Infrastructure Development Department (IDD)

GOVERNMENT OF KARNATAKA

Directorate of Municipal Administration

Pre-Feasibility Report

Integrated Solid Waste Management Project

Bijapur City Municipal Council

July 2012

ICRA Management Consulting Services Limited

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Abbreviations and Acronyms

MSW	Municipal Solid Waste
ULB	Urban Local Body
HUA	Hyderabad Urban Agglomeration
MSWM	Municipal Solid Waste Management
DTDC	Door To Door Collection
GHMC	Greater Hyderabad Municipal Corporation
REEL	Ramky Enviro Engineers Limited
BOT	Build Operate Transfer
O&M	Operation and Maintenance
GOI	Government of India
RMC	Rajkot Municipal Corporation
HBEPL	Hanjer Biotech Industries Private Limited
MCD	Municipal Corporation of Delhi
NDMC	New Delhi Municipal Corporation
DMA	Directorate of Municipal Administration
KUIDFC	Karnataka Urban Infrastructure Development & Finance Corporation
SHG	Self-help Group
NGO	Non-Governmental Organisation
IEC	Information, Education and Communication
TPD	Tons Per Day
CMC	City Municipal Council
O&M	Operation and Maintenance
BCMC	Bijapur City Municipal Council

1. Introduction

1.1 Project Idea

The Government of Karnataka (GoK) has identified Public Private Partnerships (PPPs) as one of the key elements of its infrastructure development strategy. To build capacity across various departments for conceptualizing, developing and implementing PPP projects, GoK, through its Infrastructure Development Department (IDD) has initiated an exercise for Institutional strengthening and developing sector level inventory for mainstreaming PPPs across a number of departments and sectors.

Under this initiative, the Department of Municipal Administration (DMA) has been identified as a nodal agency for urban infrastructure projects in Urban Local Bodies (ULBs) other than Bangalore Metropolitan Area. The exercise envisages creation of sector level inventory of PPP projects, conduct pre-feasibility studies for 5 projects (with potential for replication in rest of the state), maintenance of an MIS on PPP projects in the sector.

In view of the above, GoK has appointed Ms. ICRA Management Consulting Services Limited (IMaCS) as transaction advisors for Directorate of Municipal Administration. The objective of the assistance is to develop five types of projects in the urban sector.

After meetings and discussions with Infrastructure development Department, Karnataka (IDD), Directorate of Municipal Administration, Karnataka (DMA) and Bijapur City Municipal Council (BCMC) in February and March 2012, the following PPP project was identified for further scrutiny and development as part of this initiative in Bijapur Municipal Council. The project is:

Integrated Municipal Solid Waste Management - This project intends to evaluate the scope for and structuring a PPP solution for addressing Municipal Solid Waste Management in Bijapur town.

The primary objective of this assignment is to prepare a Pre-feasibility study report for Integrated Municipal Solid Waste Management in Bijapur on Public-Private Partnership (PPP) mode, which would include assessment of, prima facie, feasibility for development of such Project on PPP mode, recommendations, conditionalities & enablers for development of the Project on PPP basis, preliminary assessment of the project financials, cash flow and viability issues, exploring options of packaging with other allied commercial components to make the project viable for a PPP mode, identifying criteria for measuring and monitoring service quality to be provided by developers/ operators to be selected for the Project, recognition of infrastructure, financing & other requirements for establishing the Project and Plan of Action for initiating next steps of project development and bid process management of the Project.

In Bijapur, MSWM is completely being handled by the municipality. The current population of the city is 3.26 lakh with a large number of commercial establishments and generates about 109 TPD of MSW.

1.2 Scope of Work

The objective of the engagement for IMaCS is to support Directorate of Municipal Administration in developing the project listed above in Bijapur city. The scope of work for the study is to prepare a Pre-Feasibility Report for the PPP project "**Integrated Municipal Solid Waste Management** at Bijapur" which includes:

1. Understanding the existing Municipal Solid Waste Management(MSWM) system in Bijapur w.r.t the infrastructure
2. Assessing the Income and Expenditure of the Bijapur CMC

3. Identification of key issues & bottlenecks in the current system
4. Understanding the role and merits and demerits of PPP in Municipal Solid Waste Management and its success key factors through case studies.
5. Preparation of preliminary financial Model in order to explore the viability of a PPP model for managing Municipal Solid Waste (MSW)
6. Understanding the statutory and legal framework which prevails in this project and identifying the policy issues which may slow down the process of implementation of the project on PPP mode.
7. Identifying environmental and social impacts of the project and to suggest mitigation measures to overcome these impacts
8. Recommendation of a possible project framework
9. Way forward

1.3 Approach and Methodology

The approach and methodology adopted in assessing the feasibility of the Integrated Solid Waste Management project in Bijapur CMC is given below:

A. Situation Analysis and Review

1. City Profiling: Understanding & Analysis of demographics, density distribution and overview of existing infrastructure and future growth pattern.
2. Existing Situation: Study of existing MSWM system, area and population coverage, infrastructure and manpower availability, financial aspects and review of on-going management plans within Bijapur CMC.

B. Technical Feasibility – To finalize the system, best practices have been seen and considered for technical input for the study.

C. Preliminary Financial Viability Assessment

As per the study requirements, IMaCS has carried out a Preliminary Financial Viability Assessment for the Project based on estimations of Capital costs, O&M costs, revenues and other key performance parameters. For this market data relating to cost of new equipments, new technology, etc. has been considered based on secondary research. Financial data related to budget sheets has been collected from the Municipal Council to understand its financial health and its current expenses on Solid waste management system. Cost analysis has been performed for different options. After choosing the best option, financial analysis and project structuring has been finalized.

D. Project Implementation Structure

An appropriate project implementation structure have been recommended for implementation of the project through PPP mode on the basis of the Preliminary Financial Viability Assessment, market and economic assessment, existing regulatory framework and risk assessment.

E. Project Development Framework & Way Forward

The Pre-feasibility study report of the Project has included the suggested Project Development Framework and Way Forward for development of the Project.

1.4 Report structure and contents

This document covers Pre-Feasibility Report for the Integrated Solid Waste Management system on PPP mode for Bijapur town. The report has been prepared based on information provided by Bijapur City Council; is organised along the following sections:

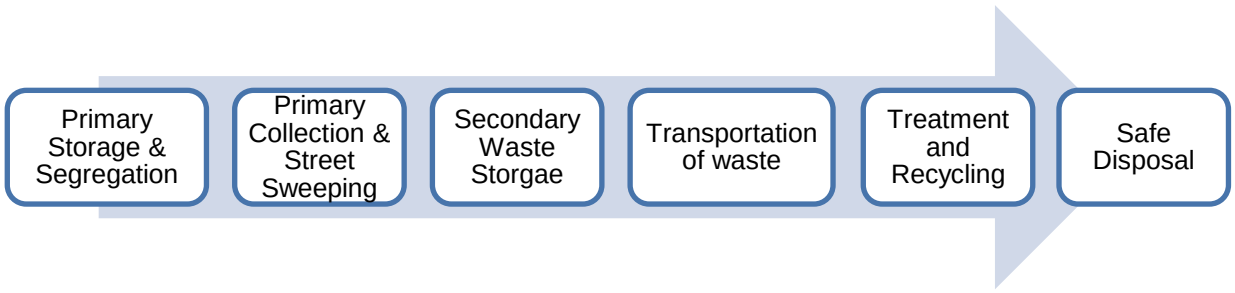
1. Section 1: “Introduction” provides the project idea, the scope of work and the methodology adopted to achieve the stated objective
2. Section 2: “Sector Profile” includes an overview of solid waste management in India, the current status of municipal solid waste management in Karnataka, initiatives by the state and the issues faced
3. Section 3: “Bijapur Overview” gives information about the location, demography, connectivity to nearby towns and the municipal organisation relevant to solid waste management, existing solid waste management system in Bijapur, interaction with the stakeholders, identifying the need of an integrated solid waste management system, study of best practices related to solid waste management on PPP mode and the reports available in this sector for Bijapur
4. Section 4: “Project Brief” covers project design details out the technical estimations
5. Section 5: “Risk Analysis, Project Structuring and Bid Variable”
6. Section 6: Project Financials
7. Section 7: “Statutory & Legal Framework” describes the various Acts, Laws and Rules pertaining to municipal solid waste management in the State of Karnataka
8. Section 8: “ Indicative Environmental & Social Impacts” this includes the anticipated impacts on the environment and the society in the different phases of the project and mitigation measures for the same
9. Section 9: “Way Ahead”

2. Sector profile - Municipal Solid Waste

2.1 Sector overview

Municipal Solid Waste (MSW) is the non-liquid waste generated from households, markets, hotels, hospitals, nursing homes etc. The per capita waste generation in Indian cities varies from 0.2-0.6 kg/capita/day. With the increasing population managing the waste generated becomes a difficult task for the ULBs, which under the 74th amendment to the Indian Constitution and Municipal Solid Waste (Handling & Management) Rules, 2000, are entrusted with the task of managing the MSW generated within their jurisdiction. Most ULBs spend 60%-70% of their budget allocated to solid waste management on collection, 20%-30% on transport and less than 10% on processing and disposal. The Municipal Solid Waste Management (MSWM) process chain comprises of the following components:

Exhibit 2-1: MSWM Process Chain



Current system of MSWM in India

The current practice of MSWM in most of the Indian cities is unscientific and poses a health and environmental hazard. **Error! Reference source not found.** Shows the process of MSWM followed in a large number of Indian cities.

Storage & Collection

In many Indian cities the citizens store the waste in plastic dustbins and deposit the waste at the community bin located nearest to their house. The waste segregation at source is minimal. In some cities DTDC is practised, in these cities the waste from individual houses, commercial areas etc. is collected using tricycles or handcarts. The waste in the handcarts is either transferred to the community bins or it is transferred to the vehicles going to the disposal site.

Transportation of Waste

For waste transportation to disposal site vehicles such as trucks, tractors, dumper placers, compactors, trailers etc are normally used. Most of the vehicles used for transportation are not covered and are loaded manually.

Treatment/ Processing of the Waste

In most of the cities the MSW generated is not treated but taken directly to the disposal site. Few cities have composting plants but they function well below the installed capacity.

Disposal of Waste

Most of the cities adopt the practice of dumping the waste in areas within the city or on its outskirts. This is the most neglected part of the MSWM. The waste deposited such is neither spread nor compacted.

It has been observed that there is a lack of proper MSWM services in the country primarily due to reasons including; financial constraints of ULBs, institutional problems within the departments, fragile links with other concerned agencies, lack of suitable staff, and other allied problems. Mostly, expenses towards MSWM are met from the general budget and allocation from Property taxes. Very often, funding for operations and maintenance relating to provision of MSWM services is not earmarked and properly budgeted for.

2.2 Regional profile

To ensure the implementation of the provisions of the MSW Rules, 2000 in the state of Karnataka the Directorate of Municipal Administration (DMA) and Karnataka Urban Infrastructure Development & Finance Corporation (KUIDFC) under the Nirmal Nagar program of Government of Karnataka (GoK) prepared a state policy on integrated MSW management.

Committee for issuing authorisation under MSW Rules

In 2002 a Committee for issue of authorizations under Municipal Solid Waste (Management and Handling) Rules, 2000 was constituted. The Committee examines the proposals submitted by the Municipal Authorities and takes decisions on issue of authorization under MSW Rules for setting up of waste processing and disposal facility including landfill.

IEC initiatives

Under IEC campaign seminars and workshops have been conducted with involvement of NGOs and materials for hoardings, booklets and posters generating awareness about SWM have been prepared.

