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# Action Plan for Integrated Solid Waste Management in the State of Goa

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**Government of Goa**



**April 2015**

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## Executive Summary

Waste generation is an integral outcome of human existence. With progress comes a change in the waste characteristics and an increase in the quantity of waste.

Goa has had its tryst with the problems of Solid waste management and the State Government being aware and concerned of the situation commenced its fight against waste a couple of years back. This is evident from the Budget Speech for the year 2015-16.

The Government constituted a High Level Task Force to resolve the problems of Solid Waste Management. It has also constituted the Monitoring cum Working Committee and has set up Solid Waste Management Cell under the aegis of the Department of Science & Technology, a specialised unit to handle waste.

One of the first decisions taken was to set up three State-of-the-Art Integrated Solid Waste Management facilities (SWMFs). A plastic to fuel plant is on the anvil and these facilities shall be operational shortly.

The Government has amended various rules and laws after due consultation with the public, and has made waste segregation at source mandatory. It is presently impressing upon the local bodies on door to door collection of segregated waste.

In a short term perspective, dry non-bio-degradable waste is being collected by the Solid Waste Management Cells from 189 Panchayats, 12 Municipalities and 1 Corporation in the State. The waste is collected, segregated and the non-recyclable waste is baled at its two baling stations and is sent for co-processing in Cement Kilns.

Once the SWMFs are operational, the designed solid waste management system shall then collect dry and wet waste and deposit it at the SWMF for processing. The design of an

efficient and state of the art transfer station network is in progress and shall be constructed and operated by DST.

The State has also taken steps towards the setting up of a Common Biomedical Waste Treatment Facility for treatment and disposal of the Biomedical waste generated in the State. An area has been identified for setting up a bio-medical waste treatment facility by the Goa Industrial Development Corporation (GIDC) in one the Industrial Estates in the State. Thereafter, the Department of Science & Technology shall invite Expression of Interest for setting up the said facility after following due procedures.

The Government has allocated areas to various departments to manage solid waste and has designated the Heads of Departments as Nodal Officers for Solid Waste Management Activities in their allocated areas. Solid waste management is being taken up as a module at school levels to inculcate the concept of Solid Waste Management at a young age. It is a hope that the children will impart civic sense to their parents and hopefully be the change we want to see.

Technology is being used to design, implement, and monitor solid waste management. MIS, GIS and GPS are planned to be used to efficiently and economically manage the system of waste management.

The SWM Plan of Goa is in line with the MSW 2000 rules, the Punjab Plan for Solid Waste Management as outlined in the Capt. Mall Singh judgement, the Order of the Hon'ble National Green Tribunal dated 20.03.2015 w.r.t O.A. No. 199 of 2014 and the Plan submitted by the State of Haryana. The Goa Solid Waste management Plan has evolved from learnings, & analyses of the present system of waste management in the State and directions issued in different legal matters.

# 1. Introduction

The Government of Goa has given utmost importance to the task of solid waste management. Extracts of the Budget Speech 2015-16 by Hon. Chief Minister of Goa and Minister of Finance, Shri. Laxmikant Parsekar on March 25, 2015 appear below:

*(Pg. 6, No. 30) "Sir, scientific solid waste management is the need of the hour, particularly in a state with global recognition for tourism. In this regard, we have commenced the work of state-of-art integrated solid waste management land at Saligao / Calangute plateau, which is slated for completion in 2015-16"*

*(Pg. 6, No. 31) "It is proposed that an integrated solid waste management plant at Cacora for South Goa will commence immediately after handing over of land formalities are completed. Both these projects are being taken up at an estimated cost of Rs. 738 crores and I propose to make an allocation of Rs 30 crores for this purpose in the coming financial year."*

*(Pg. 6, No. 32) "This project needs financial outlay for the long period of its operation of 10 years. Being a green initiative, I propose to create a separate mechanism for payment of annuity through various taxes / cess collected by us for Green Goa, This will put in place a regular and predictable payment mechanism for capital grant and gross annual operational support grant to the concessionaire over the decade long contract period."*

*(Pg. 6, No. 33) "Apart from this, cleaning of major highways and state roads connecting major towns in Goa has been undertaken and new roads have been added thereby bringing new areas in Porvorim, Saligao, Calangute, Siolim, Raia, Corlim, Ponda under the ambit of the cleanup."*

## 1.1 Goa at a Glance

Situated in the Konkan region, Goa is the smallest state in India. Synonymous with tourism in India, Goa remains one of the favourite tourist destination for millions across the globe. Bordered by the Arabian Sea on its west, Goa is blessed in terms of topographical beauty. The state of Goa is divided into two districts North Goa and South Goa. This State is situated on the western coastal region of the Indian Peninsula. Geographically Goa bears a striking resemblance to its neighbouring states of Maharashtra and Karnataka. The state of Goa lies between 15°48'00" north to 14°53'54" north latitudes and 74° 20'13" east to 73° 40'33" east longitudes. The one unique feature about the geography of Goa is that it is a seamless concoction of Mountainous, Plateau Regions and coastal plains.

Goa is situated on the South Western part of India. It is the smallest state in India spreading over an area of 3,702 sq km. The beaches in Goa cover almost 83 percent of its total coastline. Goa by far is among the most frequented tourist's destinations in India.

Goa is connected by a broad network of roads. Traveling to Goa is extremely easy as it is connected with a number of National and state highways.

Table 1: Goa State Information

Goa State Information	
Capital	Panaji
Date of formation	30. May. 1987
Tourist attractions	Anjuna, Arambol, Basilica of Born Jesus, Se Cathedral
Languages	Konkani, Marathi
Size	3,702 sq. km
Population (Census 2011)	1,458,545

<b>Rivers</b>	Mandovi, Zuari, Tereldiol, Chapora, Sal, Talpona
<b>Forests and wildlife sanctuaries</b>	Bondla WS, Modem NP, Dr Salim Ali Bird Sanctuary, Cotigao WS, Bhagwan Mahavir WS
<b>Major crops</b>	Paddy, ragi, maize, cashew
<b>No. of District</b>	2

### 1.2 Goa and India

Goa is the smallest state in the Indian Union with an area of 3,702 square kilometres.

