MINISTRY OF LOCAL DEVELOPMENT
HIS MAJESTY'S GOVERNMENT OF NEPAL

JAPAN INTERNATIONAL
COOPERATION AGENCY

ACTION PLAN
ON
SOLID WASTE MANAGEMENT

September 2005

Kirtipur Municipality

Action Plan on Solid Waste Management of Kirtipur Municipality

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Abbreviations

<Organizations>

BKM	Bhaktapur Municipality
CBO	Community Based Organization
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
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
CEO	Chief Executive Officer
CKV	Clean Kathmandu Valley
CRC	Community Recycling Center
CSO	Civil Society Organization
EIA	Environmental Impact Assessment
FY	Fiscal Year

HH	Household
HRD	Human Resource Development
LF	Landfill
L/T	Long-term
LFS	Landfill site
M&E	Management and Evaluation
OFP	Overall Facility Plan
OVI	Objectively Verifiable Indicators
PSO	Private Sector Organization
PPP	Public-Private Partnership
PR	Public Relations
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 2060[1]) 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 ratios[2] 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.

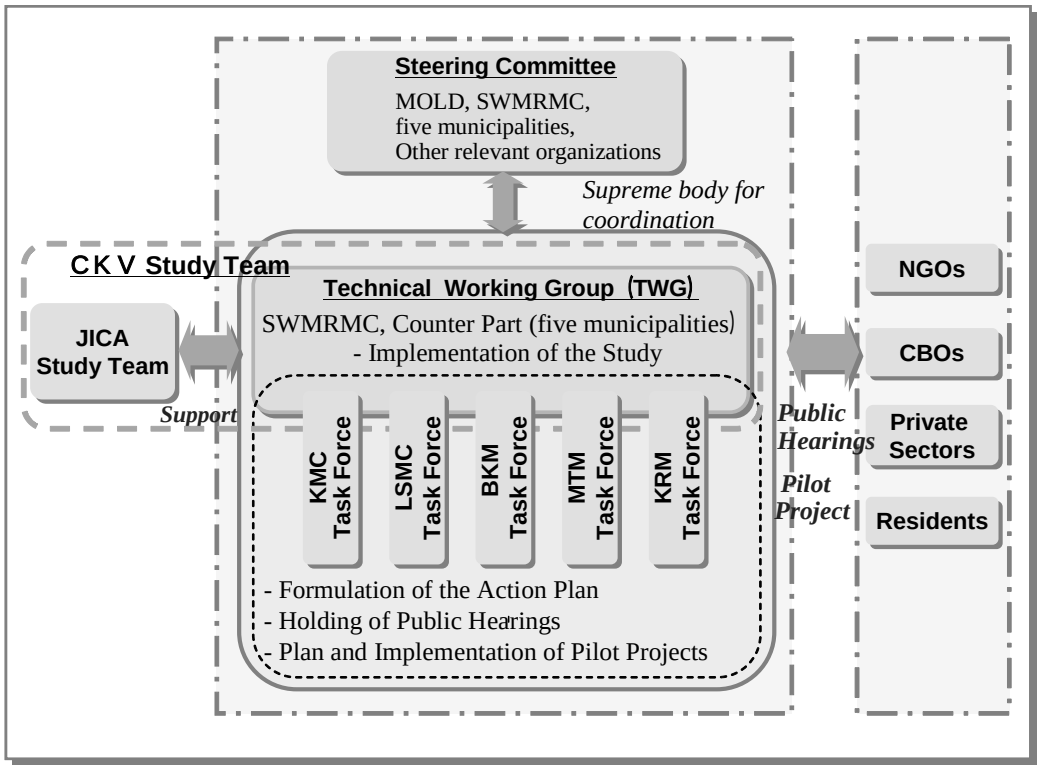


Figure 1.5-1 Implementation Organization of the Study

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	- 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	- 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	- 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	- 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	- 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	- 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 KIRTIPUR MUNICIPALITY

2.1 Outline of Kirtipur Municipality

Kirtipur Municipality (KRM) whose altitude is ranging from 1,284 m to 1,524 m above mean sea level is situated in the south-western part of Kathmandu District. The municipality was established in 1997, combining eight contemporary VDCs. Total area of the municipality is 14.76 km^2 divided into 19 wards administratively.

According to the 2001 census, 40,835 people lived in 9,487 households within the municipal area in 2001. It is estimated that population growth rate of the municipality would be annually 2.07% in coming ten years of 2001-2011, which is the lowest within the five municipalities.

"Kirtipur" means "City of Honor", and a row of old houses built by adobe brick and old Newal temples are still creating the quiet town, where the people are living with traditional Newal culture life. Surrounding of the town area, there are agriculture lands spreading in the Southern part of the municipality. At the entrance of the municipality from KMC, Tribhuvan University is located, which was founded in 1959 and is the first university and the pioneer institute of higher education in Nepal. In Chobhar, located in Southern part of KRM, there was a Himal cement factory with quarry.

2.2 Waste Generation and Stream

(1) Waste Quantity

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

Waste Unit Generation Rate:	0.3 kg/day-capita
Total Waste Generation:	12.25 tons/day

The JICA Study Team conducted a waste quantity survey in KRM with very small sample numbers, which were five households and three commercials. The result of the waste quantity survey of households in KRM is shown below. Less than 0.5 liter of waste with 205 to 215 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 (KRM: Dry Season)

Income Level	Weekdays			Weekends		
	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)
Average	86.0	0.4	215	61.6	0.3	205

Source: JICA Study Team

From commercial areas, it was observed that 3.5 to 8.2 kg/day was generated from each surveyed restaurant with 190 to 410 g/L of bulk density. From a selected office which was the bank, 0.7 to 2.0 kg/day of waste were generated with 180 to 220 g/L of bulk density. From a store, 0.8 kg of waste with 380 g/L of bulk density was generated on both weekdays and weekends.

The second waste quantity survey in wet season conducted in KRM in September 2004, sampled 50 households, and 15 commercials as well as MTM. The result of this detail waste quantity survey of households in MTM is shown in Table 2.2-2.

Table 2.2-2 Result of Daily Waste Generation Quantity Survey of Households (KRM: 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	119	0.7	165	133	0.8	165
Middle	161	0.9	186	169	0.8	212
Low	150	0.8	187	131	0.8	160
Average*	150	0.8	182	154	0.8	187

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 UGR for surveyed households for each income level is shown around 50 to 200 g/day-capita and a small peak around 350 to 400 g/day-capita. There is no household that generates waste more than 500 g/day-capita.

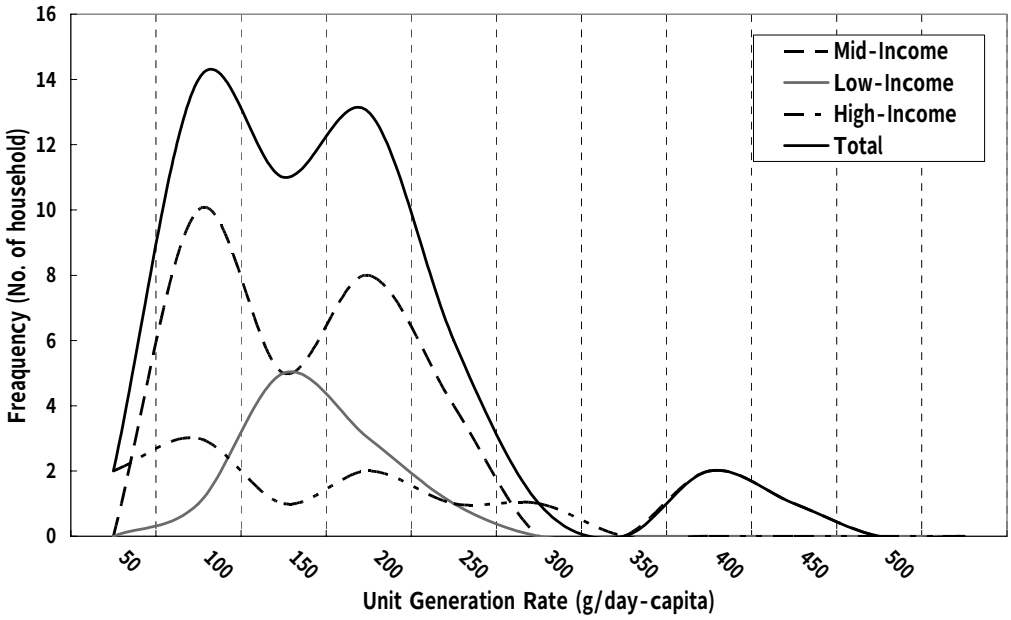


Figure 2.2-1 Frequency Distribution of UGR of Household in KRM

Source: JICA Study Team

(2) Waste Quality

Waste quality given by TWG members and as surveyed by the JICA Study Team is shown in the following table. From households, more than 70% is kitchen waste and plastic is around 10%. The organic portion from commercial establishments is high, almost the same as households.