Waste generation

Karnataka has 213 ULBs excluding BBMP, these include; City Corporations, City Municipal Councils, Town Municipal Councils and Town Panchayats. Together these ULBs generate 4700 TPD of MSW.

Exhibit 2-2: MSW Generated in ULBs of Karnataka

State Policy on MSW Management

The state policy sets the goal of an effective MSWM system to be one which protects the environment, natural resources and public health. It emphasises the importance of waste reduction, segregation, recycling and resource recovery from waste in implementing an effective MSWM system.

The objectives of the State Policy on MSW management are as follows:

- Providing directions for carrying out the MSW management activities viz. collection, transportation, treatment and disposal in a manner, which is not just environmentally, socially and financially sustainable but is also economically viable.
- Establishing an integrated and self-contained operating framework for MSW management, this would include the development of appropriate means and technologies to handle various MSW management activities.
- Enhancing the ability of the ULBs to provide effective MSW management services to their citizens.

Apart from this, the policy also talks about stakeholder involvement such as source segregation and primary collection to be handled by community based organisation / resident welfare association / self help group (SHG) including Non Governmental Organisations (NGOs) in Information, Education and Communication (IEC) activities and awareness programs.

S.No	Type of ULB	Waste Generation (Tonnes/ day)
1	City Corporations(7)	1700
2	City Municipal Councils(44)	1700
3	Town Municipal Councils (68)	1000
4	Town Panchayats(94)	300
	Total	**4700**

Source: Directorate of Municipal Administration

Collection and Transportation

- Action plan for SWM has been finalised for all the ULBs.
- Door to Door collection started in 142 ULBs.
- More than 1000 SHGs have been identified and more than 400 SHGs are involved in door to door collection
- Secondary collection and transportation started in 127 ULBs.

Disposal

- Mangalore, Karwar, Udupi and Puttur have developed waste processing & sanitary landfill facilities in the year 2005-2006 under 'KUDCEM project',
- Under 'Fast Track Cities' project, Shimoga and Belgaum developed these facilities on BOT basis.
- Siraguppa TMC ,Bellary District has set up a 1.5 TPD Capacity Bio-Methanation Pilot Plant
- Kundapura TMC by utilizing 2008-09 special SFC grant, TFC & municipal funds have developed Inertization and Land filling facilities
- Mysore CC have developed sanitary landfill facilities on BOT basis
- 11 ULBs have invited Expression of Interest (EOI) to develop integrated MSW treatment and land filling facilities on DBOT basis.

Exhibit 2-3: Status of MSW landfills facilities by the local bodies in Karnataka

S.No.	Status	Number
1	No of ULBs possessing required landfill sites	205
2	No of ULBs having common landfill site	3
3	No of ULBs yet to procure landfill sites	5
4	No of ULBs who have developed basic infrastructure at landfill sites	162
5	No of ULBs who have developed sanitary landfill facilities for scientific disposal of waste	8
6	No of ULBs following pit method	148

Source: Directorate of Municipal Administration

2.3 Key Issues

1. No segregation of waste at source
2. Absence of Door to Door Collection leads to open dumping of waste
3. Lack of public awareness and education regarding source storage and segregation
4. The waste depots designed for secondary storage of waste are often not evenly distributed within the city and are open
5. Manual handling of waste without protective equipment poses danger to the health of the sanitary workers
6. The normal practice of waste transport is in open trucks or tractors which leads to spilling of waste on the roads
7. Waste generated is not treated in many cases but directly taken to dumpsites where instead of scientific disposal they are dumped into pits or left in heaps to decay
8. The ULB staff is often not trained on aspects of scientific waste management
9. Financial constraints of ULBs and Institutional problems within the departments lead to mismanagement of solid waste

3. Existing Situation of MSW at Bijapur

3.1 Project Objective

The objective of this feasibility study is to evaluate the scope for an integrated PPP project starting with source segregation and door-to-door collection, transportation, processing and landfilling to improve sustainability of waste-management operations in the city. Financial feasibility would be assessed to determine whether the project offers reasonable return on investment and can be an option for private sector participation.

3.2 Description of the Project

To provide an effective MSWM service we plan to propose a system which ensures 100% collection, minimum manual handling, safe transport, maximum resource recovery and minimum waste diversion to landfill.

3.3 Components of the Project

Broadly the project would be divided into the following phases:

- Primary Collection & Transportation
- Secondary Storage & Transportation
- Treatment & disposal

Before suggesting a possible project structure there is a need to study the current practice of MSWM being followed in Bijapur CMC, and the issues and gaps in service delivery.

3.4 Description of the Site

3.4.1 Introduction

Bijapur city is the district headquarters of Bijapur district of the state of Karnataka and is a major economic centre. The city is located on NH - 13 which connects Sholapur, Maharashtra and Chitradurga in Karnataka. Bangalore is at a distance of 530 km and Mumbai and Hyderabad are at a distance of 550 km and 384 km respectively. The city occupies an area of 93.5 sq. km and has a population of 3,26,360 (Census 2011). Bijapur city is historical city and in existence from 11th century Chalukyan dynasty. It came under Muslim rule of the Bahamani Sultans followed by the rule of Adil Shahi dynasty and finally the Mughals. The city is broadly divided into two parts; old city and newer areas. These are further divided into 35 wards. The average literacy rate of Bijapur is 84%; the male literacy rate stands at 89% and female at 78%. About 14 % of the population are slum dwellers. There are 41 notified slums and 4 non notified slums in Bijapur city. Bijapur has grown into an educational, commercial and tourist centre.

Exhibit 3-1: Population Trends of Bijapur city

S.No	Year	Population	Increase	Growth %
1	1951	65736		
2	1961	78854	13118	20.0%
3	1971	103931	25077	31.8%
4	1981	147313	43382	41.7%
5	1991	193131	45818	31.1%
6	2001	253891	60760	31.5%
7	2011	326360	72469	28.5%

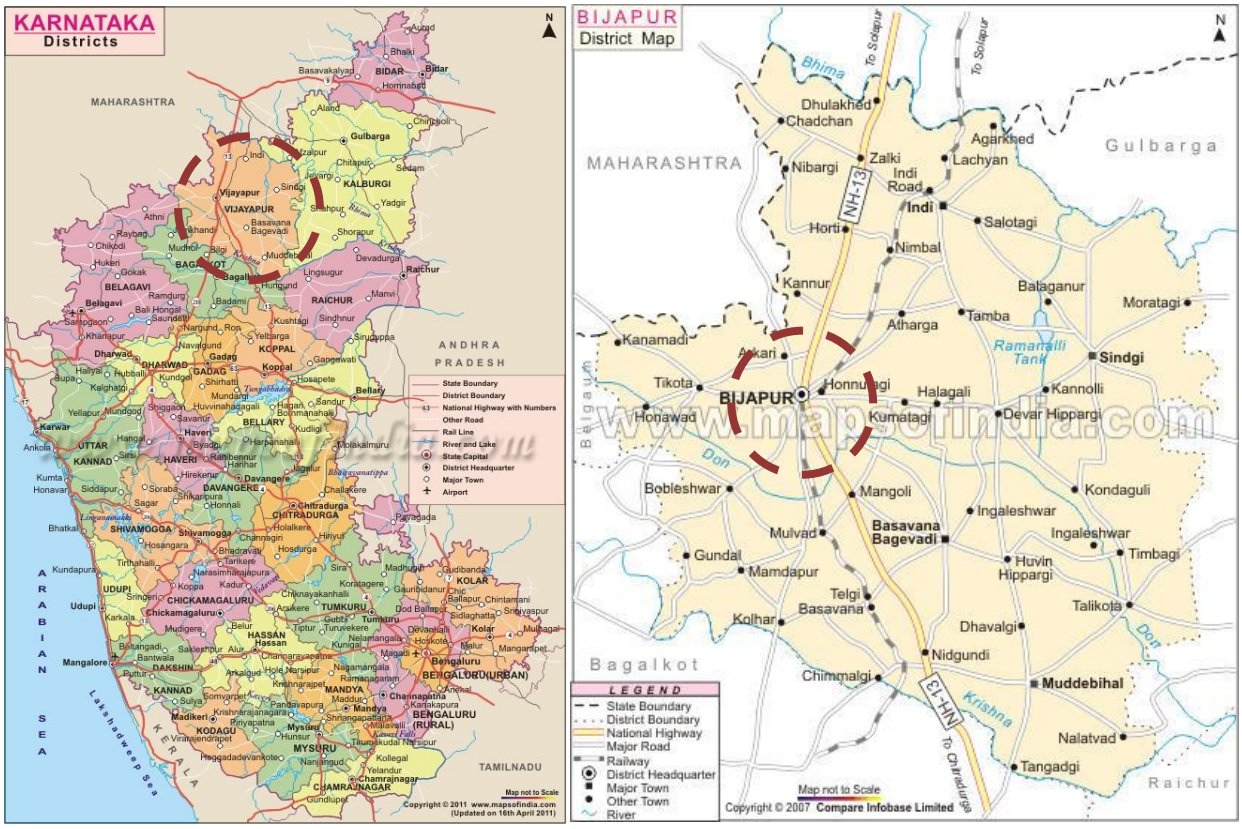
Source: Census of India

Exhibit 3-2: Population Projection for Bijapur CMC

S.No.	Year	Projected Population
1	2021	433637
2	2031	582772
3	2036	675592

Source: IMaCS Analysis

Exhibit 3-3: Location of Bijapur



Source: www.mapsofindia.com

The BCMC is responsible for infrastructure development and managing the various civic services such as water supply, solid waste management, sanitation etc. of Bijapur city. BCMC has various departments such as engineering, revenue, health, administrative, accounts etc for managing and administrative purposes. These are headed by the municipal commissioner. In Karnataka the ULBs have a post of environmental engineer who is responsible for managing the environmental functions of a ULB. Solid waste management is carried out by the environmental engineer who is supported by senior and junior health inspectors who are further supported by sanitary supervisors and sweepers. The municipal organizational structure related to SWM in Bijapur is given in Exhibit 3-4 below.

