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 Panipat

April 2010

Contents

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 Panipat, 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 Panipat 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 Panipat Town
   (ii) Section 3 describes the existing solid waste management system in Panipat
   (iii) Section 4 presents the proposed solid waste management system for Panipat with capital cost estimates

2. PRIFILE OF PANIPAT TOWN

A. Location

5. Panipat is located in the eastern part of Haryana State in north India. Geographically, Panipat District is located between 29^0 09' 15"and 29^o 27' 25" north latitudes and 76^o 38' 30"and 77^o 09' 15" east longitudes. Panipat is located at about 165 km south of State Capital Chandigarh, and about 85 km north of Delhi. Town is well connected with other parts of the State and Country. NH 1 (Grand Trunk Road) passes through the town. It is also a Railway Junction; the Delhi- Ambala Railway line, runs parallel to the G.T. Road.

6. Panipat is a major Industrial town of Haryana and is famous for handlooms product, carpets and blankets. Panipan city is famous in India by the name of "City of Weaver". Panipat district has significant place in International Market for "Handloom Production". Darri, Carpet Mat, Table Cover, Bed Sheet, Bed Cover, Curtain etc. are exported to Canada, Japan, Germany & Australia.

7. The railway line divides the town into two parts; the old town of Panipat lies on the eastern side of the railway line, while the recent development, the industrial area and the Model Town, is on the western side. Till 1989 Panipat was part of Karnal District. Thereafter the Panipat passed through various changes in its administrative jurisdiction, and finally in 1992 it is formed as a separate district.

8. Panipat has a rich historical background. Panipat was used as a Gateway to India by foreign invaders during the medieval period, and was the great-battle field for three most important and decisive battles of Indian political history in 16^{th} and 18^{th} Centuries.

B. Topography and Soils

9. Panipat district forms part of Indo gangetic plain and lies in Yamuna Sub basin of the Ganges basin. Physio-graphically, the district is characterized by two distinct features - vast upland plains and Yamuna flood plains. The district is mainly drained by River Yamuna and its tributaries. Topography of Panipat Town is almost flat with gentle slope in the northwest to southeast direction towards Yamuna River. Panipat Main Drain originating in the northwestern side passes through the town towards Yamuna in southeast direction.

10. Panipat District is occupied by geological formations of Quaternary Age comprising of recent alluvial deposits belonging to the vast Gangetic alluvial plains. The district has two types of soils – tropical arid brown and arid brown soils. The arid brown soils are found in major parts of the district whereas tropical arid brown soils are found in north eastern part of the district, especially in Panipat and Bapoli blocks.

C. Climate

11. Panipat is located in the northwest part of the country where the climate is mostly sub tropical and semi arid. There are three distinct seasons. Monsoon - hot and humid season from mid-June to September. Second season, Winter, is the cool and dry season from October to March. The third season, Summer, is characterized by hot and dry weather which prevails from April to mid-June. Panipat experiences large variations in temperature across the year. May and June experiences high temperatures and the lowest is recorded in the months of December and January.

12. Panipat experiences unreliable rainfalls which are mainly concentrated in monsoon seasons. The region receives rainfall mainly under the influence of southwest monsoon from July to September. Around 70 percent rainfall is received during this season and the remaining rainfall is received during December to February. The annual average rainfall is about 610 mm , which is spread over 31 rainy days.

Table 2-1: Annual Rainfall of Panipat

Year	Yearly Rainfall in mm
2004	560.3
2005	555.5
2006	353.0
2007	290.3
2008	430.5

D. Water Resources

13. Yamuna River flows at about 20 km east of Panipat Town in north-south direction. This is the only river which is passes through Haryana State. Within or nearby the Panipat Town, there are no notable water bodies in the town. A drain of 4-6 m wide – known as Panipat Drain (*Gandha Nalla*), flows across the town from north-west to south-east. Rainfall in the town is erratic and the water flow is limited only to wastewater received from residential and industrial areas. Since there is no proper sewerage system in the town, domestic wastewater is disposed into open drains, which finally discharge into Panipat Drain.

