

NCR Planning Board
Asian Development Bank

Capacity Development of the National Capital Region Planning Board (NCRPB) – Component B (TA No. 7055-IND)

Solid Waste Management Master Plan for Hapur

April 2010



Contents

1. INTRODUCTION	1
A. BACKGROUND	1
B. OVERVIEW OF THIS MASTER PLAN & STRUCTURE	1
2. PRIFILE OF HAPUR TOWN.....	2
A. LOCATION	2
B. TOPOGRAPHY AND SOILS	2
C. CLIMATE	2
D. WATER RESOURCES	3
E. DEMOGRAPHY	3
3. EXISTING SOLID WASTE MANAGEMENT SYSTEM.....	4
A. GENERAL	4
B. SOLID WASTE GENERATION – QUANTITY AND CHARACTERISTICS	4
C. SOLID WASTE COLLECTION & TRANSPORTATION	5
D. SOLID WASTE PROCESSING & DISPOSAL.....	6
E. INSTITUTIONAL AND FINANCIAL ASPECTS	6
F. SERVICE LEVEL OF EXISTING SWM SYSTEM	7
4. PROPOSED SOLID WASTE MANAGEMENT SYSTEM.....	8
A. PROJECTED POPULATION AND WASTE GENERATION.....	8
B. PROPOSED SOLID WASTE MANAGEMENT SYSTEM FOR HAPUR.....	8

1. INTRODUCTION

A. Background

1. The National Capital Region Planning Board, constituted in 1985 under the provisions of NCRPB Act, 1985, is a statutory body functioning under the Ministry of Urban Development, Government of India. NCRPB has a mandate to systematically develop the National Capital Region (NCR) of India. It is one of the functions of the Board to arrange and oversee the financing of selected development projects in the NCR through Central and State Plan funds and other sources of revenue.
2. On Government of India's request, Asian Development Bank (ADB) has formulated the technical assistance (TA) to enhance the capacities of National Capital Region Planning Board and its associated implementing agencies. Component B of TA relates to improving the capacity of the implementing agencies in project identification, feasibility studies and preparing detailed engineering design. As part of this model project reports and tool kits were prepared to guide and assist the implementation agencies in preparation of project reports.
3. This is the SWM Master Plan for Hapur, prepared using the SWM tool kits prepared under the TA for formulation of SWM Master Plans.

B. Overview of this Master Plan & Structure

4. This Master Plan is prepared based on the baseline data provided by Hapur Municipality. No primary or field surveys were specifically conducted for this purpose. This SWM Master Plan is organized into five sections including this introductory section:
 - (i) Section 2 provides a brief profile of Hapur Town
 - (ii) Section 3 describes the existing solid waste management system in Hapur
 - (iii) Section 4 presents the proposed solid waste management system for Hapur with capital cost estimates

2. PRIFILE OF HAPUR TOWN

A. Location

5. Hapur Town is in Ghaziabad District of Uttar Pradesh State in north India. Geographically, Hapur is situated at 28° 44' N latitude and 77° 47' E Longitude. Hapur Town is situated at about 54 Km east of Delhi, and 432 km west of the State Capital, Lucknow. The district headquarter and fast growing city of Ghaziabad is situated about 36 km east of Hapur. Town is well connected with important cities of the country; two National Highways (NH 24 - Delhi-Lucknow-Muradabad Road, and NH 18 - Meerut-Bulandsahar Road) passes through Hapur city. Two branches of northern railway pass through Hapur Town.
6. The population of Hapur Town as per census 2001 was 211,983. Hapur Municipality (Hapur Nagar Palika Parishad) was established in 1982. At present, the municipal area of Hapur is 1,401 ha (14 sq. km).

B. Topography and Soils

7. The town has almost flat topography except a small portion in the south, which is marginally higher than the general ground level. The general slope of the town is from north to south. The depth of groundwater in the town varies from 9-12 m. The town is located in the catchment area of the Ganges River. River Kali, a tributary of the Ganges, flows in the eastern outskirts of the town in the north-south direction. Hapur Town drains into this Kali River. The general nature of the soil is sand mixed with clay.

