulk density. On the other hand from selected markets, about 1 kg/day of waste were generated with 140 to 190 g/L of bulk density. In the street, about 21.0 kg of waste are collected per day per each 100m and bulk density was 217 g/L.

In September 2004, the second waste quantity survey in the wet season was conducted on a large scale in LSMC, sampling at 140 households, 40 commercials and 5 points from the street. The result of this detail waste quantity survey at households in LSMC is shown in Table 2.2-2.

**Table 2.2-2 Result of Daily Waste Generation Quantity Survey of Households
(LSMC: Wet Season)**

Income Level	Weekdays			Weekend		
	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)	Waste generation per person weight (g)	Waste generation per person volume (L)	Bulk density (g/L)
High	204	1.2	165	262	1.5	173
Middle	398	1.0	391	151	1.0	148
Low	216	1.9	115	146	2.5	57
Average*	304	1.3	236	178	1.5	116

Note: * This is the average for only the surveyed households, it does not reflect the actual dispersion of income level
Source: JICA Study Team

Figure 2.2-1 shows the frequency distribution of the unit generation rate (UGR) at different income levels of surveyed households. A large peak of unit generation rate for total surveyed households is shown on around 50 to 250 g/day-capita and mid/small peaks on 300 to 450 g/day-capita and 500 to 650 g/day-capita. At LSMC, the peak for low income household tends to appear on around 100 g/day-capita that is smaller than that at mid and high income households. It is also shown that high/mid income households have a wide range of peaks from 100 to 650 g/day-capita.

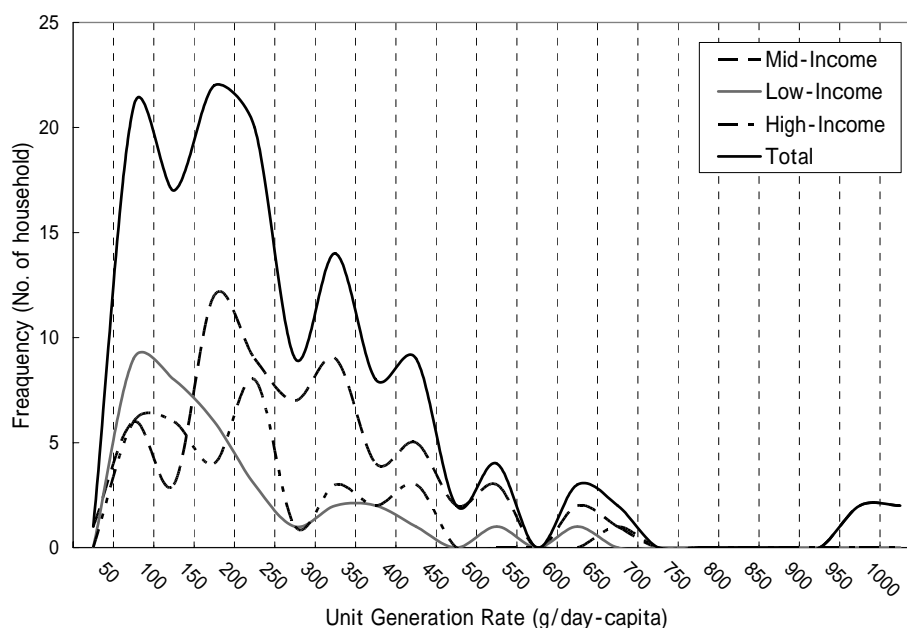


Figure 2.2-1 Frequency Distribution of UGR of Households in LSMC

Source: JICA Study Team

(2) Waste Quality

Waste quality data given by TWG members of LSMC and surveyed by the JICA Study Team in the dry season are shown in the following table. From households, about 70% is kitchen waste and plastic, paper and wood/leaves make up around 10% each. The organic portion at hotels, restaurants or offices fluctuated greatly. Offices can be large generators of paper waste as in LSMC.

Table 2.2-3 Waste Quality (LSMC: Dry Season)

Items	Households		Hotels and Restaurants	Markets	Offices	Streets**
	LSMC data	Study				
Kitchen waste	67.5%	68.9% (64.0%)	76.9% (41.6%)	NS	0% (69.4%)	51.5%
Paper	8.8%	6.5% (8.8%)	10.3% (20.8%)	NS	72.7% (4.6%)	8.2%
Textile	3.6%	2.3% (0.6%)	0% (3.6%)	NS	0% (13.9%)	6.4%
Wood/leaves	0.6%	8.1% (6.5%)	0% (0%)	NS	0% (2.8%)	4.1%
Plastic	11.4%	12.2% (16.2%)	12.8% (11.2%)	NS	18.2% (9.3%)	8.8%
Rubber/leather	0.3%	0% (0%)	0% (0%)	NS	9.1% (0%)	4.7%
Metal	0.9%	1.0% (0.7%)	0% (1.0%)	NS	0% (0%)	2.3%
Glass	1.6%	1.0% (2.8%)	0% (20.3%)	NS	0% (0%)	4.7%
Ceramics	-	0.0% (0.4%)	0% (1.5%)	NS	0% (0%)	2.3%

Items	Households		Hotels and Restaurants	Markets	Offices	Streets**
	LSMC data	Study				
Others	5.3% *	0.0% (0.0%)	0% (0%)	NS	0% (12%)	7.0%
Bulk density	400 g/L	202 g/L (187 g/L)	189 g/L (252 g/L)	NS	138 g/L (244 g/L)	216 g/L
Water content	-	55% (54%)	76% (43%)	NS	27% (43%)	43%

Note: Lower numerical value in parenthesis is data on weekends and upper on weekdays

Total value of each composition is not always 100% because each one was rounded off.

NS: Not Sampled in this Survey

* Construction Debris was categorized as others

** Street waste on weekends was not collected or analyzed.

Source: JICA Study Team

Table 2.2-4 shows the result of the wet season survey. There is no significant change from the dry season and much paper and plastic waste is generated from markets and offices.

Table 2.2-4 Waste Quality (LSMC: Wet Season)

Items	Households	Hotels and Restaurants	Markets	Offices	Streets
Kitchen waste	78.2% (79.6%)	68.8% (74.2%)	60.8% (14.2%)	28.5% (4.4%)	41.8% (38.1%)
Paper	9.1% (7.0%)	20.4% (11.2%)	21.6% (69.8%)	63.7% (77.7%)	31.2% (35.4%)
Textile	0.9% (1.3%)	0.1% (0.0%)	1.8% (1.4%)	0.0% (0.0%)	5.5% (11.1%)
Wood/leaves	3.0% (1.1%)	0.0% (1.2%)	0.0% (0.0%)	0.0% (0.0%)	2.6% (1.6%)
Plastic	6.2% (8.6%)	7.2% (10.3%)	10.8% (14.6%)	4.5% (11.2%)	11.3% (9.3%)
Rubber/leather	0.2% (0.0%)	0.0% (0.0%)	0.0% (0.0%)	0.0% (0.0%)	1.8% (0.0%)
Metal	0.3% (0.4%)	0.3% (1.5%)	0.2% (0.0%)	0.5% (1.1%)	0.5% (0.4%)
Glass	0.8% (1.3%)	3.2% (1.7%)	4.1% (0.0%)	0.0% (0.6%)	0.9% (0.0%)
Ceramics	0.3% (0.4%)	0.0% (0.0%)	0.0% (0.0%)	2.9% (0.0%)	0.0% (3.8%)
Others	0.9% (0.3%)	0.0% (0.0%)	0.6% (0.0%)	0.0% (4.9%)	4.4% (0.4%)
Bulk density	236 g/L (116 g/L)	160 g/L (150 g/L)	48 g/L (39 g/L)	96 g/L (56 g/L)	179 g/L (200 g/L)
Water content	67.7% (69.9%)	64.4% (69.9%)	48.0% (17.8%)	21.1% (13.5%)	60.5% (65.4%)

Note: Lower numerical value in parenthesis is data on weekends and upper on weekdays

Total value of each composition is not always 100% because each one was rounded off

Source: JICA Study Team

2.3 Collection and Transportation

TWG members of LSMC summarized the current situation of waste collection and transportation as follows:

The method being practiced is to throw mixed waste in packs covered with plastic bags. When the municipal vehicle arrives near the community route it signals the people with a siren, and the people throw the waste in the open type collection vehicles. The waste is being collected almost free of cost for the city dwellers. The following points hint the present scenario.

- 1) Waste Management process- (Collection-transportation) no special waste processing (3R) is done. (No recycle centers and only very limited composting facilities, incinerators (only Patan Hospital has their own) and processing facilities.)
- 2) Plastic bags are being widely used. This ultimately produces a great deal of waste.
- 3) Very little sorting of waste at the source has been practiced.
- 4) People are not directly charged for waste management service by the municipality.

People think they should not have to pay; the Municipality is responsible for solid waste management (lack of awareness).

Based on the above facts, LSMC office board and council had already approved the policy to involve the private sector to make them responsible to collect fees from polluters. The collection tariff had also been approved at the same time.

Table 2.3-1 List of Collection Vehicles (LSMC)

Types of Services	Vehicle Type	Total	Operating	Maintenance required	Not used by LSMC
Container Service	Dumper Pressure (ISUZU)	2	1	1	0
	Dumper Pressure (EICHER with Indian Hydraulics for 1 x 4.5 m ³ skips)	3	1	2	0
Pick up Service	3.5 m ³ Tripper (EICHER)	21	11	5	5
	Tractor Small	4	0	4	0
	Tractor Big	4	2	2	0
Sanitary Service	Water Jet Machine with high Suction (KAMBI)	2	1	1	0
	Small Jet Machine	5	1	0	4

Source: LSMC, 2004

Table shows the currently used vehicles are –

- Tippers -11
- Dumpers-2
- Tractors -2
- Loaders -2
- Jet machine -1

Collection area - basically there are three types of zonal requirements. They are

- Tourism area - Durbar square and connecting routes
- City core area - 11 wards
- Out side city core area - 11 wards

Current waste collection and transportation flow of LSMC is shown in Appendix 5.

In LSMC, there are many private sectors which have provided collection services in addition to LSMC as follows.

- WEG: Ward No. 10
- WID: Ward No. 2
- WEPCO: Wards No. 1 & 2 (Kumari pati to Jawalakhel)
- NEPCEMAC: Wards No. 2 (Jawalakhel to Pulchowk), 3, 4, 5 & 13
- NEPCO: Ward No. 15
- LSMC: All Wards (1 to 22)

Before February 2005, the waste collection in LSMC was carried out in a single shift from 6:00 a.m. to 2:00 p.m. There are altogether 170 sweepers in LSMC, out of which 100 sweepers work in street sweeping, and the remaining 70 sweepers are deployed to different wards for waste collection and they are directly managed by the respective wards. About 70% of sweepers are female. There are also about 10 small private organizations carrying out door-to-door waste collection services and they collect service fees of about Rs 100 per household for the service rendered. Street sweeping is carried out in two shifts of 6:00 a.m.-10:00 a.m. and 10:00 a.m.-5:00 p.m. only at Mangal Bazar.

The municipal containers are placed in the following locations:

- Ward No. 1: Bagmati Bridge (used by NEPCEMAC)
- Ward No. 2: Sanepa
- Ward No. 3: Naya Basti (used by WEPCO)
- Ward No. 10 : Pulchowk behind Institute of Engineering
- Ward No. 10: Jwagal
- Ward No. 14: Tasikhel
- Ward No. 15: Dhalaut Factory

In addition, there are also some private containers, where service is provided by LSMC for waste collection. These include:

- Patan Hospital
- SATA Office, Jawalakhel
- B&B Hospital
- Wai Wai Noodles Factory

Table 2.3-2 shows the result of the Time and Motion survey conducted by the JICA Study Team in April 2004 on 6 selected routes. This shows that the average collection time of the placer less than the tripper but the average traveling speed of the placer when loaded with waste is lower than the tripper.

Table 2.3-2 Result of Time and Motion Survey in LSMC

Vehicle	Average Collection/ Dumping Time in min	Total Distance Travel in km	Average Speed of Vehicle in moving km/hr	Average Speed of vehicle*	Return Distance in km	Average Speed on Return km/hr	Total Time for One Trip in min
Tripper	6.3	7.1	11.2	5.0	6.6	18.4	65.9
Placer	3.3	3.1	8.0	7.0	5.1	24.3	39.1

Note: *this includes collection and dumping time

Source: JICA Study Team

The JICA Study Team followed selected trippers during the survey and observed the bell collection system in LSMC. In some areas, especially observed in Chandi Binayak Tole near Pim Bahal or in Durbar Square, the bell collection was conducted quite well without waste littering around the collection point. In Chandi Binayak Tole, the truck stopped for 15 minutes and a total of 137 people came out from their houses to discharge the waste

directly into the truck, in which 19 males and 61 females discharged with plastic bags, 8 males and 36 females discharged with buckets, and 2 males and 11 females brought the garbage with other containers like cardboard. During this bell collection, two loaders and the driver of the truck were just waiting except for helping some people to discharge into the truck. However in other places, regardless of having a bell collection point or not, there were waste piles on the ground and loaders had to load them into the truck by shovel with great effort. Piled waste was also scattered around the collection point.

LSMC has also shifted the waste collection system from the former daytime collection to the night/early morning shift, with the work being done mostly in the night shift, in order to complete the collection by 7:00 a.m. every day since February 2005. As well as other municipalities, some bewilderment or difficulties have been occurred, especially at the beginning days of this new collection shift. LSMC staff and the JICA Study Team carried out a Time & Motion Survey on one tipper truck on April 19, 2005 after changed to the night/early morning shift. The truck departed from the municipal garage at 6:49 p.m. and made four trips to Bagmati River dumping site before the truck returned to the garage at 11:40 p.m. The truck collected the waste at two to four collection points by staying 5 to 10 minutes at each per each trip and bell/siren collection was mostly made before 10:00 p.m., which means at the first to third trip because residents rarely came out for waste discharge after 10:00 p.m. at night.

Compared with the result of former Time & Motion Survey for daytime bell collection, more males were observed to bring their garbage to the collection truck. For example at the collection point at Mangal Bazar, 31 males came with plastic bags or garbage bins in addition to 15 females and 7 children. However, at some collection points, residents complained to LSMC about frequently irregular collection times.

2.4 Solid Waste Minimization Activities

(1) Composting

Composting activities using the compost bin and vermi-composting have been promoted by LSMC as well as several NGOs in LSMC, though less popular than in KMC. On the other hand, community composting activities have been conducted by some NGOs. Table 2.4-1 shows one of the activities which has been implemented actively and successfully since 1996.

Table 2.4-1 Community Composting Activity at LSMC

No.	Items	Contents
1.	Composting method	Compost pit method
2.	Starting time	Year 1996
3.	No. of targeted households	About 100 households
4.	Waste collection	Door-to-door collection by NGO (separate collection)
5.	Operation & maintenance of facility	All works throughout waste collection to compost harvest are controlled by NGO (Women's Environmental Preservation Committee)
6.	Composting duration	Two to three months
7.	Selling price	10 Rs/kg

Source: JICA Study Team

(2) Recycling

Although LSMC does not have a list of kabadi shops, there should be more than a dozen there and some independent recyclers who collect the recycle materials and sell to kabadi shops. On the other hand, about 150 waste pickers are working at Bagmati River dumping site full time and there are more waste pickers who are not recorded and operate individually in streets-side wastes.

Community Development Section (CDS) of LSMC is promoting awareness of recycling to women's groups, especially housewives, through training, in which CDS sometimes invites specialists on recycling from academics or NGOs/CBOs, or through awareness campaigns in collaboration with NGOs/CBOs.