Table 2.2-3 Waste Quality (KRM)

Items	Households			Commercial**	
	KRM data	Study			
		Dry Season	Wet Season	Dry Season	Wet Season
Kitchen waste	74.24%	86.7% (77.4%)	79.2% (82.7%)	74.2% (86.5%)	73.1% (79.4%)
Paper	5.72%	3.3% (3.2%)	5.2% (6.9%)	6.5% (9.0%)	15.4% (11.0%)
Textile	1.92%	3.3% (6.5%)	1.6% (1.3%)	0.8% (0%)	0.8% (3.0%)
Wood/leaves	0.09%	0% (3.2%)	2.8% (0.6%)	7.3% (0%)	0.4% (0.0%)
Plastic	8.83%	6.7% (9.7%)	6.6% (5.3%)	8.9% (3.7%)	9.6% (4.7%)
Rubber/leather	0.96%	0% (0%)	0.0% (0.0%)	0% (0%)	0.1% (0.0%)
Metal	1.94%	0% (0%)	0.4% (0.5%)	0.8% (0.2%)	0.5% (0.3%)
Glass	2.91%	0% (0%)	3.8% (2.7%)	1.6% (0.5%)	0.0% (0.0%)
Ceramics	-	0% (0%)	0.0% (0.0%)	0% (0%)	0.0% (0.0%)
Others	3.39%*	0% (0%)	1.2% (0.0%)	0% (0%)	0.0% (1.6%)
Bulk density	225 g/L	215 g/L (205 g/L)	182 g/L (187 g/L)	143 g/L (269 g/L)	116g/L (243g/L)
Water content	-	57% (65%)	65% (65%)	59% (71%)	52 % (64%)

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.
* Includes batteries
** Commercial data in dry season is only from hotels and restaurants
Source: JICA Study Team, May 2004 for Dry Season, June 2005 for Wet Season

2.3 Collection and Transportation

KRM is not directly involved in solid waste collection, transportation and dumping. It had entered into a contract agreement under a Public Private Partnership arrangement with a CBO, UNIQUE, for managing solid waste in Wards 3 and 17 (Naya Bazar) in the municipality since 1998, but the contract expired in 2003. Under the contract, necessary equipment had also been lent to UNIQUE for management. UNIQUE purchased their own tractor. In addition to Naya Bazar, solid waste is also collected from Ward 16 (Na Gaon), Wards 9, 10, 11, 12 (Panga) and Ward 5 (Khasi Bazar), serving about 2,000 households. Other than UNIQUE, an NGO, National Environment Pollution Control (NEPCO), also provided door-to-door collection service in KRM using a tractor and two rickshaws. NEPCO provided services for about 1,000 households in Wards 1, 2, and 3. Together the organizations have been collecting only 30 to 40% of the total wastes generated in KRM and

are transporting them to the right bank of the Bagmati River with a collection charge to residents, which is Rs 30 to 110 depending on the generation volume. However, recently, NEPCO has withdrawn from the waste collection service in KRM and UNIQUE is covering some areas which used to be covered by NEPCO. UNIQUE has also shifted its collection services to night/early-morning collection due to the government policy change regarding solid waste management in February 2005.

Table 2.3-1 shows the result of the Time and Motion survey conducted by the JICA Study Team on April 21, 2004 on one selected route. At the moment, three or four trips from generation sources to the final disposal site are implemented per day.

Table 2.3-1 Result of Time and Motion Survey in KRM

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
Tractor	6.3	5.4	6.9	2.9	2.8	11.1	68.4

Note: *This includes collection and dumping time
Source: JICA Study Team

2.4 Solid Waste Minimization Activities

In KRM, conventional home composting activities known as “Noga” or “Saga” are still common in some areas. A few NGOs have promoted home composting activities by using compost bins in Wards 3, 12 and 13. In addition, home composting activities by using 100 liter compost bin have also recently started to be promoted in Wards 1, 5, 14 by KRM through the Pilot Project.

In the year 2001, in the Ward 3, UNIQUE temporarily operated a community composting facility using a field heaping method. Nevertheless it ceased after only one year mainly due to odor problem. Making good use of their experience, a new composting facility with door-to-door collection service has been proposed by NGOs and is under review of the municipality. KRM reported that there are no kabadi shops within the Municipality. Independent recyclers take recyclable materials to kabadi shops located outside of the Municipality.

2.5 Final Disposal

Waste collected in KRM is open dumped on the western bank of the Bagmati River near the site being operated by KMC as of June 2005. KRM does not have any staff assigned at the disposal site. Some waste pickers are observed at the dumping site. Once or twice a month, the municipality covers the waste at the site. Some open dumping areas are observed within the municipality. However, KRM has a plan to transport their waste to Sisdol S/T-LF through Teku T/S in collaboration with KMC, when Valley 1 of Sisdol goes to full-scale operation.

2.6 Social Aspects

(1) Major Findings of the Household Behavior and Attitude Survey on SWM[1]

1) Priorities of Public Services

A total of 20% of sample HHs gave the third priority to waste collection regarding public services and utilities for improvement. Water supply was ranked as the first priority (35%), followed by drainage/sewerage (25%).

2) Waste Disposal and Management

A total of 56% of sample HHs in KRM responded that they disposed of their waste by door-to-door collection services. Further, combustion (35%) and open dumping outside the house (23%) were still popular disposal practices. These practices were observed in MTM as well. Most of the 17 HHs were dumping their waste on the banks of streams and rivers, on vacant land or on farmland. The major reason for open dumping was that no door-to-door services were available. Female adults (67% of sample HHs responded) and children (29%) were more responsible for handling waste. Further, female adults (65% of sample HHs) and other members of family (31%) were in charge of taking out waste for disposal. Almost 60% of HHs were disposing waste once every 2 or 3 days while 33% of HHs were doing it once a day. The majority of HHs used the backyard for waste storage (almost 84%) and the remaining HHs used the kitchen. This was very similar to MTM. Compared to the other three municipalities i.e. KMC, LSMC and BKM, there was more space available within and near the houses. Plastic bags were one of the most popular containers (64% of sample HHs), followed by metal/plastic/wood bins (20% of HHs).

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

Sample HH nos.	75#	133%
Dispose of waste by door-to-door collection service	42	56%
Dispose of waste by putting into Municipal or Communal Container	2	3%
Dispose of waste at Municipality's designated disposal site	1	1%
Dispose of waste by open dumping out side the house	17	23%
Dispose of waste by open combustion	26	35%
Dispose of waste by burying in the ground	4	5%
Dispose of waste by Composting	8	11%
Dispose of waste by giving it for recycling	0	0%
Dispose of waste by using as animal feed	0	0%

Note: Considering more than one method given by the respondent, the summation of responses exceeds 100%
Source: JICA Study Team, 2004 "Interview and Questionnaire Survey on Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

3) Existing Waste Collection Services

The ratio of those who could receive service and used it remains at 56% of sample HHs. This proportion was the second lowest among the five municipalities. Almost 30% of HHs expressed their need to have such services. Regarding the mode of waste collection, door-to-door collection services were prevailing among HHs surveyed. A total of 73% of

[1] In KRM, 3 out of 19 wards were selected based on the core area, sub-core are and fringe area. A total of 75 sample HHs were selected.

respondent sample HHs noted that they received door-to-door collection services from NGOs/CBOs. Although KRM has not directly provided such services, and contracted out them to NGOs/CBOs, some of HHs mentioned the municipality and private companies as service providers. Door-to-door collection services were likely to be provided irregularly, as 40% of respondent sample of HHs noted. Close to 30% of those who received such services noted that they were available 2-3 times per week. There seemed to be some room for improvement in terms of collection services provided by CBO and NGO. A total of 57% of HHs surveyed said that they paid for services. Almost 80% of them reported that they were somewhat satisfied with these services. Only 9% of those who paid for services were very much satisfied. Except those who were very satisfied, 39 HHs described the main reasons for less satisfaction as follows; a) services were not properly done (31%), b) services were irregular (23%), and c)frequency of services was too low (21%).

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

Sample HH nos.	75#	100%
Service available and used	42	56%
Service available and not used	6	8%
Service not available but required	23	31%
Service neither available nor required	4	5%

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

4) Waste Reduction and Recycling

Almost 27% of sample HHs responded that they have knowledge about separation and actually separate waste, mostly into two categories while about 19% of HHs responded that they have knowledge but are not practicing separation. It was noted that 32% of sample HHs neither had knowledge nor practiced source separation of waste. This proportion was the highest among the five municipalities. There seemed to be a limited program related to awareness and education programs in KRM. Almost half of sample HHs were willing to cooperate for recycling. On the other hand, 13% of sample HHs had no willingness to do so, which was the highest proportion among the five municipalities. The main reasons for unwillingness to cooperate were as follows; a) inconvenient and difficult to separate and b) taking too much time to separate. Only 16% of sample HHs noted that they sold their recycling materials to a buyer. A total of 60% of HHs did not sell these materials although buyers visit the house. Approximately 20% of HHs responded that they did not sell recyclable materials, and that buyers rarely visited to collect recyclables. Major items collected for sale were glass and papers. In addition, kitchen waste was reported as the major item for recycling. Close to 60% of sample HHs said that they had knowledge about composting, and all of them learned how to make composting by themselves. Only 17% of sample HHs noted having experience in making compost. Most of these respondents composted their waste in an open space or organic field. The majority of those having no experience have shown no interest in making compost (82% of respondent sample HHs). The major reasons for unwillingness to compost included; a) taking too much money and we cannot afford (24% of respondent sample HHs) and b) taking much time and we have no time (20%).