14. Two canals of the West Jamuna Canal (WJC) system –Parallel Delhi Branch (PDB) Canal and Carrier Link Canal (CLC), flow through western part of the town in north-south direction.

15. Groundwater is the main source of water supply for Panipat. Depth of groundwater table ranges from 20 - 40 m and general flow of ground water is towards south- west direction. The groundwater resources in Panipat are overexploited and also polluted in some areas. Deeper ground water is by and large safe. (Source: Ground Water Information Booklet, Panipat District Haryana, Central Ground Water Board, 2007)

E. Demography

16. Population of Panipat was 191,000 in 1991 and 261,740 in 2001 (decadal growth rate of 37 percent). The preceding decade of 1981-91 also experienced a higher growth (38.5 percent). Gross average density has increased from 96 persons per hectare in 1991 to 132 in 2001. Following Table shows the population growth of Panipat in the municipal limits.

Table 2-2: Population Growth of Panipat

Year	Population	Decadal Growth Rate (%)
1941	38,000	-
1951	54,981	44.73
1961	67,026	21.81
1971	87,981	31.34
1981	137,927	56.82
1991	191,000	38.41
2001	268,823	27.00

Source: Census of India

F. Land Use

17. Located close to the national capital Delhi, and along NH 1, Panipat is traditionally a commercial and industrial centre. NH 1 and the railway line running parallel to NH, divides the town into two parts. On the western side across the railway line are the industrial area and the model town. The older, historical part of the town is on the eastern side. Total area of the town is 19.86 sq. km comprising 31 municipal wards, inhibiting 261,740 population (2001 Census). As shown in the following Table, of the total area about 50 percent is in residential use followed by industrial land use of about 21 percent.

Table 2-3: Existing & Proposed Land Use in Panipat Municipal Limits

Land Use Classification	Existing Land Use		Proposed Land Use	
	Area	% of total area	Area	% of total Area
	ha	*%*	*Ha*	*%*
Residential	1,075	52.3	980	49.3
Commercial	28	1.4	165	8.3
Industrial	427	21.5	555	27.9
Public & Semi-Public	95	4.8	113	5.7
Transport & Communication	33	1.7	42	2.1
Public Utility			44	2.2
Open Spaces	252	12.7	88	4.4
Special Zone	-	-	-	-
Agricultural Zone	77	3.9	-	-
Total	**1,987**	**100.0**	**1,987**	**100.0**

Source: Development Plan 2001

3. EXISTING SOLID WASTE MANAGEMENT SYSTEM

A. General

18. 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 system is Panipat is the responsibility of Panipat Municipal Council (PMC). Existing solid waste management system of Panipat is presented in this section.

B. Solid Waste Generation – Quantity and Characteristics

19. Spreading over an area of 22.5 sq. km, the PMC is divided into 31 municipal wards for administrative purposes. PMC is undertaking solid waste management in all 31 wards. Total road length is 270 km. PMC engaged services of an NGO (EXNORA) for solid waste management in the town. This agency is involved in door-to-door collection (in part of the town), street sweeping, drain disilting, collection and transportation of waste from all 31 wards of the town.

20. As per the current estimates (2009) of the Panipat Nagar Nigam, about 124.5 tons of solid waste is generated daily in Panipat –at a per capita waste generation rate of 358 gm per day per person (projected population of 2009 is 347,500). 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 textile-based) in the town, industrial solid waste also enters illegally into municipal solid waste. The source of waste generation is presented in **Table 3-1**.