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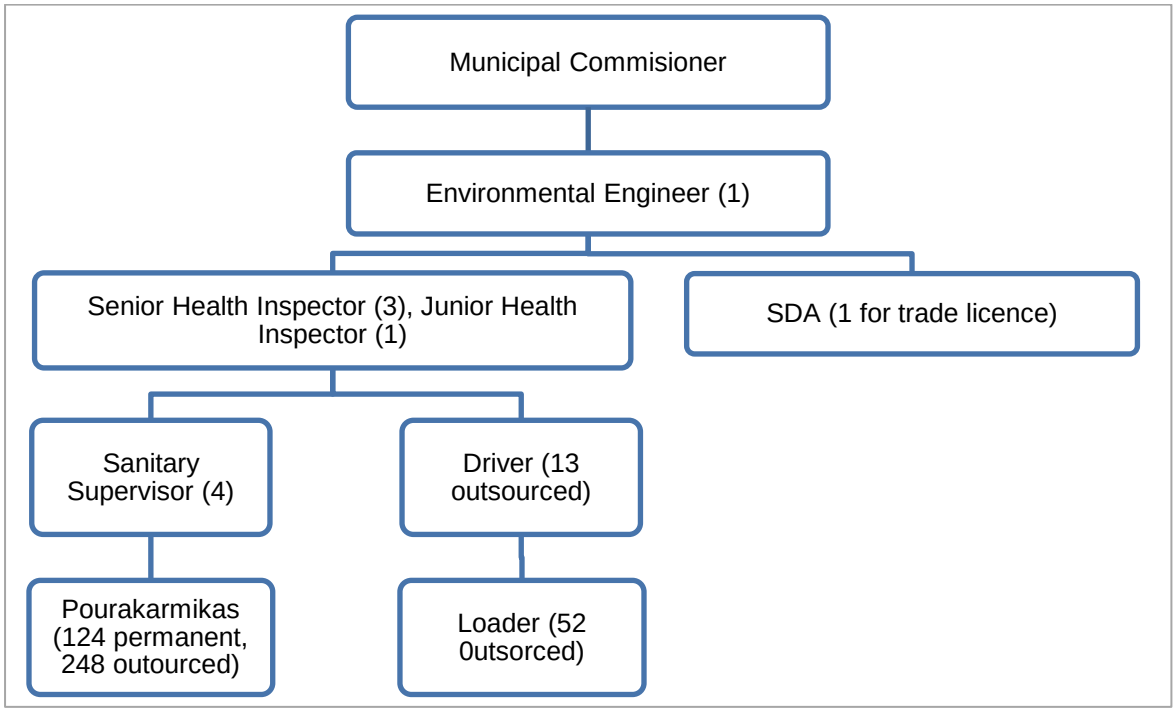
Exhibit 3-4: Municipal Organisational Structure Related to SWM in Bijapur



Source: Bijpur City Municipal Council

The issues identified in Bijapur are similar to the issues identified at the state level which are elaborated in Chapter 2 of this report. In existing o the current issues and gaps, the increase in population would further worsen situation of MSWM. In the absence of an effective waste management system this would result in degradation of the environment as well as affect the health of the citizens, thus there is an urgent need for proper solid waste management in the city.

3.4.2 Current Status of MSW in Bijapur

Waste Generation

Bijapur has a population of 326,360 and generates about 109 TPD of waste out of which nearly 75 TPD is collected, making the collection efficiency to 69%. The major waste generators in the city are residential areas; where only 50% of the waste gets collected. From the trade and institutional areas 80% of the waste gets collected.

Exhibit 3-5: MSW Generators in Bijapur

S. No.	Waste Generator	Unit	Estimated number of waste generators
1	Household	No.	64693
2	Shops	No.	5597
3	Hospitals (MSW)	No.	312
4	Temples	No.	157
5	Cinema theatres	No.	7
6	Parks	No.	10
7	Small hotels	No.	333
8	Large hotels	No.	28
9	Meat stalls	No.	128
10	Markets (major)	No.	9
11	Street sweepings		0
	Type A	Km.	96.55

S. No.	Waste Generator	Unit	Estimated number of waste generators
	Type B	Km.	134.22
	Type C	Km.	156.12
12	Convention halls	No.	157
13	Educational institutes	No.	495

Source: DPR on Solid Waste Management, 2011, Bijapur CMC

A DPR, which has been prepared for end to end management of Municipal Solid Waste of Bijapur categorizes the MSW of Bijapur into following portions: a) 47 % is organic content, b) 13.5 % of recyclable materials, c) 29.3 % of silt and stones and d) 10.2% miscellaneous items. Detailed breakup is given below.

Exhibit 3-6: Physical Composition of Waste

S. No	Type of Waste	Composition in %
1	Food waste	20.6
2	Cloth piece	9.0
3	Plastic material	7.0
4	Paper	5.4
5	Glass pieces	1.1
6	Wood pieces	3.2
7	Rubber material	0.7
8	Grass & leaves	23.6
9	Silt & stones	29.3
	Total	100

Source: DPR on Solid Waste Management, Bijapur, 2011

Exhibit 3-7: Chemical composition of waste

S. No.	Component	Percentage (%)
1	Organic Carbon	31.3
2	Total Nitrogen	1.34
3	C / N Ratio	23.4
4	Phosphorous	0.15
5	Moisture	43
6	pH	7.62
7	Organic Matter	32.88
8	Volatile matter	54.24
9	Ash	42.44

Source: DPR on Solid Waste Management, Bijapur, 2011

Waste Storage & Segregation

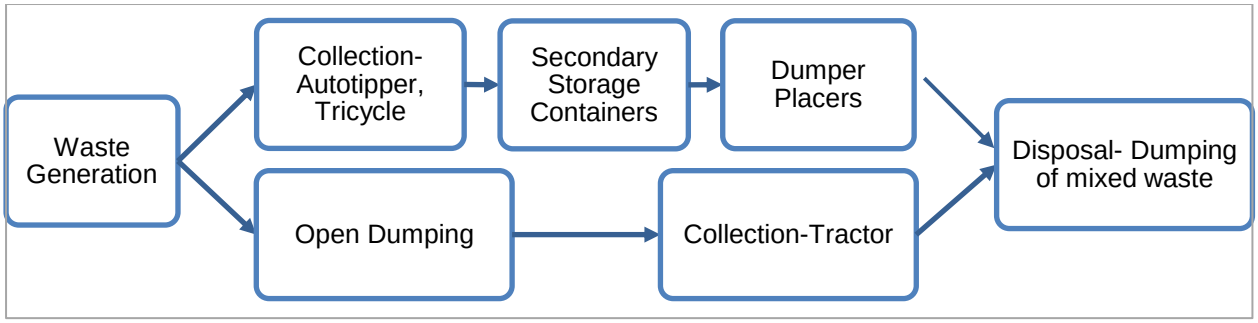
Out of the total domestic waste generated in Bijapur, it is estimated that only 40% of the waste is stored for regularised collection and rest 60% is thrown out in open. In the major market areas though the ULB has provided container bins which are cleared on a daily basis; the waste generated from shops, offices etc. is thrown in the open and which reflects on poor public awareness towards health hazards of uncollected/untreated waste. Situation further worsens with lack of infrastructure in the smaller market areas where there is no provision for the container bins at all. Food Water generated in Hotels is stored separately and is used in the animal husbandry to feed the cattles, whereas the other waste generated by hotels is either handed over to DTDC service providers or dumped at one of the numerous open dumping points in the city. There is no systematic segregation of waste either at source or at the disposal site. Also there is no provision for collecting or transporting the waste in a segregated manner. Some of the residents segregate the waste to the extent of extracting good

quality plastics, glass bottles, utensils and other such items and sell them to scrap dealers. Rag pickers operate in certain areas segregating waste deposited in container bins, open dumping points and also some rag pickers segregate waste at the disposal site where they have been provided with gloves by the ULB. It is estimated that around 2300 tonnes per annum of recyclable waste is collected.

The key stakeholders with regard to MSWM in Bijapur include the City Municipal Council and SHGs with following repective functions.

- Bijapur CMC provides the secondary collection of MSWM services in the city of Bijapur.
- Self-help groups provide DTDC of waste from certain areas where the CMC does not collect the waste.

Exhibit 3-8: MSWM Process Chain Bijapur



Collection and Primary Transportation

The ULB has initiated Door to door collection (DTDC) through 10 Self Help Groups (SHGs) and through its own staff. Exhibit 3-10 gives the details of the wards in which the SHGs operate. The SHGs use auto tippers provided by the ULB to collect the domestic waste and institutional waste being generated in areas located within the wards. The municipality staff uses tricycles to collect the waste. The waste collected by the SHGs is not segregated and is deposited at the nearby container bin from where it is transported to the disposal site by the ULB.

Exhibit 3-9: Tri-cycles containing 8 containers in Bijapur

Exhibit 3-10: SHG's involved in Primary collection of Municipal solid waste

S. No.	Name of SHG	Area covered	Ward no.
1	Santoshimata Women Self Help Group	Gyangbowdi, sangamesh colony, Bavasar nagar	1,3
2	Bhavani Women Self Help Group	Chalukya nagar (E&W), KHB colony, Sadashiva nagar, alakunte nagar, Banker's colony, Godbolemala	4,6,31
3	Bhagyajyothi Women Self Help Group	Banjara cross, Adarshanagar, Ashrama road, pragati nagar	5,12
4	Jaishakti Women Self Help Group	Shapet, inamdar colony, gachchinakatti colony, BLDE Road, Gurukul road	10,11,13

S. No.	Name of SHG	Area covered	Ward no.
5	Khaviskan Women Self Help Group	Police quarters	3 , 7
6	Ramabai Women Self Help Group	KC market, Tippu chowk, subash colony	32,18
7	Banashankari Women Self Help Group	Kavi plot, mukund nagar, deshpande colony, Deevatageri, Dhanvantri, Shantinagar, Bagayat galli	14,15,19, 24,25,23
8	Samata Women Self Help Group	Keertinagar, Muran keri, Pulikeshi nagar,	21,22,23
9	Samkadevi Women Self Help Group	Jalanagar, Raghavendra colony, Rajaji nagar, navbagh	22,29,28
10	Gulfsha Women Self Help Group	Itagi colony, Bairav nagar, Butada colony, Shastrinagar, Sainik school	33,35,1

Source: Bijapur CMC

A sum of Rs. 30 pmis charged by the SHGs to every Household for providing DTDC. For hotels and large shops, the charges are Rs. 50 pm, for Kalyan Mandaps Rs. 800 pm with an extra amount of Rs 300 levied per function. Big hotels/lodges' hostels are charged at Rs. 200/ month. Meat shops have to pay Rs. 50/ month for the waste disposal. However, this revenue collected doesnot go into the pocket of the ULB and is used by the SHGs to pay the salaries of the group and for maintaining the auto tippers.

Exhibit 3-11: Auto-Tippers used by SHGs in Bijapur

Street sweeping

Bijapur city has a total road length of 533 Km, out of which 507 Km (453 Km Metalled Road + 54 Km Un-metalled Road) while 26 Km of roads are PWD roads. At present CMC is looking after 386 Km of roads for sweeping purpose; which is divided into 3 types of roads on the basis of the frequency of street sweeping required. The frequency of sweeping in 3 categories, i.e., Type A (High density areas like city centre, commercials and important areas), Type B (Medium Density areas and housing colonies) and Type C (Low density areas and fringe areas is given in Exhibit 3-12.

Exhibit 3-12: Street Sweeping Frequency

Parameter	Road Length (km)	Frequency of Sweeping
Type A (city centre, commercial areas and important areas)	96.22	Daily
Type B (Medium density areas and housing colonies)	134.22	Twice a week
Type C (low density areas and fringe areas)	156.12	Once in a week

Source: Solid Waste Management DPR, 2011

Private contractors have been engaged in street sweeping by ULB. There are 4 street sweeping packages out of which 3 are handled by private contractors and 1 by the ULB. The timing of street sweeping is from 6:00 a.m. to 12:00 p.m., on an average a sweeper sweeps 400 m2-600 m2 in an

hour. The sweeping rate is way lower than the standard rate of 1000 m^2 an hour because of excess waste and dust in the city. The dusty soil gets accumulated on streets and makes it difficult for the sweepers to sweep streets. The sweepers employed by the private contractors do not have any safety gear and are not provided by the necessary tools required for sweeping. They use brooms for sweeping and collect the waste in plastic bags. This waste is then deposited into open points or container bins.

Exhibit 3-13 shows the sweeping staff in the city.

Exhibit 3-13: Sweeping Staff in Bijapur City

S. N	Packages	Contractors	Sweeping staff
1	Package 1	N C segabal	97
2	Package 2	Gowtham enterprise	77
3	Package 3	Gowtham enterprise	72
4	Package 4	CMC	133
	Total		379

Source: Solid Waste Management DPR, 2011

Under this sweeping contract the contractor also has to collect the construction waste and dispose it. This waste is generally disposed by dumping in low lying area near Hotel Godavari. The contractors are not paid any extra amount for the handling of construction waste while the CMC charges a fee from construction companies, individuals etc. who wish to get their waste removed.