Rank	State or union territory	Population (2011 Census) <sup>(12)</sup> (% of Population of India) <sup>(12)</sup>	%Decadal Growth (2001-2011)	Rural Pop. <sup>(13)</sup> (%)	Urban Pop. <sup>(13)</sup> (%)	Area <sup>(13)</sup>	Density
NCT	Delhi	16,753,235 (1.38%)	21%	419,319 (02.50%)	16,333,916 (97.50%)	1,484 km <sup>2</sup> (573 sq mi)	11,297/km <sup>2</sup> (29,260/sq mi)
16	Punjab	27,704,236 (2.30%)	13.7%	17,316,800 (62.51%)	10,387,436 (37.49%)	50,362 km <sup>2</sup> (19,445 sq mi)	550/km <sup>2</sup> (1,400/sq mi)
18	Haryana	25,353,081 (2.09%)	19.9%	16,531,493 (75.75%)	8,821,588 (24.25%)	44,212 km <sup>2</sup> (17,070 sq mi)	573/km <sup>2</sup> (1,480/sq mi)
26	Goa	1,457,723 (0.12%)	8.2%	551,414 (37.85%)	906,309 (62.17%)	3,702 km <sup>2</sup> (1,429 sq mi)	394/km <sup>2</sup> (1,020/sq mi)
<b>Total</b>	<b>India</b>	<b>1,210,193,422 (100%)</b>	<b>17.64%</b>	<b>833,087,662 (68.84%)</b>	<b>377,105,760 (31.16%)</b>	<b>3,287,240 km<sup>2</sup> (1,269,210 sq mi)</b>	<b>382/km<sup>2</sup> (990/sq mi)</b>

Table 2: Population and Population Density of Selected States/UTs

It can be seen from the above table that Goa has one of the lowest population densities in the country.

### 1.3 Administrative Description of Goa

For administrative purposes, Goa is divided into two districts:

- a. North Goa
- b. South Goa

The North Goa and South Goa districts are further divided into 12 talukas.

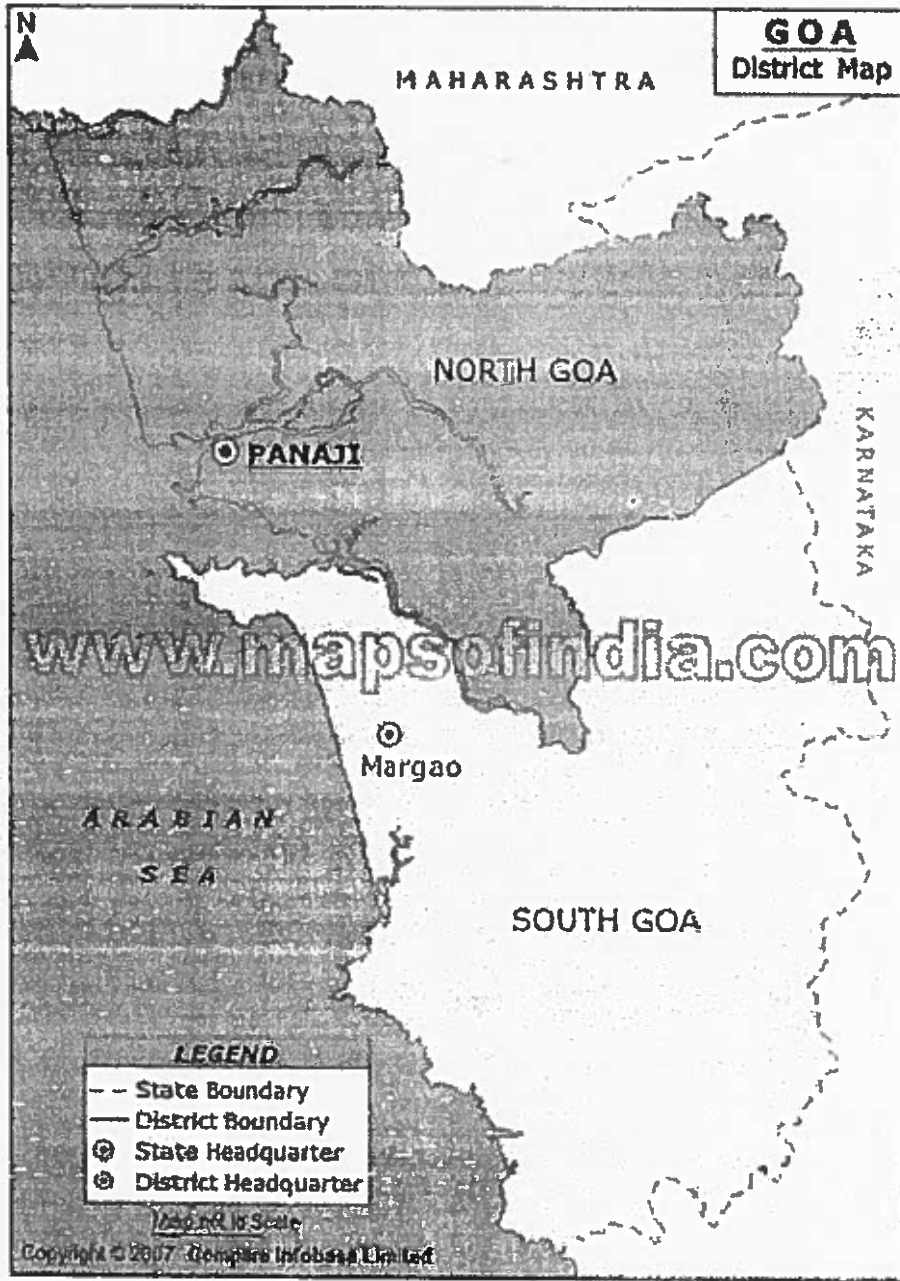


Figure 1 Administrative Divisions (Districts) of Goa

## North Goa District

The area of the District is 1736 Sq. Km. North Goa being a part of the West Coast region of India has many physical features that are common to its neighboring states of Maharashtra and Karnataka. The Talukas present in the North Goa District are as follows:

- a. Bardez
- b. Bicholim
- c. Pernem
- d. Ponda
- e. Sattari
- f. Tiswadi

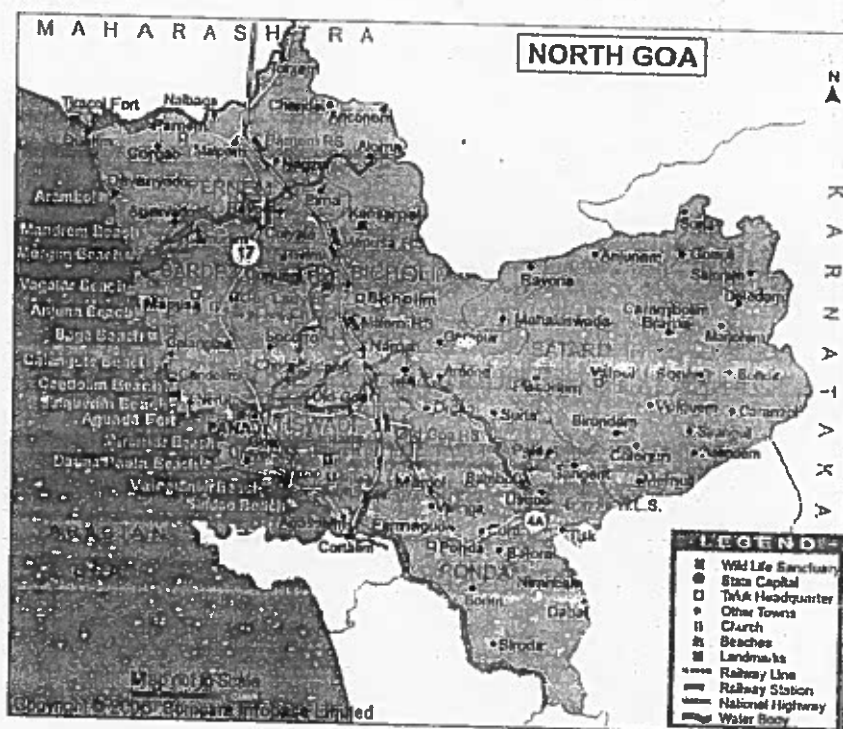


Figure 2 North Goa District

## South Goa District

South Goa District covers the entire southern part of the state of Goa. From north to south and from east to west the district spans a distance of 86 kms and 40 kms respectively, with an area of 1966 sq.kms. Tehsils/talukas present in South Goa:

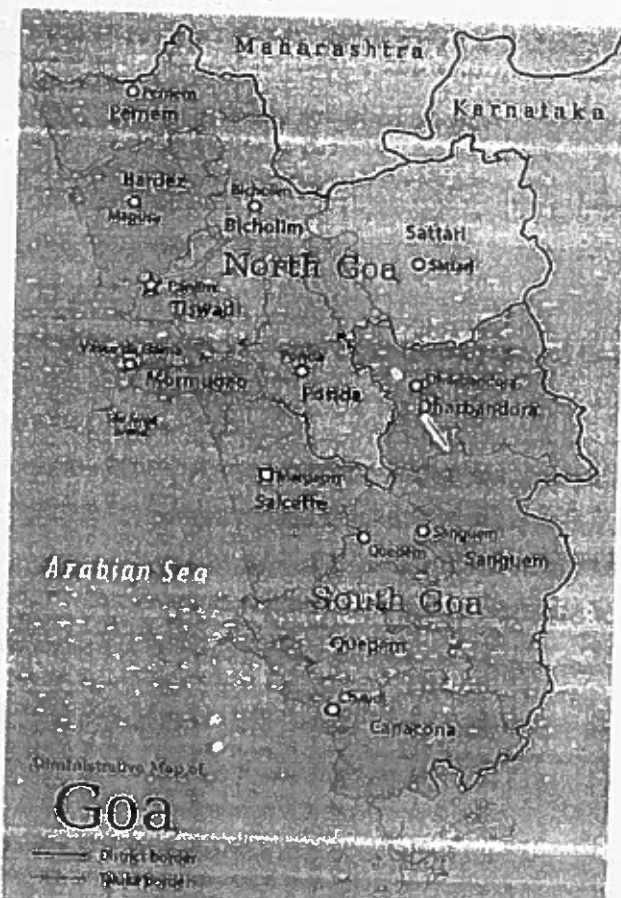
- a. Canacona

- b. Mormugao
- c. Salcette
- d. Sanguem
- e. Quepem
- f. Dharbandora



Figure 3 South Goa

The of Goa showing taluka below:



District administrative map the talukas and the headquarters is given



### 1.4 Panchayati Raj Institutions in Goa

The State of Goa has 190 Village Panchayats, 12 Municipal Councils and 1 Corporation.

### 1.5 Major Occupations & Sources of Income

Mining and Tourism form important occupations of the State. Goa is visited per year by a large number of tourists, and the tourist statistics is given below:

Tourist Arrivals (Year Wise)				
Year	Domestic	Foreign	Total	% Change
2000	976804	291709	1268513	1.9
2001	1120242	260071	1380313	8.8
2002	1325296	271645	1596941	15.7
2003	1725140	314357	2039497	27.71
2004	2085729	363230	2448959	20.1
2005	1965343	336803	2302146	-6.0
2006	2098654	380414	2479068	7.7
2007	2208986	388457	2597443	4.6
2008	2020416	351123	2371539	-9.5
2009	2127063	376640	2503703	5.5
2010	2201752	441053	2642805	5.6
2011	2225002	445935	2670937	0.98
2012	2337499	450530	2788029	4.20
2013	2629151	492322	3121473	10.68
2014	3544634	513592	4058226	--

Table 3 Tourist Arrivals in the State of Goa

## **2. The Evolution of the Solid Waste Management Plan for Goa**

This chapter provides a brief background on which the present Action Plan for Solid Waste Management has been formulated.

### **2.1 Directions of the Hon'ble High Court w.r.t Suo Motu W.P. 2/2007**

In the Order of the Hon'ble High Court dated 13.08.2013 w.r.t Suo Motu Writ Petition 2/2007, specific directions had been given to certain Village Panchayats, Municipal Councils, Corporation and the State Government w.r.t Solid Waste Management; which are as follows:

- a. Directions to the Corporation/ Municipal Councils included time-bound targets to identify sites and to set-up sanitary landfills (as applicable) for burial of inert/residual waste collected by the Municipal Councils/ Corporations. In addition, there were specific directions about collection, baling and disposal of the plastic waste.
- b. Directions to the Village Panchayats include the following Clauses among others:
  - (1) The Village Panchayats shall ensure that the plastic waste that is collected every week from all wards of the Village Panchayats is baled properly and stored at an appropriate site, until it is collected by the agency appointed for the purpose. If the Government selects a site for storage of plastic waste, the Village Panchayats shall transport the plastic waste to this site in secure condition for baling.
  - (2) The VPs of Calangute, Candolim, Taleigao, Benaulim, Colva and Chicalim have to make adequate composting facilities for disposal of organic/biodegradable waste.

- (3) The Village Panchayats of Mandrem, Morjim, Taleigao, Benaulim, Varca, Colva, Majorda, Chicalim, Sancoale and Fatorpa were directed not to issue construction licence/s to multi-dwelling projects of 5 residential units and above, until the Goa State Pollution Control Board was satisfied that the plastic waste is collected weekly from all wards of the Village and baled properly for onwards disposal through the plastic waste collector.
- c. Directions to the State Government include setting up of two or more sanitary landfills within a period of one year for accepting the residual/inert waste of VPs of North & South Goa, setting up of a plastic waste disposal unit and appointment of an Agency for collection of plastic waste among others.

The above Order w.r.t Suo Motu Writ Petition 2/2007 has been instrumental in initiating a lot of action w.r.t Solid Waste Management in the State, outlined as follows:

- a. The status of setting up of treatment facilities and sanitary landfills in the Municipal Councils/ Corporation as per information obtained from the Goa State Urban Development Agency (GSUDA), Department of Urban Development is provided in Annexure A.
- b. The status of the compliance by Village Panchayats & Municipal Councils/ Corporation to the Directions of the Hon'ble High Court is as prepared by the Goa State Pollution Control Board provided at Annexure B.

Past the Order of the Hon'ble High Court, the State has undertaken proactive measures towards Solid Waste Management including setting up of a collection mechanism for dry/ non-biodegradable waste, undertaking procedures for setting up two solid waste management facilities in the State, etc.