5) Public and Community Involvement

The majority of sample HHs considered that SWM was the duty of the Municipality (71%). This figure was the highest among the five municipalities. The fact that KRM has not provided SWM services might influence such response. Only 7% of HHs responded that they themselves should be responsible for SWM (See Table 2.6-3). There has been limited community mobilization in KRM, which might also lead to the low level of sense of responsibility for SWM among the public. In this regard, only 8% of HHs took initiatives towards SWM activities. However, 93% of HHs, including those who have been already paying, were positive about paying a service charge for SWM. Most of them reported that they could afford to pay Rs 31-50 or Rs 11-30 per month. Regarding the reasons for unwillingness to pay, 3 HHs of the respondent sample noted that they did not have any problems from waste. A total of 2 HHs were also not willing to pay because they considered SWM as the duty of municipality. Only 16% of sample HHs have participated in CBOs' activities in SWM. Nevertheless, all of HHs surveyed noted that these CBOs' activities related to SWM were necessary or somewhat necessary. Those who showed a positive attitude would like to participate in the following activities; a) waste collection in the community, b) any activities related to SWM, and c) clean-up program.

Table 2.6-3 Perception on Responsibility for SWM in KRM

Sample HH nos.	75#	100%
Government/Ministry of Local Dev.	10	13%
Municipality	53	71%
Sweepers	0	0%
Yourselves	5	7%
Our Communities/CBOs	0	0%
Private Company	7	9%
NGO	0	0%
Do not know	0	0%
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 for SWM

Since KRM, being newly established and having very limited staffs, has contracted out SWM services to two organizations i.e. UNIQUE and NEPCO, it has not taken initiatives in community mobilization programs on SWM by its own effort. It is apparent that these organizations have provided collection services in certain areas, but have yet to provide sufficient awareness and education programs.

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

UNIQUE and NEPCO have had partnerships with KRM in terms of collection services. However, there are few organizations working in the field of community mobilization and public education. The major organizations' activities are indicated below.

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

Name of NGOs/CBOs	Year of foundation	Number of staff	Working Areas
UNIQUE*	1994	14 staff	Door-to-door collection in Wards 1,3, 4, 5, 6, 9, 10, 11, 12, 16, and 17 (2,000 HHs) compost, Training
NEPCO*	1998	28 paid staff 7 volunteers	Door-to-door collection (1,000 HHs) Partially in Wards 1, 2, and 3
We Team / Jai Kisahan	2001	5 paid staff and 760 volunteers	Home composting in Wards 3 and 12
SOUP	1992	2 paid and 33 volunteers	Community development including composting in Ward 13 (15 HHs)

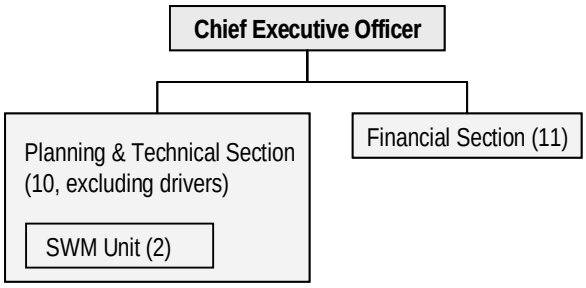
Note: * According to KRM, there is coordination with KRM at program/activity levels.
Source: JICA Study Team "Interview and Questionnaire Survey of Households, Establishments and NGOs/CBOs regarding Solid Waste Management in the Kathmandu Valley"

2.7 Managerial Condition

(1) Organizational Structure and Managerial Practices

1) Organizational Structure

Although KRM is the site for one of the oldest settlements in the Kathmandu Valley, as a municipality, it has relatively a short history. Reflecting its short history, KRM organizational structure is still underdeveloped with many of the sections within the organogram either not functioning or operating in a limited capacity.



Note: ( ) shows number of staff

Figure 2.7-1 New Organizational Structure of KRM SMW Related Sections

Source: KRM, 2005

For SWM, the Planning and Technical Section (PTS) has the overall responsibility within KRM. However with the privatization of SWM services since 1999 to two operators, UNIQUE and NEPCO, the day-to-day responsibilities of this Section decreased to providing logistical support to private operators. Within the past year, with the increased capacity of the private operators, such logistical support has been minimized, and the only task held by the municipality is to periodically conduct monitoring of the activities.

More recently, with the support of the Study, a new organogram was introduced where a SWM Unit was established within the Planning and Technical Section. The new structure is operationally in practice, but awaits official approval from the Municipal Council in July 2005.

2) Managerial Practices

The advantage of a small municipality is the limited hierarchical layers in the management structure. Staff in the PTS, as well as the Account Section claim that they had very good access to the Mayor when he was in office and more recently the CEO. They also appear to have very good coordination among themselves. The downside of such flat management structure is that due to such proximity, influences from the high level officials on implementing day-to-day operations is significant, and their blessing is necessary in conducting any kind of activities.

The PPP strategy for SWM adopted by KRM was a prudent strategy, especially with due consideration of the severe staff shortage of the municipality. KRM and the private operators in general have forged good partnerships; however more recently, with the expiration of the original agreement, some conflict over operational issues has put such partnership under strain. KRM should not take it for the services provided by the two private operators. PPP is not a panacea to all SWM issues, and as a municipality, KRM will not be relieved from SWM responsibilities. As the needs and expectations for better SWM services expand in KRM, the municipality's contribution to development of various SWM facilities and improved monitoring of the Private Operators' activities would become vital.

(2) Human Resources

KRM has only 3 officers among 87 staff, and in 2002 became the municipality with the least number of staff per capita among all 58 municipalities. Under such constraints, no specific post existed for SWM related staff, and the PTS staff had accepted SWM responsibilities. Under the new organogram where a SWM Unit, two staff were designated on a part time basis, one from PTS, and one from the Account Section. The latter staff is a graduate of a UDLE SWM training course.

2.8 Financial Condition

KRM spent Rs 150,000 on SWM in FY2002/03 (2059/60) and 2003/04 (2060/61), which accounted for only 1% of total municipal expenditure because private sectors provide all SWM services in the core areas of the municipality.

2.9 Issues and Constraints on Municipal Solid Waste Management

The analyzed issues and constraints on SWM in KRM are discussed as follows.

(1) Collection and Transportation

- KRM hasn't introduced a collection and transportation system as a municipal service by KRM so far.
- Currently some NGOs/CBOs collect the waste in specific areas and transport it to the Bagmati River dumping site without any contract between the organizations and KRM.
- KRM has not introduced an appropriate management system for the private sectors for primary collection or other solid waste management activities, but KRM is very much dependant on the fact that the private sector alone is taking care of waste collection.

(2) Solid Waste Minimization Activities

- KRM wasn't involved in any waste minimization activities and discarded plastic litter was seen in the streets. KRM has to expand introduced plastic recycling activities and home composting activities.
- An NGO, UNIQUE, which has collected the waste in some areas in KRM, has proposed a waste processing facility in KRM with door-to-door collection service, but this proposal is still under consideration.

(3) Final Disposal

- Similar to KMC and LSMC, KRM has been disposing of its collected waste at the Bagmati River dumping site along the west banks without any assigned staff.
- After full operation of Sisdol S/T-LF and complete close of the Bagmati River dumping site, KRM has to transport the waste to other areas. Currently, KRM is starting to enter into discussion with KMC for transportation of the waste to Teku T/S.

(4) Social Aspects

- There have not been visible community-based SWM activities in KRM due to the lack of recognition and institutionalization of community-based SWM activities in KRM. Although there are a few trained staffs in the areas of community development or community-based SWM, they have had a few opportunities to conduct community mobilization activities for SWM as part of a municipal program.
- There are a few NGOs/CBOs working in the field of community mobilization and public education in KRM.

(5) Managerial Conditions

- KRM was the only municipality among the five without any municipal SWM program prior to the Study. This was due to their early successes in implementing PPP with local NGO/CBO, which are collecting and transporting in some areas. This success has in turn, fostered a view within the municipality that if possible, all burdens for SWM should be bourn by external partners, and not by the municipality.
- Although a SWM unit was established within the Planning and Technical Section, the total two staff were employed on a part time basis from another section.

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 (2058/59[1])-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.