C. Climate

8. Typical humid subtropical climate of north India prevails in Hapur, with high variation between summer and winter temperatures and precipitation. There are three distinct seasons – first of which is the monsoon season - hot and humid season from mid-June to September. Second season, winter, is the cool and dry season from October to March. The third phase, summer, is characterized by hot and dry weather which prevails from April to mid-June. The average temperature ranges from a minimum of 1.8oC to a maximum of 44.9oC; occasional extremes may in the ranges of 0.6oC to 47oC. Predominant winds are from north, northwest and wes. Extreme temperatures have ranged from –0.6 °C to 47 °C. Annual average rainfall is 732 mm.
9. Rains in Hapur are mainly concentrated in monsoon season. The region receives rainfall mainly under the influence of southwest monsoon from July to September. Over 75 percent of the total rainfall is received from July to September. The annual average rainfall is 745 mm.

D. Water Resources

10. River Kali, a tributary of River Ganges, flows in the eastern outskirts of the town. There are no other notable rivers/streams in Hapur. Due to erratic rainfall in the catchment, flow in the river is mostly wastewater joining from the catchment area.
11. Hapur is located in Central Gangetic Alluvium of quaternary age. The alluvium comprises of clay mixed kankar and fine and medium sand. Ground water in the area occurs under the unconfined to semi confined conditions. The saturated/tapped granular zones occur between the depth ranges of 70 - 100 meter below ground level. Depth of tube wells is about 110 meters. Groundwater is potable and is the prime and only source of water supply to Hapur Town.

E. Demography

12. Population of Hapur was 146,591 in 1991 and 211,983 in 2001 (decadal growth rate of 44.6 percent). The preceding decade of 1981-91 also experienced a higher growth (42.5 percent). Gross average density has increased from 105 persons per hectare in 1991 to 155 in 2001. Following Table shows the population growth of Hapur in the municipal limits.

Table 2-1: Population Growth of Hapur

Year	Population	Decadal Growth Rate (%)
1951	49,260	-
1961	55,248	12.16
1971	71,266	28.99
1981	102,837	44.30
1991	146,591	42.55
2001	211,983	44.61

Source: Census of India

3. EXISTING SOLID WASTE MANAGEMENT SYSTEM

A. General

13. Municipal solid waste management is an obligatory function of the urban local bodies in India. As per the definition provided by the Municipal Solid Waste (Management and Handling) Rules, 2000 of Government of India, municipal solid waste (MSW) includes commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes. With growing population and increasing waste generation, solid waste management has become a major environmental issue. ULBs across India face similar challenges in handling and disposal of municipal solid waste: lack of adequate financial and human resources, poor technology and lack of public participation to list a few. Solid waste management in Hapur is the responsibility of Hapur Municipality. Existing solid waste management system of Hapur is presented in this section.

B. Solid Waste Generation – Quantity and Characteristics

14. Spreading over an area of 14.01 sq. km, the Hapur Municipal Area is divided into 27 municipal wards for administrative purposes. Hapur Municipality (Hapur Nagar Palika, HNP) undertakes solid waste management in all 27 wards. Total road length is 389 km.
15. As per the current estimates (2009) of the HNP, about 84 tons of solid waste is generated daily in Hapur –at a per capita waste generation of rate of 305 gm per day (projected population of 2009 is 275,000). The main solid waste generation sources are residential, commercial and institutional establishments, vegetable and meat markets, hospitals, hotels and restaurants, and construction and demolition waste (debris). Due to a large number of small scale industrial units (mostly agro-based) in the town, industrial solid waste also enters illegally into municipal stream.