Table 3-1: Solid Waste Generation Sources in Panipat

S. No	Source	Quantity (tons)	% of Waste
1	Residential	39	31.3
2	Commercial, Industrial, Hospital	48	38.6
3	Hotels	5	4.0
4	Institutions	0.5	0.4
5	Markers (Vegetable, Fruit & Meat)	16	12.9
6	Construction and Street Sweeping	8	6.4
7	Garden Waste	3	2.4

8	Other waste	5	4.0
	Total	**124.5**	**100.0**

21. *Composition of Waste*. No data on composition of waste generated in Panipat 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 Panipat (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

22. In absence of waste composition data from Panipat, average values based on the above is considered:
    - Compostable matter – 56%
    - Recyclable fraction – 20%.
    - Inert and other waste – 24%

C. Solid Waste Collection & Transportation

23. PMC has initiated door-to-door collection system through an NGO (EXNORA) in some parts of the city covering 10,000 households, which is about 20 percent of the total 51,000 households in the town. This system is initiated in January 2010 in the following localities: Model Town, Sukhdev Nagar, Geeta Colony, Narayan Singh Park, Virat Nagar, Friends Colony, Agrasen Colony and Bishansworoop Colony. EXNORA employed 80 sanitary workers exclusively for door-to-door collection. The workers use auto tippers and hand carts for the purpose. Waste from auto tippers is directly transported to the waste disposal site while waste collected through push carts is shifted to tractor-trailers for further transport. The details of these vehicles are not available. The response to door-to-door collection is encouraging however there is a need for awareness creation among the general public.

24. In the remaining areas the waste collection is mostly through community dust bins. There are 268 waste collection points, of which only 16 are closed containers and the remaining are open dust bins (**Table 3-3**). In addition there are a large number unauthorized open collection points where people dump waste regularly. Due to lack of proper collection system and civic sense, most of the 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.

Table 3-3: Details of Waste Collection Bins

S. No	Type	No.s
1	Closed container bins (3 m3 capacity)	16
2	Open cement concrete dust bins (1 m3 capacity)	107
3	Open cement concrete dust bins (0.5 m3 capacity)	143
4	Open dumping points	12
	Total	**268**

25. Total road length of Panipat is 270 km, in which there are 268 waste collection points – on an average 1 collection bin/point is provided per every kilometer of road length.

26. 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. PMC has engaged the services of an NGO, EXNORA, for street sweeping, drain disilting, collection and transportation of waste from bins to disposal site in all 31 wards in Panipat. Of the 270 km, street sweeping is carried out in 210 km, and the remaining are mostly roads in undeveloped areas.

27. 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 2 intermediate collection points. A total of 267 workers are engaged by the NGO for street sweeping and drain desilting activities. In addition, 32 sanitary workers of the PMC are also involved in this activity.

28. *Transportation of Solid Waste*. Waste from community dust bins/open collection points is manually lifted into vehicles for transportation to disposal site at Nimbri Village (about 9 km in the eastern side of the town and is accessible by Panipat – Sanoli Road). Waste is mostly transported in open tractor-trailers, without any cover. Of the total generated 124.5 tons, PMC collects and transports 81 percent of the waste daily (**Table 3-4**). Closed container bins are transported by dumper placer. Waste collected by door-to-door collection through auto tippers is transported to disposal site directly.

Table 3-4: Details of Transportation Vehicles

Description	Owner Ship	Nos.	Vehicle Capacity	Trips / Day	Total quantity
			Tons	*Nos.*	*Tons*
Tractor-Trolley	Private	20	1.5	3	90.0
Dumper placer	PMC	1	2.0	3	6.0
Auto Tipper	PMC	3	0.5	3	4.5
Total		**21**	**-**	**-**	**100.5**

D. Solid Waste Processing & Disposal

29. There is no scientific solid waste processing or disposal facility in Panipat; waste collected from the city is disposed at a site in Nimbri Village (9 km from the city in eastern direction) by crude open dumping method. This practice is very unhealthy and environmentally unsafe. Area of the site is 5 acres. The site is located on the back side of a textile industry, who owns this land. Since it is a low-lying land, the owner requested PMC to use the land for waste disposal to raise the ground level.

30. Waste is dumped and left open without any daily cover material thus solid waste dumps are exposed to atmosphere. Site is accessible by a good road and the site fenced on two sides. The area of existing dumping site is inadequate to accommodate the quantity of municipal solid waste being generated. Moreover, this is a temporary arrangement with the land owner and the waste disposal needs to be discontinued once it is filled.