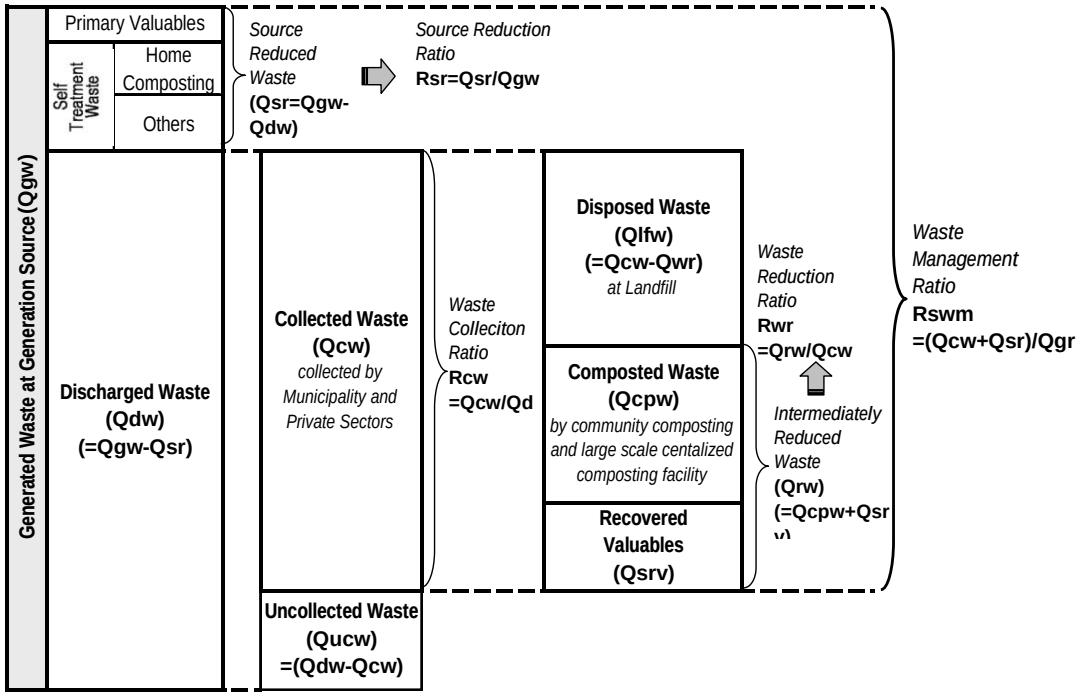


Figure 3.2-1 Definition of Waste Management Ratio

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.

(Collected waste quantity + Source reduced waste quantity) /
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 Study[2] 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).

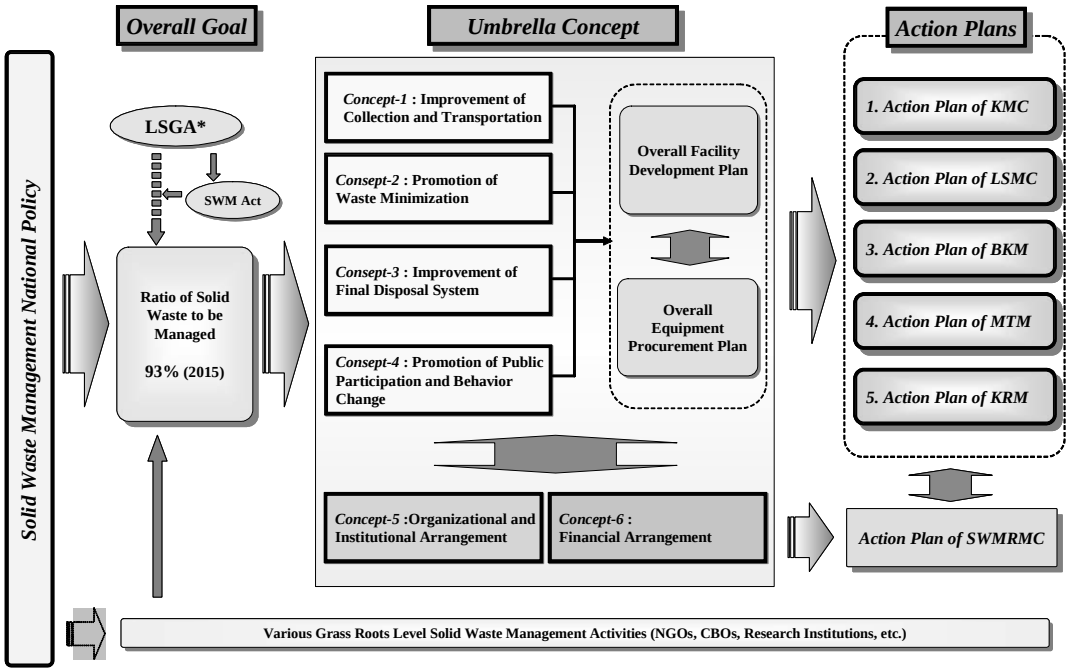
Table 4.1-1 Components of Action Plans

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 slid 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.

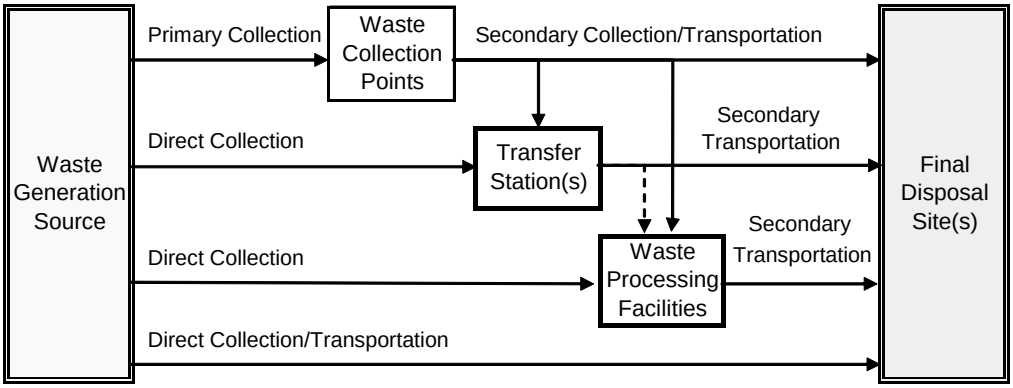


Figure 4.2-1 Definition of Collection and Transportation

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.

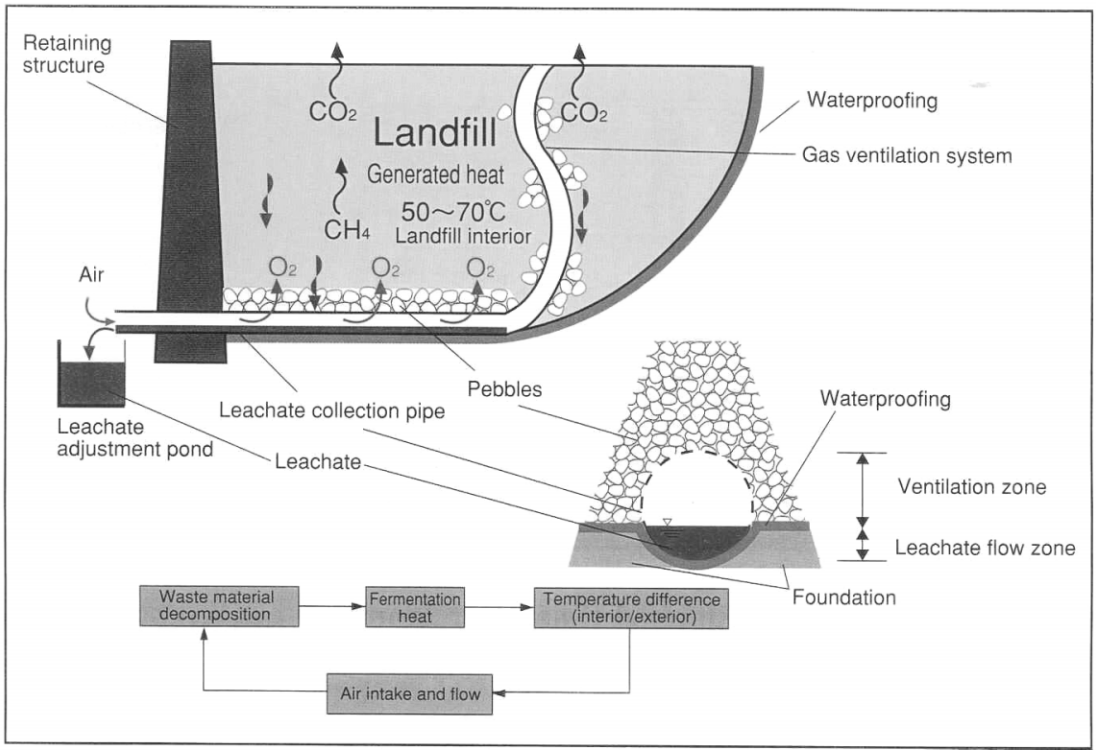


Figure 4.4-1 Schematic Presentation of Semi-aerobic System

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.