Table 3-1: Solid Waste Generation Sources in Hapur

S. No	Source	Quantity (tons)	% of Waste
1	Residential	58.0	69.0
2	Commercial	12.0	14.3
3	Hotels	2.0	2.4
4	Institutions	1.0	1.2
5	Hospitals	0.5	0.6
6	Markers (Vegetable, Fruit & Meat)	4.0	4.8
7	Construction and Street Sweeping	5.0	6.0
8	Garden Waste	0.5	0.6
9	Industrial	0.5	0.6
10	Others waste	0.5	0.6
	Total	84.0	100.0

16. *Composition of Waste.* No data on composition of waste generated in Hapur is available. A study conducted in Ghaziabad in 2009 indicated the composition as: biodegradable - 56%, recyclable - 28%, and inert and other waste – 16%. Based on a study conducted by NEERI in 2005 in 59 cities across India, the following Table provides waste composition in the towns of similar population size as Hapur (1-5 lakhs population).

Table 3-2: Composition of Waste in Indian Cities of 1-5 lakh population

S. No	Composition	Value/Fraction
1	Compostable Matter	34% – 62%
2	Recyclable Fraction	13% - 36%
3	Moisture Content	24% - 63%
4	C:N ratio	14 – 37

Source: “Assessment of Status of Municipal Solid Wastes Management in Metro Cities and State Capitals”, study conducted in 59 cities by NEERI/CPCB in 2005

17. In absence of waste composition data from Hapur, average values based on the above is considered:
- Compostable matter – 56%
 - Recyclable fraction – 15%
 - Inert and other waste – 29%

C. Solid Waste Collection & Transportation

18. There is no door to door solid waste collection system in Hapur. Waste collection is through community dust bins. HNP provided 20 collection bins for the purpose, but there are a large number unauthorized of open collection points where people dump waste and HNP collects regularly. Due to lack of proper collection system and civic sense, almost all households throw waste onto the streets, drains and open spaces within the localities creating unhealthy conditions. Lack of door-to-door collection is also one the main reason for this situation. Most open drains in the city are choked due to indiscriminate solid waste disposal. There are a number of open points where people dump waste regularly.
19. Total road length in Hapur municipal limit is 100 km, in which there are only 20 waste collection points.
20. One of the major activities of the solid waste management is street sweeping, which is time consuming and labor intensive. Due to open drain system, regular desilting of drains is also necessary. Since throwing and indiscriminate disposal of waste on to streets is prevalent, collection of waste is mainly through street and road sweeping. HNP carries out both street sweeping and drain desilting activities in all wards. Sweepers use traditional short-handled brooms to sweep, and collect and transport community bins/intermediate collection points using wheel barrows. The sweeping is carried on the basis of a single-tier system by forming “beats”. Each beat is allocated to a sanitation worker/sweeper.

Sweepers work in single shift. There are 5 intermediate collection points for waste collection in addition to 20 waste collection points.

21. *Transportation of Solid Waste.* Waste from community dust bins/open collected points is manually lifted into vehicles for transportation to disposal site along Rampur Road. HNP transports waste using tractors and dumper placers. Of the total generated 84 tons, HNP collects and transports just about 33 percent daily.

Table 3-3: Details of Transportation Vehicles

Description	Owner Ship	Nos.	Vehicle Capacity	Trips / Day	Total Quantity
			Tons	Nos.	Tons
Tractor-Trolley	HNP	4	1.5	5	7.5
Dumper placer	HNP	4	2.0	5	10.0
JCB	HNP	2			
Loader	HNP	3			
Truck	HNP	4			
Tractors	HNP		2	5	10.22
Hand Carts	HNP	103			
Total		120	-	-	27.72

Source: Hapur Nagar Palika

D. Solid Waste Processing & Disposal

22. There is no scientific solid waste processing or disposal facility in Hapur; waste collected from the city is disposed at a site along Rampur Road by crude open dumping method. This practice is very unhealthy and environmentally unsafe. Area of this site is 5 acres.

E. Institutional and Financial Aspects

23. Safe disposal of solid waste generated in an urban area is an obligatory function of the respective urban local body - it is HNP in case of Hapur.
24. Total expenditure on SWM during 2008-09 was Rs. 439 lakhs. This is very high considering just about 27.5 Tons of waste being collected and transported daily.
25. *Private Sector Participation in SWM.* There is no private sector participation in SWM in Hapur.