Exhibit 3-14: Container bins in Bijapur

Secondary Storage & Transportation

The city has 102 container bins out of which 51 have the capacity of 3 cum. and 51 have the capacity of 4.5 cum. Apart from these, the city has 50 circular R.C.C bins having 1.0 cum capacity. The transportation of waste to the disposal site is carried out by the CMC using its own and hired vehicles. The CMC uses 5 dumper placers and 12 tractor- trailers for transporting the waste. Out of the entire fleet, all dumper placers and 3 tractor- trailers are owned by the CMC and it has hired the rest of the tractor-trailers. The dumper placers lift the containers from residential and market areas. In major market areas such as APMC market area, Lal Bahadur Shastri market the dumper placer makes 4 trips daily, in residential and commercial areas where DTDC is practiced the dumper placer makes 2-3 trips daily. In rest of the areas containers are lifted once in 3 days. Tractor- trailers are used to collect waste from the open dumping points and the R.C.C. bins. Each tractor trailer makes 1 trip/day on an average and in some cases they make 2 trips/ day to the disposal site.

Exhibit 3-15: Tractor-trolleys used for secondary transportation

Exhibit 3-16: Vehicles involved in Collection & Transportation of MSW

S. No.	Type of vehicle	No of vehicle	Waste collecting point	Disposing point	Owned by	Managed by
1	Auto tippers	9	Households & domestic generators	Container bins	CMC	SHGs
2	Tricycles	4	Households & domestic generators	Container bins	CMC	CMC and SHGs
3	Tractors	12	Open points	Disposal site	3 by CMC 9 contractors	CMC and contractors
4	Dumper placers	5	Container bins	Disposal site	CMC	CMC

Source: Bijapur City Municipal Council

Treatment & Disposal

The disposal site is located at a distance of 5 Kms from the city at Mahalbagayath, survey no. 138 and 139 on Indi road. This site measures 32 acres and 33 guntas. Currently the mixed waste transported by dumper placers and tractor trailers from the secondary storage points is simply dumped by digging pits in the disposal area and this dumped waste is not being covered by inert material. Open burning of waste at the disposal site is also practiced. The disposal area has a 10 feet high wall constructed around it. Out of 32 acres, 3 acres has been allotted to the Karnataka Medical Association for the disposal of Bio-medical waste.

Exhibit 3-17: Land fill Site of Bijapur

A front end loader with backhoe of 72 HP capacity is present at the disposal site for turning the waste. There is no formal composting plant operational at present but the decomposed waste lying in pits over the years is shredded, sieved and sold to the farmers as compost. Approximately 21600 tonnes of waste is dumped annually at the disposal site out of which only 150 tonnes per annum of compost is produced.

A vermi- compost unit for treating the organic part of the waste is under construction. The plant has 10 pits and is capable of treating 7 TPD of waste and 6 more pits would be constructed later on with the total capacity of 15 TPD. Adjacent to the composting unit a platform is proposed to be constructed for segregation of waste into biodegradable, recyclable and inert. Apart from this a weigh bridge at the entry point is also under construction.

Exhibit 3-18: Details of Existing Landfill Site

S.No.	Activity	Area	Unit
1	Area earmarked for Biomedical waste management	3	Acre
2	Area for plantation around the site	15030	Sqm.
3	Area for road around the site	7980	Sqm.
4	Vermi compost unit	900	Sqm.
5	Watchman shed & weigh bridge	230	Sqm.

6	Compost pits	7500	Sqm.
7	Area available for further activities	21.89	Acre

Source: Bijapur City Municipal Council

3.4.3 Initiatives taken by Bijapur City Municipal Council for MSWM

The Bijapur CMC has taken the following initiatives to improve the MSWM in the city:

1. Conducted one day workshop on MSWM for Sthree Shakti Groups (Self Help Groups)
2. Conducted workshops on MSW for Chief officers/ Commissioners and elected representatives of ULBs
3. Competitions conducted for school and college students on MSW Rules and MSWM
4. Distributed pamphlets explaining the importance of managing MSW among public through newspapers, schools, colleges and market places
5. Awareness program conducted through SHGs
6. Announcements regarding the management of MSW made through loud speakers

3.5 Interaction with Stakeholders

1. The stakeholders interacted with included members of BCMC, SLGs and local residents. Some of the concerns which were highlighted during the discussions are listed below: The practice of waste storage and segregation is not practiced on a large scale leading to open dumping of garbage at many locations in the city.
2. DTDC is not practiced in all wards and wherever DTDC is being provided by SHGs, only a part of that ward is getting covered because many of the residents are not willing to pay monthly charges for solid waste collection. The residents cite reasons such as lack of basic infrastructure facilities such as proper roads, streetlights etc. as a reason for not paying the charges levied on solid waste collection.
3. This dissatisfaction among residents is resulting in high revenue losses, last year the revenue collected from solid waste charges was 6.9 lakh whereas demand of 61.2 lakhs.
4. The CMC has only 9 auto tippers for waste collection. These are not sufficient to cover the 35 wards within the city
5. Though the SHGs have been provided with the auto tippers by the municipality, the O&M cost has to be borne by them. The cost to maintain the auto tipper is high which becomes tougher for SHGs due to low collection of user charges
6. The SHGs have not been provided with any safety gear such as gloves and masks by CMC
7. The hospitals hand over large amounts of non-biomedical waste and at the same time the charges are not very high
8. The street sweeping staffs employed by the private contractors have neither been provided with the required tools for street cleaning nor they have been given proper safety gear

3.6 Development Needs, Public needs & Planning Considerations

After the interaction with the stakeholders and assessing the service level gaps in solid waste management it was found that a large number of issues exist in the current system. These issues range from collection to ultimate disposal, which means it covers entire process cycle of SWM. In collection phase, the absence of DTDC in all wards combined with the attitude of the citizens leads to waste being thrown on the roads. During transportation, Manual handling of waste with no provision for safety gears for the sanitary workers and the lastly at disposal site, waste is getting dumped without segregation. This practice is far from the compliance set up by the MSW Rules, 2000 which directs ULB to carry out the collection & transportation in a scientific manner, increase awareness regarding segregation, set up a processing and scientific disposal facility. The low level of collection efficiency, open dumping of mixed waste at disposal site make it necessary to come up with an alternative solution to the problem of MSWM being faced by the city of Bijapur. For achieving the standards laid down by the MSW Rules, 2000 and to provide citizens a good and healthy environment an integrated waste management system (ISWM) is required so as to comply with the regulations at each phase.

3.7 Best practices and case studies

India has seen rapid growth in the role of private sector in MSWM. In the mid 1990s this role was limited to activities such as collection, road sweeping and transportation. Following the notification of Municipal Solid Waste (Management & Handling) Rules, 2000 which made waste processing and development of sanitary landfill mandatory, the ULBs has increased the involvement of the private sector and successfully implemented public private participation (PPP) projects in the components of waste processing, sanitary landfill and closure of existing dumpsites. The 3 successful PPP projects in solid waste management have been discussed, which are:

- Integrated Solid Waste Management in Hyderabad
- Processing & Sanitary Landfill in Rajkot
- Collection & Transportation in Delhi

3.7.1 Integrated Solid Waste Management in Hyderabad

Hyderabad Urban Agglomeration (HUA) has a population of 77.5 lakhs and is spread over an area of 778.17 sq. km. HUA generates around 3800 TPD of MSW.

Need for private sector intervention

In 2006-07 the Greater Hyderabad Municipal Corporation (GHMC) initiated the “Clean Hyderabad Program”. Prior to this the GHMC was facing problems like non monitoring of the garbage clearance activity, until there was no complaint by the residents regarding garbage cleaning the GHMC assumed that the system was working to its maximum capacity. A large number of citizens were not practicing storage and segregation of waste and wherever waste was stored it was in open containers in un-segregated manner. Also there was lack of waste storage facilities in market areas.

Private Sector Intervention

In order to efficiently manage the MSW generated within HUA, GHMC has privatized a large part of the SWM system. The intervention of PPP in SWM in Hyderabad started in 1996-97 when contracts to private parties were awarded for street-sweeping and waste collection and transportation. In 2007-08 this practice extended to involving private operator in an integrated SWM system with end to end responsibility. For this M/s Ramky Enviro Engineers Limited (REEL) was chosen at a tipping fee of Rs.1, 431 per ton of MSW.

Private Party obligation: Under this agreement the private party would initiate primary and secondary collection, transportation and road sweeping in a phased manner starting with 2 zones and on successful implementation all the 5 zones under GHMC have to be covered by the private operator. Apart from this the private party has to operate, maintain and upgrade the existing transfer stations and develop new transfer stations. The development, operation and maintenance of landfill facility has also to be covered by the private party.

ULB obligation: The ULB would hand over the existing infrastructure like vehicles, container bins etc to the private party. Facilities such as road connectivity, power connections etc. to the transfer station, treatment and disposal facility were to be provided by the ULB.

Concession period and project cost

The concession period is 25 years but could be extended on mutual agreement between the GHMC and REEL. REEL has certain post closure obligation for the landfill for 15 years after the expiry of the current agreement of 25 years. The total project cost is Rs. 434.91 crore out of which Rs. 152.22 crore is provided as grant under JnNURM scheme of Government of India (GOI) and Rs. 65.24 crore is the grant share by government of Andhra Pradesh. The capital investment by private party is Rs. 217.46 crore.

3.7.2 Processing & Sanitary Landfill in Rajkot

Rajkot located in the state of Gujarat has a population of 3.7 lakh and covers an area of 104.68 Sq. Km. Administratively; the city has been divided into 3 zones with 23 wards. The MSW generation in the city is estimated at 300 TPD.

Need for private sector intervention

Prior to 2005 the collection, transportation and disposal was being carried out by the Rajkot Municipal Corporation (RMC). The ULB was able to collect 80% of the waste generated with the help of sakhi mandals and cooperative societies. Transportation of waste was carried out by both; the ULB and private contractors. But there was no provision of treatment and processing of MSW, and the RMC used to dump all the waste generated at a dump yard located at a distance of 8 Kms from the city.

Private Sector Intervention: RMC realized the importance of scientific waste disposal and selected M/s Hanjer Biotech Industries Private Limited (HBEPL) to build and operate an integrated processing and landfill facility in 2003 at a tipping fee of Rs 220 per ton of rejects to landfill. The construction of the facility commenced from June 2005 and the plant has been fully operational since April 2006. The waste brought at the waste disposal site is first segregated and then processed to produce bio-fertiliser (40 MT), Fluff (70 MT) and eco-bricks – 15,000 nos. The bio-fertiliser is sold to Reliance Industries at Jamnagar and Reliance Energy at Dhanuo. The fluff is sold to the paper mills and cement industries nearby. The eco-bricks are used for construction within the processing plant. Thus this plant utilizes nearly 85%-90% of the waste leaving behind only 10%-15% of the waste as rejects.

Private Party obligation: The private party has to segregate the MSW at the processing facility, construct and develop the treatment facility and sanitary landfill and carry out O&M for the same. The private party has to transport the inert/ rejects to the landfill site.

ULB obligation: For the construction of sanitary landfill the RMC had 100 acres of land out of which it leased 30 acres to HBEPL at the rate of Re. 1 per sq. m. Facilities such as road connectivity, power connection etc. to the transfer station, treatment and disposal facility has to be provided by the ULB. RMC agreed to supply a minimum quantity of waste per day to the processing facility.