**2.2 Directions of the Hon'ble NGT w.r.t O.A. No.199 of 2014  
(Almitra H. Patel & Anr. Vs Union of India and Ors.)**

The Hon'ble National Green Tribunal vide its Order dated 20.03.2015 has directed all the States to come up with an Action Plan for Solid Waste Management, referring to the following three documents:

- a. Order of the Hon'ble National Green Tribunal w.r.t O.A. No. 199 of 2014 (Almitra.H. Patel & Anr. Vs Union of India& Ors.)
- b. Order of the Hon'ble NGT w.r.t the case of Capt. Mall Singh Vs State of Punjab
- c. Plan for Solid Waste Management submitted by the State of Haryana in O.A. No. 199 of 2014.

The Action Plan of Goa and the existing management of Solid Waste is completely in line with the Punjab Plan as well as the Haryana Plan and the Directions of the Hon'ble Tribunal with respect to the following salient features:

1. The Integrated Solid Waste Management Facilities in Goa are coming up on degraded sites which have been used for unsegregated solid waste dumping for several years.
2. The Integrated Solid Waste Management Facilities in Goa will generate Electricity from the waste through a process of Bio-methanation.
3. The Integrated Solid Waste Management Facilities in Goa are based on a cluster approach which will source the waste from the respective clusters in North, Central and South Goa.
4. A Green Belt will be developed around the Integrated Solid Waste Management Facilities which will cover around 33% of the total area. This will be used for landscaping, for planting trees, developing garden.

5. The Goa Non-Biodegradable Garbage (Control) Act 1996 has been amended to make Segregation at Source compulsory and provisions have been made to fine offenders.
6. The dry waste will be further segregated into recyclable and non-recyclable waste. The Recyclable waste will be only given to authorized recyclers for recycling while the Non-Recyclable waste will be either converted into RDF or to Fuel through Plastic to Fuel Technology.
7. RDF:
  - a. Non-biodegradable and non-recyclable waste is currently being collected in a completely segregated manner from 189 Panchayats out of 190 and 12 M.C.'s out of 13 and the CCP. This waste is baled and sent to Vasavadatta Cement Factory in Karnataka for Co-Processing where all the checks and balances for emission standards are taken care of and the technology is approved by the CPCB.
  - b. Once the Integrated Solid Waste Management Facilities come up the responsibility of disposing off the non-biodegradable non-recyclable waste will be with the Contractor who may also send it for co-processing.
  - c. A Plastic to Fuel plant of 10 tons per day capacity is coming up in Pernem taluka. The non-biodegradable and non-recyclable waste can also be sent to this plant for generation of fuel.

Therefore there will be no incineration of non-biodegradable and non-recyclable waste.

8. Biodegradable waste will either be composted or be used for generating Biogas which in turn will be used for generating electricity. No part of biodegradable waste will be incinerated.

Hence, proper collection, treatment and disposal of Municipal Solid Waste will be ensured thereby fully protecting the environmental interest.

### 2.3 Principles for waste management

The Action Plan on Solid Waste Management presented in the Chapter 5 has been formulated keeping in mind the following principles of waste management:

- Effective Segregation of waste at Source
- Total Collection of waste as per prevailing rules and laws in force.
- Transportation of the collected waste efficiently at the lowest cost.
- Practicing the 4Rs i.e. Refuse, Reduce, Reuse and Recycle at every stage.
- Safe and scientific disposal of all streams of waste.
- Amending laws in accordance with the requirements to ensure the success of the plan
- Implementing the *Polluter Pays* principle.
- Setting up a financially viable SWM system
- Documentation and quantification of the entire waste management system.
- Periodic Reviewing and feedback of the Solid Waste Management System and applying necessary corrections immediately.
- Utilization of modern technology in SWM like MIS, GIS, etc.

The main goal of the Solid Waste Management Plan is to scientifically dispose the waste at the lowest cost / ton while conforming to all the prevalent laws and thereby ensuring a clean surrounding to all the citizens of the State of Goa.

## 3. Administrative and Organizational Set-up for Solid Waste Management

Since the Organizational set-up for solid waste management is very crucial for effective operation of the entire system of Solid Waste Management, the State is in the process of

setting up the required Organizational Structure for SWM. The following paragraphs outline the Organizational set-up in the State of Goa for Solid Waste Management:

**3.1 High Level Task Force on Solid Waste Management**

A High Level Task Force under the Chairmanship of Hon'ble Chief Minister of Goa has been formed to take decisions pertaining to setting up of solid waste management facilities in the State. The Order of Constitution of the High Level Task Force is attached as Annexure H.

**3.2 Monitoring-cum-Working Committee for Solid Waste Management**

A Monitoring-Cum-Working Committee on Solid Waste Management under the Chairmanship of the Minister of Environment and Forests has been formulated to implement provisions of various Acts and Rules pertaining to Solid Waste Management. The Order of Constitution of the High Level Task Force is attached as Annexure I.

**3.3 Solid Waste Management Cell**

A Solid Waste Management Cell under the Department of Science and Technology has been formulated to provide secretarial assistance to the Monitoring-cum-Working Committee and to perform tasks pertaining to setting up of the Solid Waste Management facilities in the State.

The Cabinet of the Council of Ministers has also decided that the policy decisions pertaining to Solid Waste Management will be taken by the Department of Science and Technology.

### 3.4 Roles and Responsibilities of the Village Panchayats, Municipal Councils, Corporations

As per the Municipal Solid Waste (Management & Handling) Rules 2000, it is the responsibility of the Local Authority to manage the waste generated within their jurisdiction. The Roles and Responsibilities of various Government bodies w.r.t Solid Waste Management are outlined in the table below:

Table 4 Roles and Responsibilities of Different Bodies w.r.t Solid Waste Management

S. No.	Organisation	Roles & Responsibilities
1	High Level Task Force on Solid Waste Management in Goa State (HLTF)	Decision Making body and approving body for all decisions regarding SWM and SWM Plan in Goa
2	Monitoring cum Working Committee on Solid Waste Management (McWC)	Implementation of HLTF decisions and monitoring body for SWM
3	Department of Science, Technology & Environment - Solid Waste Management Cell (DSTE - SWMC)	Nodal department for Solid Waste Management in Goa and co-ordinating agency for Solid Waste Management in Goa. Monitoring of SWMF and MRF. Preparation of policies and monitoring implementation of the policies and plans in Goa. Approval authority for all SWM in Goa. Services the HLTF and McWC.
4a	Department of Urban Development	Nodal department for SWM in all 13 municipalities and 1 Corporation
4b	Department of Panchayats	Nodal department for SWM in all 190 Village Panchayats
4c	Tourism Department	SWM in beaches, tourist sites.