F. Service Level of Existing SWM System

26. Based on the above discussion, service levels of solid waste management system in Hapur are presented in the following Table.

Description	Value	Remarks
Per capita waste generation	305 gm/day	No proper estimates of waste generation are available with HNP
Collection performance	33%	Acceptable is over 95%.
Door-to-door waste collection coverage	Nil	No door-to-door waste collection system in Hapur
Average distance between dust bins	-	There are only 20 dust bins covering total road length of 100 km. Acceptable spacing is 100 m.
Waste segregation percentage	Nil	Not practiced. Waste is collected and disposed unsegregated, although street rag pickers collect recyclable waste from dust bins, streets and disposal area.
Waste collection frequency	Frequency varies from a day to 1 month	This refers to waste collection and disposal from community dust bins/open points. It is necessary that biodegradable waste is collected and disposed daily. Since waste is not segregated, total waste generated shall be disposed daily.
Collection type	Multiple and manual collection	Multiple waste collection and handling is often inefficient and some waste left on ground at each point. Manual waste handling is unhealthy.
Road length per sweeper		Data not available
Disposal	No safe disposal facility	Waste is disposed by crude open dumping method at the disposal site of PMC. There are no facilities and no fencing. This practice poses potential pollution and health risk.
Private sector participation in SWM	-	No private sector participation in SWM activities in Hapur
O & M expenditure on SWM	-	Details not available

4. PROPOSED SOLID WASTE MANAGEMENT SYSTEM

A. Projected Population and Waste Generation

27. **Table 4-1** shows the projected population of Hapur Town from 2011 to 2041. Considering the potential growth of the town, geometric growth method has been used for population projection.
28. The present per capita waste generation is worked out a 305 gm per day (based on the projected current population and waste present water generation data). To account for increase in waste generation due to economic development, an annual increase of 1.41 percent per annum is considered in per capital waste generation. This was suggested in a study conducted by NEERI.
29. The present waste generation is 84 tons per day, which will increase to 111 tons per day in 2011 and 332 tons per day in 2041 (**Refer Table 4-1**).

B. Proposed Solid Waste Management System for Hapur

30. This Master Plan report is prepared with an objective to formulate a suitable integrated solid waste management system (ISWM) with a design period of 30 years (2011-2041). The proposed SWM system is described below:

Component	Proposed System Details
SWM service	Provide SWM services 7-days a week throughout the year
Door-to-door collection	<ul style="list-style-type: none"> • Initiate daily door-to-door collection; cover 100 % houses in 5 years (2011-16) • Preferably, engage a private agency or NGO for door-to-door collection (DTDC) • Separate sanitary workers shall carryout DTDC • Use auto tippers (in areas with wide roads) & Pushcarts in other areas. <ul style="list-style-type: none"> ○ Pushcart with 4/6 containers – 250 households; 1 sanitary worker ○ Auto Tipper – 1,800 households; 2 - workers (driver and sanitary worker) • Collect wet/biodegradable waste and other waste in separate containers
Street sweeping	<ul style="list-style-type: none"> • Streamline street sweeping activities to cover all the roads/streets • Segregate streets/roads based on the following street sweeping frequency <ul style="list-style-type: none"> ○ Daily (main/important areas of the town & high density areas) ○ Alternative day ○ Weekly twice ○ Weekly once ○ Fortnightly (undeveloped/least developed fringe areas) • Divide streets into street sweeping beats; <ul style="list-style-type: none"> ○ Allocate 1 beat per sweeper for sweeping/drain desilting. ○ Fix beat length between 400 -600 m depending on the population density; divided roads to be considered as two roads ○ Complying with this norm, ULB can manage as per the local requirement such