3.7.3 Collection & Transportation in Delhi

Delhi the capital city of India has a population of 1.67 crore and covers an area of 1, 483 Sq. Km. It shares borders with Uttar Pradesh and Haryana and is one of the fastest growing cities in India. The Municipal Corporation of Delhi (MCD) and the New Delhi Municipal Council (NDMC) are responsible for handling the MSW generated within the city.

Need for private sector intervention

With regard to solid waste management the Delhi government was facing problems such as inefficient collection and removal of garbage, street sweeping, no appropriate disposal technologies etc. and required strategy for waste reduction thus reducing the land requirement for final disposal.

Private Sector Intervention

To address the issue of efficiency in waste collection and transportation the MCD in January 2005 signed agreement with 3 private companies to handle the waste generated in its 6 zones. Metro Waste Handling (P) Ltd. (MWH) was chosen for west zone at a tipping fee of Rs 693 per ton of waste collected and transported to the disposal site.

The west zone of Delhi spread over an area of 79.75 Sq. km. has a population of 15.80 lakhs and generates above 500 TPD of solid waste. Under the PPP arrangement the waste generators deposit the waste at the waste storage depots, for this they may employ sweepers, rag pickers etc. At the waste storage depots the workers segregate the waste and recyclables are taken to a centralized workshop in Shubhash Nagar where it is further segregated, the organic waste is sent to centralized compost plant at Bhalsawa and the rest is transported to Bhalsawa landfill.

The benefits of incorporating a PPP format in solid waste management can be seen in the procurement of better suited vehicles for waste transportation such as compactor loaders with mechanized loading and unloading, also the biodegradable and non- biodegradable waste is transported separately. Before the involvement of the private party open trucks were being used for transportation of waste and manual handling of waste was taking place. Both these practices are unhygienic and unscientific. Introducing PPP has also improved the status of the rag – pickers; they have now been inducted into the civil framework of waste handling and are provided with safety gear.

Private Party Obligation: The private party has to collect the waste from waste storage depots, segregate it and transport the waste to the disposal facility. The party has to ensure the cleanliness of waste storage depots and their surroundings. A service level benchmark is set for segregation; if the party fails to achieve this in a month then the monthly tipping fee is calculated after deducting penalty.

ULB Obligation: The primary collection of waste is to be carried out by MCD. The MCD has to ensure that the private operator receives the monthly payment and also gets the required permissions and authorisations.

3.7.4 Critical Success Factors

- In both Hyderabad and Rajkot the ULB agreed to ensure the supply quantity of waste per day to the processing facility. This was necessary to ensure that the treatment was running to its full capacity.
- The market demand for outputs like compost, refuse derived fuel, pellets, eco-bricks etc. is low as the quality is not upto the market requirement. In case of Rajkot processing plant, initial experiments were carried out so as to make the quality of the by-products in line with market requirements which led to sustainable operations with desired returns. Also the use of better

customised technologies for screening and segregating the MSW into wet waste and dry waste improved the quality of the end products.

- In case of Delhi a segregation benchmark was set, if the segregation level achieved for a month was lower than the segregation benchmark then the tipping fee was calculated after deducting penalty leading to operational gains.

3.8 Studies and surveys already available

Master Plan for Bijapur Local Planning Area formulated in the year 2001-03 gives an overview of the solid waste management system. After this, a Detailed Project Report (DPR) for solid waste management was prepared by M/s AEE in 2003. This was followed by preparation of an Action Plan for SWM by CMC of Bijapur. The most recent study is the DPR on solid waste prepared by M/s Tide Technocrats (P) Limited in 2011. This study talks about the current solid waste management system in Bijapur, including details of the waste generators and the practice followed by the CMC for handling waste. The DPR has also provided a plan for managing the solid waste. Some of the recommendations made in the DPR are:

- Storage & Source Segregation needs to be practiced with the view of reducing the practice of dumping the waste on roads
- IEC activities with regard to SWM need to be conducted to induce behavioural change for scientific waste disposal
- Waste from shops, hotels etc and non slum households to be carried out on DTDC basis and community bin system to be followed in slum areas and market areas
- Transport of waste should be done using dumper placers and refuse compactors in place of tractors.
- Processing of waste through methods such as aerobic composting, vermin-composting prior to disposal
- Instead of dumping mixed waste only the waste which is inert and cannot be processed or recycled in to be disposed in a scientific landfill
- The street sweeping staff and the waste collectors need to be provided with proper tools and safety gear
- Need for capacity building, training and motivation for the ULB staff
- Need to develop a monitoring mechanism within the Bijapur Municipal Council like Geographic Information System (GIS), Management Information System (MIS) etc for the effective Solid Waste Management
- Need for encouraging the involvement on NGOs in SWM

4. Project Brief

4.1 Technical Assessment

The envisaged integrated solid waste management project for Bijapur city would include complete process chain; source storage and segregation, collection, transportation, treatment and disposal.

The proposed process chain is detailed below:

4.1.1 Source Storage & Segregation

The waste generators such households, commercial establishments such as shops, restaurants, hotels, slaughter houses, markets etc. would be directed by the CMC to store the waste in suitable containers and practice segregation of the waste into kitchen waste, recyclables, hazardous waste and other wastes. The container size may vary depending upon the quantity of waste generated per day.

4.1.2 Primary Collection & Street Sweeping

Primary Collection

In Non-Slum Areas

- Primary collection of waste would be through DTDC through containerised tricycles in congested areas and through auto-tippers in the rest of the city
- Currently 26 out of 35 wards are covered partially by DTDC; this practice needs to be extended to the entire city.
- The waste generators would hand over segregated waste to the collector. The auto tipper would make separate trips for biodegradable and non-biodegradable waste or it will have separate containers to collect waste

In Slum Areas

- In slum areas community bin system would be practiced; for this 40 litre HDPE bins would be placed at a frequency of 1 bin per 20 households.
- Pourikarmas with tricycle would collect waste from these bins and deposit it in the secondary storage containers.

Market Areas

- The 9 major market as well as weekly and biweekly markets would be provided with containers of 3 cu.m or 4.5 cu.m capacity. The containers would be lifted by the dumper placers
- Shop keepers would be directed to deposit their waste in the containers and not dispose the waste in open
- Construction & Demolition Waste
- The street sweeping contracts would include the collection of construction waste
- Hotels, Restaurants, Marriage Halls
- This waste would be collected through DTDC along with the household waste.

Street Sweeping

Street sweeping would be carried out on the basis of the road classification as given in Exhibit 4-1, which has been suggested in detailed project report and has been contracted out at present.

Exhibit 4-1 Street sweeping frequency according to road length

Type of Road	Length in Km.	Frequency of Sweeping
Type A (High Density areas- city centres, commercial areas)	96.22	Daily
Type B (Medium Density areas- semi-residential areas, schools)	134.22	Twice a week
Type C (Low Density areas- purely residential areas)	156.12	Once in a week

Source: Bijapur City Municipal Council

Apart from sweeping the sweepers would also collect the waste from open points and deposit it in the community bins. Each sweeper would sweep on an average of 1 km of road length/day. The sweepers would be provided with proper tools and safety gear such as metal plates, long handled brooms, uniforms, masks, gloves etc.

4.1.3 Secondary Waste Storage

The entire city would be covered with dumper bins of 3 cu.m or 4.5 cu.m capacity. With the current waste generation and road length the city would require 91 new dumper bins to the existing storage points.

4.1.4 Transportation of Waste

The transportation would be through dumper placers. Use of dumper placers would eliminate the need of manual loading. For this 19 dumper placers would be required. Details of Vehicles required are shown in Exhibit 4.2.

4.1.5 Treatment and Recycling

As a vermi- composting plant of capacity 15 TPD is under construction. The organic portion of the waste would be subject to composting. In this process partially decomposed waste is filled in covered pits along with earthworms. The earthworms feed on this waste and the degradation process takes places inside the worm body by microorganisms and the compost is the worm castings which are removed at regular intervals. The recyclable components would be segregated and sold to the scrap dealers, which can be in consonance to the existing system of rag pickers.

Other than vermin-composting, Windrow Composting System has also been suggested for rest of the bio-degradable waste.

4.1.6 Disposal of Waste

A sanitary landfill complying with the following conditions as per the provisions of MSW Rules, 2000 shall be constructed. The following facilities/ infrastructure would be required:

- Road – access and internal
- Equipment Maintenance shed
- Weigh bridge
- Temporary waste storage

- Leachate Collection and Recovery System (LCRS)
- Landfill gas management facility
- Water supply system
- Toilets

Presently, weigh bridge, water supply system (bore wells), and security shed etc. is under construction. The waste at the site would be compacted and provided with daily cover of minimum 10cm of soil debris. Buffer zone around the landfill site and a vegetative cover shall be provided. The design life of the landfill would be 25 years.

Exhibit 4-2: Infrastructure requirement for Solid waste management in next 25 years

S.No	Infrastructure	Unit	Existing	2012		2021		2031		2036	
				Demand	Gap	Demand	Gap	Demand	Gap	Demand	Gap
1	Tricycles	No.	04	76	76	98	60	130	81	150	85
2	Auto Tipper	No.	9	12	3	16	10	21	13	24	14
3	Community Bins	No.	102	166	64	166	-	166	-	166	-
4	Dumper Placer	No.	5	19	14	19	10	19	10	19	10
5	J.C.B.	No.	1	1	0	1	1	1	1	1	1
6	Compactor	No.	0	1	1	1	1	1	1	1	1
7	Shredder	No.	0	2	2	2	2	2	2	2	2

Source: IMaCS Analysis

It is envisaged to equip the town with adequate manpower to perform the functions envisage. However the manpower plan would be left to the PPP partner to finalize.

5. Risk Analysis, Project Structuring and Bid Variable

5.1 Risks & Mitigation

The success of the PPP projects in MSWM revolves around identification, allocation and mitigation of risks in the project. The BCMC should comprehensively identify all risks inherent in the project and the principle should then be to allocate the risks the entity that is best equipped to deal with them. Exhibit below provides a risk allocation matrix that captures select risks and possible ways of dealing with them.

Exhibit 5-1: Risk Allocations

Type of Risk	How does it arise?	Risk Implication	Risk Allocation
			BOT/ Concession
Design Risk	1. Design fault while preparing DPR 2. In-consistent assumptions taken while preparing the tender documents; 3. Faulty design consideration of the PPP operator.	This would adversely affect the desired out-come and cost structure of the project, and the financial out-come expected from the PPP intervention	Private Developer should adhere to the obligations regarding these aspects and failure to comply with the obligation should attract penalties
Construction Risk	1. Due to inefficient working practice by the Private service provider; 2. Delay in asset transfer from ULB and/or state agency	This would result into cost escalation & time overrun thus affecting the timely service delivery & its quality, would also adversely affect the project financials.	To be borne by the private developer other than the asset transfer delay.
Operation Risk	1. Change in the project scope during the operation period by the project sponsor; 2. Mobilization delays in manpower/ equipment; 3. Due to labour unrest, imprudent management practices; 4. Financial mis-management and significant increase in the input cost.	Project objective not achieved, increased operating cost and/or reduced revenue realization from the project	To be borne by the Private developer other than the change in scope of the project by the BCMC and/or state agency.
Revenue Risk	1. Change in tariff rates; 2. Inadequate MSW generation; 3. Inadequate demand for the processed waste	The financial objective of the project not achieved.	Partly by BCMC and Private player as per the provision of the contract. The revenue for collection and transportation depends upon

Type of Risk	How does it arise?	Risk Implication	Risk Allocation BOT/ Concession
	and/or by-product.		per ton of waste handled. For disposal revenue depends on the tipping fee and the composition of waste in the form of recyclables and compostable matter, which determine the revenues from waste recovery. So to minimise this risk the BCMC can provide assurance through either a minimum assured quantity commitment and/or reliable past information on quality and quantity of waste
Financial Risk	1. This will arise due to improper capital structure resulting in high debt component and fluctuation in the interest rate.	Not able to service its financial obligations.	Private developer. As the private operator is supposed to make large financial investment the BCMC should share the sources of income and demonstrate that it has the financial capacity to pay the operator. BCMC can create appropriate payment security mechanisms either in the form of escrow of portion of its visible revenue streams or through creation of Payment Reserve Account, where the BCMC keeps a fixed amount of money that the operator has access to in case of delays in payment beyond a pre-set threshold
Environmental Risk	1. Non-compliance to the applicable laws (like environmental, MSW Rules etc.), or pre-existing environmental liability.	Additional cost incurred to rectify an adverse environmental impact on the project	Private developer other than the pre-existing environmental liability to be taken care by BCMC and/or state agency
Force Majeure Risk	1. This may arise due to act of God, public unrest, change in tax and law, breach or contract cancellation	Additional cost to rectify resulting in increased cost or operation, time overrun, non-	To be borne by the parties as per the provisions of the contract.