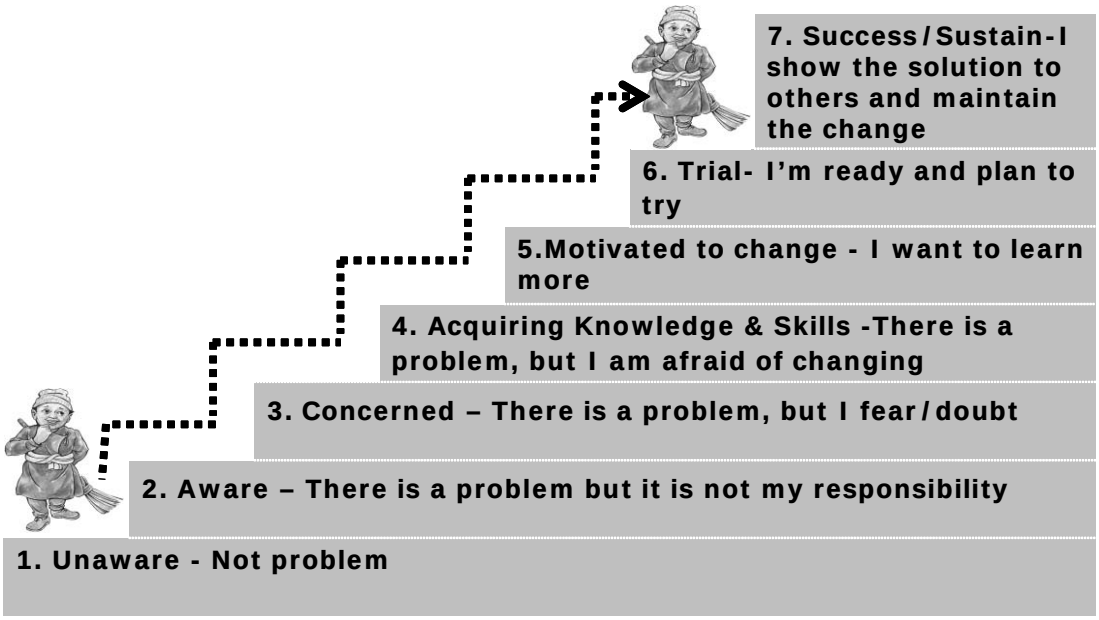


Figure 4.5-1 Behavior Change Stages

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 steps[1] 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.

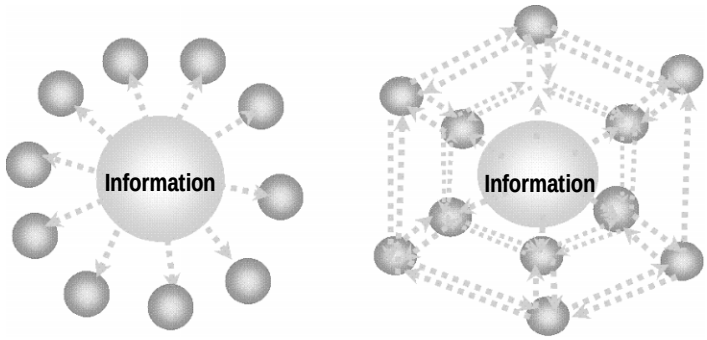


Figure 4.5-2 Difference between Mass Communication and Interpersonal Communication

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.

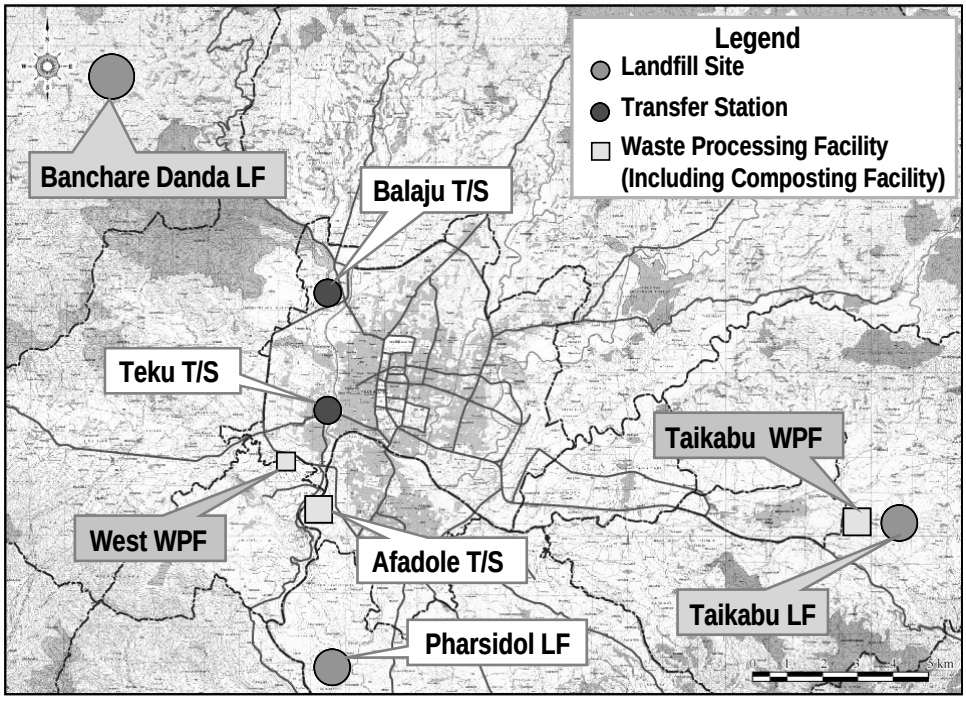


Figure 4.6-1 Facilities Incorporated in the Alternatives 1-3

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	Alt. 1a: 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	Alt. 1b: 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	Alt. 1c: 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	Alt. 2a: proposes two landfills, in Okharpauwa outside the valley and Taikabu. Two WPFs are also proposed.
2b	Taikabu Pharsidol	West Taikabu	Teku Balaju	Alt. 2b: proposes two landfills, Taikabu and Pharsidol, both located within the valley, and two composting facilities.
2c	Taikabu Pharsidol		Teku Balaju West	Alt. 2c: 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	Alt. 3a: proposes three landfills and two WPFs.
3b	Okharpauwa Taikabu Pharsidol		Teku Balaju Afadole	Alt. 3b: 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	Alt. 4: 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 Banchare Danda site in Okharpauwa.

Pharsidol north site was preferred over Banchare 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 Banchare Danda site has is the committment 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	Banchare 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 areas 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.

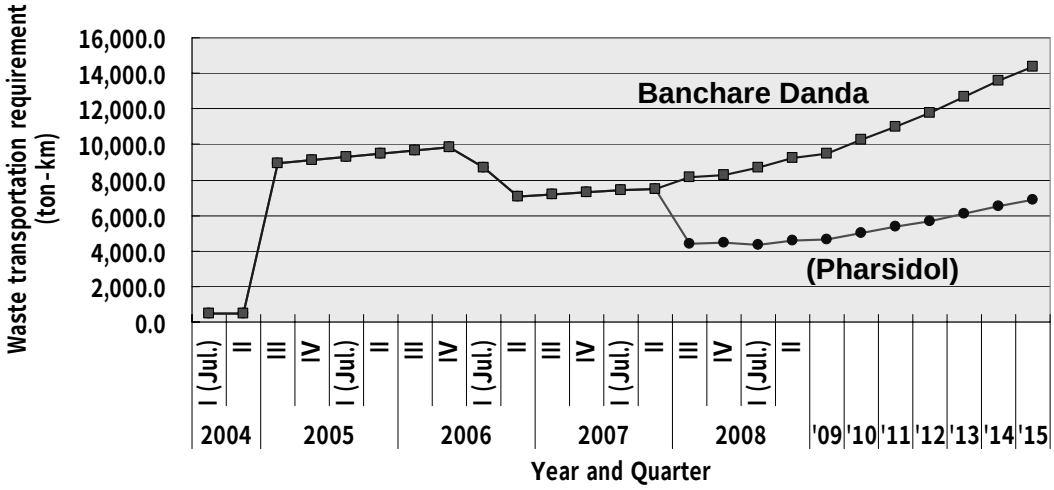


Figure 4.7-1 Future Projection of Transportation Requirement

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.