As in KMC, some NGOs/CBOs have been trying to promote recycling activities to the local people. For example, the Women Environment Preservation Committee (WEPCO) stresses source segregation and recycling as well as composting. They have been producing recycled paper (5,000 sheet/month) from used paper (300 kg/month) by collecting from government offices, business offices, schools, NGOs and embassies since 1997. The paper recycling machine was provided by the Japanese Embassy as the Grass-roots grant assistance. Plastics, metals and bottles have also been collected at around 2 ton/month since 1995 so as to be sold to kabadi shops. WEPCO has also been emphasizing public awareness programs on segregation, recycling and composting at household and school levels.

2.5 Final Disposal

LSMC reports that about 200 m³/d of waste is disposed of at the Bagmati River dumping site. While KMC is reported to be overseeing the overall operation of the site near the Bagmati River, LSMC has 2-3 staff members stationed there to record the incoming waste trucks hauling LSMC waste and also to operate the one bulldozer they have at the site. Again many open dumping areas and wide waste burning is noticed in LSMC.

Since June 5, 2005, a part of the waste collected in LSMC together with some from KMC is being transported to Sisdol S/T-LF.

2.6 Social Aspects

(1) Major Findings of Household Behavior and Attitude Survey on SWM¹

1) Priorities of Public Services

According to the results of the Household Behavior and Attitude Survey on SWM, waste collection was ranked as the third priority (13% of sample HHs) and below water supply (47%) and drainage/sewerage (20%) among eight options of public services and utilities for improvement.

¹ In LSMC, 5 out of 22 wards were selected based on the core area, sub-core area and fringe area. A total of 162 sample HHs were selected.

2) Waste Disposal and Management

As Table 2.6-1 indicates, 56% of the sample HHs have noted that they disposed of waste by using a door-to-door collection service. A total of 33% of HHs disposed of waste by putting it into municipal or communal containers. Only 3 HHs responded that they practiced open dumping on vacant land, or the bank of a stream or river. Regarding the responsibility of handling waste, close to 70% of sample HHs noted that a female adult took this role. Children were also responsible for this (23% of sample HHs). Female members were less involved if other members of the family took out waste for disposal. The majority of HHs (52%) disposed of waste once a day and around 41% of sample HHs did it once every 2 or 3 days. Almost 60% of sample HHs used the backyard for storing the waste. A total of 31% of HHs responded that they had no space. Plastic bags were the most common containers

Table 2.6-1 Waste Disposal Practice among HHs Surveyed (LSMC)

Sample HH nos.	162#	109%
Dispose of waste by door-to-door collection service	91	56%
Dispose of waste by putting into Municipal or Communal Container	54	33%
Dispose of waste at Municipality's designated disposal site	11	7%
Dispose of waste by open dumping out side the house	3	2%
Dispose of waste by open combustion	4	2%
Dispose of waste by burying in the ground	1	1%
Dispose of waste by Composting	9	6%
Dispose of waste by giving it for recycling	1	1%
Dispose of waste by using as animal feed	2	1%

Note: Because more than one method was given by the respondents, the summation of responses exceeds 100%.
Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Household, Establishment and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

3) Existing Waste Collection Services

As shown in Table 2.6-2, the majority of HHs surveyed (96%) noted that waste collection services were available in their areas and they used these services. This group was the highest proportion in the five municipalities. The door-to-door collection was the most prevailing service (61% of respondent sample HHs), and was followed by carrying to container/truck (33%). NGOs/CBOs (73% of respondent sample HHs) and municipality (19% of respondent sample HHs) were main service providers for door-to-door collection in LSMC. It was assumed that the existence of these different service providers could contribute to high availability of collection services in LSMC. A total of 6% of respondent sample HHs have received daily collection services while 32% of HHs have services 2 or 3 times per week. A total of 54% of sample HHs have already made payment for waste collection services, and out of which 95% of HHs were very or somewhat satisfied with these services. Except those who were very satisfied, the rest of the respondent 27 HHs described the main reasons for less satisfaction or dissatisfaction with services as follows; a) waste collection and sweeping services were irregular (9 respondent sample HHs), b) waste collection time was too early or too late (6 HHs), c) behavior of workers for waste collection and sweeping was bad (3HHs), and, d) fees were too expensive (3HHs).

Table 2.6-2 Availability and Use of Waste Collection Service in LSMC

Sample HH nos.	162#	100%
Service available and used	155	96%
Service available and not used	6	4%
Service not available but required	1	1%
service neither available nor required	0	0%

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Household, Establishment and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

4) Waste Reduction and Recycling

A total of 55% of sample HHs responded that they have knowledge about separation and actually separating waste while 25% of HHs noted that they have knowledge but are not doing so. It was also noted that 17% of sample HHs neither had knowledge nor practiced source separation of waste. However, a significant number of sample HHs who did not practice were "very much" willing to cooperate for recycling (46%) or "somewhat" (41%). The following reasons for unwillingness to cooperate for separation were; a) takes too much time and b) no space inside the house to keep the separated waste. A total of 51% of sample HHs did not sell their recycling items although buyers visited the house. A total of 48% of sample HHs responded that they were selling their recycling material to the buyer. The major items collected for sale were glass and papers. The level of knowledge about composting was relatively high indicating that 77% of sample HHs knew what compost was. A total of 71% of those who knew about compost noted that they learned about making compost by themselves. A total of 13% of respondent sample HHs reported that NGOs/CBOs taught them. One fourth of sample HHs reported having experience in making composts, and out of which 60% of HHs composted their waste in an open space or organic field. A total of 38% of HHs made compost in containers or composting bins. Close to 70% of those having no experience in making compost responded they were willing to do. The rest of HHs did not show interest in such activity. The major reasons for unwillingness to compost were as follows; a) no space available (34% of respondent sample HHs) and b) unclear regarding needs for composting (16%).

5) Public and Community Involvement

A relatively high proportion of sample HHs considered that they themselves should be responsible for SWM (Table 2.6-3). This proportion was the highest among the five municipalities. The fact that a wide range of community mobilization and participation activities have taken place actively in LSMC might make the public have a sense of self-responsibility for SWM. Nevertheless, only 7% of sample HHs actually have taken initiatives in 3R activities, clean up and proper disposal practice. A total of 95% of sample HHs, including those who have already been paying had willingness to pay for SWM services. Most of them could afford to pay Rs 31-50 or Rs 11-30 per month. Among the 5% of sample HHs who were not willing to pay, the following reasons were noted; a) we could manage solid waste ourselves and b) we had no problems with SWM. Although few HHs have taken initiatives towards SWM by adopting various methods, almost half of sample HHs have participated in CBOs' activities related to SWM. According to the comparison result among the five municipalities, it was clearly noted that the level of participation in such community-based SWM activities was highest in LSMC. All respondents considered that these CBOs' activities related to SWM were necessary or

somewhat necessary. Almost 70% of HHs surveyed also reported being willing to participate in relevant SWM activities in addition to the awareness campaign. To sum it up, it could be said that the level of knowledge and attitude towards public involvement in SWM was relatively high. Although the extent of actual practice or involvement of community-based SWM has been limited, LSMC has high potential for promotion of community-based SWM in existing community-based groups and organizations.

Table 2.6-3 Perception of Responsibility for SWM in LSMC

Sample HH nos.	162#	100%
Government/Ministry of Local Dev.	11	7%
Municipality	31	19%
Sweepers	0	0%
Yourselves	107	66%
Our Communities/CBOs	0	0%
Private Company	7	4%
NGO	1	1%
Do not know	5	3%
Others	0	0%

Source: JICA Study Team, 2004 "Interview and Questionnaire Survey of Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

(2) Municipality's Programs regarding Community Mobilization on SWM

CDS is responsible for promoting community participation in development activities. CDS has implemented integrated community development activities including awareness, education/literacy, skill development, sanitation and conservation by group formation and mobilization at the tole levels with the technical and financial support from UDLE/GTZ (1992-2000). Up to date, approximately 40 women's groups have been established at the tole levels, covering all 22 wards. Further, 50 children's clubs were also formed at the initial stage of the UDLE project and of which 25 are likely to be active. Regarding SWM activities, CDS has carried out an awareness program, clean-up activities at the tole levels and 3 or 4-day training sessions. The training which focuses on a variety of SWM issues like the effects of solid waste on health and society and the 3Rs was given to the groups in the second year of its establishment by the CDS in collaboration with resource persons from external organizations. A total of 20 groups have received this training. LSMC has just taken initiatives in a pilot project in collaboration with two NGOs i.e. WEPCO and Nepal Pollution Control Environment Management. These contracted NGOs are responsible for door-to-door collection services targeting 200 HHs in Jawalakhel areas covering part of Wards 4, 5, 13 and 20 whereas LSMC have distributed 2 disposal bins each for all 200 HHs in order to introduce a source separation system.

(3) NGOs/CBOs' Programs regarding Community Mobilization on SWM

In the field of SWM, the partnership program with NGOs/CBOs is not being carried out as planned due to internal problems. Although there is no formal agreement with LSMC, several NGOs have provided collection services in relatively large areas. There is little coordination among NGOs/CBOs, which may sometimes make the public be confused since they are adopting and introducing different approaches with different messages on SWM.

Table 2.6-4 Major NGOs/CBOs Working in the Field of SWM in LSMC

Name of NGOs/CBOs	Year of foundation	Number of staff	Working Areas
Women Environment Prevention Committee (WEPCO)*	1996	28 paid staff 7 volunteers	Door-to-door collection, Recycling of paper, Awareness campaign, Sweeping, Composting, Training in Wards 1 and 10
Women Environmental Group (WEG)*	1997	12 paid staff 6 volunteers	Door-to-door collection in Wards 3, 10, and 22 (600 HHs), Awareness campaign, Composting in Ward 10, Recycling in Ward 10
National Environment Pollution Control (NEPCO)	1998	28 paid staff 7 volunteers	Door-to-door collection, Awareness campaign, Sweeping, Composting in Wards 6, 8, 14, 15 & 17 (1,050 HHs)
Nepal Pollution Control Environmental Management*	2001	137	Door-to-door collection in Wards 2, 3, 4, 5, 13, 14, and 19 (2,500-2,800 HHs) and pilot project with support of LSMC in Wards 4, 5, and 13 (150 HHs)
Society for Urban Poor (SOUP)	1992	2 paid and 33 volunteers	Community development including clean up in Wards 7&17 and 18&22, Composting (560 HHs)
Environmental Camps for Conservation Awareness (ECCA)	1987	8 paid and 50 volunteers	Public awareness on environmental education
Zero Waste Nepal	2001	20 volunteers	Public awareness and campaign on SWM
Women's Initiative for Environment and Development (WEID)	2000	3 paid and 25 volunteers	Door-to-door collection in Ward 2 (300 HHs + 2 schools)
Kathmandu 2020	1995	1 paid and 1,500 volunteers	Composting (20 HHs), Awareness campaign

Note: * According to LSMC, there is coordination with LSMC at program/activity levels.
Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Household, Establishment and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

2.7 Managerial Condition

(1) Organizational Structure and Managerial Practices

1) Organizational Structure

In 2004, LSMC approved a new organizational structure where it designated the Environment Section to be responsible for SWM activities. The Environment Section is comprised of two sub-sections, the Sanitation Sub-section and Mechanical Sub-section. It is located at Balkumari separately from the central LSMC office with its own garage and workshop building.



Figure 2.7-1 Organizational Structure of LSMC SMW Related Sections and Sub-Sections

Source: LSMC, 2005

The physical distance from other relevant sections has made coordination with other SWM relevant sections a challenge. The Public Works Division is responsible for identification, planning, development, and monitoring of municipal infrastructure projects. In matters of SWM facilities planning, this Section should be closely involved. Also, CDS has been implementing waste minimization training as a component of their community mobilization program for the last ten years. LSMC should tap into the experience of this section, and jointly formulate and implement effective community level SWM programs.

2) Managerial Practices

The post of the Environment Engineer heading the Environment Section was recently established, and an officer has been working as the Section Chief. In terms of reporting, the Environment Section Chief reports directly to the CEO of the municipality. Close coordination with the Public Works Division is maintained on various SWM issues.

LSMC established the Solid Waste Management Committee, composed of four Ward Chairpersons with relevant municipality staff as observers, which is usually convened on a monthly basis. This platform is used to settle daily waste management problems and make recommendations of some principles about SWM. As of June 2005, this Committee was not active since the members comprised of political appointees are not in office.

(2) Human Resources

Total number of staff under the Environment Section is 206 persons or about 40% of all LSMC staff. Over 80% of 206 persons are field level staff. The breakdown of human resources of the Environment Section is as follows:

Table 2.7-1 LSMC Environment Section Staff

Staff Category	Number of persons
Sweepers	165
Drivers	19
Mechanics	9
Supervisors	5
Administrative	7
Engineers/Officers	1
Total	206

Source: LSMC, 2005

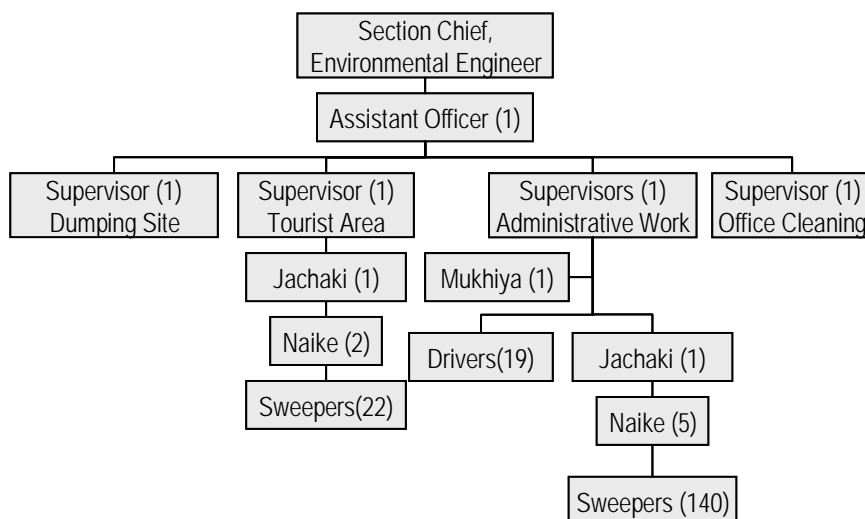
1) Senior Officers and Mid-Level Staff

LSMC senior officers all have solid educational and technical backgrounds in their respective fields, but not close relating to SWM. Some technical reorientation training would be useful so that they could build on their previous knowledge and expand capacities in the field of SWM. The Environment Section would need more strengthening of management capacities, especially in view of their responsibility to manage a sizable field staff.

Mid-Level staff also needs support in office management and communication skills. Furthermore, most of the staff at this level, aside from the assistant officer (Naya Subba), have not received any training on SWM and are only familiar with certain aspects such as street sweeping, waste collection, and transportation.

2) Field Level Staff

In LSMC, an assistant officer (Naya Subba), with the support of four supervisors and field level supervisors called Jachakis and Naikes, are managing all field level staff. Among the sweepers, 76 are assigned at the ward level and conduct various cleaning jobs in addition to regular street sweeping. The rest of the sweepers is assigned under the central LSMC office and separated into the following groups: sweepers concentrating on tourist areas, sweepers cleaning the major streets and highways, waste loaders going around with the collection trucks, and drainage cleaners. The sweepers usually work in two shifts, (6:00 a.m. to 10:00 a.m., 10:00 a.m. to 5:00 p.m. only at Mangal Bazar) but some like the drainage cleaners work only in one eight-hour shift. Figure 2.7-2 shows the organizational structure of the LSMC field staff.



Note: () shows number of staff

Figure 2.7-2 Structure of LSMC Field Level Staff

Source: LSMC, 2005

2.8 Financial Condition

LSMC estimates direct annual expenditures for SWM services at Rs 25 million which corresponds to 25% of the total municipal expenditure (FY2002/2003). Fuel cost of Rs 4 million regarding transportation is included among the direct expenditures. All financial sources necessary for SWM are covered by the municipal budget.