Component	Proposed System Details
	<ul style="list-style-type: none"> as assigning the desilting and sweeping works to two different sweepers <ul style="list-style-type: none"> ○ Provide a wheel barrows/pushcart with containers to each sweeper
Litter bins	<ul style="list-style-type: none"> ● Provide litter bins on main roads and commercial areas (1 bin in 50 m road length)
Temporary storage/secondary collection	<ul style="list-style-type: none"> ● Waste collected through DTDC & street sweeping shall be deposited in waste container bins for further collection & transport. Use following norms: <ul style="list-style-type: none"> ○ Use closed metal containers (3.0 m³/4.5 m³ capacity) ○ Provide 1 bins for 1-1.5 ton waste generation/day ○ Biodegradable/wet/mixed waste shall be collected daily ○ Other waste can be on alternative day, if the bin is not filled in a day
Waste Transportation	<ul style="list-style-type: none"> ● Containers shall be transported using dumper placer vehicles (modified tractor trolley for with lifting, transport and unloading arrangement for twin bins) ● Number of trips per day – 8 trips i.e. 16 bins per day per vehicle ● Prepare route for each dumper placer vehicle to transport waste to disposal site
Waste collection from Bulk generators	<ul style="list-style-type: none"> ● DTDC will generally cover all residential and mixed residential areas; in other exclusive areas (like markets) waste shall be collected through containers. <ul style="list-style-type: none"> ○ Use closed metal container bins (3.0 m³& 4.5 m³ capacity) ○ Provide 1 bin for 1-1.5 ton waste generation/day ● Collect waste from establishments like hotels/function halls etc using on fixed schedule and transport directly to site. Collect user charge based on quantity ● Collect construction waste separately on demand. Collect user charge ● Utilize existing vehicles (tractors) for this; use auto tippers in narrow lanes
Waste processing & disposal	<ul style="list-style-type: none"> ● Develop an integrated waste processing & disposal facility ● Composting for biodegradable material ● Recyclable material to recycling industries ● Other waste and rejects of compost to sanitary landfill ● Select a suitable site sufficient of 30 years ● Facility shall be developed on PPP

31. With the above recommendation, the equipment, vehicles, land requirement for compost and landfill facility, man-power requirements of proposed SWM system and capital cost estimates are worked out using the “toolkit for preparation of SWM master plan”. The input data and necessary assumptions used to run the tool kit are presented in the following Table. The outputs are presented in **Table 4-1 to Table 4-5**.
32. Land requirement is estimated for 20 years and 30 years design life – it is however recommended that the ULB should look for a site sufficient for 30 years. A suitable site - away from habitations, forest areas, water bodies and places of important cultural, historically or religious interest, shall be selected. The site should be at least 20 km away from Airfield. There should not be any major issues related to social, resettlement, environment and geotechnical matters.
33. Cost of land required for processing and disposal facility is not included in the cost estimates. It is suggested that the ULB should look for an appropriate government waste land, even if it is away from the town.