4d	Education Department	Preparation of curriculum for schools and SWM in schools
4e	Industries Department & GIDC	Solid Waste Management in Industrial estates
4f	Goa State Infrastructure Development Corporation Ltd.	Construction of the SWMFs Highway cleaning
4g	Public Works Department	Use of construction & Demolition waste in road building, filling, etc.
4h	Town & Country Planning	Identification of landfill sites. Providing all maps and data as required by the DSTE at no cost.
4i	Collectors & District Magistrate	SWM in all Government offices in the district
4j	Police Department	Implementation of Fines and Solid Waste Management at all police stations
4k	Commercial Taxes	Collection of cess & reporting to High Level Task force
4l	Kadamba Transport Corporation	Solid Waste Management at all bus stands including placement of separate bins
4m	Forest Department	SWM in forests

It can thus be seen that the state plans to involve all concerned stakeholders to ensure that all areas in the state are maintained clean.

The Organizational Structure for solid waste management appears in the Figure given next.

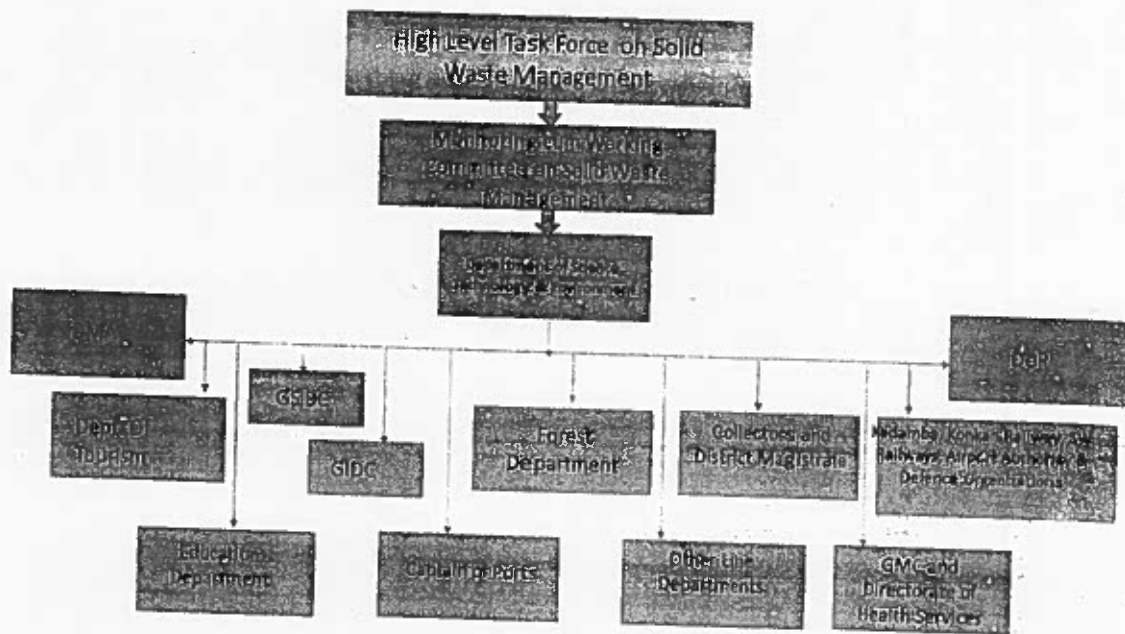


Figure 5 Proposed Organizational Structure for SWM

It has been resolved that since Solid Waste Management is a topic to be addressed on priority, the Head of each of the above offices have been designated as the Nodal Officers for all SWM related matters and compliance with directions given by the Government.

#### 4. Present Status of Solid Waste Management in the State of Goa

This Chapter provides a brief overview of the present status of solid waste management in the State. This background is important to understand the basis of formulation of the State-wide Action plan on Solid Waste Management.

##### 4.1 Collection mechanism for non-biodegradable dry/plastic waste from various locations in Goa

Realizing the issue of a lack of Scientific disposal mechanism for non-biodegradable waste, the State Government through Monitoring cum Working Committee for Solid Waste

management has taken up the initiative of collection non-biodegradable dry/plastic waste from various Village Panchayats, Municipal Councils, Schools, Industrial Estates, and Defence Establishments, etc. across the State. The Monitoring cum Working Committee has entered into a Memorandum of Understanding with M/s Vasavadatta Cement for disposal of non-biodegradable combustible waste through co-processing in the cement kilns.

The waste collected from various locations across Goa by the Contractor appointed is transported to the Segregation and Baling Stations set up by the Committee. The segregated Non-Biodegradable Waste reaching the baling stations is baled and transported to M/s Vasavadatta Cement for co-processing.

The process for such collection appears in the flow chart that follows:

### Mechanism for collection & disposal of non-biodegradable waste

Collection of plastic/dry waste happens from:

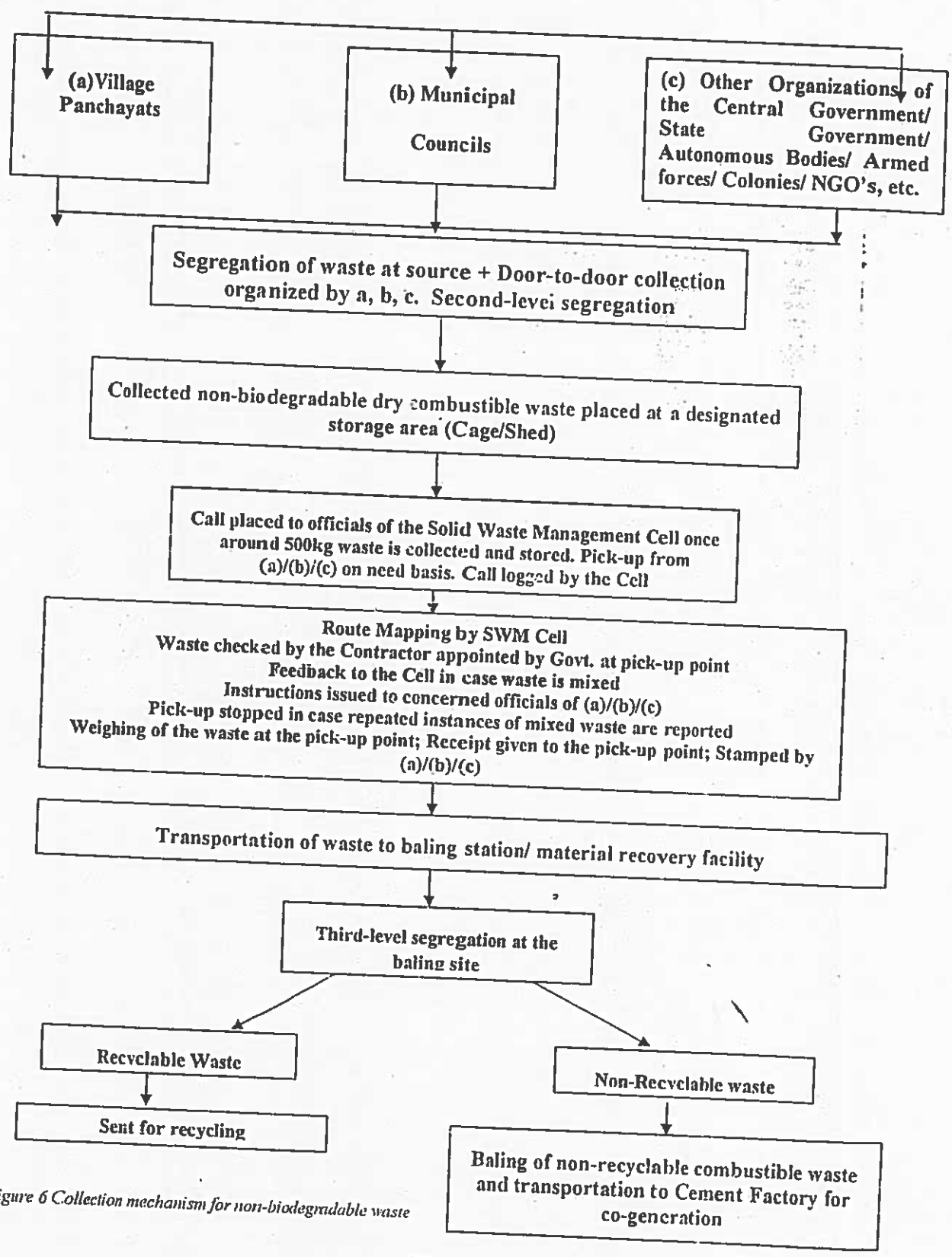


Figure 6 Collection mechanism for non-biodegradable waste

Thus, the non-biodegradable waste collected from different locations across the State is collected as per the route plan prepared by the SWM Cell of DST. The collection mechanism for dry waste is improving across the month as is visible from

The graph showing total collection of dry waste from various location across the State along the months.

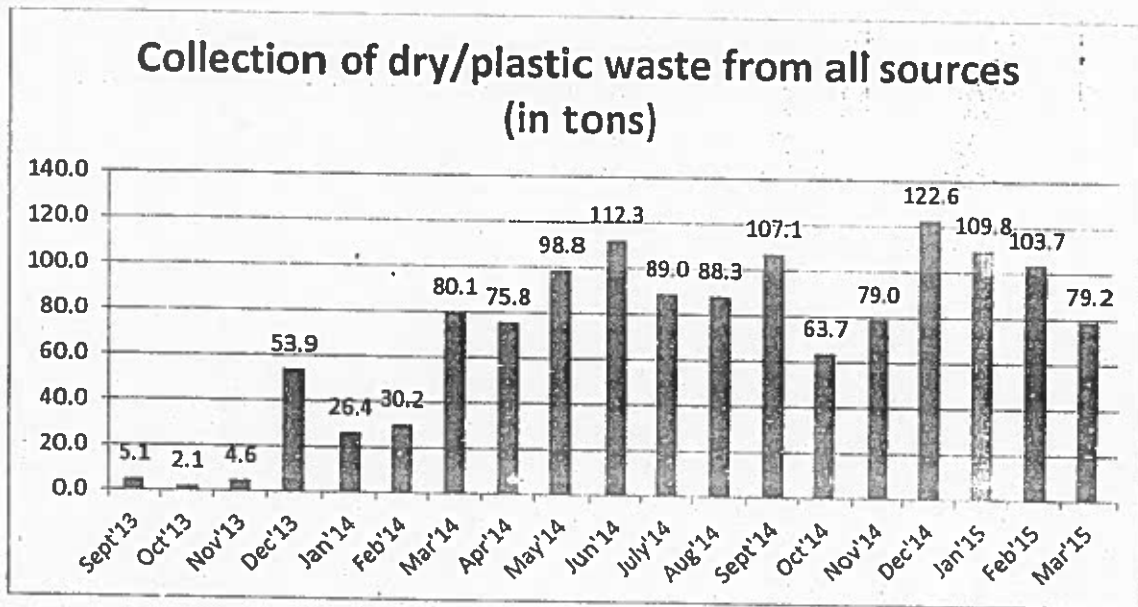


Figure 7 Graph of amount of dry waste collected from all sources (Tons)

The collected dry waste, after due segregation, is baled & the quantity of waste transported for scientific co-processing has gone up due to improvement in the collection mechanism.

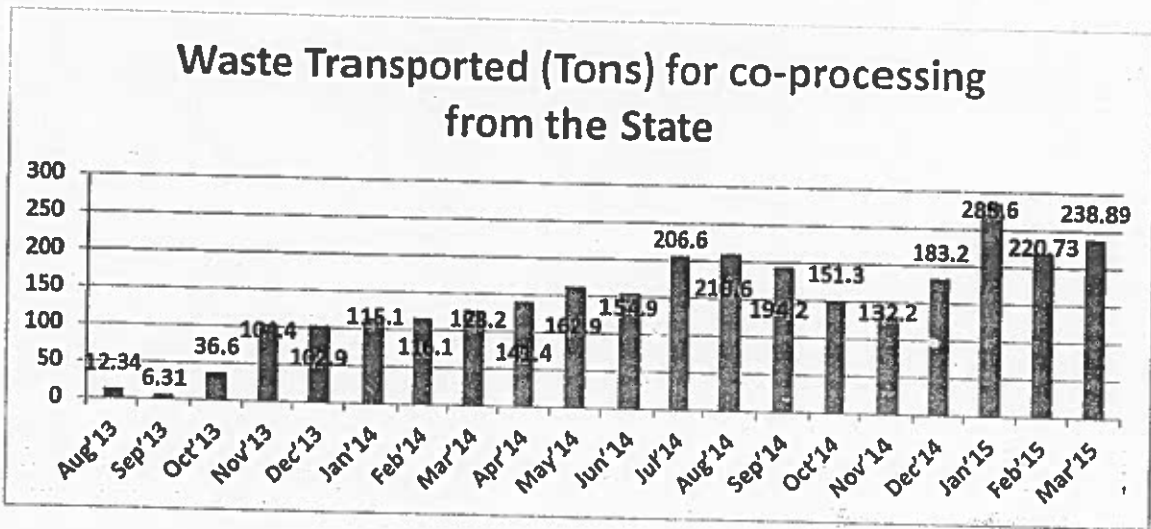


Figure 8 Graph showing amount of baled non-biodegradable waste transported for co-processing (Tons)

As per available records, a total of 2942.715 tons of baled waste (1717.14 Tons from CCP and 1225.305 Tons from Cacora and Sarvona Baling stations & other Village Panchayats/Municipal Councils) have been sent for co-processing at the cement kilns of M/s Vasavadatta Cement, Sedam, Karnataka till 31<sup>st</sup> March 2015.

As on date, 189 Village Panchayats out of 190, 12 Municipal Councils out of 13 and one Municipal Corporation, are currently handing over Non-Biodegradable dry waste for the above process. The collection, segregation, baling & transportation system has improved with time. Proper records & data & consort follow up are important factors on which the SWM Cell, who manages this entire system on a day to day basis, focuses.

**4.2 Status of Solid Waste Management in Municipal Councils and Corporation**

As per the MSW 2000 Rules, the local Municipal body is responsible for management of solid waste generated in its jurisdiction.