Type of Risk	How does it arise?	Risk Implication	Risk Allocation BOT/ Concession
	expropriation, and discrimination by the project sponsor etc.	achievement of service levels.	
Insurance Risk	1. Uninsured loss or damage to project facilities due to act of God or public unrest.	Financial loss	To be borne by the private developer as per the provisions of the contract

5.2 Possible PPP structures and preferred options

5.2.1 Critical structuring considerations

Apart from allocation of risks detailed above, we outline some specific issues that tend to confront practitioners while developing MSWM PPPs and possible structuring options to deal with these issues. As a principle, the BCMC should minimise uncertainty by providing reliable inputs and information (including waste quantity and quality, land availability, manpower and assets, clearances etc.) while passing on the risks relating to outputs (such as technology, operations, performance and service delivery) to the private operator.

- **Assurance on Waste quantity and quality:** The quality and quantity of waste generated often have a significant bearing on the Revenue models in PPP projects. For instance in a waste transportation or collection project where the bidding is done on the basis of fees per ton of waste collected and deposited at the processing facility, the revenues clearly depend on the quantity of waste. Similarly composition of waste in terms of extent of recyclable and compostable material is clearly a key determinant of the extent of revenues from waste recovery and the tipping fee to be quoted. Therefore, providing assurance through either a minimum assured quantity commitment and/or reliable past information on quality and quantity of waste tends to address bidder risk perceptions. Inability to provide these will only increase uncertainty of the bidding process
- **Incentivising Waste recovery and extent of tipping fees:** Since waste processing and disposal PPPs are a relatively recent phenomenon, Private operators have tended to be conservative in valuing the potential for waste recovery. However, as BCMC mature and bring in systems to capture, sort and segregate waste, waste recovery levels could potentially improve. Therefore it is important for BCMC that are planning PPP projects to explore ways to incentivise waste recovery. For instance, if BCMC can structure an assured compost buy-back either for its own urban forestry or through other Government owned institutions or agricultural cooperatives in the adjoining areas, this can help the BCMC bring down the tipping fee levels. Initiatives like this can potentially improve project viability and help get in efficient price discovery.
- **Construction, Technology and Operating risk:** In general, all technology, construction and operating risk should be passed on to the private operator. These are related to 'outputs' and service delivery outcomes and it is imperative that the private operator handles these risks. There should be stringent obligations with respect to these aspects and failure to comply should attract penalties and under extreme circumstances termination.
- **Financing and Bankability:** BCMC should share the sources of income and demonstrate financial capacity to make payments. Especially when the private operator is required to make an upfront investment, the BCMC should provide adequate comfort to bidders about its ability to pay.

Sharing of initiatives taken by the BCMC to increase revenue buoyance, implementation of reforms such as levy of user charges and sharing of recent improvements in financials transparently will raise bidder confidence. In addition, bankability considerations will require the BCMC to create appropriate payment security mechanisms either in the form of escrow of portion of its visible revenue streams or through creation of Payment Reserve Account, where the BCMC will keep a fixed amount of money that the bidder has access to in case of delays in payment beyond a pre-set threshold. Again, initiatives like this are critical to signal seriousness and positive intent and help in influencing risk perceptions of bidders favourably.

- **Manpower transitioning:** BCMC own manpower may be resistant to the idea of a PPP project. It is important that the BCMC tackles this issue head-on and get the employees and labour unions on board early during the preparatory stage. Side-stepping labour resistance will only postpone the problem and will make things even more difficult.

5.2.2 Possible PPP structures

The options for the private sector participation in the Municipal Solid Waste Management (MSWM) are spread across the MSW value chain. At one end of the spectrum the BCMC can invest across the value chain by creating the fixed & movable assets and outsourcing the management of the complete value chain to the private operator through a **Service Contract**. On the other end of the spectrum the BCMC can invite the private developer to invest and maintain MSW value chain through the **Concession or a Build-Operate-Transfer (BOT) contract**. It is imperative for the ULB to understand the project need and outcomes based of their own internal project analysis and desired outcome. The main options for private sector participation can be clearly distinguished by how they allocate responsibility for such aspects as asset ownership and capital investment between the public and private sectors as shown in Exhibit 5.2.

However in practice private sector arrangements are often hybrids of these contract structures for instance, a build-operate-transfer (BOT) contract for waste processing might be combined with a management contract for developing sanitary landfill sites. Further to this, the different types of contracts are explained in the section below are based on the successful PPP structures implemented in the country.

Exhibit 5-2: PPP contracting options

Options	Service contract *(Collect, transport, cleaning, disposal of MSW)*	Management Contract *(Collect, transport, cleaning, disposal of MSW)*	BOOT/ Concession *(Integrated MSWM/ Waste Processing)*
Asset Ownership	Ownership with ULB other than investment by private service provider in transportation fleet.	Ownership with ULB other than investment by private service provider in transportation fleet & related equipment.	Ownership with private developer during the contract period other than the land, and to be transferred back to ULB at the end of the contract.
Operation & Maintenance	Private service provider	Private service provider	Private developer
Capital Investment	Only in transportation fleet by private service provider.	Only in transportation fleet and related equipment by private service provider.	By private developer other than the land.

Options	Service contract *(Collect, transport, cleaning, disposal of MSW)*	Management Contract *(Collect, transport, cleaning, disposal of MSW)*	BOOT/ Concession *(Integrated MSWM/ Waste Processing)*
Commercial Risk	ULB or state agency	Partly with private service provider and with ULB	Completely with private developer
Duration	1-2 years	3-8 years	Above 10 years

Source: IMaCS Analysis

5.2.3 Proposed PPP structure

To manage MSW in BCMC a BOOT/Concession Contract for Integrated MSWM system /or Integrated Processing & Disposal Facility /or MSW Processing Facility) has been proposed under this prefeasibility.

Concession contract gives private partner the responsibility for O&M of the MSW assets and also for capital investments in asset creation. The full use rights to all the assets, including those created during concession period remains with the private developer, but at the end of the contract term, the created asset reverts to the BCMC. The concession is governed by a contract that sets out such conditions as the main performance targets (coverage, quality), performance standards, arrangements for capital investment, mechanisms for adjusting tariffs, and arrangements for arbitrating disputes.

The main advantage of a concession is that it passes full responsibility for capital investment and O&M to the private sector and instils incentives for gaining efficiencies in managing the MSW value chain. On the BCMC side, administering a concession is a complex business, however, because it confers a long-term monopoly on the concessionaire. The quality of contractual covenants is important in determining the success of the concession, particularly the distribution of its benefits between the concessionaire (in profits) and benefits to consumers (in lower user charges and improved service).

Exhibit 5-3: Proposed PPP Framework

Item	Description
Concept	Integrated end to end Municipal Solid Waste Management system including Collection, Transportation and Disposal of Waste
Payment envisaged	Tipping Fee from BCMC per MT of MSW collected & transported to designated sites (transfer station /or disposal site)
Procurement	Based on competitive procurement procedure
Asset Ownership	Facilities are owned by the Private developer except land and all existing and new facilities developed during the concession are to be transferred back to the BCMC at the end of the concession period
Contract Period	25 years
Risk Allocation	• BCMC is responsible for only provisioning of land for the project. • All risks related to design, construction, commissioning, commercial, revenue, force majeure to be borne by the private developer

6. Project Financials

6.1 Concept and Methodology

A preliminary financial model has been prepared to assess the Estimated Project Cost, Estimated Revenues and the Project Returns. The Cost and Revenue assumptions were taken based on gross bulk estimate only to assess the feasibility of the project. However, it is recommended that the Project Financials may be firmed up only after preparation of the Feasibility report for the project. The salient features of the preliminary financial model are highlighted in this section of the report.

The purpose of the Financial Analysis is to determine the financial viability of the investment in the project considering the cost of developing the project and the expected revenue stream over a period of time. It also includes study of different scenarios from the developer's perspective and to assess the receivables for Bijapur CMC from the developer while ensuring that the developer gets a reasonable return on his equity.

6.2 Assumptions for Financial Analysis

6.2.1 Construction Period

It is assumed that development of project will take 1 year.

6.2.2 Concession Period

Concession period has been taken as 25 years.

6.2.3 Cost Assumptions

While calculating the project cost, the assumptions have been based on market feedback, other similar projects as well as IMaCS' own experience of advisory and project management consultancy.

6.3 Summary of Financial Analysis Results

6.3.1 Cost Estimation

The estimated cost of the **Project is Rs.20.79 Crore.** The details of the Project Cost estimation are set out in Exhibit 6-1 below. For the Purpose of estimation of project cost we had considered the gap existing in the infrastructure required for future populations based on the certain assumptions mentioned in Annexure 1. In case of Bin and Vehicles required, we have considered all the vehicles will be replace after every 10 years.

Exhibit 6-1 Estimated Project Cost

S.No.	Project Components	Cost Estimates - Amount (Rs. Lakhs)		
		For 1-10 Year	For 10-20 Year	For 20-25 Year
A	**Collection**			
1	HDPE bins	1.82	3.99	7.53
2	Hand Carts	4.50	10.10	16.98
3	Tricycle	9.00	19.79	33.83
3	Community Bins	83.00	135.20	220.22
4	Auto tipper	30.00	63.53	111.44
	Total CAPEX for Collection	**128.32**	**232.60**	**390.00**
B	**Transportation**			
1	Skip Lifters - Construction Waste	18.00	51.31	71.64

S.No.	Project Components	Cost Estimates - Amount (Rs. Lakhs)		
		For 1-10 Year	For 10-20 Year	For 20-25 Year
2	Dumper Placer	115.00	187.32	305.13
	Total CAPEX for Transportation	**133.00**	**238.63**	**376.77**
C	**Disposal/ Landfill site**			
1	**Equipment**			
i	JCB	22.00	35.84	58.37
ii	Weighing Bridge	7.00	11.40	18.57
iii	Tractor-Trolley	4.50	7.33	11.94
iv	Compactor	20.00	32.58	53.07
v	Shredder	6.50	21.18	34.49
2	**Infrastructure**			
i	Plantation	2.00		
ii	Fencing	-		
iii	Warehouse	0.60		
iv	Platform	1.40		
v	Shed for Equipment	15.00		
vi	Internal Road	30.41		
vii	Toilet	0.30		
viii	Security Gate	0.50		
ix	Street Light, borewell and Transformer	10.00		
x	Landfill	165.00		
xi	Geo-textile Membrane for landfill (32X32m2)	10.00		
	Total CAPEX at Land fill site	**295.21**	**108.32**	**176.44**
D	**Grand Total CAPEX for ISWM**	**556.53**	**579.56**	**943.21**

Out of total Cost, about 20% of the CAPEX is envisaged to get funded by Viability Gap Funding scheme of Central Government through Government of Karnataka, So net **CAPEX required by Private player will be of Rs. 16.63 Crore.**

6.3.2 Operating Expense

The estimated Operating costs for the 1st year are Rs. 6.97 Crore. The operation and maintenance costs mainly include salaries of staff and operational costs of the vehicles and equipments for collection, transportation and disposal of waste. The detailed estimations of next 25 years have been presented in the Annexure 2.