2.9 Issues and Constraints on Municipal Solid Waste Management

The analyzed issues and constraints on SWM in LSMC are summarized as follows.

(1) Collection and Transportation

- LSMC, as KMC, faced some difficulties with the night time and early morning collection system, because of limited collection hours, working in the dark, irregular collection frequency that causes confusion to the public.
- For primary collection, it is difficult for LSMC, as for KMC i) to collect the waste especially in the core area due to the narrow streets and dense population, ii) to manage efficiently because of the low operation rate of old equipment and iii) to securely grasp the activities of private sectors under their control because of an inadequate monitoring system for such collection activities on a business basis.
- It is not efficient to load the waste from the ground at the collection point into the collection vehicle.
- For the Bagmati River dumping site closure, LSMC has to transport their waste to Sisdol directly without any transfer station. For that reason, LSMC has embarked on a process to consider a temporary transfer station at Afadole.

(2) Solid Waste Minimization Activities

- The Community Development Section (CDS) has promoted awareness for recycling to women's groups through training. Further, they have begun to work on the spread of

home composting as one of the community based waste minimization activities. Coordination with SWM related sections, Environment Section, Public Works Division, is needed for making CDS' activities effective.

- As in KMC, it has been observed that several NGOs/CBOs are active in promoting home composting as well as community-based composting activities and collect recyclable waste to sell to kabadi shops where they deal with recyclable waste. Making most of them is needed for more effective waste minimization activities.

(3) Final Disposal

- In cooperation with KMC, LSMC has also transported part of its waste to Sisdol S/T-LF and has co-responsibility for the operation of the site. LSMC should determine the role of LSMC for the operation, including provision of manpower and equipment in association with KMC.
- It is necessary for LSMC to prepare a safe closure and rehabilitation plan for the Bagmati River dumping sites and to regulate and control land use over closed dump site carefully in cooperation with KMC.

(4) Social Aspects

- Although CDS executed good practice in terms of community participation with know-how about community mobilization and facilitation over the past years through the programs assisted by GTZ/UDLE, these experiences have seldom been shared even with the relevant sections within LSMC.
- Due to insufficient publicity activities, the media has rarely covered activities undertaken by CDS.

(5) Managerial Conditions

- Coordination among SWM related sections (Environment Section, Public Works Division and CDS) has been the biggest challenge in LSMC, which could be attributed to the fact that both the Environmental Section and CDS have separate offices away from the main municipal complex. Each section is already well established with a relatively heavy workload in its core functions.

CHAPTER 3 FUTURE FRAMEWORK FOR ACTION PLAN

3.1 Socio-economic Framework (Projection of Future Population)

In Nepal, the official document which can be an aid to project future socio-economy at the national level is the Tenth Plan (Poverty Reduction Strategy Paper) 2001/02 (2058/59¹)-2006/07 (2059/60), May 2003, National Planning Commission (NPC) of HMG/N. The Tenth Plan is the government's main medium-term strategic planning document which provides sharply focused strategies for poverty alleviation.

This Tenth Plan discussed two alternative scenarios. The Normal Case scenario aims to reduce the overall poverty ratio from 38% estimated at the end of the Ninth Plan (2001/02) to 30% by 2006/07, while an alternative Lower Case scenario was 33%. This lower case scenario was used as the basis for formulating the budget and the Medium Term Expenditure Framework (MTEF) FY2003/04-05/06.

On the other hand, at the Valley level, the Kathmandu Valley Town Development Committee (KVTDC) under the Ministry of Physical Planning and Works (MOPPW) and the Department of Urban Development and Building Construction (DUDB) has a responsibility for preparing a physical development plan of the Kathmandu Valley.

The Kathmandu Valley Town Development Plan (KVTDP) 2020 was prepared in the year 2002 by KVTDC to establish a broad regional framework plan (strategic plan) for the Kathmandu Valley integrating both land use and the urban transportation network, which guides the valley's future growth in a planned manner.

The KVTDP 2020 had estimated that if a gross density of 300 persons per hectare could be achieved within the existing urban areas, the demand for urban land in the 20 years would be slightly over 3,600 ha. However, considering the difficulty in effecting public perception about apartment housing and overturning the current trend of owner occupied single housing, demand for urban land could be much higher than envisaged.

Since the 2001 national census data has become available recently, the JICA Study Team together with the TWG members examined these annual growth rates taking into account the actual growth rate between 1991 and 2001, and has decided to adopt this KVDTC study's rates except for MTM. For MTM, the actual growth rate between 1991 and 2001 was assumed to continue up to 2015 because MTM has relatively large potential for urbanization in land use in the future.

The projected future population based on the 2001 population is shown in Table 3.1-1.

¹ Nepalese Year

Table 3.1-1 Projected Population of Five Municipalities

Municipality	Actual Population	Projected Population	Annual Growth Rate (%)	
	2001 (2058)*	2015 (2072)	2001-2011 (2058-2068)	2011-2015 (2068-2072)
KMC	671,846	1,055,591	3.32	3.18
LSMC	162,991	260,790	3.44	3.35
BKM	72,543	117,380	3.52	3.44
MTM	47,751	83,696	4.09	4.09
KRM	40,835	54,400	2.07	2.07
Total Municipality	995,966	1,571,857	3.34	3.24
VDCs	525,498	603,891	0.95	0.84
Total Valley	1,521,464	2,175,748	2.61	2.54

Note: *Nepalese Year

Source: Draft Kathmandu Valley Development Plan 2020, KVTDC, July 2000

JICA Study Team

3.2 Solid Waste Management Ratio

For clear understanding of the solid waste management, the definition of waste index was proposed as follows and as shown in Figure 3.2-1.

- a) Generated waste: Material that has become useless and valueless for the owner if it is to keep it at the source
- b) Discharged waste: Part of generated waste that is discharged out from the owner's territory
- c) Self treatment waste: Part of generated waste that is treated, disposed of or utilized within the owner's territory
- d) Collected waste: Part of discharged waste that is collected by the municipality or a private sector operator
- e) Uncollected waste: Part of discharged waste but not collected and disposed of somewhere
- f) Disposed waste: Part of collected waste that is disposed of at the designated final disposal site
- g) Primary Valuables: Materials that become useless but may be valuable for the owner in exchange for cash or for some recyclable collector. The owner intends to separate that material from the waste and bring it directly to recycling dealers for sale or to a municipal/community recycling center. Private recyclable collectors can also visit each generation source to pick up those valuables as their business activity. Returnable bottles for deposit refund are also included in this category.
- h) Secondary Valuables (Recovered Valuables): Valuable materials that are collected and recovered for reuse and recycling after waste is discharged, from the various stages such as from streets, collection points, transfer stations, waste treatment facilities, or final disposal sites. This includes the recyclable waste collected by recyclable waste pickers.

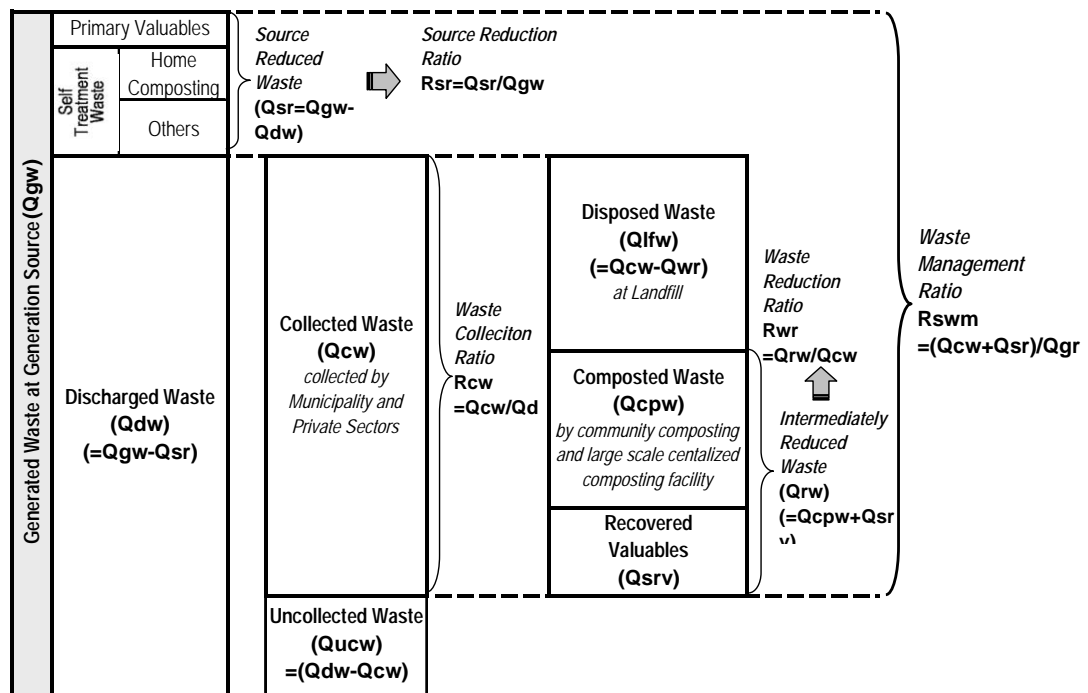


Figure 3.2-1 Definition of Waste Management Ratio

Source: JICA Study Team

It was proposed to introduce the concept of “Solid Waste Management Ratio” in the Study. Solid Waste Management Ratio can be estimated by the following formula.

$$\frac{\text{(Collected waste quantity + Source reduced waste quantity)}}{\text{Generated waste quantity}}$$

One of the major purposes of solid waste management is to reduce the uncollected waste amount for improvement of the cleanliness, beautification and sanitation of the city. The wastes other than such uncollected waste are the waste reduced at source and that collected from the source. This means that the solid waste is managed by some organization like the municipality, the private sector, or the waste generator itself. Therefore, the “Solid Waste Management Ratio” has been set up as the waste index that collectively shows how much waste can be managed appropriately in various ways.

3.3 Projection of Future Generation of Solid Waste

3.3.1 Future Waste Generation without Measures

Considering the existing data of waste generation quantity in the Kathmandu Valley by various past studies, the result of the waste quantity and quality survey done by the Study, and an assumption of an annual increasing rate of unit generation rate which of 2%, the waste generation quantity of each municipality is estimated to be as shown in the following table.

Table 3.2-1 Projected Solid Waste Generation Quantity

Municipalities	Population		Municipal UGR (kg/d-capita)		Average daily generated quantity (tons/day)		
	Year (Nepalese Year)	2004 (2061)	2015 (2072)	2004 (2061)	2015 (2072)	2004 (2061)	2015 (2072)
KMC		741,008	1,055,591	0.416	0.519	308.4	547.9
LSMC		180,397	260,790	0.416	0.519	75.1	135.4
BKM		80,476	117,380	0.316	0.394	25.5	46.2
MTM		53,853	83,696	0.266	0.332	14.3	27.8
KRM		43,424	54,400	0.266	0.332	11.6	18.1
Total 5 municipality		1,099,158	1,571,857	-	-	434.9	775.4

Source: JICA Study Team

3.3.2 Scenario Analysis

The 2% of annual increasing rate of waste unit generation predicted in the previous section is based on the future economic growth in the Kathmandu Valley as well as other country's experiences. In this assumption, total generated waste will be increased up to 1.8 times more than it is at present. Therefore, waste reduction at source such as home composting or material recycling activities is very important to reduce the waste generation. In the Kathmandu Valley, such source reduction activities have just been started promotion together with community development activities, and further waste reduction at source can be expected. Considering these circumstances, the following scenarios for the Study² was proposed and it is expected that for reach municipality will make an effort to reduce the waste at source to shift to Scenario 2 from Scenario 1 by promoting source reduction activities under the concept of waste management ratio.

Scenario 1: without measures (with 2% annual increase of the unit generation rate)

*Scenario 2: with measures for source reduction by home composting and source recycling.
Target reduction ratio in 2015 is around 85% of total generated quantity.*

² Since there is no existing data or record that can be used to estimate the annual increasing rate of waste unit generation in the past, the JICA Study Team suggested that all municipalities to carry out regular waste generation quantity surveys, at least once a year, to get an understanding of the changes of unit generation rate from the practical experience during the Study.

CHAPTER 4 UMBRELLA CONCEPT FOR FORMULATION OF ACTION PLAN

4.1 Umbrella Concept of Solid Waste Management in the Kathmandu Valley

Action plans (A/Ps) of each of the five municipalities should be developed reflecting their characteristics in terms of solid waste flow, waste quality and quantity, collection methods, waste minimization activities and the associated requirements such as promotion of public awareness and behavior change, and organizational and institutional arrangements. However, it is recommended that some activities to be included in the respective A/Ps should be conducted in a valley-wide in order to maximize the effect of these activities. In addition, in terms of facilities and equipment for intermediate treatment or landfill, the developments need to be done taking into consideration potential for inter-municipal coordination and sharing of these facilities and equipment so that development loads as well as investment and O&M costs be minimized. Table 4.1-1 indicates the components of the A/Ps that need to be discussed for each respective municipality or that may be combined for more than one municipality (zone).

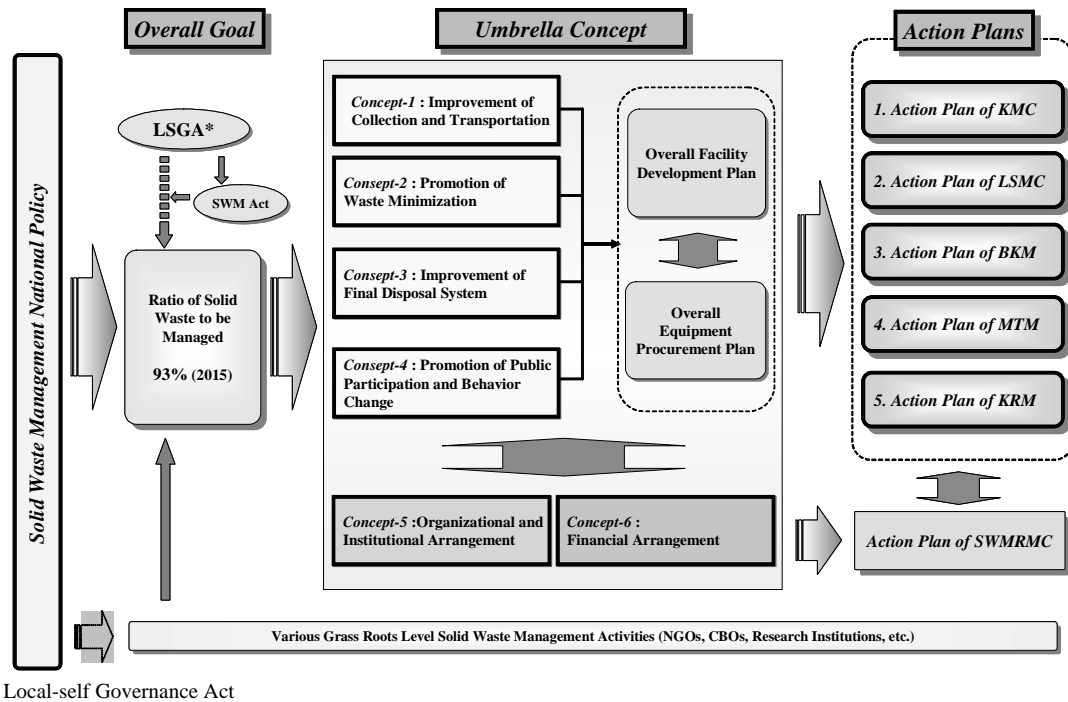
Table 4.1-1 Components of Action Plans

Components of A/Ps	Individual Municipality or Zone
1. Primary and secondary collection	Individual municipality
2. Transportation (transfer haul)	Individual municipality or zone
3. Waste minimization (composting and recycling)	Individual municipality or zone
4. Waste disposal	Zone
5. Public participation and behavior change	Individual municipality and zone
6. Organizational and institutional arrangement	Individual municipality and zone

Source: JICA Study Team

In this connection, a basic concept common for all five municipalities, *an umbrella concept of solid waste management in the Kathmandu Valley (Umbrella Concept)*, has been proposed to clarify the administrative responsibilities of each municipality and to show a basic direction (road map) for effective solid waste management.