31. PMC has acquired a site of 9 acres, about 1 km further away from the existing disposal site at Nimbri Village for development of a disposal facility. The site is connected to Panipat-Sanoli Road by a Kutcha Road. The site is surrounded by agricultural fields and is located away from habitations.

E. Institutional Aspects

32. Safe disposal of solid waste generated in an urban area is the obligatory function of the respective urban local body - it is Panipat Municipal Council (PMC) in case of Panipat Town. SWM Department, headed by Chief Sanitary Inspector (CSI) is responsible for the solid waste management component in the town; CSI is supported by Sanitary Inspectors and Supervisors. Total staff strength of SWM department is 67. EXNORA, the private agency involved in SWM activities in the town, has employed 467 sweepers for the purpose (**Table 3-5**).

Figure 1: Organizational Set-up of PNP SWM Department

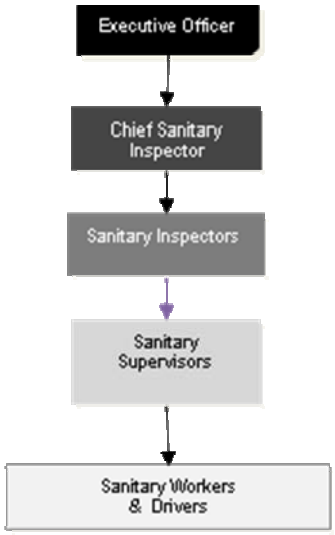

Table 3-5: Staff Details of Panipat SWM Department

S. No	Designation	PMC Staff	Contractor Staff
1	Chief Sanitary Inspector	1	-
2	Sanitary Inspectors	2	-
3	Supervisors	14	-
4	Sanitary Workers (street sweeping & drain desilting)	32	267
5	Sanitary workers (Door to Door collection)	-	80
6	Sanitary workers (transport)	15	100
7	Drivers	3	20
	Total	**67**	**467**

33. Total expenditure on SWM during 2008-09 was Rs. 128 lakhs, which is about Rs. 349 per ton of waste collected and disposed. However, this is on lower side and appears that all the costs incurred by SWM department (for example salaries of permanent staff) are not included.

34. *Private Sector Participation in SWM*. Panipat MC has been involving private sector in solid waste management since 2007. EXNORA, an NGO having a vast experience in handling solid waste management, has been engaged to provide all SWM services including street sweeping, drain desilting, waste collection and transport to disposal site in the entire town through its own personnel and vehicles/equipment. In January 2010, PMC also handed over door-to-door collection in part of the city to EXNORA.

F. Service Level of Existing SWM System

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

Description	Value	Remarks
Per capita waste generation	358 gm/day	Generally varies from 200 gm to 600 gm.
Collection performance	71%	Acceptable is over 95%.
Door-to-door waste collection coverage	20%	PMC recently initiated door-to-door collection system with private participation covering 10,000 of total 51,000 households
Average distance between dust bins	1,000 m	Acceptable spacing is 100 m. Moreover most of these are open collection points. Due to lack of proper door-to-door collection system and insufficient dust bins, street littering is prevalent in the town.
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 15 days (waste is transported when the bins are full)	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	634 m	Varies generally from 250 – 750 m
Disposal	No safe disposal facility	Waste is disposed by crude open dumping method at the disposal site of PMC. This practice poses potential pollution and health risk.
Private sector participation in SWM	100 %	Presently entire SWM system (sweeping, collection and transportation) is handed over to a private agency. PMC is only supervises and manages the system.
O & M expenditure on SWM	Rs. 349/ton	This appears low and needs to be verified. Currently, there is no expenditure on disposal as the PMC resorts to crude open dumping.

4. PROPOSED SOLID WASTE MANAGEMENT SYSTEM

A. Projected Population and Waste Generation

36. **Table 4-1** shows the projected population of Panipat Town from 2011 to 2041. Considering the potential growth of the town, geometric growth method has been used for population projection.