Exhibit 6-2: Estimated Operating Costs for 1st year

S.No.	Component	Cost Estimates (Rs. Lakh)
1	Collection Expenses	461.24
2	Transportation Expenses	224.11
3	Expenses at Landfill Site	11.67
	Total	**697.01**

6.3.3 Tariff Revenue Stream

The main streams of Revenue for this project are:

1. Revenue generated by the sale of compost
2. Revenue generated by charging users
3. Revenue generated through Tipping Fee

Exhibit 6-3: Tariff Revenue Stream for the 1st year

S.No.	Components	Revenue Estimates (Rs. Lakh)
A	**Revenue from compost after losses(15%)**	**103.14**
B	**Revenue from User Charges**	
1	Households (Residential Properties)	120.88
2	Shops	17.79
3	Meat shops	1.54
4	Hotels	8.88
5	Educational Institutes	23.76
	Total Revenue from User Charges	**275.98**
C	**Tipping Fee (RS./tonn disposal)**	**165.99**
Total		**441.97**

The estimated revenue generation in the 1st year of the project is Rs. 4.41 Crore with the tipping fee of Rs. 687/ ton disposal. The detailed estimations for next 25 years have been presented in the Annexure 2.

6.3.4 Viability Assessment (NPV, Project IRR)

The key financial indicators for the project are summarized in Exhibit 6-4 Key Financial Indicators below.

Exhibit 6-4 Key Financial Indicators

Indicator	Value
Project IRR (Pre-Tax)	15%
Tipping Fee (Rs. Per Ton)	687

As can be seen that at the tipping fee of Rs. 687/ ton disposal (estimated given the assumptions and the project structure as described in the report) for a 25 year concession, the Pre-Tax Project IRR is coming out at 15% and hence the project seems do-able.

7. Statutory & Legal Framework

Internationally, the emphasis on environmental problems and social problems such as land degradation, pollution and health problems have led to the emergence of important drivers of support for solid waste management.

In order to integrate solid waste management in the development agenda, the Govt. of India has put in place an overarching legal, regulatory and policy framework to promote market based solid waste management in the Indian economy.

7.1 Applicable laws

Municipal Solid Waste (Management & Handling) Rules, 2000

Under the Environmental Protection Act (EPA), 1986 the Ministry of Environment and Forests (MoEF), Government of India, enacted the Municipal Solid Waste (Management & Handling) Rules, 2000. This rules made the ULBs responsible for waste segregation, collection, transportation, treatment process and disposal. The Secretary, Urban Development Department (UDD) for Municipal Corporations & District collectors for the Municipal Councils is responsible for the implementation of these rules. These rules give the criteria and procedure for collection and transport and also provide specification regarding the design of treatment and disposal facilities. According to the Constitution (74th Amendment) Act, 1992 of the Government of India (GoI), it is the ULB which would be responsible for the provision of SWM services. Other legislations covering the waste management include;

- The Bio-Medical Wastes (Management & Handling) Rules, 1998.
- The Recycled Plastics (Manufacture and Usage) rules, 1999.

Reform Principles governing MSW Management

The MSW disposal in most of the cities till recently was viewed as an administrative function or worst still, as an employment generation opportunity or confined to dumping the garbage away from the city areas. However, in the recent past there is a perceptible change in this behaviour and attitude, since the time reform based rules and principles have been introduced for management of MSW. Scientific MSW disposal is now being thought of and implemented by city managers. Given the huge capital costs incurred for managing each stage of SWM in a scientific manner, the State Government is subsidizing a part of the capital costs through some government incentive schemes and is also encouraging private sector participation. In order to render the MSW management system sustainable, the stress is laid on private participation & community involvement through sensitization, regulation and promotional activities.

The above-mentioned rules, acts, notifications and reform principles have been envisaged with a view to improving the efficiency and effectiveness of the MSW management system in the country. In addition to the regulatory and policy framework that has been put in place, the objective of achieving good standards in public health & hygiene can only be possible when the institutional structures are designed for delivering these desirable outcomes.

Karnataka State Policy on Integrated Solid Waste Management

The goal of effective MSWM services is to protect public health, the environment and natural resources (water, land, air). An effective MSWM service can be achieved only by improving the efficiency of MSWM activities, thereby leading to the reduction of waste generation, separation of MSW and recyclable material, and recovery of compost and energy.

The objectives of Karnataka State Municipal Solid Waste Management Plan are:

1. Providing directions for carrying out the waste management activities (collection, transportation, treatment and disposal) in a manner, which is not just environmentally, socially and financially sustainable but is also economically viable.
2. Establishing an integrated and self-contained operating framework for MWSM, which would include the development of appropriate means and technologies to handle various waste management activities.
3. Enhancing the ability of ULBs to provide effective waste management services to their citizens.

The State Municipal Solid Waste Management Plan details out; Normative Standards and Procedure for Collection, Storage and Transportation of MSW; Guidelines for Establishment and Operations of Treatment and Landfill Facilities; and broadly the terms of reference for Information Educational Communication Programme (IEC) for Solid Waste Management in the cities/ towns of Karnataka.

The Karnataka Municipalities Act, 1964

This act gives the municipal councils the right to lease, sale or enter into contract in respect of any of the immovable property belonging to them or acquired by them in order to implement the provisions of the Act. As management of the MSW is one of the obligations of municipal council, the municipal council may transfer the land belonging to them to a project developer for implementing the project relating to MSW management.

Municipal council has to make adequate provisions to clean public streets, places, sewers and all spaces that are not private property and they have to provide covered metallic receptacles mounted on wheels for use by servants employed by the Municipal Council for the removal and disposal of waste. The municipal council is allowed to take up any improvement scheme or work and execute it as per the terms and conditions specified by the Government.

7.2 Legal & Regulatory framework

Legally urban local bodies have responsibility to handle municipal solid waste in the cities and towns. They act as regulators for the complete process. Either they have to handle the whole process on their own or they can outsource few components of the system to the local contractors or they can convert this into a PPP project. They have a complete responsibility to decide the process and prepare a tariff framework for user charges.

In Bijapur, the user charges collected from domestic households is Rs 30/ month whereas it is Rs.50; Rs. 200 and Rs. 800/ month from Shops, Meat Shops and Big Hotels/ Lodges/ Kalyan Mandaps/ Hostels respectively. In addition to the fixed monthly charge the Big Hotels, Lodges, Kalyan Mandaps and Hostels would be charged Rs 300/program.

Exhibit 7-1: Tariff Framework for MSWM

S. No	Category	Rs/month
1	Households	30
2	Shops	50
3	Meat shops	200
4	Big Hotels/ Lodges/Kalyan Mandaps/ Hostels	800

Source: Bijapur City Municipal Council

8. Indicative environmental & social impacts

Municipal Solid Waste Management is an initiative with certain objectives such as; improving environment, reducing land degradation, improving health conditions, using waste as resource to create energy, compost, eco-bricks, oil etc. With all initiatives certain impacts have been identified. The chapter detail outs the long-term and short-term environmental and social impacts with its mitigation measures.

8.1 Environmental Impacts

The impact on the environment on implementing an integrated MSWM plan can be divided into;

Positive Impacts

Negative Impacts

The Negative impacts can further be divided into the following categories;

Pre-construction Phase: Normally during this phase the impact is maximum on biodiversity as it involves falling of trees in clearing the area for constructing a sanitary landfill but Bijapur already has an existing landfill site measuring over 33 acres so there will be no need for clearing more land.

Construction phase of the landfill: During this, increased particulate matter during excavation work is observed. The excavated earth would also have to be disposed, which can effect environment. Noise pollution due to the machinery for excavation can be seen. Also soil and water contamination due to construction is generally observable. Since, landfill site is already there, these effects would be very little.

Operation & Maintenance Phase: During this phase foul smell from the landfill site is observed, thus it is required that it remains far from other land uses. It leads to escape of methane, a green house gas (GHG) into the atmosphere. If landfill site is not properly, stray animals and birds can intrude inside the landfill site. It leads to breeding of mosquitoes. The waste could blow over the landfill area and litter outside the boundary wall. There can be escape of leachate contaminating ground water

Positive impacts of the envisaged ISWM project;

1. As maximum amount of waste is to be collected through DTDC the open dumps would reduce and would eliminate from the cities in coming time.
2. The transportation of waste would be in covered vehicles thus avoiding the spillage of waste. It also reduces the foul smell on the city roads and it will avoid birds flying over the vehicles
3. Instead of open dumping the waste would be disposed in cells at the landfill site and would be covered by a layer of soil/inert material, which will reduce the scavenging and environmental nuisance
4. It will eradicate the practice of open burning of waste at the disposal site or in the city at vacant places, thus reducing the pollution

8.2 Social Impacts

The implementation of an ISWM system would have impact on the citizens, the SHGs, the rag pickers and others involved in the informal sector of waste management. A scientific waste management practice benefits the health of the people residing in the area as well as those carrying out the waste collection, transportation and disposal. A proper collection system would ensure that there is no garbage decaying on the roads and being a breeding ground for mosquitoes.

On increasing the DTDC services throughout the city there would be more employment generation in the form of waste collectors. At the disposal site, current practice of open burning poses a health risk. Scientific disposal would ensure that there is no burning of waste.

The negative impact could be that involving the private operator in collection would hamper the DTDC system currently being carried out by SHGs. At the disposal site currently the CMC allows rag pickers to enter and take the recyclables but once the disposal is privatised, the operator of the site may not allow this practice to continue.

8.3 Mitigation Measures

For mitigating the anticipated negative impacts on the environment and the society the following measures could be followed;

- Each cell at the landfill site should have a provision of bottom impervious liner
- There should be Provision of leachate collection and treatment system and a landfill gas management system
- The waste should be provided with daily cover to avoid foul smell and breeding of insects
- The SHGs could be allowed to function in the areas they presently do and the private operator could cover the rest of the areas
- The rag-pickers could be employed by the private operator for handling the waste management system thus including them in the formal waste management chain

9. Way Ahead

9.1 Project Development Framework

The key task for DMA/ BCMC is to appoint a transaction advisor to carry out feasibility studies as well as to undertake bid process management on behalf of BCMC.

Project Development framework would involve:

1. Engaging a Transaction Advisor
2. Detail Feasibility Study
3. Take necessary Policy Sanctions
4. Project Structuring
5. Preparation of Bid Documents
6. Bid Process
7. Selection of Private Operator and Issuing Letter of Award (LoA)
8. Signing of Contract

9.2 Procurement Plan for further development

TOR for Transaction Advisor/ Technical Consultant and deliverables (Task, Deliverables, Timeline); Experience required for firm and experts for Transaction Advisor/ Technical Consultant Evaluation Matrix (This will be moderated by the Dept/ Agency/ IDD to remove any bias).