As parts of the Umbrella Concept, four basic concepts, i.e. improvements of collection and transportation and final disposal system, and promotion of waste minimization and public participation and behavior change have been proposed. In order to achieve these basic concepts, an overall facility plan (OFP) and overall equipment plan (OEP) in the Kathmandu Valley have been discussed. In addition, the directions for financial arrangement as well as organizational and institutional arrangement including the involvement of the private sector regarding SWM have been proposed. The overall framework of the Umbrella Concept is shown in Figure 4.1-1.



* Local-self Governance Act

Figure 4.1-1 Overall Framework of the Umbrella Concept of the Kathmandu Valley

Source: JICA Study Team

4.2 Basic Concept for Improvement of Collection and Transportation

4.2.1 Collection and Transportation Practices and Coverage Improvement

The collection and transport systems are broadly identified in the Kathmandu Valley in the as shown in Figure 4.2-1.

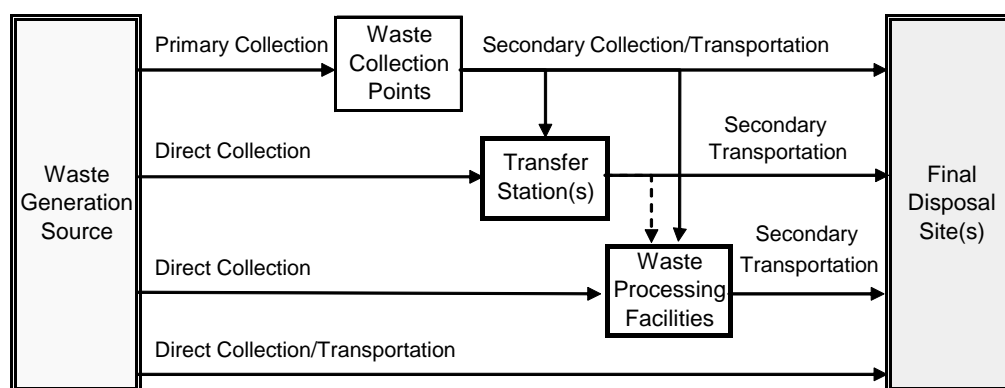


Figure 4.2-1 Definition of Collection and Transportation

Source: JICA Study Team

Accordingly, a basic concept for improvement of collection and transportation are summarized in the Table 4.2-1.

Table 4.2-1 Basic Concept for Improvement of Collection and Transportation

Activity	Basic Concept	Descriptions
Primary Collection	Decrease of street sweepers	Number of municipal sweepers: less than present
	More utilization of private sector	Share of private sector for primary collection: 60% in KMC, LSMC, 100% in KRM.
	Improvement of waste collection point	No direct manual loading point with shovels in the Valley
Direct Collection	Promoting of Door to Door collection	Preparation of private door to door collection service guideline
	Promoting bell collection system	Bell collection in all the collection area except the area of Door to Door collection and container collection
Secondary Collection	Abolishment of municipal tractor	100% of municipal tractors will be replaced by small sized compaction trucks
Secondary Transportation	Procurement of new secondary transportation vehicles	The existing equipment will also be replaced by the same type of new vehicle.
Others	Introduction of source-separated collection	In BKM, all waste to the existing composting facility should be separated at the generation source. In future including other municipalities, at least 50% of waste is separated at the source and the rest is separated at the facility by waste pickers.
	Improvement of mechanical workshop	All the equipment should be maintained appropriately with minimum cost.

Source: JICA Study Team

4.2.2 Collection and Transportation Facilities (Transfer Stations)

The streets of the five municipalities are mostly narrow and cannot accommodate large collection trucks, making smaller collection trucks, tractors and tri-cycles more suitable. These small trucks need to be served by small transfer stations or mini transfer points (depos) and are directly related to the primary collection activities.

As for larger transfer stations, as a basic concept, KMC should push forward with construction of another transfer station in Balaju in addition to the improved Teku T/S, and LSMC should secure the land and construct a temporary transfer station in Afadol and then should utilize a waste processing facility as a transfer station.

4.3 Basic Concept for Promotion of Solid Waste Minimization

4.3.1 Promotion of 3Rs Activities

In order to realize effective SWM, it is important that the residents should promote 3Rs activities as follows:

- Reduce: To minimize generated or discharged waste
- Reuse: To use goods or materials that can still be used a number of times
- Recycle: To recover waste as raw material and use it for reproduction

In order to promote 3Rs activities smoothly, cooperation of the private sector and support from municipalities are needed as shown below:

- 1) Cooperation of Private Sector
 - Produce and sell easy-to-recycle goods
 - Produce and sell long-life goods
 - Minimize packing and packaging for goods
 - Improve quality of recyclable and recycled goods and develop new products
- 2) Support by Municipality
 - Increase awareness for reduction of waste to residents and private sector
 - Establish more recycling centers (places for purchasing recyclable materials)
 - Develop and improve distribution pipeline for recyclable materials
 - Provide subsidies for the private sector involved in recycling activities
 - Develop legislation to establish a recycling-based society

4.3.2 Promotion of Waste Processing and Composting

Since approximately 70% of the generated solid waste is organic, composting has been actively conducted in the Kathmandu Valley. Composting activities can be broadly divided into three types as discussed in Table 4.3-1.

Table 4.3-1 Composting Activities conducted in the Kathmandu Valley

No.	Items	Composting Plant	Community Composting	Home Composting
1	Experience in the Kathmandu Valley	Composting plant in Bhaktapur Old composting plant in Teku	Compost chamber in Thimi 3,000 L compost bins in KMC	100 L compost bins of KMC Vermi-composting
2	Source separation of organic waste	Necessary for plant operation	Necessary for community composting operation	Necessary at each house
3	Waste collection and transportation to facility	Wide collection area and long distance transportation	Limited collection area and short distance transportation	Not necessary
4	Separation of non compostable material at facility site	To be required	To be required	Not necessary
5	Operating labor	Many exclusive operators are required.	Exclusive operators not required.	Household members operate
6	Operation and maintenance technique	Harder than community composting	Harder than domestic composting	Easy
7	Installation area	Large area with public consensus is required.	Limited area with community consensus is required	Small space is required in house
8	Investment cost	Large	Medium	Little
9	Running cost	Medium	Little	Little
10	Advantage for public participation	Getting produced compost or revenue by selling compost	Getting produced compost or revenue by selling compost	Getting produced compost or revenue by selling compost
11	Other related	Selection of installation area Financial balance	Cooperation of community	Expansion of number of cooperative households

Source: JICA Study Team

Considering necessary investment and O&M costs, ease of operation and environmental impact, home composting is considered to be the most practical in the Kathmandu Valley. For community composting, a pit method is recommended because of ease of operation and maintenance. For planning purposes, the suitable method or best combination of the above three types of composting should be examined.

From the viewpoint of reduction of waste transportation cost, a composting plant should be constructed in or near the city area of KMC or LSMC. The windrow method should be adopted because Nepal has experience in operation of the BKM composting plant with this method. This method may be enhanced through:

- Separated waste being received at the composting plant as much as possible.
- At the sorting area, uncompostable materials being removed manually, while compostable materials are piled up at the fermentation yard by using a wheel loader.
- During composting the heap being turned over several times and exposed to air for accelerating fermentation
- After about 60 days, raw compost being screened for the final product to be ready

4.3.3 Considerations to Waste Pickers

Waste pickers, one third of the estimated number of 2,500 who are below 15 years of age, are considered as the primary recyclable waste collectors. The main items salvaged by waste pickers are plastic bags and milk and oil pouches. The government and related authorities need to harness their contribution and efforts.

In several places, it was observed that waste pickers help with loading and unloading works. However, sometimes waste picking activities may obstruct waste collection or landfilling works and scatter the waste on the roads. It is apparent that waste pickers are working in a dirty, dangerous and health-hazard environment. Furthermore waste pickers are alienated from social communities and sometimes subject to many forms of discrimination. There is also a specific linkage between waste work and children. As the market for recyclables have increased, a number of children previously involved in begging have turned to rag-picking/scavenging as a means of survival.

For improvement of effective SWM in the Kathmandu Valley, the following consideration should be given to waste pickers.

- Improve working conditions among waste pickers
- Disseminate effectively information targeting waste pickers
- Gradually abolish child labor as waste pickers
- Incorporate waste pickers within new SWM facilities

4.4 Basic Concept for Improvement of Final Disposal System

4.4.1 Landfill System

The new landfills for the valley should be developed under clear standards. Two of these standards; landfill type and landfill level are described hereafter.

(1) Semi-aerobic Landfill Type

Anaerobic decomposition of organic matter produces methane and water, and the decomposition is slow and leachate content is large. On the other hand, under aerobic decomposition, organic matter decomposes into carbon dioxide and water and the decomposition is rapid. Aerobic decomposition requires a supply of oxygen to be pumped into the landfill, but this is a costly system. To cope with these problems, a particular type of semi-aerobic landfill known as “Fukuoka Method” was developed as a joint project of Fukuoka City and Fukuoka University. The semi-aerobic system is schematically presented in Figure 4.4-1.

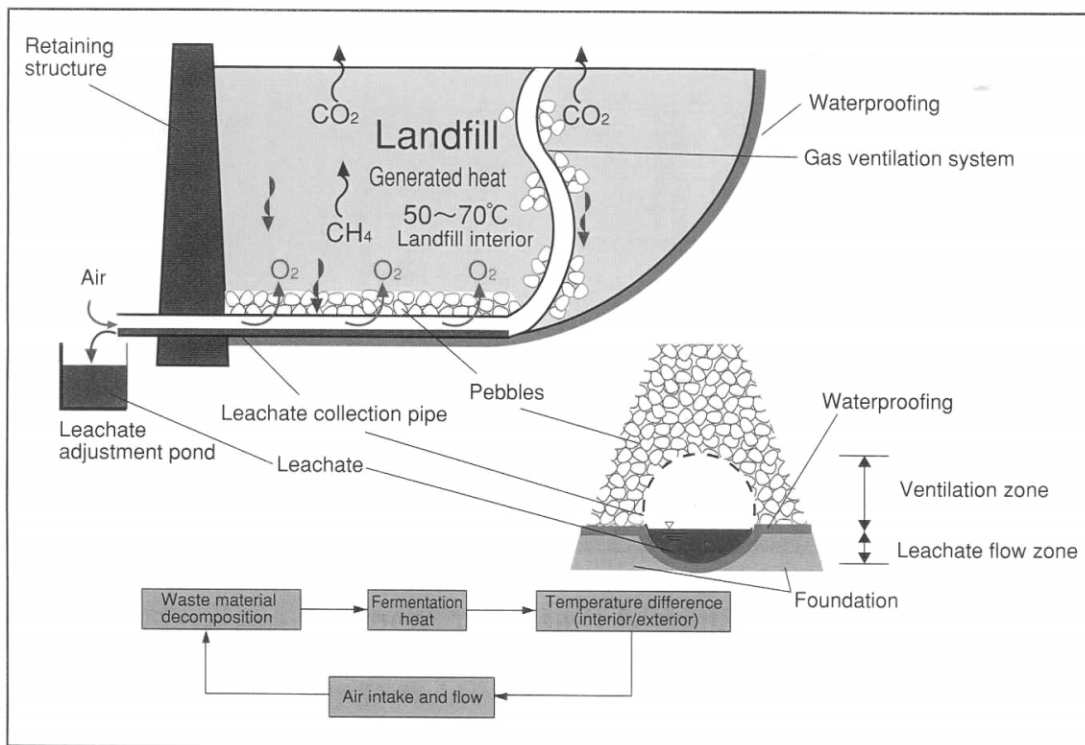


Figure 4.4-1 Schematic Presentation of Semi-aerobic System

Source: The Fukuoka Method, Fukuoka City Environmental Bureau

It is proposed to develop the landfills using the semi-aerobic system. The Sisdol S/T-LF has been designed under this concept and has started operation since June 2005. The operation of the Sisdol S/T-LF should be carefully monitored to determine the suitability of the semi-aerobic landfill system.

(2) Landfill Level

In past JICA studies in other developing countries, four landfill levels have been discussed as shown in Table 4.4-1. Level 4 offers the best countermeasures for mitigation of impact on the environment and therefore it is proposed that the Nepali decision makers aim to achieve that level in future. However considering the issues of high construction and operation costs for leachate treatment facilities and liner installation, and difficulty in treating the resulting chemical wastes from the leachate treatment, level 3 may be acceptable in the short term.

Table 4.4-1 Sanitary Landfill Levels

Facility	Level 1	Level 2	Level 3	Level 4
Description	Controlled tipping	SLF with bund and daily cover	SLF with leachate recirculation	SLF with leachate treatment facilities
Soil cover	O (Periodic)	O	O	O
Embankment		O	O	O
Drainage facility		O	O	O
Gas venting		O	O	O
Leachate collection			O	O
Leachate re-circulation			O	O
Leachate treatment				O
Liners				O

Source: JICA Study Team

In the case of the Sisdol S/T-LFS, it is expected to be operated for only 3-4 years and therefore application of natural liner and leachate re-circulation with natural attenuation treatment was recommended. This may be considered as Level 3 (+).

4.4.2 Post Closure Management of Landfill Sites

Management aspects with respect to closed landfills include collection and monitoring of landfill gas and leachate, landfill settlement, land use and access control and dissemination of information on the use of the site as a landfill.

A detailed mapping of the dump sites along the Bagmati River should be prepared and the priority sections for safe closure identified. For these sites river bank slope reformation, and installation of leachate collection pipes, landfill gas vents and storm water drains are considered.

4.5 Basic Concept for Public Participation and Behavior Change

4.5.1 Public Awareness and Behavior Change for Effective SWM

A successful SWM requires various forms of community mobilization and participation. The following Figure 4.5-1 provides a framework of stages of behavior change of the people. Most people go through these steps, sometimes moving forward or backward and sometimes skipping steps. Even when people adopt new behaviors, they may revert to old behaviors, at least under certain circumstances.

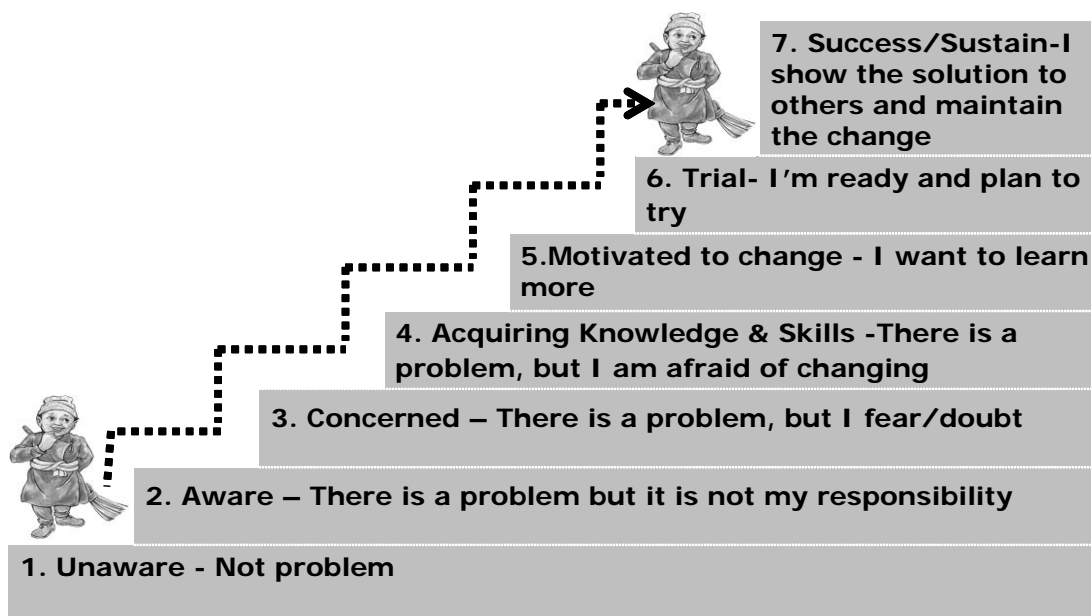


Figure 4.5-1 Behavior Change Stages

Note: The process of changing behaviors and attitudes may happen in the sequence. Most people move back and forth between steps before achieving success. Source: JICA Study Team, adopted from “A manual for communication for water supply and environmental sanitation programs” (UNICEF, 1999), and “How to create effective communication project” (AIDSCAP/FHI/USAID).