37. The present per capita waste generation is worked out at 358 gm per day (based on the projected current population and waste present water generation data). To account for the increase in waste generation due to economic development, an annual increase of 1.41 percent per annum is considered in per capita waste generation. This was suggested in a study conducted by NEERI.

38. The present waste generation is 124.5 tons per day, which will increase to 137 tons per day in 2011 and 544 tons per day in 2041 (**Refer Table 4-1**).

B. Proposed Solid Waste Management System for Panipat

39. 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	• Expand door-to-door collection; cover 100 % houses in 4 years (2011-15) • 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. o Pushcart with 4/6 containers – 250 households; 1 sanitary worker o Auto Tipper – 1,800 households; 2 - workers (driver and sanitary worker) • Collect wet/biodegradable waste and other waste in separate containers
Street sweeping	• Streamline street sweeping activities to cover all the roads/streets • Segregate streets/roads based on the following street sweeping frequency o Daily (main/important areas of the town & high density areas) o Alternative day o Weekly twice o Weekly once o Fortnightly (undeveloped/least developed fringe areas) • Divide streets into street sweeping beats; o Allocate 1 beat per sweeper for sweeping/drain desilting. o Fix beat length between 400 -600 m depending on the population density; divided roads to be considered as two roads o Complying with this norm, ULB can manage as per the local requirement such

Component	Proposed System Details
	as assigning the desilting and sweeping works to two different sweepers o Provide a wheel barrows/pushcart with containers to each sweeper
Litter bins	• Provide litter bins on main roads and commercial areas (1 bin in 50 m road length)
Temporary storage/ secondary collection	• Waste collected through DTDC & street sweeping shall be deposited in waste container bins for further collection & transport. Use following norms: o Use closed metal containers (3.0 m3 and 4.5 m3 capacity) o Provide 1 bins for 1 ton waste generation/day o Provide 2 bins at each location – 1 for wet/biodegradable waste & 1 for others o Biodegradable/wet/mixed waste shall be collected daily o Other waste can be on alternative day, if the bin is not filled in a day
Waste Transportation	• 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	• DTDC will generally cover all residential and mixed residential areas; in other exclusive areas (like markets) waste shall be collected through containers. o Use closed metal container bins (3.0 m3& 4.5 m3 capacity) o 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	• 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

40. With the above recommendations, 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 are presented in the following Table. The outputs are presented in **Table 4-1 to Table 4-5.**

41. 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 an Airfield. There should not be any major issues related to social, resettlement, environment and geotechnical matters.

42. 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	Year Population Households 1951 54,981 1961 67,026 1971 87,981 1981 137,927 1991 191,000 2001 268,823 51,000
Current Waste Generation	Year Population Quantity *no. s* *ton* 2009 347,495 124.5
Waste Composition	Biodegradable waste 56% Recyclable waste 20% Inert & other waste 24%
Street Sweeping	Total road length 270.0 km Length of main/market roads 25 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
Population Projections	Geometric Growth Method (GM)
Appropriate size of container bins	4.5 m3 containers 60% 3.0 m3 containers 40%
Door-to-Door Collection	% households covered by Auto Tipper 30% % households covered by Push Carts 70%

Table 4-1: Projected Population & Waste Generation

Year	Population	Decadal Growth Rate	Households	Waste Generation
	No,s		*No,s*	*Tons*
2001	2,68,823	85.79%	51,000	
2011	4,99,438	40.42%	94,751	184
2016	5,91,825		1,12,279	234
2021	7,01,302	36.85%	1,33,048	297
2026	8,20,407		1,55,644	373
2031	9,59,740	32.82%	1,82,078	468
2036	11,06,088		2,09,842	578
2041	12,74,752		2,41,841	715