The Directorate of Municipal Administration (DMA) is responsible for overseeing the functioning of the Municipal bodies. The Goa State Urban Development Agency (GSUDA), which is an undertaking body of the DMA, has been acting as a Nodal Office for all

Municipal Councils and has so far provided basic infrastructure for door-to-door collection of solid waste. GSUDA also provides training, awareness programs and is also responsible for organizing cluster meetings for the Swachh Bharat Mission.

A status report of existing solid waste management infrastructure in different Municipal Authorities in the State as obtained from the GSUDA is placed at Annexure A, an extract of which is presented below. The data on the non-biodegradable waste handed over, as per records of the SWM Cell also appears in the table below.

Name of Council/ Corporation	Quantum of Waste Generated	Sanitary Landfill	Baling machine provided?	Whether Baling is undertaken?	Dry Waste handed over till date (Kg)
Corporation of the City of Panaji	72 TPD	Not Available.	Yes	Yes	171741
Margao Municipal Corporation	50 TPD	Waiting for TCP permissions (Hill cutting)	Yes	No	-
Mormugao Municipal Corporation	40 TPD	Not available	Yes	Yes	20305
Bicholim Municipal Corporation	4 metric tons /day	Available	Yes	No	4758
Canacona Municipal Corporation	3-4 TPD	Available (But already covered with Un authorized dumping and has damaged the geo textile)	Yes	No	15653
Cuncolim Municipal Corporation	3 TPD	Available	Yes	No	8500
Sanquelim Municipal Corporation	3 TPD	Available	Yes	No	3310
Quepem Municipal Corporation	3 - 4 TPD	Available	Yes	No	6602

Curchorem Municipal Corporation	2-3 TPD	Not available	Yes	No	1331
Sanguem Municipal Corporation	2-3 TPD	Not available	Yes	No	1913
Valpoi Municipal Corporation	2-3 TPD	Available (Under construction almost 70% work completed have proposed DMA to give grants for completion of project)	Yes	No	778
Mapusa Municipal Corporation	20 TPD	Not available	Yes	Yes	21501
Ponda Municipal Corporation	12-13 TPD	Not available (Has moved a proposal to state govt. for grants to built scientific landfill)	Yes	Yes	338738
Pernem Municipal Corporation	1 TPD	Available	Yes	No	520

Table 5 Solid Waste Management Infrastructure in Municipal Councils & Corporation

### 4.3 Status of Solid Waste Management in Village Panchayats

There are 190 Village Panchayat in Goa i.e. (121 Village Panchayats in North Goa and 69 Village Panchayats in South Goa) list of these appears in the table below.

All Village Panchayats are encouraged to undertake door to door collection of waste. As on date, 189 Village Panchayats have joined the initiative of collection of non-biodegradable waste and the amount of such waste handed over to the contractor appointed by the Government also appears in the table below.

Table 6 List of Village Panchayats in the State

Sr. No.	District	Block/ Taluka	Name of Village Panchayats	Dry Waste handed over till date (kg)
1	North Goa	Pernem	Paliem	458
2	North Goa	Pernem	Querim - Tiracol	3587



3	North Goa	Pernem	Parcem	4661
4	North Goa	Pernem	Mandrem	9776
5	North Goa	Pernem	Morjim	1458
6	North Goa	Pernem	Dhargal	289
7	North Goa	Pernem	Virmoda	766
8	North Goa	Pernem	Chandel- Hasapur	577
9	North Goa	Pernem	Casarvarnem	1355
10	North Goa	Pernem	Ibrampur- Hankhane	194
11	North Goa	Pernem	Tuem	2096
12	North Goa	Pernem	Agarwada-Chopdem	4327
13	North Goa	Pernem	Corgao	400
14	North Goa	Pernem	Ozarim	51
15	North Goa	Pernem	Arambol	367
16	North Goa	Pernem	Torxem	858
17	North Goa	Pernem	Tamboxem-Mopa- Ugvem	1349
18	North Goa	Pernem	Casne-Amere- Porascadem	12
19	North Goa	Pernem	Warkhand-Nagzar	333
20	North Goa	Pernem	Allorna	26
21	North Goa	Bardez	Aldona	1350
22	North Goa	Bardez	Anjuna-Caisua	29847
23	North Goa	Bardez	Arpora-Nagoa	10524
24	North Goa	Bardez	Assagao	198
25	North Goa	Bardez	Assonora	67
26	North Goa	Bardez	Bastora	457
27	North Goa	Bardez	Calangute	-
28	North Goa	Bardez	Camurlim	2229
29	North Goa	Bardez	Candolim	787
30	North Goa	Bardez	Colvale	1251
31	North Goa	Bardez	Guirim	22
32	North Goa	Bardez	Moirra	251
33	North Goa	Bardez	Nachinola	423
34	North Goa	Bardez	Nadora	325
35	North Goa	Bardez	Nerul	4529
36	North Goa	Bardez	Oxel	25

37	North Goa	Bardez	Parra	13748
38	North Goa	Bardez	Penha De France	223451
39	North Goa	Bardez	Pilerne-Marra	92
40	North Goa	Bardez	Pirna	132
41	North Goa	Bardez	Pomburpa- Olaulim	2595
42	North Goa	Bardez	Reis Magos	2726
43	North Goa	Bardez	Revora	91
44	North Goa	Bardez	Saligao	9129
45	North Goa	Bardez	Salvador Do Mundo	758
46	North Goa	Bardez	Sangolda	625
47	North Goa	Bardez	Siolim-Marna	40
48	North Goa	Bardez	Siolim Sodiem	9
49	North Goa	Bardez	Sirsaim	110
50	North Goa	Bardez	Socorro	4396
51	North Goa	Bardez	Tivim	13940
52	North Goa	Bardez	Ucasaim-Paliem-Punola	801
53	North Goa	Bardez	Verla-Canca	25
54	North Goa	Bicholim	Advalpale	72
55	North Goa	Bicholim	Amona	55
56	North Goa	Bicholim	Cudnem	21
57	North Goa	Bicholim	carapur- Sarvan	382
58	North Goa	Bicholim	Latambarcem	464
59	North Goa	Bicholim	Maem-Vaiguinim	1814
60	North Goa	Bicholim	Menkurem-Dhumashe	600
61	North Goa	Bicholim	Mulgao	40
62	North Goa	Bicholim	Navelim	315
63	North Goa	Bicholim	Narao	27
64	North Goa	Bicholim	Ona-Maulinguem-Kudcãirem	840
65	North Goa	Bicholim	Pale-Cothambi	130
66	North Goa	Bicholim	Harvalem	113
67	North Goa	Bicholim	Piligao	7
68	North Goa	Bicholim	Salem	150
69	North Goa	Bicholim	Sirigao	21
70	North Goa	Bicholim	Surla	10182
71	North Goa	Bicholim	Velguem	1452