Behavior Change Communication (BCC) is considered to be an effective component of a comprehensive SWM program. It can impart information and knowledge regarding environment friendly behaviors and SWM issues and promote essential attitude change. It can also contribute to creating a demand for relevant information and services related to SWM, and to improving skills and sense of self-efficacy, which are required to stimulate behavior change. In order to integrate a BCC component into A/Ps effectively, the following steps¹ need to be taken.

- 1) Identification of the Program’s Goal and Target Group/Audience
- 2) Formative BCC Assessment and Definition of Behavior Change Objectives
- 3) Development of Messages
- 4) Communication Channels
- 5) Pre-testing
- 6) Implementation, Monitoring and Evaluation

4.5.2 Mass Communication and Education

Mass communication and education is a useful approach that reaches large groups of people quickly and effectively. It includes mass media, small media including print media, social marketing and public/educational events. However, producing awareness programs on SWM through mass media is relatively expensive. Thus, it requires inter-municipality

¹ These steps have been developed by FHI (“BCC for HIV/AIDS A Strategic Framework, FHI/USAID, 2002) and adopted by a number of BCC programs and projects in the world. Since they can be applied to SWM programs, Interpersonal Communication and BCC Skill Training conducted as part of Pilot Project D-1 for municipal staffs also highlighted and recommended these steps.

coordination among the five municipalities and technical as well as financial support from SWMRMC/MOLD, or other external organizations. On the other hand, since print media such as brochures, posters and flip charts are not so expensive, each municipality can produce them with their own financial resources. Social marketing, which uses similar commercial marketing techniques for stimulating public behavior change, is useful for promoting commodities with effective messages on SWM.

Public events are effective to disseminate basic information on SWM quickly and increase the level of knowledge on SWM among a large number of people. It is expected that all municipalities in coordination with SWMRMC carry out these events at least once a year on an occasion such as Earth Day or Environment Day according to their A/P for SWM.

4.5.3 Interpersonal Communication and Education

An approach using Interpersonal communication and education is recognized as an effective two-way communication channel that encourages the interactive dialogue between individuals or among group members. Figure 4.5-2 illustrates the difference between interpersonal and mass communications. The interpersonal communication and education approach, based on personal communication sources and channels, can disseminate, improve and reinforce the acquired knowledge, skills, attitude and behavior between individuals or among diverse group members.

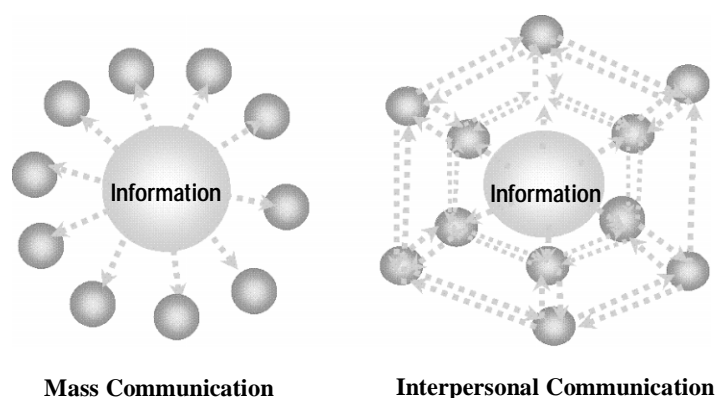


Figure 4.5-2 Difference between Mass Communication and Interpersonal Communication

Source: JICA Study Team

4.6 Overall Facility Plan in the Kathmandu Valley

4.6.1 Principle for Overall Facility Plan in the Kathmandu Valley

The principles adopted to develop the OFP were threefold:

Principle 1 : Waste Hierarchy; The SWM facilities should contribute to a more balanced SWM system that first works to reduce the waste at source, re-use, recycle and recover, treat and finally dispose of the waste.

Principle 2 : Sustainable Facilities; Facilities should be sustainable both financially and technically and should suit the existing Nepalese conditions.

Principle 3 : Urgent Implementation: To avoid delays in providing needed facilities, a step-wise approach was adopted. The past studies and plans were taken into consideration as much as possible.

4.6.2 Alternative Evaluation of OFP

As a first step, a short list of candidates for long-term landfill sites (L/T-LFSs) was prepared based on the 1998 study by the Department of Mines and Geology (DOMG). It is noted that six years have passed since the implementation of that study and development has been rapidly progressing. The four candidate sites, Pharshidol South, Pharshidol North, Taikabu, and Okharpouwa, for development of long-term sanitary landfill were selected. Ranking of these sites was made taking into account field visits and available information.

The facilities to be incorporated in the formulated alternatives mostly reflect existing plans and nine alternatives, based on the number of landfills, were analyzed. Alternatives 1a, b and c call for one sanitary landfill to serve the whole the Kathmandu Valley with provision of WPFs. Alternatives 2a, b and c call for two landfills to be developed. Alternative 2c is an offshoot of Alt. 2b but without WPFs. Alternatives 3a and b provide three landfills, and once more Alt. 3b is an offshoot of Alt. 3a but without WPFs. Alternative 4 has each individual municipality developing its own SWM facilities in the absence of the Umbrella Concept. Figure 4.6-1 shows the locations of these facilities.

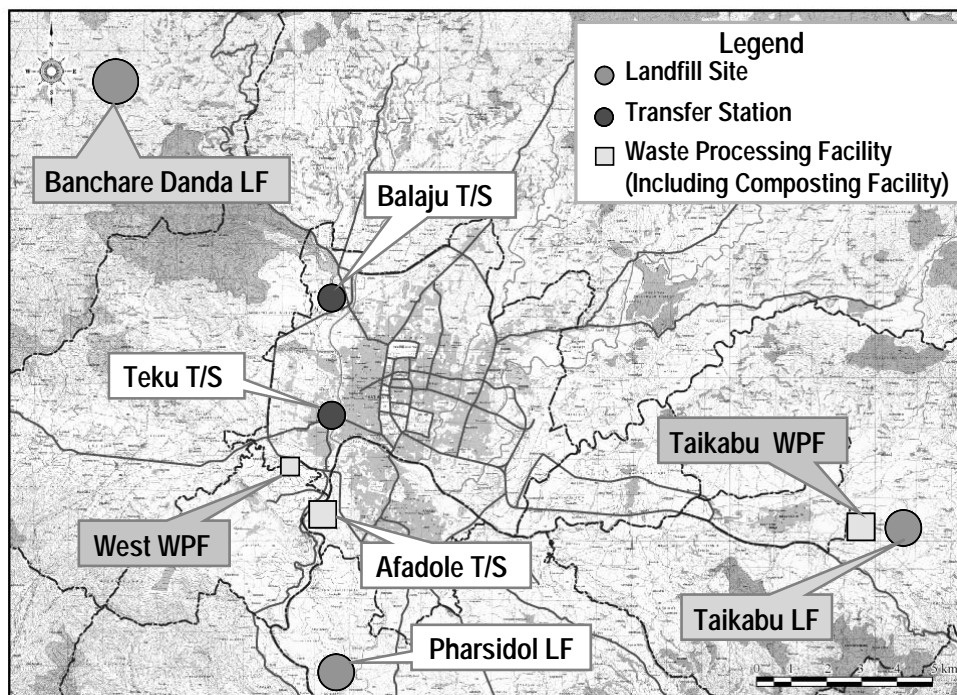


Figure 4.6-1 Facilities Incorporated in the Alternatives 1-3

The developed alternatives are described in the following Table 4.6-1.

Table 4.6-1 Alternatives Formulation

Alt	LF	WPF	T/S	Comments
1a	Okharpauwa	West Taikabu	Teku Balaju Taikabu	<u>Alt. 1a:</u> examines one landfill for the total valley, located outside the valley and the effect of waste reduction by two composting facilities. Three transfer stations are required.
1b	Taikabu	West Taikabu	Teku Balaju	<u>Alt. 1b:</u> locates one landfill within the valley at Taikabu LF candidate site which is under EIA process. WPF is proposed on an unidentified site west of the two cities to reduce transfer haul distances.
1c	Pharsidol	West Taikabu	Teku Balaju	<u>Alt. 1c:</u> locates the sole landfill for the valley at a site proposed in the Pharsidol area, Pharsidol of LSMC, and close to the municipalities.
2a	Okharpauwa Taikabu	West Taikabu	Teku Balaju	<u>Alt. 2a:</u> proposes two landfills, in Okharpauwa outside the valley and Taikabu. Two WPFs are also proposed.
2b	Taikabu Pharsidol	West Taikabu	Teku Balaju	<u>Alt. 2b:</u> proposes two landfills, Taikabu and Pharsidol, both located within the valley, and two composting facilities.
2c	Taikabu Pharsidol		Teku Balaju West	<u>Alt. 2c:</u> is an offshoot of Alt. 2B without WPFs, in order to study the effect of waste reduction.
3a	Okharpauwa Taikabu Pharsidol	West Taikabu	Teku Balaju	<u>Alt. 3a:</u> proposes three landfills and two WPFs.
3b	Okharpauwa Taikabu Pharsidol		Teku Balaju Afadole	<u>Alt. 3b:</u> is an offshoot of Alt. 3A without the WPFs, in order to study the effect of waste reduction.
4	Okharpauwa Taikabu Pharsidol Thimi Kirtipur	Aletar Afadole Taikabu Thimi Kirtipur	Teku Balaju	<u>Alt. 4:</u> proposes that each municipality achieves its targets through construction of its individual composting facility and sanitary landfill.

Source: JICA Study Team

The main comparison items considered were:

- SWM aspects: How the alternative reflected the proposed waste hierarchy and satisfied the “Proximity Principle”²
- Transportation aspects: The transfer haul costs represent the largest portion of the O&M cost and this is reflected in the ton • km produced by each alternative

4.6.3 Overall Facility Development Plan in the Kathmandu Valley

Since the analysis indicated that two landfills and two WPFs would provide stable and sustainable SWM service for the Kathmandu Valley, Alt. 2b or 2a should be considered.

² The principle whereby waste should be treated and disposed of nearby the generation area as much as possible to nourish responsibility of the waste generator for its management, uphold environmental justice, and decrease transportation costs

In terms of waste transportation and related costs; Alt. 2a would entail an added O&M cost of Rs. 278.9 million over the period of 2007 to 2015 or average Rs.24.9 million annually. On the other hand Alt. 2a holds an edge over Alt. 2b in terms of the site allocation. Out of the two sites required to be identified, EIA for Taikabu site is already in process and barring any unforeseen circumstances is expected to be found suitable for construction of the landfill there. This study has narrowed the candidates for the remaining landfill site to two sites; in Pharsidol and the Banchara Danda site in Okharpauwa.

Pharsidol north site was preferred over Banchara Danda in view of the shorter transport distance and other factors. However three major issues may delay the development of this site. These are the Pharsidol wellfields, the direction of Tribhuvan Airport runway and the close proximity of the culturally important village of Khuipa. A long time may be required to resolve these issues. On the other hand the major advantage that Banchara Danda site has is the commitment of the Central Government to develop this site as a landfill (as underlined in the Government's National Plan). Social and cultural issues are much less critical here and development is expected to be much faster. However the Government needs to carefully discuss with the beneficiaries of the site, namely KMC and LSMC on how to bridge the high haulage costs. The Overall Facility Plan (OFP), therefore, has been developed based on Alt. 2a in order to expedite the process of developing long-term landfill by building on all the effort that has been applied so far and also to clarify the costs incurred.

Accordingly the OFP is discussed in Zone A (KMC, LSMC and KRM) and Zone B (BKM and MTM) as shown in Table 4.6-2.

Table 4.6-2 Overall Facility Plan under the Umbrella Concept

Facilities		Descriptions
ZONE A – KMC, LSMC and KRM		
1	Sisdol LF	
	(1) Valley 1	Valley 1 will be operated for about 12-14 months
	(2) Valley 2	Valley 2 to be developed and operated for about 12 months
	(3) Post closure	Upon completion of disposal operations at Sisdol proper site closure will be implemented and environmental monitoring will continue until as required
2	Bagmati River Dumping Site	Bagmati River dumping site will cease operation once the new transfer trucks arrive (around Oct. 2005) and all the waste is transported to Sisdol LF. For a couple of years thereafter, safe closure works will be implemented along the Bagmati River banks where waste has been deposited.
3	Banchara Danda L/T-LF	This LF is expected to be developed within the next three years. It will be operated as a Level 3, semi-aerobic landfill.
4	West WPF	A WPF, basically for compost production but that will also include recyclable materials separation facilities to be developed west of KMC and LSMC and within 7-10 Km distance. The facility will be developed in three phases, starting with an input capacity of 100 t/d and reaching 300 t/d. Residues will be transported from the plant to the landfill
5	Teku T/S	Teku T/S has been improved with a capacity of 200 t/d (40 t at peak hour). Tipping at the station will continue to be mixed with some loading by wheel loaders.
6	Balaju T/S	Balaju T/S will be developed on the allocated land within 2006. It will be a split level unloading system without compaction. It will have a capacity of 120 t/d.
7	Afadole Temporary T/S	For the first 2-3 years of the Action Plan period, a temporary T/S will be developed for LSMC waste at Afadole. Upon completion of the waste processing facility the LSMC waste will be transported there.

Facilities		Descriptions
Zone B – BKM and MTM		
1	Hanumante River dumping site	For the next 2-3 years waste will continue to be dumped at Hanumante River bank, with the application of cover soil.
2	MTM temporary LF	The solid waste collected in the central area will be transported to Teku T/S, while remaining waste will be disposed of a temporary landfill with the application of cover soil.
3	Taikabu LF	The Taikabu LF will be developed within the next 2-3 years as a Level 3, semi-aerobic landfill.
4	Taikabu WPF	Within the same Taikabu LF site, a compost plant will also be developed. The plant will have an initial capacity of 10 t/d and expand to 15 t/d.

Source: JICA Study Team

4.6.4 Facility Operation Schedule and Cost Estimation

Bearing in mind that Sisdol LF has a short life of around 3 years, the operation schedule for the facilities has been prepared. Figure 4.6-2 shows the operation schedule, while the estimated costs for the period of 2005 to 2015 are shown in Table 4.6-3.