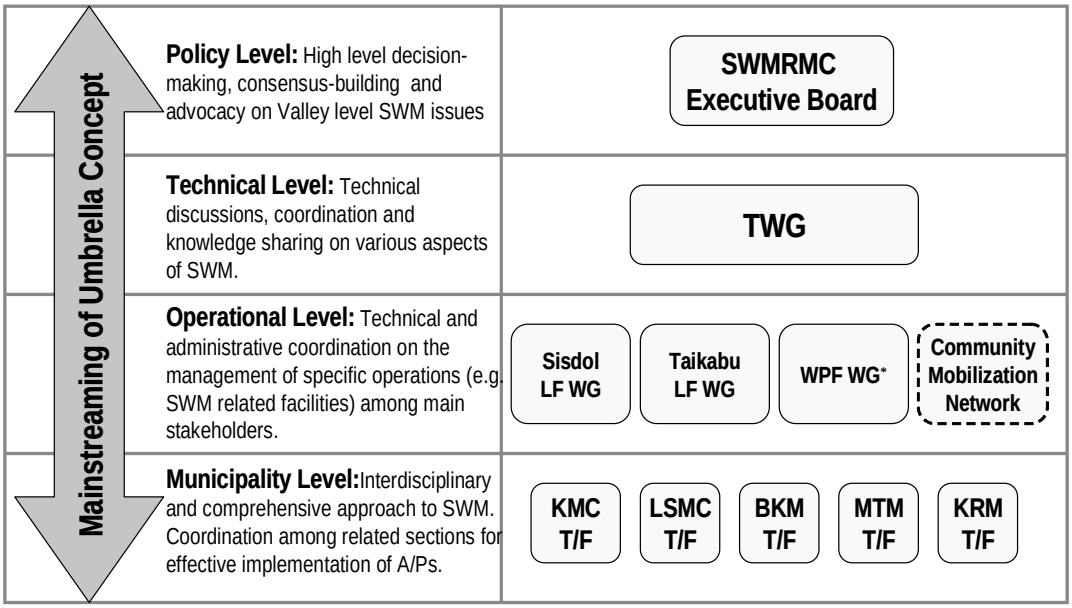
4.8 Basic Concept for Organizational and Institutional Arrangement

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 born 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

Base 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 bare 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	264.1
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 KIRTIPUR MUNICIPALITY

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 KRM 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 KRM has been determined as "**Neat, Clean, Pollution Free City, Kirtipur Municipality**". As for the target, KRM have adopted collection ratio in terms of quantity as an objectively verifiable indicator (OVI) aiming to reduce the amount of uncollected waste as shown in Table 5.2-1.

Table 5.2-1 Target of KRM

Present Situation	Targets		
	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) : 35 % (4 t/d)	Management ratio (amount) : 50% (7 t/day)	Management ratio (amount) : 70% (10 t/day)	Management ratio (amount) : 80% (15 t/day)

Source: KRM Task Force

5.3 Approaches, Strategies and Necessary Activities

The approaches, strategies and necessary activities established by KRM 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 (KRM)

Approaches	Strategies	Necessary Activities		
		Short-term (2005/06-2007/08) (2062 Shrawan – 2065 Ashadh)	**Mid-term (2008/09-2010/11) (2065 Shrawan – 2068 Ashadh)**	**Long-term (2011/12 – 2014/15) (2068 Shrawan – 2072 Ashadh)**
A. Improvement of Collection and Transportation System	A-1: Involvement of private sector for extension of collection area	A-1-S1: Preparation of agreements with private sector (NGOs/CBOs) and conclusion of the contracts (up to two parties)	A-1-M1: Increase of involvement of private sector (up to four parties)	A-1-L1: Continuation of mid-term activities
B. Promotion of Waste Minimization	B-1: Establishment of a community composting facility	B-1-S1: Selection and arrangement of land for a community composting facility	B-1-M1: Development of a community composting facility	B-1-L1: Expansion of the established community composting facility
	B-2: Promotion of home composting	B-2-S1: Promotion of home composting program (by providing bins, bags)	B-2-M1: Promotion of home composting program (by providing bins, bags)	B-2-L1: Continuation of mid-term activities
	B-3: Promotion of proper management of plastics	B-3-S1: Continuous implementation pilot bases separated collection of plastic bags (by providing wires (suiros), etc.)	B-3-M1: Expansion of target areas for separated collection of plastic bags	B-3-L1: Continuation of mid-term activities
C. Improvement of Final Disposal System	C-1: Transportation of the waste to the nearest transfer station	C-1-S1: Coordination with KMC for utilization of Teku transfer station	C-1-M1: Procurement of a vehicle for transportation of the collected waste C-1-M2: Transportation of the collected waste to the nearest transfer station	C-1-L1: Transportation of the collected waste to the nearest transfer station
D. Promotion of Public Participation and Behavior Change	D-1: Dissemination about SWM by education program	D-1-S1: Implementation of education program on SWM for school children and households (by promoting home composting, plastic bag separation, etc.)	D-1-M1: Continuation of short-term activities	D-1-L1 Continuation of midterm activities
E. Organizational and Institutional Arrangement	E-1: Establishment of SWM unit/section	E-1-S1: Establishment of a section (unit) on SWM	E-1-M1: Strengthening of SWM unit	E-1-L1: Establishment of SWM Section
	E-2: Implementation of HRD program	E-2-S1: Implementation of staff training on SWM and other related skills	E-2-M1: Implementation of staff training on SWM and other related skills	E-2-L1: Implementation of staff training on SWM and other related skills
	E-3: Management of solid waste data by database	E-3-S1: Collection of related data for SWM from private sector E-3-S2: Arrangement of the collected data in the database	E-3-M1: Establishment of data collection system from private sector E-3-M2: Continuous data arrangement in the database	E-3-L1: Continuous data arrangement in the database
F. Others	F-1: Coordination among all SWM stakeholders	F-1-S1: Coordination with SWMRMC, neighboring municipalities and NGOs/CBOs	F-1-M1: Continuation of short-term activities	F-1-L1: Continuation of mid-term activities

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

Strategies	Short-Term Activities	Responsible Section, Unit	Related Organizations (Section, NGO/CBO)	2005/2006 I (July 16)	2005/2006 II	2005/2006 III	2005/2006 IV (July 16)	2006/2007 I (July 17)	2006/2007 II	2006/2007 III	2006/2007 IV (July 16)	2007/2008 I (July 17)	2007/2008 II	2007/2008 III	2007/2008 IV (July 15)
				2062/2063				2063/2064				2064/2065			
				Shrawan			Ashadh	Shrawan			Ashadh	Shrawan			Ashadh
A-1: Involvement of private sector for extension of collection area	A-1-S1: Preparation of agreements with private sector (NGOs/CBOs) and conclusion of the contracts (up to two parties)	PTS, SWMU	private sector	Preparation; Signing; Monitoring				Review				Review			
B-1: Establishment of a community composting facility	B-1-S1: Selection and arrangement of land for a composting facility	PTS, SWMU	SWMRMC, KMC	Discussion and coordination with							Operation				
B-2: Promotion of home composting	B-2-S1: Promotion of home composting program (by providing bins, bags)	PTS, SWMU	NGO/CBO												
B-3: Promotion of proper management of plastics	B-3-S1: Continuous implementation separated collection of plastic bags (by providing wires (suiros), etc.)	SWMU	NGO/CBO				Evaluation								
C-1: Transportation of the waste to the nearest transfer station	C-1-S1: Coordination with KMC for utilization of Teku transfer station	CEO, PTS													
D-1: Dissemination about SWM by education program	D-1-S1: Implementation of education program on SWM for school children and households (by promoting home composting, plastic bag separation, etc.)	SWMU	NGOs/CBOs, ward offices, schools	Exhibition; Clean up campaign				Exhibition; Clean up campaign				Exhibition; Clean up campaign			
E-1: Establishment of SWM unit/section	E-1-S1: Establishment of a section (unit) on SWM	Municipal Board, Task Force													
E-2: Implementation of HRD program	E-2-S1: Implementation of staff training on SWM and other related skills	PTS			HRD plan										
E-3: Management of solid waste data by database	E-3-S1: Collection of related data for SWM form private sector	SWMU													
	E-3-S2: Arrangement of the collected data in the database	SWMU													
F-1: Coordination among all SWM stakeholders	F-1-S1: Coordination with SWMRMC, neighboring municipalities and NGOs/CBOs	CEO, T/F, SWMU	SWMRMC, KMC, LSMC, NGO/CBO												

Legend : Continuous activitie
: Intermittent activitie
: Spot activities

PTS : Planning and Technical Section
SWMU : Solid Waste Management Unit

5.4 Financial Plan

As shown in Table 5.4-1, total SWM cost, summing up current SWM cost and Action Plan cost, amounts to Rs.22million 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.189 million. Thus, the ratio of total SWM cost to total own revenue results in 12%, which is very much higher than current ratio of 0.2%. However, obviously, current ration ratio is too low because of privatization operated in core areas of the municipality. Consequently, it is suggested that KRM bears entire Action Plan cost by reducing other expenditures, applying to donation of Reserved Fund, etc.