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	292	346	410	480	561	647
	To be Procured	no,s	292	346	410	480	561	647
Auto Tippers for D2D Collection								
	Gross Requirement	no,s	16	19	22	26	30	35
	To be Procured	no,s	16	3	3	20	7	8
Push Carts for Street sweeping								
	Gross Requirement	no,s	380	390	401	414	429	444
	To be Procured	no,s	380	390	401	414	429	444
Litter Bins								
	Gross Requirement	no,s	625	642	661	682	706	732
	To be Procured	no,s	625	642	661	682	706	732
Closed Containers (3 m3 capacity)								
	Gross Requirement	no,s	82	104	133	166	208	258
	To be Procured	no,s	82	22	111	55	153	105
Dumper Placers (twin containers of 3 m3)								
	Gross Requirement	no,s	6	7	9	11	13	17
	To be Procured	no,s	6	1	2	8	3	6
Closed Containers (4.5 m3 capacity)								
	Gross Requirement	no,s	82	104	133	166	208	258
	To be Procured	no,s	82	22	111	55	153	105
Dumper Placers (twin containers of 4.5 m3)								
	Gross Requirement	no,s	6	7	9	11	13	17
	To be Procured	no,s	6	1	2	8	3	6

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)	262	400						
Land Required for compost (ha)	4.0	6.1						
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 (%)	30%	30%						
Design Capacity (tons)	7,04,332	14,56,752						
Land required for landfill (ha)	12.5	25.9						
Landfill cell area required (sq. m)	79,237	1,63,885	13,508	17,167	21,539	27,024	37,272	47,375
Equipment required	Backhoe Loader-1, Bull Dozer-1							
Total Land Requirement (20 Years)		16.5	ha (Compost + Landfill)					
Total Land Requirement (30 Years)		32.1	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	356	365	376	388	401	416
For D-2-D collection (Auto Tipper)	37	44	52	61	72	82
For D-2-D collection (Push Carts)	311	368	436	510	597	688
Total (collection & street sweeping)	704	777	864	959	1,070	1,186

Table 4-5: Capital Cost Estimates

Particulars	Total (2011-2041)	2011-16	2016-21	2021-26	2026-31	2031-36	2036-41
		Rs. Lakhs					
Equipment & Vehicles (Collection & Transportation)							
Containerized Push Carts for D2D Collection	273.60	29.20	34.60	41.00	48.00	56.10	64.70
Auto Tippers for D2D Collection	142.50	40.00	7.50	7.50	50.00	17.50	20.00
Push Carts for Street sweeping	245.80	38.00	39.00	40.10	41.40	42.90	44.40
Litter Bins	202.40	31.25	32.10	33.05	34.10	35.30	36.60
Closed Containers (3 m3 capacity)	264.00	41.00	11.00	55.50	27.50	76.50	52.50
Dumper Placers (twin containers of 3 m3)	156.00	36.00	6.00	12.00	48.00	18.00	36.00
Closed Containers (4.5 m3 capacity)	343.20	53.30	14.30	72.15	35.75	99.45	68.25
Dumper Placers (twin containers of 4.5 m3)	234.00	54.00	9.00	18.00	72.00	27.00	54.00
Total - Collection & Transportation	*1,861.50*	*322.75*	*153.50*	*279.30*	*356.75*	*372.75*	*376.45*
Landfill Facility							
Equipment							
Backhoe Loader	40.00	20.00				20.00	
Bull Dozer	120.00	60.00				60.00	
Sub-total	160.00	*80.00*	-	-	-	*80.00*	
Civil Works							
Landfill Cell Development	1,638.85	135.08	171.67	215.39	270.24	372.72	473.75
Other infrastructure (roads, drains, fencing, building, et	179.25	86.67				92.58	
Sub-total	1,818.10	*221.74*	*171.67*	*215.39*	*270.24*	*465.30*	473.75
Total - Landfill Facility	*1,978.10*	*301.74*	*171.67*	*215.39*	*270.24*	*545.30*	*473.75*
Compost Plant							
Equipment							
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*	
Civil Works							
Interal roads, drains, tipping floor, office building, store,	307.13	198.45				108.7	
Total - Compost Plant	*637.13*	*371.45*	*-*	*-*	*-*	*265.68*	*-*
Total	4,476.72	995.94	325.17	494.69	626.99	1,183.73	850.20