YEAR		Short-term			Mid-term		Long-term				
		2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
ZONE A - KMC, LSMC and KRM											
1	Sisdol S/T-LF										
	(1) Valley 1										
	(2) Valley 2										
2	Banchare Danda L/T Sanitary LF										
3	West Waste Processing Facility										
	(1) Phase 1 (100 t/d)										
	(2) Phase 2 (200 t/d)										
	(3) Phase 3 (300 t/d)										
4	Teku T/S										
5	Balaju T/S										
6	LSMC Temporary T/S (Afadole)										
ZONE B - BKM and MTM											
1	Hanumante River Dumping Site (BKM)										
2	Temporary LF (MTM)										
3	Taikabu LF										
4	Taikabu WPF										
	(1) Phase 1 (10 t/d)										
	(2) Phase 2 (15 t/d)										

Figure 4.6-2 Operation Schedule of Overall Facility in the Kathmandu Valley

Source: JICA Study Team

Table 4.6-3 Estimated Costs of the Facility Plan (million Rs)

SN	Facility	Investment Costs
1	Improvement/Development of Transfer Station	
	1.1 Teku T/S (Improvement)	2.0
	1.2 Balaju T/S	44.2
	1.3 Afadol Temporary T/S	19.7
	Sub-total 1	65.9
2	Development of Waste Processing Facility	
	2.1 West WPF (including equipment)	219.8
	2.2 Taikabu WPF (including equipment)	80.2
	Sub-total 2	300.0
3	Development/Closure of Landfill	
	3.1 Sisdol LF (Closure of Valley I and development of Valley II)	26.4
	3.2 Banchare Danda LF (including equipment)	906.1
	3.3 Taikabu LF (including equipment)	272.0
	Sub-total 3	1,204.5
4	Closure of Dumping Site	
	4.1 Bagmati River dumping site (Closure)	5.0
	4.2 Hanumante River dumping site (Closure)	0.5
	4.3 MTM temporary LF (Closure)	0.2
	Sub-total 4	5.7
	TOTAL	1,576.1

Source: JICA Study Team

4.7 Overall Equipment Procurement Plan in the Kathmandu Valley

4.7.1 Basic Concept of Overall Equipment Procurement Plan

The equipment to be procured for implementing the OFP is mainly divided into the equipment for secondary transportation, LF operation, T/S operation, WPF operation and there is maintenance for that equipment.

Considering that operation has already commenced at Sisdol S/T-LF, the first priority should be given to the procurement of secondary transportation equipment because no suitable large-capacity vehicles are presently available for effective operation. As for the equipment for landfill operation, the current equipment may be utilized in Sisdol S/T-LF. Therefore, the immediate priority for procurement of this equipment is a little bit lower than for the secondary transportation vehicles, although in the near future replacement of that aging equipment will be necessary.

4.7.2 Secondary Transportation Vehicle

The total transportation requirement increases explosively up to about 9,000 ton-km per day when the Sisdol S/T-LF starts accepting all collected waste from KMC and LSMC. The requirement then decreases step by step by shortening the transportation distance or reducing the waste quantity by each facility's operation as shown in Figure 4.7-1. From the second quarter of 2007, the upper curve shows the ton.km produced in case of Banchare Danda LF

while the lower graph depicts the ton.km in case of Pharsidol North LF. In the case of Banchare Danda LF, 25 secondary transportation vehicles (STVs) are required.

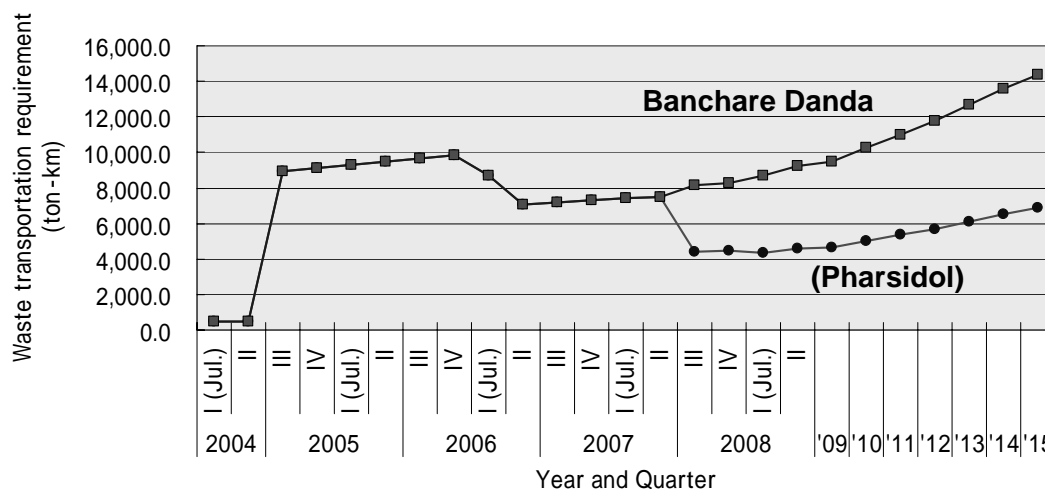


Figure 4.7-1 Future Projection of Transportation Requirement

Source: JICA Study Team

4.7.3 Heavy Equipment for Landfill and Transfer Station Operation

The equipment available in KMC and LSMC and required for the landfills to be developed under the OFP, such as compactor (one unit), dozers (two units) and excavator (one unit), are very old and were procured over 16 years ago (with the exception of one dozer procured over 9 years ago). On the other hand wheel loaders, required for the transfer stations and WPFs are relatively new and may be used in the new facilities to be developed under the OFP. Therefore, KMC and LSMC should concentrate on procurement of dozer and compactor for the landfills.

4.7.4 Workshop Equipment

Daily or regular maintenance and minor repair work of light vehicles such as tractor trailer and tippers are implemented at the KMC mechanical workshop, while repair or maintenance work for large vehicles or heavy equipment are carried out outside. However, because the LSMC mechanical workshop is not adequate to maintain all vehicles and equipment, some major maintenance work for LSMC should be considered to be entrusted to KMC. As for STVs, as special devices such as hydraulic parts are not available at the KMC workshop, such special work may be entrusted to the private sector or the STV manufacturers.

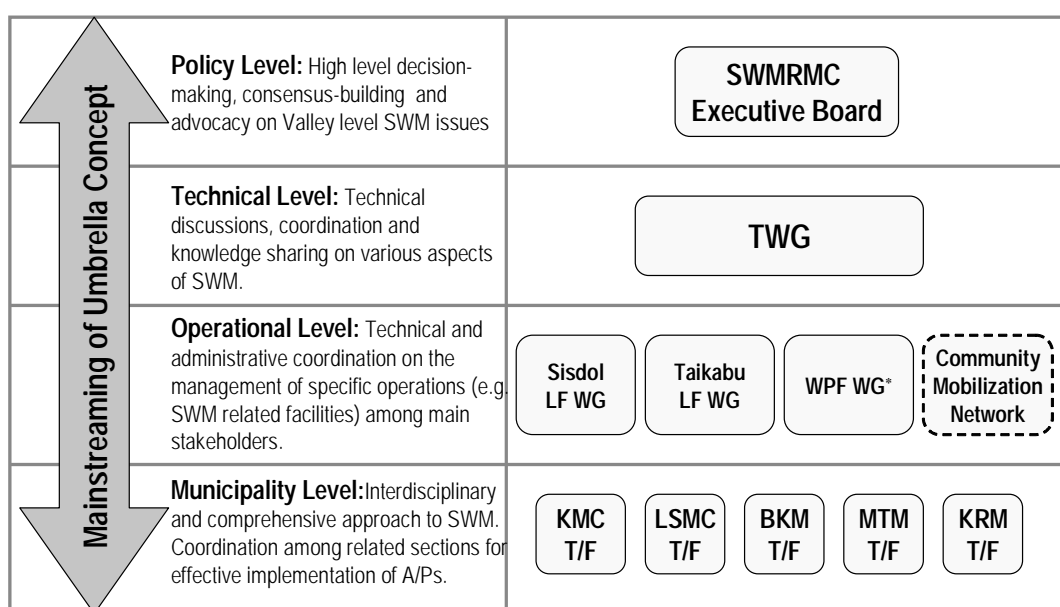
4.8 Basic Concept for Organizational and Institutional Arrangement

Institutionalization of the Umbrella Concept is critical in ensuring the sustainability of its operation, and subsequently its implementation. It is worthy to highlight those issues of

lack of institutional mandates and unclear demarcation of responsibilities among SWMRMC, KMC, and LSMC that are some of the major constraints that lead astray policy dialogue on SWM for over a decade. The principles of the Basic Concept for Organizational and Institutional Arrangement for the Umbrella Concept are:

- Institutional/organizational arrangements should build on existing organizational set up.
- There should be clarity in the mandate and terms of reference for each of the institutions.
- Linkages among various levels of institutions should be identified.
- The specific role and mandate of SWMRMC should be determined.

The basic concept is conceptualized in Figure 4.8-1. Institutional and organizational arrangement is divided into four levels, each with specific significance in guaranteeing the smooth implementation of the Umbrella Concept.



* In case of adoption of public-private partnership approach in development and operation of WPF, this WG will be responsible for Supervision and Management of operations.

Figure 4.8-1 Basic Concept for Institutional and Organizational Arrangement as Umbrella Concept

Source: JICA Study Team

For not only monitoring the implementation of the Umbrella Concept but also preparing the A/Ps based on reliable data, formulation of the solid waste data management system should be quite crucial with the following Basic Concept.

- At the commencement stage, a semi-manual system should be introduced, and then it will be gradually upgraded to an online system or other advanced system
- Each municipality and SWMRMC should modify the common database program based on the data that should be managed respectively
- The data at each municipality should be finally concentrated at SWMRMC to monitor the overall SWM progress and to prepare the SWM white paper

4.9 Basic Concept for Financial Arrangement

4.9.1 Estimated Cost to be Allocated for Umbrella Concept

Costs for the Umbrella Concept consist of investment cost and incremental operation and maintenance (O&M) cost which are estimated separately by each zone and summarized in Table 4.9-1. The total cost until FY2014/15 is estimated at Rs 2,559 million; consisting of Rs 1,742 million on investment and Rs 817 million on incremental O&M.

Table 4.9-1 Estimated Cost for the Umbrella Concept (million Rs)

Cost Items	Zone	2005/06 (2062/63)	2006/07 (2063/64)	2007/08 (2064/65)	2008/09 (2065/66)	2009/10 (2066/67)	2010/11 (2067/68)	2011/12 (2068/69)	2012/13 (2069/70)	2013/14 (2070/71)	2014/15 (2071/72)	Total
I. Investment Cost	A	129.0	859.4	141.2	78.8	89.1	18.4	0.0	17.6	13.0	5.0	1351.5
	B	298.3	34.1	18.0	3.8	2.1	3.2	6.4	24.5	0	0	390.4
	Total	427.3	893.5	159.2	82.6	91.2	21.6	6.4	42.1	13.0	5.0	1,742.0
1. Collection & Transportation	A	6.3	59.9			33.8	7.2		8.4		5.0	120.5
	B			17.7	3.8	2.1	3.2	6.4	4.3			37.5
	Total	6.3	59.9	17.7	3.8	36.0	10.4	6.4	12.6	0	5	158.1
2. Transfer Station	A	65.9										65.9
	B											0
	Total	65.9	0	0	0	0	0	0	0	0	0	65.9
3. Waste Processing Facility	A	14.3	150.4		45.9				9.2			219.8
	B	80.2										80.2
	Total	94.5	150.4	0	45.9	0	0	0	9.2	0	0	300.0
4. Landfill (including closure works)	A	34.8	649.1	141.2	32.9	55.3	11.2			13.0		937.6
	B	218.1	34.1	0.3					20.2			272.7
	Total	252.9	683.2	141.5	32.9	55.3	11.2	0	20.2	13.0	0	1210.2
5. Workshop	A	7.8										7.8
	B											0
	Total	7.8										7.8
II. Incremental O & M Cost	A	45.5	56.1	59.2	74.7	78.2	70.2	77.2	78.7	72.1	75.0	686.8
	B	2.8	9.7	13.9	14.7	15.4	14.4	14.8	15.2	14.6	15.2	130.6
	Total	48.3	65.8	73.0	89.4	93.7	84.6	92.0	93.9	86.7	90.1	817.5
1. Collection & Transportation	A	27.8	36.8	43.2	58.7	63.9	57.0	63.6	67.1	60.1	63.0	541.1
	B	2.3	2.6	6.8	7.7	8.4	7.7	8.0	8.5	7.9	8.4	68.2
	Total	30.0	39.4	50.0	66.4	72.2	64.7	71.6	75.6	68.0	71.4	609.3
2. Transfer Station	A	3.2	4.9	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	36.5
	B											0.0
	Total	3.2	4.9	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	36.5
3. Waste Processing Facility	A			-1.6	-1.6	-3.3	-3.3	-3.3	-4.9	-4.9	-4.9	-27.9
	B		-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-5.6
	Total	0	-0.6	-2.3	-2.3	-3.9	-3.9	-3.9	-5.5	-5.5	-5.5	-33.5
4. Landfill	A	12.4	12.4	12.0	12.0	12.0	12.0	12.4	12.0	12.4	12.4	122.3
	B	0.0	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	64.3
	Total	12.4	19.6	19.2	19.2	19.2	19.2	19.6	19.2	19.6	19.6	186.6
5. Public Awareness /Community Mobilization	A	1.8	1.8	1.8	1.8	1.8	0.9	0.9	0.9	0.9	0.9	13.5
	B	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	3.0
	Total	2.2	2.2	2.2	2.2	2.2	1.1	1.1	1.1	1.1	1.1	16.5
6. Institutional/ Organizational Strengthening	A	0.3	0.3	0.3	0.3	0.3						1.3
	B	0.2	0.2	0.2	0.2	0.2						0.8
	Total	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	2.0
III. Total (= I + II)	A	174.5	915.5	200.4	153.5	167.3	88.6	77.2	96.3	85.1	80.0	2038.3
	B	301.1	43.8	31.8	18.5	17.6	17.6	21.2	39.7	14.6	15.2	521.1
	Total	475.6	959.3	232.2	172.0	184.9	106.2	98.4	136.0	99.7	95.1	2559.4

Source: JICA Study Team

4.9.2 Concept for Cost Sharing Among the Organizations Concerned

(1) Concept for Cost Sharing between Municipality and Government

The municipalities are continuously facing financial difficulties because the revenue amount is not enough to satisfy the increasing costs of municipality services. In addition, the

municipalities may face serious financial problems when the Local Development Tax fades out by December 2013. Although KMC and LSMC have started to strengthen their revenue systems, much remains to be done. Accordingly the Government (SWMRMC) is required to bear the costs for development of landfill, transfer station, waste processing facility and closure of LF. On the other hand, municipalities should bear the rest of the costs from their own revenues, i.e. equipment procurement and O&M costs. The costs for public participation and behavior change, and institutional and organizational arrangement should also be borne by the respective municipalities.

Consequently, the cost sharing concept under the Umbrella Concept is summarized as shown in Table 4.9-2, but external financial support may be expected for some areas.

Table 4.9-2 Cost Sharing Concept under the Umbrella Concept

Action Plan	Component	Municipality	Government	Ref: External Sources
Transport & Haulage	Vehicles and Container Carrier	Full	-	Expected
	Container	Full	-	-
	O&M	Full	-	-
Transfer Station	Construction	-	Full	-
	Improvement works	-	Full	-
	Equipment	Full	-	Expected
	O&M	Full	-	-
Compost Plant	Land acquisition	-	Full	-
	Construction	-	Full	-
	Equipment	Full	-	Expected
	O&M	Full	-	-
Landfill	Land acquisition	-	Full	-
	Construction	-	Full	Expected
	Equipment	Full	-	Expected
	Closure	-	Full	-
	O&M	Full	-	-
Workshop	Facilities	Full	-	-
	Machinery & equip.	Full	-	-
Public Awareness/community mobilization		Full	-	-
Institutional/organizational strengthening		Full	-	-

Note: Full means full share, and Expected means financial aid to be expected

Source: JICA Study Team

Based on the above concept, the costs to be shared by SWMRMC and the municipalities can be estimated as shown in Table 4.9-3. SWMRMC should bear 56% of the total cost, while 44% should be borne by the municipalities.