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

Items	2005/0 2062/6	2006/0 2063/6	2007/0 2064/6	2008/0 2065/6	2009/1 2066/6	2010/1 2067/6	2011/1 2068/6	2012/1 2069/7	2013/1 2070/7	2014/15 2071/72	Total
I. Own Revenue	18.3	19.1	19.9	20.2	20.5	20.1	19.2	18.2	17.2	16.3	189.1
1. Actual Revenue	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	176.0
2. Projected Revenue Increase	0.7	1.5	2.3	2.6	2.9	2.5	1.6	0.6	-0.4	-1.3	13.1
II. SWM Cost	1.3	3.1	1.7	2.2	2.0	2.5	2.0	3.0	2.2	2.4	22.5
1. Current SWM	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.0
2. Action Plan	1.0	2.8	1.4	1.9	1.7	2.2	1.7	2.7	1.9	2.1	19.5
III. Ratio (= II/I)	7%	16%	9%	11%	10%	12%	11%	17%	13%	15%	**12%**

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.

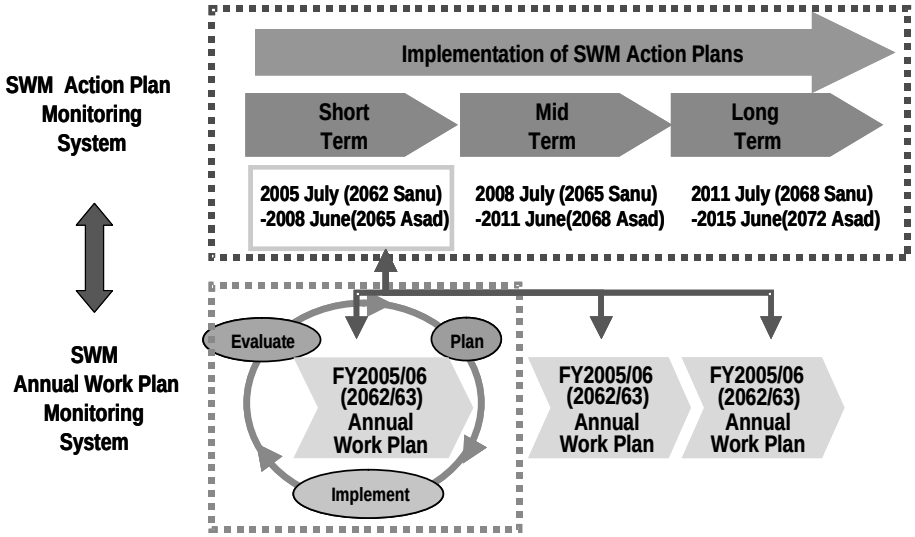


Figure 5.5-1 Linkage between Action Plan Monitoring System and Annual Work Plan
Source: JICA Study Team

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 KRM (Current and Future)
- APPENDIX 3 Annual Work Plan of Fiscal Year of 2005/06 (2062/63) Proposed by Task Force (KRM)

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 KRM (Total 6 members) *As of July 20, 2005*

Name	Designation / Organizational Position
Mr. Bal Krishna Maharjan	Chief, Planning and Technical Section
Mr. Anuj Pradhan	Assistant, Planning and Technical Section
Mr. Gyan Bazra Maharjan	Assistant, Solid Waste Management/Accounting
Mr. Krishna Bhola Maharjan	Junior Engineer, Planning and Technical Section
Mr. Sanu Babu Pariyar	Account Officer, Administration Section
Mr. Swodesh Maharjan	Unique Group (NGO)

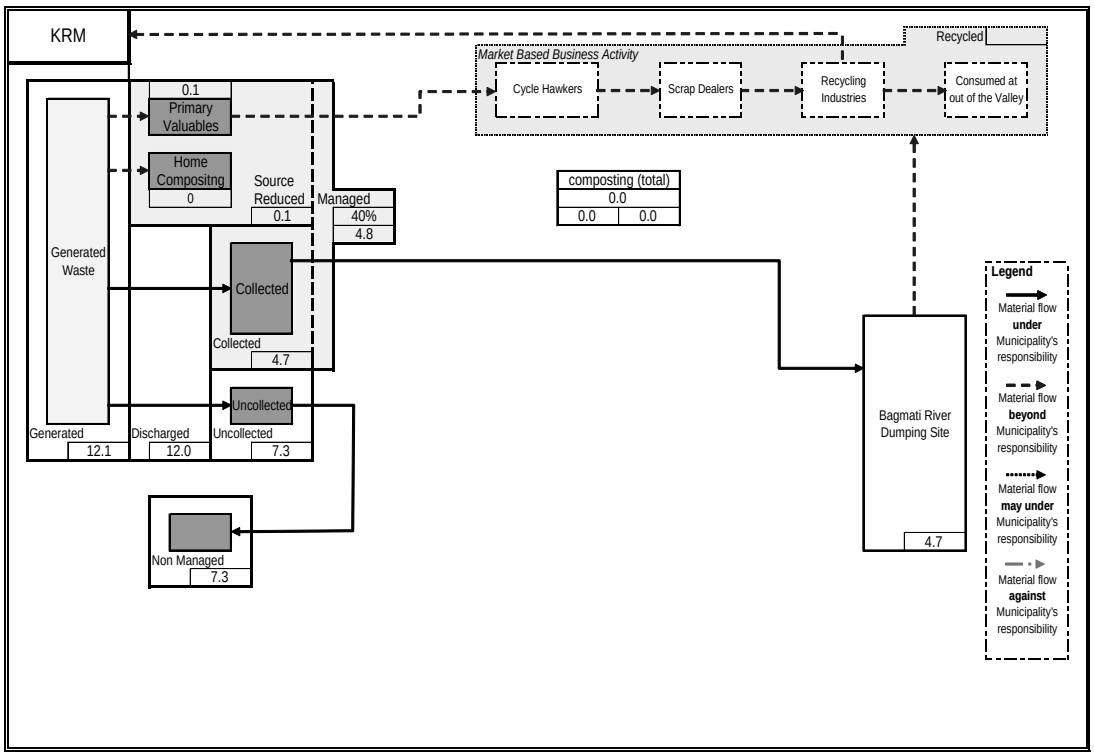
APPENDIX 2

Solid Waste Stream Flow of KRM (Current and Future)

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

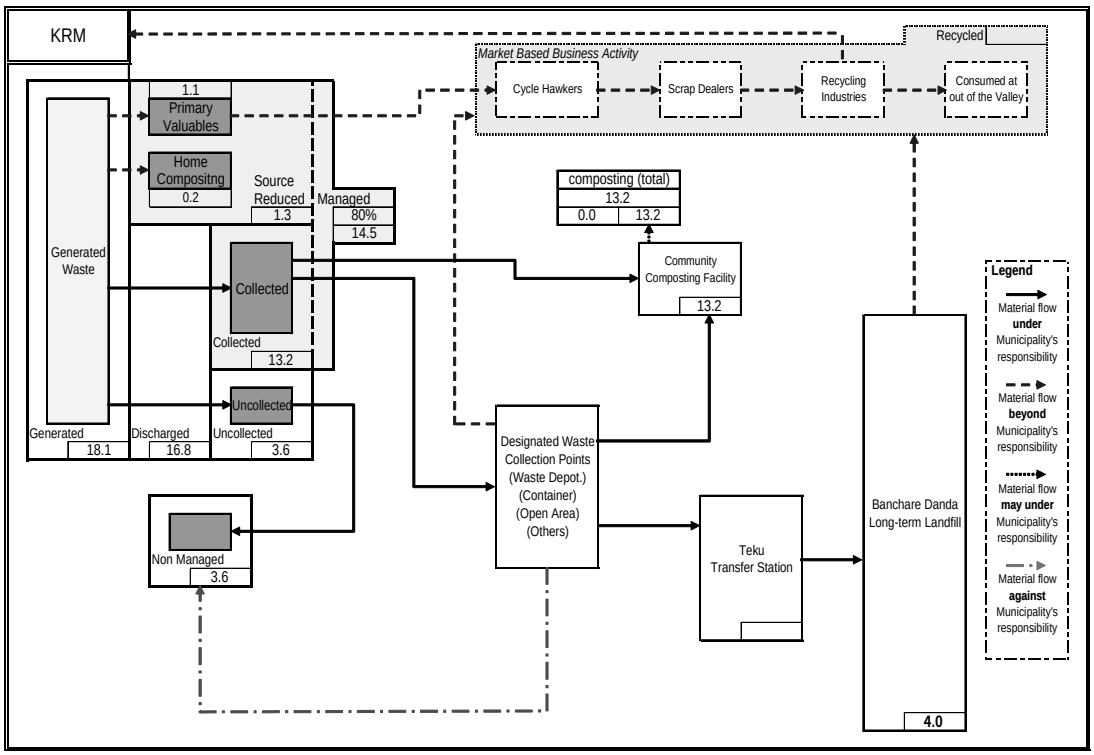
Existing Solid Waste Stream (2005)

Unit: t/day



Future Solid Waste Stream (2015)