Activity/ Months	1	2	3	4	5	6	7
Appointment of Transaction Advisors (by Nodal Agency)							
Preparation of Detailed feasibility Reports (Project Structuring)							
Project Structuring and Bid Documents preparation							
Bidding Process							
Selection of Developers and Issue of LoA							

9.3 Summary of Findings

The preliminary feasibility suggests that the project is doable from a Technical, Strategic and Viability View Point, with 25 year concession.

However there are few issues on which the Detailed Feasibility Study shall focus:.

- The accurate costs for fixtures and other equipments
- Terms of Project Expansion with expansion of the town and requirement of new street lights at newly developed area.
- Benefits of the proposed project structure for CMC
- CMC would get an Integrated SWM system without any investments of its own.
- Citizens of Bijapur will get improved service levels.

10. Annexures

Annexure 1: Assumptions

A	General Assumptions		
	waste generation per capita	300	gm
	Inflation	5%	%
	Population Growth Rate		
	year 1-10	2.53%	
	year 11-20	2.88%	
	year 21-25	3.0%	
B	**Area of the city and Roads**		
	Area of town (Sq.km)	93.5	
	Assumption Average Road Width (M)	7	
	Year	**Road Length (m)**	**Area under Roads (%)**
	Year 1 (Existing)	533,000	4%
	Year 10	667,857	5%
	Year 20	801,429	6%
	Year 25	935,000	7%
C	**Assumption on Waste quality**		**Unit**
1	**Density of Solid Waste (for composting)**	0.6	tonne/m3
2	**Density of Solid Waste (for landfilling)**	1	tonne/m3
3	**Components of the waste**		
	Biodegradable component	47%	
	Recyclable component	14%	
	Landfill Component	39%	
4	**Actual % of components given that for 4 months during monsoon, composting won't happen**		
	Biodegradable component	31.3%	
	Recyclable component	14%	
	Landfill Component	54.7%	
D	**Assumption for land Requirement**		Unit
1	**Composting**		
	Height of each windrow	1.5	m
	Length of each windrow	3	m
	Width of each windrow	2	m
	Area required for 1 pit	10	sqm
	Conversion Efficiency	75%	%
	Actual Moisture content	48%	%
	Reduction in moisture content	35%	%
	Compost Price	1.50	Rs./kg
	loss in revenue from sale of compost	15%	
2	**Landfill**		
	Height	20	m
3	**Time taken to remove manure from a pit**	1	day

E	Primary Collection	Capacity	Trips
	Hand Carts	0.06	4
	Tricycles	0.1	3
	Auto Tippers	1.5	3
	Community Bins (3 cu.m)	3	
	Community Bins (4.5 cu.m)	4.5	
	% waste collected by Handcart	15%	4
	% waste collected by Tricycles	25%	3
	% waste collected by Auto Tippers	60%	3
	Supervisor	1/20	1 for 20 sweepers
	Road length Per sweeper	800	
F	**Transportation**		Units
1	**Lifespan**		
a	Hand Cart	10	Yrs.
b	Tricycle	10	Yrs.
c	Auto Tipper	10	Yrs.
d	Dumper placer	10	Yrs.
e	JCB	10	Yrs.
2	**Distance from disposal site**		
	City to disposal site	5	Km
	to compost market	10	Km

G	Revenue	Rs. per Month
1	**Revenue per HH(Rs.)**	30
a	Commercial	50
b	meat shops	200
c	hotel/kalyan mandap	800
d	Institutions	800
2	**Rate of Increase**	
a	Residential	8%
b	Non-Residential	8%

H	Non-Domestic sources of waste	No.	% covered
1	Commercial	5930	2965
2	meat shops	128	64
3	hotel/kalyan mandap	185	93
4	Institutions	495	248
5	Vegetable Market		

Annexure 2: Detailed Financial Model

A	Investment by Private Operator	
1	Primary & Secondary Collection	Yes
2	Transport	Yes
3	Disposal	Yes

Heads	**Share**	**2012**	**2021**	**2031**	**Total by 2036**
Total Capital Investment of ISWM	100%	556.53	579.56	943.21	2,079.30
VGF	20%	111.31	115.91	188.64	415.86
Investment by Pvt. Player after VGF	**80%**	**445.22**	**463.65**	**754.57**	**1,663.44**

S.N.	Head	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
A	**Expenditure**																									
1	**Collections**																									
	CAPEX																									
	Capital Investment for Collection	128.3									232.6										390.0					
	Capital Investment by Pvt. Player	102.7									186.1										312.0					
	Operating Expenses																									
	A) Salary(lac.)	444.6	478.6	515.3	554.8	597.2	643.0	692.2	745.2	802.3	863.7	933.1	1,008.0	1,088.9	1,176.3	1,270.7	1,372.7	1,482.9	1,601.9	1,730.5	1,869.4	2,021.8	2,186.6	2,364.8	2,557.5	2,765.9
	b) Equipment	16.6	17.9	19.3	20.8	22.4	24.1	25.9	27.9	30.0	32.3	34.9	37.7	40.8	44.0	47.6	51.4	55.5	60.0	64.8	70.0	75.7	81.8	88.5	95.7	103.5
	Total (A)	461.2	496.6	534.6	575.5	619.6	667.0	718.1	773.1	832.3	896.1	968.0	1,045.7	1,129.6	1,220.3	1,318.3	1,424.1	1,538.4	1,661.9	1,795.3	1,939.4	2,097.4	2,268.4	2,453.3	2,653.2	2,869.4
2	**Transport**																									
	CAPEX																									
	Capital Investment for Transportation	133.0									238.6										376.8					
	Capital Investment by Pvt. Player	106.4									190.9										301.4					
	Operating Expenses																									
	A) Salary(lac.)	205.2	220.9	237.8	256.0	275.7	296.8	319.5	344.0	370.3	398.7	430.7	465.2	502.6	542.9	586.5	633.6	684.4	739.4	798.7	862.8	933.1	1,009.2	1,091.4	1,180.4	1,276.6
	b) Equipment	18.9	20.4	21.9	23.6	25.4	27.3	29.4	31.7	34.1	36.7	39.7	42.9	46.3	50.0	54.0	58.4	63.1	68.1	73.6	79.5	86.0	93.0	100.6	108.8	117.6
	Total(B)	224.1	241.3	259.7	279.6	301.1	324.1	348.9	375.6	404.4	435.4	470.3	508.1	548.9	592.9	640.5	691.9	747.5	807.5	872.3	942.3	1,019.1	1,102.2	1,192.0	1,289.1	1,394.2
3	**Disposal**																									
	CAPEX																									
	Capital Investment for Disposal Facility	295.2									108.3										176.4					
	Capital Investment by Pvt. Player	236.2									86.7										141.2					
	Operating Expenses																									
	A) Salary(lac.)	9.2	9.9	10.7	11.5	12.4	13.4	14.4	15.5	16.7	18.0	19.4	20.9	22.6	24.4	26.4	28.5	30.8	33.3	36.0	38.9	42.0	45.4	49.1	53.2	57.5
	b) Equipment	2.4	2.6	2.8	3.0	3.3	3.5	3.8	4.1	4.4	4.7	5.1	5.5	5.9	6.4	6.9	7.5	8.1	8.7	9.4	10.2	11.0	11.9	12.9	14.0	15.1
	Total(C)	11.7	12.6	13.5	14.6	15.7	16.9	18.2	19.6	21.1	22.7	24.5	26.4	28.6	30.9	33.3	36.0	38.9	42.0	45.4	49.1	53.1	57.4	62.1	67.1	72.6
4	**Total(A+B+C)**	697.0	750.4	807.9	869.7	936.3	1,008.0	1,085.2	1,168.3	1,257.8	1,354.1	1,462.8	1,580.2	1,707.1	1,844.1	1,992.1	2,152.0	2,324.8	2,511.4	2,713.0	2,930.7	3,169.6	3,427.9	3,707.3	4,009.4	4,336.2
B	**Revenue**																									
1	**Revenure from Exisitng Sources**																									
	a) Revenue from compost after losses(15%)	103.1	111.0	119.5	128.7	138.5	149.2	160.6	172.9	186.1	200.4	216.4	233.8	252.6	272.9	294.8	318.4	344.0	371.6	401.4	433.7	469.0	507.2	548.6	593.3	641.6
	b) Revenue from HHs	120.9	161.2	208.9	265.3	294.8	327.6	364.0	404.4	505.5	561.7	694.3	772.3	859.1	955.7	1,063.1	1,182.6	1,315.5	1,463.4	1,627.9	1,810.9	2,014.4	2,240.8	2,492.7	2,772.9	3,084.5
	c) Revenue from shops	17.8	19.7	21.8	24.2	26.7	29.6	32.8	36.3	40.2	44.5	49.3	54.6	60.5	67.0	74.1	82.1	90.9	100.7	111.5	123.5	136.7	151.4	167.6	185.6	205.5
	d) Revenue from Meat shops	1.5	1.7	1.9	2.1	2.3	2.6	2.8	3.1	3.5	3.8	4.3	4.7	5.2	5.8	6.4	7.1	7.9	8.7	9.6	10.7	11.8	13.1	14.5	16.0	17.7
	e) Revenue from Hotels	8.9	9.8	10.9	12.1	13.4	14.8	16.4	18.1	20.1	22.2	24.6	27.3	30.2	33.4	37.0	41.0	45.4	50.3	55.6	61.6	68.2	75.6	83.7	92.7	102.6
	f) Revenue from educational institutes	23.8	26.3	29.1	32.3	35.7	39.6	43.8	48.5	53.7	59.5	65.9	72.9	80.8	89.4	99.0	109.7	121.4	134.5	148.9	164.9	182.6	202.2	223.9	247.9	274.5
	Total Revenue from Other sources	276.0	329.7	392.2	464.6	511.5	563.2	620.4	683.4	809.1	892.2	1,054.8	1,165.7	1,288.4	1,424.2	1,574.5	1,740.9	1,925.1	2,129.1	2,355.0	2,605.1	2,882.7	3,190.2	3,530.9	3,908.3	4,326.6
2	**Tipping Fee (RS./tonn disposal)**	166.0	215.0	270.7	334.0	360.5	389.1	420.0	453.4	550.5	594.3	713.6	771.2	833.4	900.7	973.4	1,051.9	1,136.8	1,228.6	1,327.8	1,435.0	1,551.0	1,676.3	1,811.9	1,958.4	2,116.7
3	**Total Revenue to pvt. Player**	442.0	544.7	662.9	798.6	872.0	952.4	1,040.4	1,136.8	1,359.7	1,486.4	1,768.4	1,936.8	2,121.8	2,324.8	2,547.8	2,792.8	3,061.9	3,357.7	3,682.7	4,040.1	4,433.7	4,866.6	5,342.8	5,866.7	6,443.3
C	**Grants (Already sanctioned)**	93.00																								
D	**Net Cash Flow**	-607.27	-205.64	-144.92	-71.16	-64.34	-55.66	-44.84	-31.57	101.87	-331.33	305.55	356.59	414.68	480.72	555.70	640.76	737.16	846.30	969.77	354.77	1264.08	1438.65	1635.48	1857.27	2107.06
E	**Cumulative Cash Flow**	-607.27	-812.91	-957.83	-1029.00	-1093.33	-1148.99	-1193.83	-1225.40	-1123.52	-1454.85	-1149.31	-792.72	-378.04	102.68	658.38	1299.14	2036.30	2882.60	3852.37	4207.13	5471.21	6909.86	8545.34	10402.61	12509.66
F	**IRR**	15%																								

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