Table 4.9-3 Costs for SWMRMC and Municipalities (million Rs)

Zone	Activities	SWMRMC	Municipalities		
		Facilities	Equipment	O&M	Total
A	Transportation	-	120.5	541.1	661.6
	Transfer Station	65.8	-	36.5	36.5
	WPF	203.8	16.0	-27.9	-11.9
	Landfill	892.4	45.2	122.3	167.5
	Workshop	-	7.8	-	7.8
	Public Awareness	-	-	13.5	13.5
	Institutional	-	-	1.3	1.3
	Total	1,162.0	189.5	686.8	876.3
B	Transportation	-	37.5	68.2	105.7
	WPF	38.2	42.0	-5.6	36.4
	Landfill	218.8	53.9	64.3	118.2
	Public Awareness	-	-	3.0	3.0
	Institutional	-	-	0.8	0.8
		Total	257.0	133.4	130.7
	Total	1,419.0	322.9	817.5	1,140.4

Source: JICA Study Team

(2) Concept for Cost Sharing among the Municipalities

In principle, equipment procurement cost and incremental O&M cost become burdens on municipalities. Each municipality has to bear the cost originally generated by the municipality itself. Meanwhile, the costs generated by joint work among municipalities should be principally discussed and decided among the municipalities concerned. However, the costs generated by joint work is proposed to be separated to each municipality concerned on the basis of solid waste amount transported from the municipality to the destinations of transfer station, WPF and landfill.

4.9.3 Concept for Necessary Financial Procurement of Each Municipality

Judging from the actual financial capacity of municipalities, it is difficult to expect municipalities to cover the entire costs. The municipalities need to develop sources of funds as follows:

- 1) Enhancement of revenue generation capability especially on Property Tax
- 2) Utilization of the Reserve Fund
- 3) Other alternatives
 - Introduction of Public Private Partnership on SWM to reduce the SWM cost
 - Introduction of new charges on SWM services

CHAPTER 5 ACTION PLAN ON SOLID WASTE MANAGEMENT OF LALITPUR SUB-METROPOLITAN CITY

5.1 Solid Waste Stream for Action Plan

The most elementary but indispensable process to develop the Action Plan (A/P) on solid waste management is “to clarify the solid waste stream” as well as “to clarify the solid waste amount”. Under the Umbrella Concept for the solid waste management in the Kathmandu Valley, there are some remarkable turning points, i.e. facilities development such as waste processing facilities and long-term landfill sites, up to the target year of 2015, which should be taken into consideration in preparation of waste stream flow. In order to formulate the A/P, solid waste flow of LSMC was prepared as per attached in Appendix 2. The waste management ratios were set as main targets of the A/Ps based on the solid waste stream flows.

5.2 Vision and Target

The vision of LSMC is determined as

“Clean city through efficient management of waste collection on streets, public places and households [by the means of involvement of private sectors as maximum as possible to make the municipal resources sustainable in long run and let make the city dwellers feel responsible more aware on city cleanliness & environment, finally make them realization of polluters pay principle]”.

As for the target, LSMC have adopted management ratio in terms of quantity as an OVI aiming to reduce the amount of unmanaged waste as shown in Table 5.2-1.

Table 5.2-1 Target of LSMC

Present Situation	Target		
	Short-term	Mid-term	Long-term
	C: 2005/06 – 2007/08	2008/09 – 2010/11	2011/12 – 2014/15
	N: 2062/63 – 2064/65	2065/66 – 2067/68	2067/68 – 2071/72
Management ratio (amount) : 70% (52 t/d)	Management ratio (amount) : 80% (70 t/d)	Management ratio (amount) : 85% (88 t/d)	Management ratio (amount) : 90% (121 t/d)

Source: LSMC Task Force

5.3 Approaches, Strategies and Necessary Activities

The approaches, strategies and necessary activities established by LSMC are shown in Table 5.3-1 and implementation schedule of short-term activities is shown in Table 5.3-2.

Table 5.3-1 Strategies and Necessary Activities (LSMC)

Approaches	Strategies	Necessary Activities		
		Short-term (2005/06-2007/08)	Mid-term (2008/09-2010/11)	Long-term (2011/12 – 2014/15)
		(2062 Shrawan – 2065 Ashadh)	(2065 Shrawan – 2068 Ashadh)	(2068 Shrawan – 2072 Ashadh)
A. Improvement of Collection and Transportation	A-1: Promotion of private sector collection	A-1-S1: Review of existing policy of LSMC and establishment of strong bylaws (and rules) interacting with all stakeholders and its publication (focus on private sector involvement, paying system and assurance of municipal sweeper's job guarantee while handing over to private sector) A-1-S2: Preparation of standard TOR and agreement for PPP concept A-1-S3: Introduction of a new pilot project for waste collection from shops by private sector A-1-S4: Newly introduction of door to door collection for 25% houses at the outside the city core area by private sector (by the end of 2007)	A-1-M1: Revision of rules for private sector based on the short-term activities (from pilot projects). A-1-M2: Development of effective account system to control revenue from private sector to office A-1-M3: Expansion of pilot projects in other areas of city with correction of weakness. A-1-M4: 50 % door to door collection by private sector (Some municipal old vehicles to be handed over to private sector under leased TOR) A-1-M5: Preparation of a plan for private sector transportation (PPP as an alternative)	A-1-L1: Revision of rules for private sector based on the mid-term activities. A-1-L2: 70 % door to door collection by private sector A-1-L3: Initiation of transportation of collection points to transfer station by private sector
	A-2: Improvement of collection and transportation system	A-2-S1: Implementation of Time and Motion study A-2-S2: Introduction of new collection routes. A-2-S3: Implementation of transportation and maintenance cost analysis A-2-S4: Implementation of vehicle capacity analysis and plan for procurement of new vehicles	A-2-M1: Continuous review and improvement of collection and transportation system	A-2-L1: Continuous review and improvement of collection and transportation system
	A-3: Arrangement of a temporary transfer station	A-3-S1: Arrangement of a temporary transfer station (in Afadole) and commencement of temporary transferring	A-3-M1: Closure of the temporary transfer station	
B. Promotion of Waste Minimization	B-1: Development of a waste processing facility (WPF)	B-1-S1: Cooperation with SWMRMC and KMC for development of WPF (development, commencement of operation)	B-1-M1: Transportation of waste to WPF	
	B-2: Promotion of home composting activities	B-2-S1: Distribution of 1,200 home compost bins	B-2-M2: Distribution of 1,200 home compost bins	B-2-L1: Distribution of 1,200 home compost bins
	B-3 Promotion of 3Rs practices	B-3-S1: Promotion of 3Rs practices by local people	B-3-M1: Promotion of recycle centers at community level and individual level for minimization of waste at source. B-3-M2: Establishment of bulky waste recycling system by promoting establishment of second hand shops	B-3-L1: Establishment of recycle centers for 3Rs with PPP concept for waste pickers and promotion of plastic bag and paper recycling B-3-L2: Establishment of a medium-scale recycle centre near T/S.
C. Improvement of Final Disposal System	C-1: Operation of sanitary landfill site	C-1-S1: Operation of Sisdol LF with KMC C-1-S2: Cooperation with SWMRMC and KMC for development of long term landfill site C-1-S3: Closure of Bagmati dumping site	C-1-M1: Operation of Sisdol sanitary landfill site with KMC C-1-M2: Continuous coordination with SWMRC and KMC for development of long term landfill site	C-1-L1: Operation of long term landfill site
D. Promotion of Public Participation and Behavior Change	D-1: Implementation of mass communication and education	D-1-S1: Implementation of public awareness/education activities - Regular mechanism for awareness materials. Journal publication, drama, community interactions, reward, prize, visit, observation, establishment of SWM day.	D-1-M1: Continuous implementation of public awareness/education activities - Regular mechanism for awareness materials. Journal publication, drama, community interactions, reward, prize, visit, observation, establishment of SWM day.	D-1-L1: Continuous implementation of public awareness/education activities - Regular mechanism for awareness materials. Journal publication, drama, community interactions, reward, prize, visit, observation, establishment of SWM day.
	D-2: Formulation and mobilization of various groups for SWM	D-2-S1: Formation and mobilization of Ward Environment Conservation Committee (WECC) on a pilot basis D-2-S2: Formation and mobilization of Nature/Eco Clubs among children D-2-S3: Mobilization of youth as City Volunteers (CVs) D-2-S4: Strengthening of women groups for SWM	D-2-M1: Formation of 44 community groups in some wards for awareness raising and composting focusing on child education involving retired persons. Community development section will handle these groups	D-2-L1: Formation of 100 community groups in all wards for awareness raising and composting focusing on child education involving retired persons

Approaches	Strategies	Necessary Activities		
		Short-term (2005/06-2007/08)	Mid-term (2008/09-2010/11)	Long-term (2011/12 – 2014/15)
		(2062 Shrawan – 2065 Ashadh)	(2065 Shrawan – 2068 Ashadh)	(2068 Shrawan – 2072 Ashadh)
E. Organizational and Institutional Arrangement	E-1: Implementation of HRD program	E-1-S1: Plan for HRD and monitoring including municipal staff/NGOs/CBOs/TLOs	E-1-M1: Proper available HRD management and monitoring. Establishment of motivating working environment.	E-1-L1: Establishment of HRD and Database Section in SWM division
	E-2: Preparation of annual work plan on SWM	E-2-S1: Announcement of SWM overall yearly plan of LSMC at beginning of each fiscal year.	E-2-M1: Announcement of SWM overall yearly plan of LSMC at beginning of each fiscal year.	E-2-L1: Announcement of SWM overall yearly plan of LSMC at beginning of each fiscal year.
	E-3: Clarification of responsibility and promotion of coordination between SWM relating divisions and sections	E-3-S1: Review of SWM organization (Environment Dept.) and appoint responsible persons as a focal point to coordinate all dimensions of SWM with motivating environment	E-3-M1: Review of responsibility overlaps and decision-making simplification. E-3-M2: Establishment of 24 hr hot line for receiving complains	
	E-4: Setting up tariff system	E-4-S1: Implementation of study on tariff system to introduce paying system	E-4-M1: Revision of effectiveness of paying system. Review of tariff. Make punishment system.	E-4-L1: “Enact Municipal SWM law” from national government. E-4-L2: Preparation of municipal ordinance E-4-L3: Dissemination of those laws and ordinance to public, TLOs and NGOs
	E-5: Management of solid waste database system	E-5-S1: Collection and arrangement of solid waste data in database E-5-S2: Implementation of waste quantity and quality survey twice a year (wet and dry seasons)	E-5-M1: Continuous arrangement of solid waste data by database system E-5-M2: Continuation of implementation of waste quantity and quality surveys twice a year (wet and dry seasons)	E-5-L1: Continuous arrangement of solid waste data by database system E-5-L2: Continuity of waste quantity and quality surveys twice a year (wet and dry seasons).
F. Others	F-1: Promotion of special waste management system	F-1-S1: Examination of medical waste treatment system	F-1-M1: Establishment of a common and centre level medical waste treatment facility (incinerator)	F-1-L1: Effective use of medical waste treatment system.

Source: LSMC Task Force

Table 5.3-2 Implementation Schedule of Short-Term Activities (LSMC)

Strategies	Short-Term Activities	Responsible Division and Section	Related Organizations (Division, Section, NGO/CBO)	2005/2006				2006/2007				2007/2008			
				I (July 16)	II	III	IV (July 16)	I (July 17)	II	III	IV (July 16)	I (July 17)	II	III	IV (July 15)
				2062/2063				2063/2064				2064/2065			
				Shrawan			Ashadh	Shrawan			Ashadh	Shrawan			Ashadh
A-1 Promotion of private sector collection	A-1-S1: Review of existing policy of LSMC and establishment of strong bylaws (and rules) interacting with all stakeholders and its publication (focus on private sector involvement, paying system and assurance of municipal sweeper's job guarantee while handing over to private sector)	Environment Sec.	private sector	█											
	A-1-S2: Preparation of standard TOR and agreement for PPP concept	TDD	Environment Sec. private sector	█		● Signing		● Signing				● Monitoring			Monitoring ●
	A-1-S3: Introduction of a new pilot project for waste collection from shops by private sector	Environment Sec.	NGOs	█											
	A-1-S4: Newly introduction of door to door collection for 25% houses at the outside the city core area by private sector (by the end of 2007)	Environment Sec.	TDD, private sector			█									
A-2 Improvement of collection and transportation system	A-2-S1: Implementation of Time and Motion study	Environment Sec.		█											
	A-2-S2: Introduction of new collection routes.	Environment Sec.	private sector				█					█			█
	A-2-S3: Implementation of transportation and maintenance cost analysis	Environment Sec.	SWMRMC	█											
	A-2-S4: Implementation of vehicle capacity analysis and plan for procurement of new vehicles	Environment Sec.	SWMRMC			█									
A-3 Arrangement of a temporary transfer station	A-3-S1: Arrangement of a temporary transfer station (in Afadole) and commencement of temporary transferring	PWD	Environment Sec., SWMRMC, Ward offices	Public consultation █	Survey, Design, Budgeting █			Construction █		Operation █					
B-1 Development of a waste processing facility (WPF)	B-1-S1: Cooperation with SWMRMC and KMC for development of WPF	PWD	Environment Sec., SWMRMC, KMC, KRM	Planning, EIA, Land acquisition █				Construction █				Operation █			

Strategies	Short-Term Activities	Responsible Division and Section	Related Organizations (Division, Section, NGO/CBO)	2005/2006				2006/2007				2007/2008					
				I (July 16)	II	III	IV (July 16)	I (July 17)	II	III	IV (July 16)	I (July 17)	II	III	IV (July 15)		
				2062/2063				2063/2064				2064/2065					
				Shrawan			Ashadh	Shrawan			Ashadh	Shrawan			Ashadh		
B-2 Promotion of home composting activities	B-2-S1: Distribution of 1,200 home composting bins	Environment Sec., CDS	PWD, NGOs/CBOs		●		●										
B-3 Promotion of 3Rs practices	B-3-S1 Promotion of 3Rs practices by local people	CDS	Environment Sec.														
C-1: Utilization of SLF	C-1-S1: Operation of Sisdol LF with KMC	PWD	Environment Sec., SWMRMC, KMC														
	C-1-S2: Cooperation with SWMRMC and KMC for development of long term landfill site	PWD	Environment Sec., SWMRMC, KMC														
	C-1-S3: Closure of Bagmati dumping site	PWD	Environment Sec., SWMRMC, KMC														
D-1: Implementation of mass communication and education	D-1-S1: Implementation of public awareness/education activities - Regular mechanism for awareness materials. Journal publication, drama, community interactions, reward, prize, visit, observation, establishment of SWM day.	CDS	Environment Sec., mass media														
D-2: Formulation and mobilization of various groups for SWM	D-2-S1: Formation and mobilization of Ward Environment Conservation Committee (WECC) on a pilot basis	CDS	Environment Section, ward offices, CBOs in LSMC														
	D-2-S2: Formation and mobilization of Nature/Eco Clubs among children	CDS	Environment Section, City Level Project Planning Section, ward offices, NGOs														
	D-2-S3: Mobilization of youth as City Volunteers (CVs)	CDS	Environment Section, ward offices, NGOs (resource persons)														
	D-2-S4: Strengthening of women groups for SWM	CDS	Environment Section, ward offices, NGOs (resource persons)				●					●					●

Strategies	Short-Term Activities	Responsible Division and Section	Related Organizations (Division, Section, NGO/CBO)	2005/2006				2006/2007				2007/2008				
				I (July 16)	II	III	IV (July 16)	I (July 17)	II	III	IV (July 16)	I (July 17)	II	III	IV (July 15)	
				2062/2063				2063/2064				2064/2065				
				Shrawan			Ashadh	Shrawan			Ashadh	Shrawan			Ashadh	
E-1: Implementation of HRD program	E-1-S1: Plan for HRD and monitoring including municipal staff/NGOs/CBOs/TLOs	Task Force														
E-2 Preparation of Annual work plan on SWM	E-2-S1: Announcement of SWM overall yearly plan of LSMC at beginning of each fiscal year.	Task Force														
E-3: Clarification of responsibility and promotion of coordination of SWM relating sections	E-3-S1: Review of SWM organization (Environment Dept.) and appoint responsible persons as focal points to coordinate all dimensions of SWM with motivating environment	CEO														
E-4: Setting up tariff system	E-4-S1: Implementation of study on tariff system to introduce paying system.	PWD														
E-5: Establishment and management of solid waste database system	E-5-S1: Collection and arrangement of solid waste data in database	Environment Sec.														
	E-5-S2: Implementation of waste quantity and quality survey twice a year (Summer and Winter)	Environment Sec.		● Survey		● Survey		● Survey		● Survey		● Survey		● Survey		
F-1: Promotion of special waste management system	F-1-S1: Examination of medical waste treatment system	PWD														

Legend
 : Continuous activities
 : Intermittent activities
 : Spot activities

PWD : Public Works Division
TDD : Town Development Division
CDS : Community Development Section

5.4 Financial Plan

As shown in Table 5.44-1, total SWM cost, summing up the current SWM cost and Action Plan cost, amounts to Rs.441 million over the period until the target year of 2014/15. On the other hand, total own revenue, summing up actual revenue and projected revenue increase, amounts to Rs.1,358 million. Thus, the ratio of total SWM cost to total own revenue results in 33%, which is higher than current ratio of 20% but not very much high when considering SWM being ranked as priority service of the municipality. Consequently, it is suggested that LSMC bears entire Action Plan cost to cope with growing demand on SWM service in the municipality.