Unit: t/day

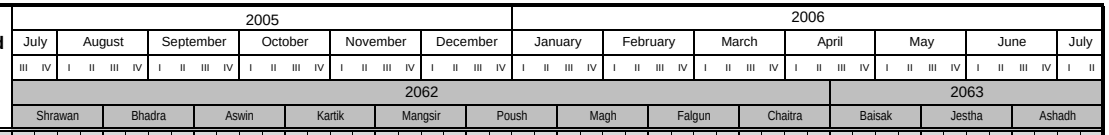


APPENDIX 3

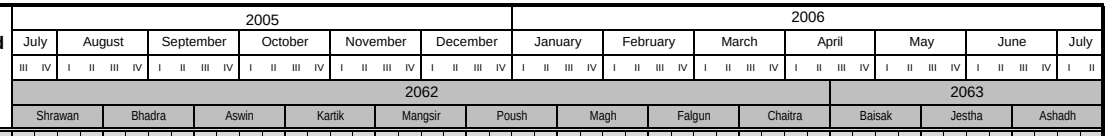
Annual Work Plan of
Fiscal Year of 2005/06 (2062/63)
Proposed by Task Force (KRM)

Table A.3 Annual Work Plan of Fiscal Year of 2005/06 (2062/63) Proposed by Task Force (KRM)

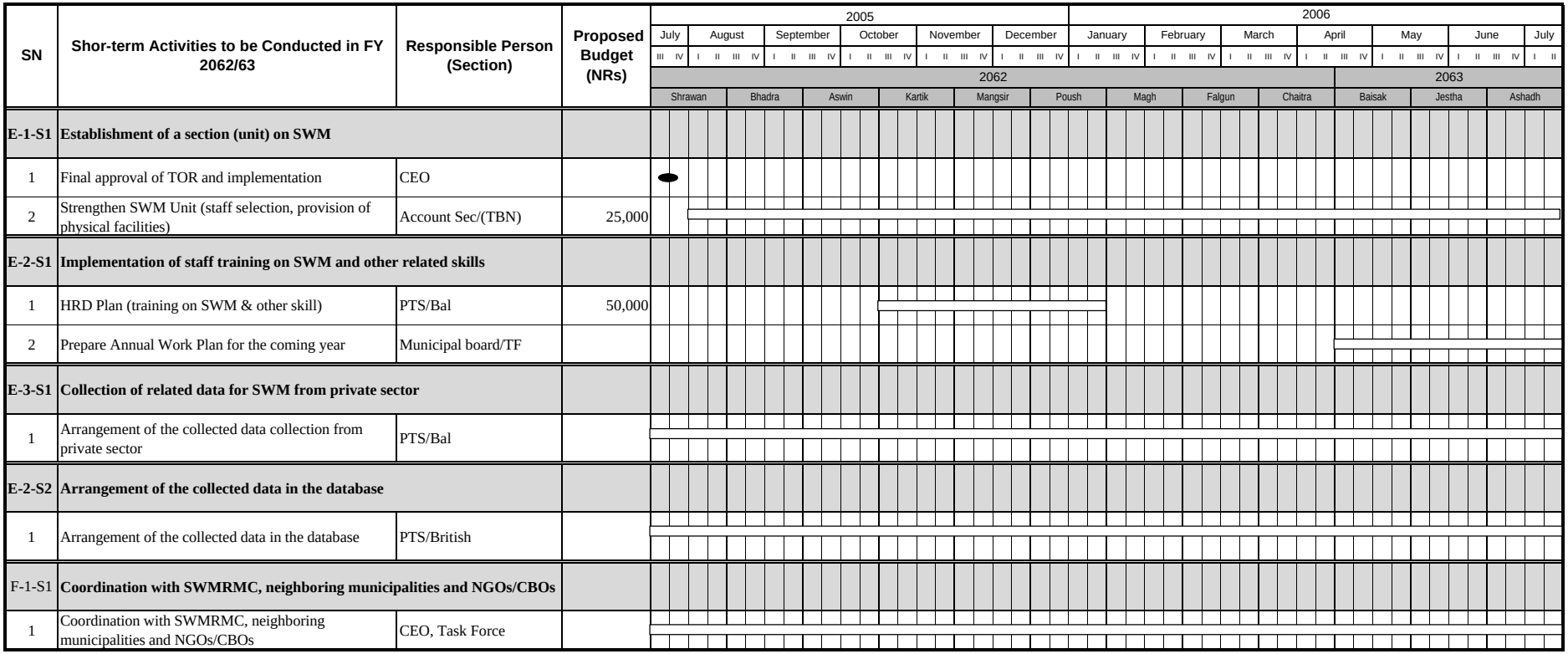
SN	Shor-term Activities to be Conducted in FY 2062/63	Responsible Person (Section)	Proposed Budget (NRs)
A-1-S1	**Preparation of agreements with private sector (NGOs/CBOs) and conclusion of the contracts (up to two parties)**		
1	Review & examine previous agreements and establishment of general rules/guideline	PTS/Bal, SWMU/Anuj, Gyan	
2	Preparation of individual agreement for PPP	PTS/Bal, SWMU/Anuj, Gyan	10,000
3	Conduct meeting with the potential private operators for identifying zoning areas	PTS/Bal, SWMU/Anuj, Gyan	30,000
4	Call for the proposal including their planning and work	PTS/Bal, SWMU/Anuj, Gyan	
5	Review and analysis of proposal and locating sites for collection	PTS/Bal, SWMU/Anuj, Gyan	
6	Signing on the agreement & contracting the work for SWM services	PTS/Bal, SWMU/Anuj, Gyan	
7	Monitoring of performance of private activities	PTS/Bal, SWMU/Anuj, Gyan	10,000
B-1-S1	**Selection and arrangement of land for a composting facility**		
1	Discussion with NGOs for development of a composting facility	PTS/Bal, SWMU/Anuj, Gyan	
B-2-S1	**Promotion of home composting program (by providing bins, bags)**		
1	Planning of extension	SWMU/Gyan	50,000
2	Preparation plan for three trainings	SWMU/Gyan	75,000
3	Development of O&M plan	SWMU/Gyan	
4	Distribution of 25 bins, 150 bags and 150 suiros	SWMU/Gyan	89,700
5	Evaluation and improvement	SWMU/Gyan	12,000



SN	Shor-term Activities to be Conducted in FY 2062/63	Responsible Person (Section)	Proposed Budget (NRs)
B-3-S1	**Continuous implementation of separated collection of plastic bags (by providing wires (suiros), etc.)**		
1	Agreement with "Kawadi" for plastic collection	SWMU/Anuj, Gyan	
2	Planning of extension	SWMU/Gyan	
3	Operation of plastic store house	SWMU/Gyan	
4	Evaluation and improvement	SWMU/Gyan	
C-1-S1	**Coordination with KMC for utilization of Teku T/S**		
1	Conclusion of agreement with KMC for Teku T/S	CEO	
2	Classification of waste quality (Data analysis)	PTS/Bal	20,000
3	Discussion with KMC on duty demarcation and cost sharing	PTS/Bal	
4	Discussion with private sector and NGOs on the manner to transport wastes to Teku T/S	PTS/Bal	
5	Procurement of necessary equipment and facilities	PTS/Bal	1,000,000
D-1-S1	**Implementation of education program of SWM for school children and households (by promoting home composting, plastic bag separation, etc.)**		
1	Collection of school level training demand	SWMU/Anuj	1,000
2	Conduct 10 training on SWM	SWMU/Anuj	250,000
3	Identify and form 5 new groups	SWMU/Anuj	
4	Train 5 newly formed groups	SWMU/Anuj	125,000
5	Exhibition	SWMU/Anuj	100,000
6	Clean up campaign	SWMU/Anuj	100,000
7	Formation of 10 Nature Clubs	SWMU/Anuj	50,000



SN	Shor-term Activities to be Conducted in FY 2062/63	Responsible Person (Section)	Proposed Budget (NRs)
E-1-S1	**Establishment of a section (unit) on SWM**		
1	Final approval of TOR and implementation	CEO	
2	Strengthen SWM Unit (staff selection, provision of physical facilities)	Account Sec/(TBN)	25,000
E-2-S1	**Implementation of staff training on SWM and other related skills**		
1	HRD Plan (training on SWM & other skill)	PTS/Bal	50,000
2	Prepare Annual Work Plan for the coming year	Municipal board/TF	
E-3-S1	**Collection of related data for SWM from private sector**		
1	Arrangement of the collected data collection from private sector	PTS/Bal	
E-2-S2	**Arrangement of the collected data in the database**		
1	Arrangement of the collected data in the database	PTS/British	
F-1-S1	**Coordination with SWMRMC, neighboring municipalities and NGOs/CBOs**		
1	Coordination with SWMRMC, neighboring municipalities and NGOs/CBOs	CEO, Task Force	



Legend

: Continuous activities
: Intermittent activities
: Spot activities

PTS: Planning and Technical Section
SWMU: Solid Waste Management Unit
TBN: To be named