INPUT DATA FOR SPREAD SHEET BASED SWM MASTER PLAN TOOL

Input for Tool	Data/Details																					
Population	<table border="0"> <tr> <td>Year</td> <td>Population</td> <td>Households</td> </tr> <tr> <td>1951</td> <td>49,260</td> <td></td> </tr> <tr> <td>1961</td> <td>55,248</td> <td></td> </tr> <tr> <td>1971</td> <td>71,266</td> <td></td> </tr> <tr> <td>1981</td> <td>102,837</td> <td></td> </tr> <tr> <td>1991</td> <td>146,591</td> <td></td> </tr> <tr> <td>2001</td> <td>211,983</td> <td>31,774</td> </tr> </table>	Year	Population	Households	1951	49,260		1961	55,248		1971	71,266		1981	102,837		1991	146,591		2001	211,983	31,774
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Current Waste Generation	<table border="0"> <tr> <td>Year</td> <td>Population</td> <td>Quantity</td> </tr> <tr> <td></td> <td>no. s</td> <td>ton</td> </tr> <tr> <td>2009</td> <td>275,000</td> <td>84</td> </tr> </table>	Year	Population	Quantity		no. s	ton	2009	275,000	84												
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	no. s	ton																				
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Waste Composition	<table border="0"> <tr> <td>Biodegradable waste</td> <td>56%</td> </tr> <tr> <td>Recyclable waste</td> <td>15%</td> </tr> <tr> <td>Inert & other waste</td> <td>29%</td> </tr> </table>	Biodegradable waste	56%	Recyclable waste	15%	Inert & other waste	29%															
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Street Sweeping	<table border="0"> <tr> <td>Total road length</td> <td>100 km</td> </tr> <tr> <td>Length of main/market roads</td> <td>10 km</td> </tr> <tr> <td>Proposed Street sweeping frequency</td> <td></td> </tr> <tr> <td> Roads swept daily</td> <td>20% of roads</td> </tr> <tr> <td> Roads swept alternative day</td> <td>40% "</td> </tr> <tr> <td> Roads swept weekly</td> <td>30% "</td> </tr> <tr> <td> Roads swept fortnightly</td> <td>10% "</td> </tr> <tr> <td>Average beat length</td> <td>400 metre/sweeper</td> </tr> </table>	Total road length	100 km	Length of main/market roads	10 km	Proposed Street sweeping frequency		Roads swept daily	20% of roads	Roads swept alternative day	40% "	Roads swept weekly	30% "	Roads swept fortnightly	10% "	Average beat length	400 metre/sweeper					
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Average beat length	400 metre/sweeper																					
Population Projections	Geometric Growth Method (GM)																					
Appropriate size of container bins	<table border="0"> <tr> <td>4.5 m3 containers</td> <td>40%</td> </tr> <tr> <td>3.0 m3 containers</td> <td>60%</td> </tr> </table>	4.5 m3 containers	40%	3.0 m3 containers	60%																	
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Door-to-Door Collection	<table border="0"> <tr> <td>% households covered by Auto Tipper</td> <td>10%</td> </tr> <tr> <td>% households covered by Push Carts</td> <td>90%</td> </tr> </table>	% households covered by Auto Tipper	10%	% households covered by Push Carts	90%																	
% households covered by Auto Tipper	10%																					
% households covered by Push Carts	90%																					

Detailed Cost Estimates – Solid Waste Management

Table 4-1: Projected Population & Waste Generation

Year	Population <i>No,s</i>	Decadal Growth Rate	Households <i>No,s</i>	Waste Generation <i>Tons</i>
2001	211,983	49.19%	31,774	
2011	316,247	31.18%	47,402	99
2016	362,216		54,292	122
2021	414,867	31.18%	62,184	150
2026	475,172		71,223	184
2031	544,243	31.18%	81,576	226
2036	623,353		93,434	278
2041	713,963		107,015	341

Table 4-2: SWM Collection & Transportation Vehicles/Equipment Requirement (2011-2041)

Vehicles/Equipment		2011-16	2016-21	2021-26	2026-31	2031-36	2036-41
Containerized Push Carts for D2D Collection							
Gross Requirement	no,s	188	215	247	283	324	370
To be Procured	no,s	188	215	247	283	324	370
Auto Tippers for D2D Collection							
Gross Requirement	no,s	3	3	3	4	5	5
To be Procured	no,s	3	-	-	4	1	-
Push Carts for Street sweeping							
Gross Requirement	no,s	141	145	149	154	160	167
To be Procured	no,s	141	145	149	154	160	167
Litter Bins							
Gross Requirement	no,s	250	257	265	274	285	297
To be Procured	no,s	250	257	265	274	285	297
Closed Containers (3 m3 capacity)							
Gross Requirement	no,s	67	82	100	123	151	186
To be Procured	no,s	67	15	85	38	113	73
Dumper Placers (twin containers of 3 m3)							
Gross Requirement	no,s	5	6	7	8	10	12
To be Procured	no,s	5	1	1	6	3	3
Closed Containers (4.5 m3 capacity)							
Gross Requirement	no,s	30	37	45	55	68	83
To be Procured	no,s	30	7	38	17	51	32
Dumper Placers (twin containers of 4.5 m3)							
Gross Requirement	no,s	2	3	3	4	5	6
To be Procured	no,s	2	1	-	3	2	1