**Table 5.4-1 Ratio of SWM Cost to Municipality Own Revenue (LSMC)
(million Rs)**

Items	2005/06 2062/6	2006/07 2063/6	2007/08 2064/6	2008/09 2065/6	2009/10 2066/6	2010/11 2067/6	2011/12 2068/6	2012/13 2069/7	2013/14 2070/7	2014/15 2071/7	Total
I. Own Revenue	119.7	126.5	133.8	139.0	144.9	144.6	141.7	138.8	135.9	133.0	1,358.0
1. Actual Revenue	113.4	113.4	113.4	113.4	113.4	113.4	113.4	113.4	113.4	113.4	1,134.0
2. Projected Revenue Increase	6.3	13.1	20.4	25.6	31.5	31.2	28.3	25.4	22.5	19.6	224.0
II. SWM Cost	26.5	49.6	41.2	45.0	43.9	45.5	44.0	51.3	46.5	48.1	441.5
1. Current SWM	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	220.0
2. Action Plan	4.5	27.6	19.2	23.0	21.9	23.5	22.0	29.3	24.5	26.1	221.5
III. Ratio (= II/I)	22%	39%	31%	32%	30%	31%	31%	37%	34%	36%	33%

Note: 1) Actual revenue is amount of FY 2004/05 which is assumed to continue the same amount, 2) Projected revenue increase consists of Local Development Fee, Gov. subsidy and Property Tax, 3) Current SWM cost is the cost presented in Chapter 3 which is assumed to continue the same amount.

Source: JICA Study Team

5.5 Monitoring and Evaluation Plan for Action Plans

The A/P is a long-term strategic plan to be implemented starting fiscal year 2005/06 (2062/63) to 2014/15 (2071/2072). In order to ensure that the Action Plan is implemented in an effective and sustainable manner, monitoring and evaluation systems need to be put in place that bind together both individual and collective achievements of SWMRMC and the five municipalities. Such systems should be installed both at the municipal level, as well as the Valley level, in line with the institutional arrangements as discussed under the Umbrella Concept.

In the case of the A/Ps, OVIs were identified with target for the year 2015. Through the implementation of the A/Ps, collectively, the municipalities and SWMRMC will aim to increase the total solid waste management rate from existing 76% to 93%. Each municipality's target, solid waste management ratio, is as specified within the respective A/Ps.

Monitoring: Monitoring of A/P implementation should be conducted at two levels. First, the solid waste management ratio should be calculated at individual municipalities, to measure the effectiveness of SWM activities as indicated in the targets of the respective A/Ps. It is suggested that each municipality's benchmark the target solid waste management ratio that they should achieve by the end of short, medium and long term activities of the A/Ps. Every three or four years, the actual percentage of the solid waste management rate should be measured against the benchmarked target ratio to assess progress.

The second level of monitoring of the A/Ps should be conducted when each municipality formulate their respective annual work plans, which in fact is a breakdown of activities as identified for short, medium, and long term. Based on the existing policy priorities, availability of resources, influences from external factors, and lessons learned from the past implementation of activities, the contents of A/Ps themselves should be reviewed and modified. This process should allow enough flexibility so that the activities stipulated in the A/Ps could be changed, dropped or added insofar as the overall effect of the SWM program would increase the solid waste management ratio. Furthermore, this exercise would serve to update the A/Ps so that it would enhance the relevance of the A/Ps for continued sustainability. The linkage between the Action Plan monitoring system and Annual Work Plan is as illustrated in Figure 5.5-1.

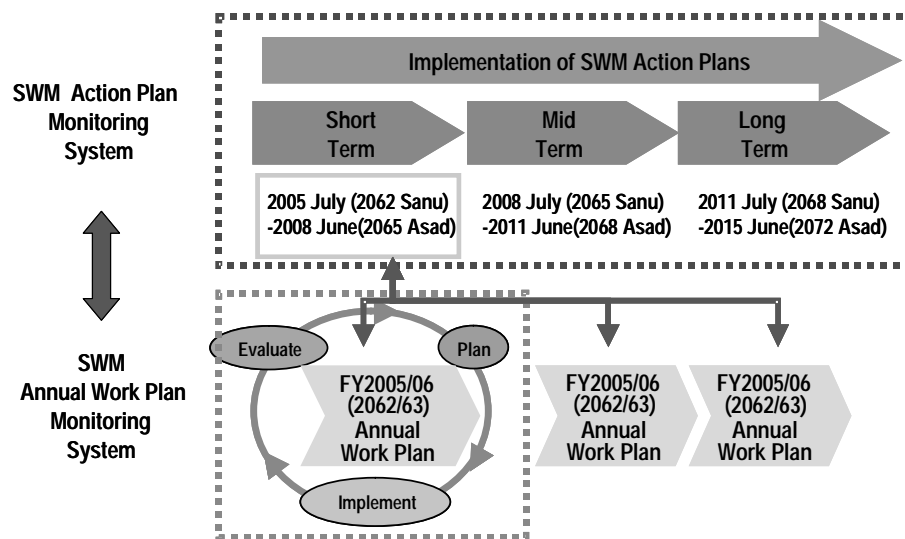


Figure 5.5-1 Linkage between Action Plan Monitoring System and Annual Work Plan

Source: JICA Study Team

Evaluation: During the benchmarked years of 2008 and 2011, which are also the final fiscal years within short and mid terms, respectively, end of term evaluations are recommended to holistically review the A/Ps implementation from the perspectives such as relevance, effectiveness, efficiency, impact and sustainability of municipal activities. In 2015, the final evaluation should be conducted to examine whether the ultimate target of 93% solid waste management ratio was achieved, and to draw best practices and lessons learned for future SWM programs.

For the end of term evaluations, it is envisaged that a joint evaluation team be formed for each municipality among the representatives from municipal T/Fs, SWMRMC, and MOLD. The results of the evaluations should be disclosed and shared with other municipalities at TWG and other forums so that the major lessons learned and recommendations could be shared with a wider audience.

APPENDICES

- APPENDIX 1 Members of Technical Working Group and Task Force
- APPENDIX 2 Solid Waste Stream Flow of LSMC (Current and Future)
- APPENDIX 3 Annual Work Plan of Fiscal Year of 2005/06 (2062/63)
Proposed by Task Force (LSMC)

APPENDIX 1

Members of Technical Working Group and Task Force

APPENDIX 1 MEMBER OF TECHNICAL WORKING GROUP AND TASK FORCE

Technical Working Group (Total 18 members)

As of July 20, 2005

Organizations	Name	Designation / Organizational Position
MOLD	Mr. Babu Ram Gautam (Mr. Prem Raj Giri up to Nov, 2004)	Under Secretary
SWMRMC	Mr. Surya Man Shakya (Chairperson up to June 23, 2005)	Former General Manager
	Mr. Ashok Shahi (Chair person after June 24, 2005)	Acting General Manager
	Mr. Ram Sharan Maharjan	Civil Engineer
	Mr. Nirmal Darshan Acharya	Civil Engineer
KMC	Mr. Rajesh Manandhar	Chief, Solid Waste Management Section
	Mr. Kiran Ulak	Engineer, Solid Waste Management Section
	Mr. Purusotam Shakya	Chief, Mechanical Section
LSMC	Mr. Rudra Prasad. Gautam	Chief, Public Works Division
	Mr. Pradeep Amatya	Chief, Environment and Sanitation Section
BKM	Mr. Laxman Kisiju	Chief, Planning and Technical Section
	Mr. Moti Bhakta Shrestha	Chief, Social Welfare & Sanitation Section
	Mr. Dinesh Rajbhandari	Sanitation Engineer, Planning and Technical Section
MTM	Mr. Satya Narayan Shah	Chief, Planning and Technical Section
	Ms. Krishna Kumari Shrestha	Assistant, Community Development and Sanitation Section
	Mr. Surendra Shrestha	Junior Engineer, Planning and Technical Section
KRM	Mr. Anuj Pradhan	Chief, Solid Waste Management Unit
	Mr. Gyan Bazra Maharjan	Assistant, Solid Waste Management Unit/Accounting

Task Force of LSMC (Total 8 members)

As of July 20, 2005

Name	Designation / Organizational Position
Mr. Komal Prashad Kafle	CEO
Mr. Rudra Prasad Gautam	Chief, Public Works Division
Mr. Pradeep Amatya	Section Chief, Environment and Sanitation Section
Mr. Prabin Shrestha	Division Chief, Town Development Division
Mr. Mukunda Ranjit	Overseer, Environment Section
Mr. Ashok Shrestha	Division Chief, Administrative Division
Ms. Laxmi Prasad Rajbhandari	Section Chief, Community Development Section
Ms. Sabina Maharjan	Community Development Section

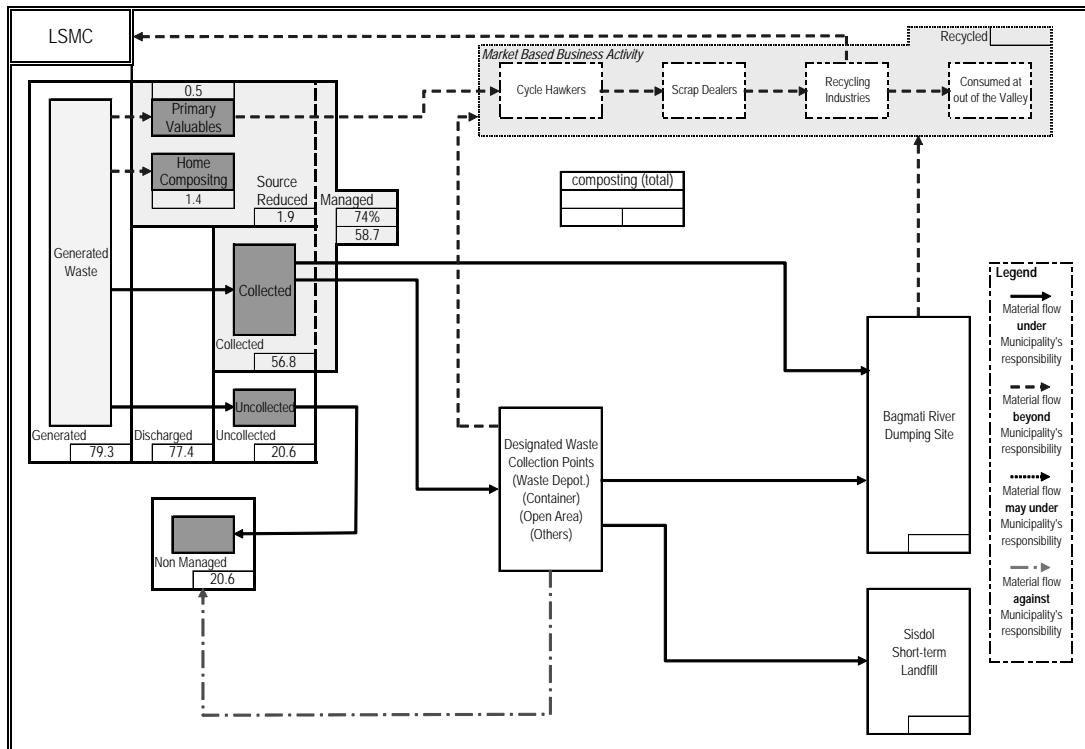
APPENDIX 2

Solid Waste Stream Flow of LSMC (Current and Future)

APPENDIX 2 SOLID WASTE STREAM FLOW OF LSMC (CURRENT AND FUTURE)

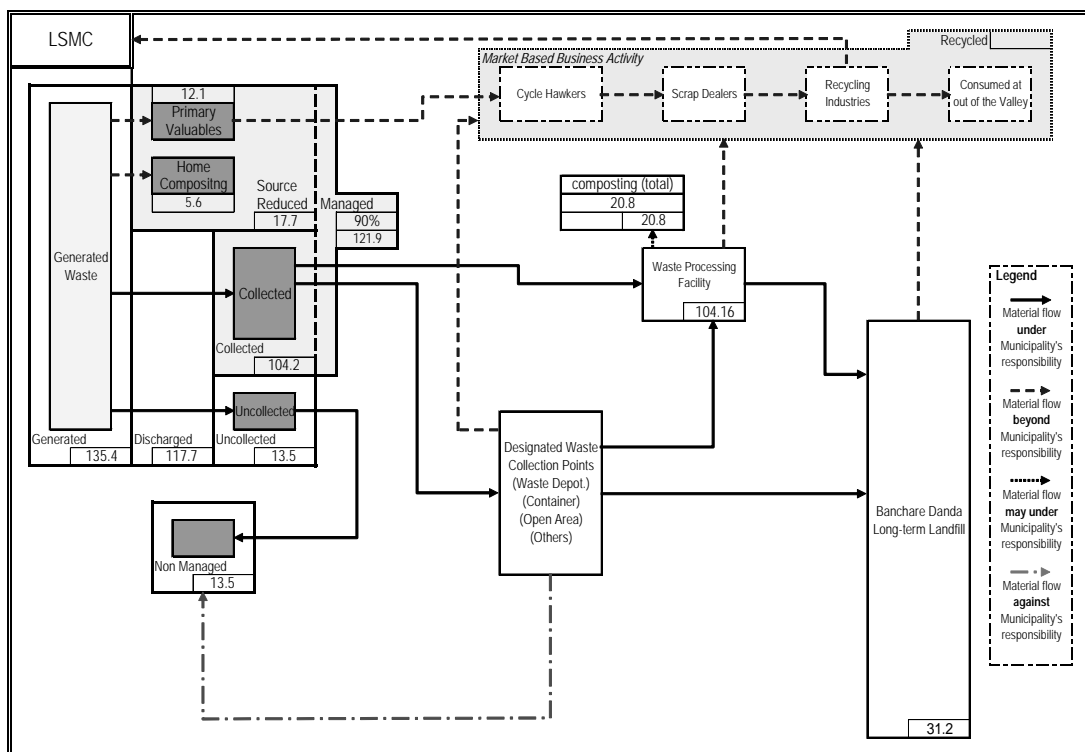
Existing Solid Waste Stream (2005)

Unit: t/day



Future Solid Waste Stream (2015)

Unit: t/day



APPENDIX 3

***Annual Work Plan of
Fiscal Year of 2005/06 (2062/63)
Proposed by Task Force (LSMC)***