Table 4-3: Details of Processing and Disposal Facility

Particulars								
A. Compost Plant								
Design Life (Years)	20	30						
Waste Fraction Composted (%)	56%	56%						
Ultimate Design Capacity (ton/d)	127	191						
Land Required for compost (ha)	2.0	2.9						
Equipment required	Backhoe Loader-1, Tipper Truck-2, Tipper Tractor -2, Water Tanker (3000 lt)-1, Weight Bridge (20 MT)-1, Plant & Machinery-1							
B. Landfill Facility								
			2011-16	2016-21	2021-26	2026-31	2031-36	2036-41
Design Life (years)	20	30						
Waste Fraction Land filled (%)	35%	35%						
Design Capacity (tons)	411,143	834,837						
Land required for landfill (ha)	7.3	14.9						
Landfill cell area required (sq. m)	46,254	93,919	8,273	10,162	12,484	15,335	21,046	26,620
Equipment required	Backhoe Loader-1, Bull Dozer-1							
Total Land Requirement (20 Years)			9.3 ha (Compost + Landfill)					
Total Land Requirement (30 Years)			17.8 ha (Compost + Landfill)					

Table 4-4: Requirement of Sanitary Workers (D-to-D Collection & Sweeping)

Particulars	2011-16	2016-21	2021-26	2026-31	2031-36	2036-41
For Sweeping & Drain Cleaning	132	136	140	145	150	156
For D-2-D collection (Auto Tipper)	7	8	9	10	11	13
For D-2-D collection (Push Carts)	200	229	262	300	344	394
Total (collection & street sweeping)	339	373	411	455	505	563

Table 4-5: Capital Cost Estimates

Particulars	Total (2011-2041)	2011-16	2016-21	2021-26	2026-31	2031-36	2036-41
Rs. Lakhs							
<i>Equipment & Vehicles (Collection & Transportation)</i>							
Containerized Push Carts for D2D Collection	162.70	18.80	21.50	24.70	28.30	32.40	37.00
Auto Tippers for D2D Collection	20.00	7.50	-	-	10.00	2.50	-
Push Carts for Street sweeping	91.60	14.10	14.50	14.90	15.40	16.00	16.70
Litter Bins	81.40	12.50	12.85	13.25	13.70	14.25	14.85
Closed Containers (3 m3 capacity)	195.50	33.50	7.50	42.50	19.00	56.50	36.50
Dumper Placers (twin containers of 3 m3)	114.00	30.00	6.00	6.00	36.00	18.00	18.00
Closed Containers (4.5 m3 capacity)	113.75	19.50	4.55	24.70	11.05	33.15	20.80
Dumper Placers (twin containers of 4.5 m3)	81.00	18.00	9.00	-	27.00	18.00	9.00
Total - Collection & Transportation	859.95	153.90	75.90	126.05	160.45	190.80	152.85
<i>Landfill Facility</i>							
<i>Equipment</i>							
Backhoe Loader	40.00	20.00				20.00	
Bull Dozer	120.00	60.00				60.00	
Sub-total	160.00	80.00	-	-	-	80.00	-
<i>Civil Works</i>							
Landfill Cell Development	939.19	82.73	101.62	124.84	153.35	210.46	266.20
Other infrastructure (roads, drains, fencing, building, etc)	102.72	50.59				52.13	
Sub-total	1,041.92	133.32	101.62	124.84	153.35	262.59	266.20
Total - Landfill Facility	1,201.92	213.32	101.62	124.84	153.35	342.59	266.20
<i>Compost Plant</i>							
<i>Equipment</i>							
Backhoe Loader	40.00	20.00				20.00	
Tipper Truck	48.00	24.00				24.00	
Tipper Tractor	16.00	16.00					
Water Tanker (3000 lt)	6.00	3.00				3.00	
Weight Bridge (20 MT)	20.00	10.00				10.00	
Plant & Machinery	200.00	100.00				100.00	
Sub-total	330.00	173.00	-	-	-	157.00	-
<i>Civil Works</i>							
Internal roads, drains, tipping floor, office building, store, etc	146.48	99.23				47.3	
Total - Compost Plant	476.48	272.23	-	-	-	204.25	-
Total	2,538.34	639.44	177.52	250.89	313.80	737.64	419.05