72	North Goa	Sattari	Bhironda	490
73	North Goa	Sattari	khotodem	359
74	North Goa	Sattari	Dongurli-Thane	405
75	North Goa	Sattari	Guleli	85
76	North Goa	Sattari	Honda	476
77	North Goa	Sattari	Mauxi	3481
78	North Goa	Sattari	Morlem	1263
79	North Goa	Sattari	Nagargao	1010
80	North Goa	Sattari	Pissurlem	1362
81	North Goa	Sattari	Poriem	1011
82	North Goa	Sattari	Querim	491
83	North Goa	Sattari	Sanvardem	176
84	North Goa	Tiswadi	Azossim Mandur	69
85	North Goa	Tiswadi	Goltim Navelim	10
86	North Goa	Tiswadi	Merces	10444
87	North Goa	Tiswadi	Neura	113
88	North Goa	Tiswadi	Siridao-Palem	17
89	North Goa	Tiswadi	St. Andre (Goa Velha)	274
90	North Goa	Tiswadi	Sao-Matias	10
91	North Goa	Tiswadi	Carambolim	17
92	North Goa	Tiswadi	Chimbel	110
93	North Goa	Tiswadi	Chodan Model	3808
94	North Goa	Tiswadi	St-Estevam	199
95	North Goa	Tiswadi	St-Lawrence (Agassaim)	30
96	North Goa	Tiswadi	Se-Old Goa	76
97	North Goa	Tiswadi	Batim	33
98	North Goa	Tiswadi	Corlim	5850
99	North Goa	Tiswadi	Cumbharjua	5
100	North Goa	Tiswadi	Curca Bambolim Talaulim	388
101	North Goa	Tiswadi	St-Cruz	1418
102	North Goa	Tiswadi	Taleigao	3695
103	North Goa	Ponda	Bandora	375
104	North Goa	Ponda	Betora - Nirankal - Conxem - Codar	996
105	North Goa	Ponda	Betkin-Candola	26
106	North Goa	Ponda	Bhoma-Adcolna	16
107	North Goa	Ponda	Borim	695

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108	North Goa	Ponda	Kundaim	1395
109	North Goa	Ponda	Curti-Khandepar	35094
110	North Goa	Ponda	Durbhat	191
111	North Goa	Ponda	Marcaim	1587
112	North Goa	Ponda	Panchawadi	34
113	North Goa	Ponda	Queula	1373
114	North Goa	Ponda	Querim	35
115	North Goa	Ponda	Shiroda	57
116	North Goa	Ponda	Tivrem-Orgao	1240
117	North Goa	Ponda	Usgao-Ganjam	215
118	North Goa	Ponda	Veling-Priol-Cuncolem	6968
119	North Goa	Ponda	Verem-Vaghurme	10
120	North Goa	Ponda	Volvoi	20
121	North Goa	Ponda	Wadi-Talauli	67
122	South Goa	Murmugao	Cansaulim-Arossim-Cuelim	7624
123	South Goa	Murmugao	Chicalim	98510
124	South Goa	Murmugao	Chicolna-Bogmalo	1555
125	South Goa	Murmugao	Cortalim-Queclossim	5118
126	South Goa	Murmugao	Majorda-Utorda-Calata	11768
127	South Goa	Murmugao	Nagoa	27
128	South Goa	Murmugao	Sancoale	5975
129	South Goa	Murmugao	Velsao-Pale-Issorcim	10817
130	South Goa	Murmugao	Verna	563
131	South Goa	Sanguem	Bhati	111
132	South Goa	Sanguem	Curdi	184
133	South Goa	Sanguem	Kalay	415
134	South Goa	Sanguem	Neturlim	451
135	South Goa	Sanguem	Rivona	603

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136	South Goa	Sanguem	Sanvordem	25
137	South Goa	Sanguem	Uguem	650
138	South Goa	Salcete	Ambelim	29
139	South Goa	Salcete	Aquem-Baixo	1746
140	South Goa	Salcete	Assolna	857
141	South Goa	Salcete	Benaulim	47091
142	South Goa	Salcete	Betalbatim	59
143	South Goa	Salcete	Camorlim	3549
144	South Goa	Salcete	Carmona	105
145	South Goa	Salcete	Cavelossim	7222
146	South Goa	Salcete	Chandor-Cavorim	15870
147	South Goa	Salcete	Chinchinim-Deussua	1110
148	South Goa	Salcete	Colva	67
149	South Goa	Salcete	Curtorim	475
150	South Goa	Salcete	Davorlim-Dicarpale	106
151	South Goa	Salcete	Dramapur-Sirlim	30
152	South Goa	Salcete	Guirdolim	4138
153	South Goa	Salcete	Loutolim	1930
154	South Goa	Salcete	Macazana	469
155	South Goa	Salcete	Navelim	624
156	South Goa	Salcete	Nuven	4136
157	South Goa	Salcete	Orlim	35
158	South Goa	Salcete	Paroda	141
159	South Goa	Salcete	Rachol	45
160	South Goa	Salcete	Raia	805
161	South Goa	Salcete	Rumdamol-Daverlim	120

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162	South Goa	Salcete	Sao-jose -De-Areal	5593
163	South Goa	Salcete	Sarzora	100
164	South Goa	Salcete	Seraulim	25
165	South Goa	Salcete	Telaulim	160
166	South Goa	Salcete	Varca	28943
167	South Goa	Salcete	Velim	81
168	South Goa	Quepem	Ambaulim	31
169	South Goa	Quepem	Assolda	206
170	South Goa	Quepem	Avedem-Cotombi & Chaifi	908
171	South Goa	Quepem	Balli-Adnem	527
172	South Goa	Quepem	Barcem-Quedem	309
173	South Goa	Quepem	Caurem-Pirla	30
174	South Goa	Quepem	Fatorpa-Quitol	1752
175	South Goa	Quepem	Molcornem	332
176	South Goa	Quepem	Morpiria	1135
177	South Goa	Quepem	Naqueri- Betul	520
178	South Goa	Quepem	Xeldem	360
179	South Goa	Canacona	Agonda	21901
180	South Goa	Canacona	Cola	170
181	South Goa	Canacona	Cotigao	607
182	South Goa	Canacona	Gaondongrem	165
183	South Goa	Canacona	Loliem-Polem	12021
184	South Goa	Canacona	Poinguinim	1060
185	South Goa	Canacona	Shristhal	275
186	South Goa	Dharbandora	Collem	40
187	South Goa	Dharbandora	Dharbandora	42
188	South Goa	Dharbandora	Mollem	40
189	South Goa	Dharbandora	Sancordem	50
190	South Goa	Dharbandora	Kirlapai- Dabal	460

#### 4.5 Awareness Campaigns

Awareness campaigns have been launched through newspapers, in English, Marathi and Konkani languages, in order to make people aware of the initiative of the Monitoring cum Working Committee of collection of non-biodegradable waste and to encourage them to segregate waste at source as well as to encourage local Panchayats and Councils to join the initiative. Advertisements were also broadcasted on Radio, and on video clips apprising people about segregation and safe disposal practices for waste were telecasted on local television Channels.

#### 4.6 Preparation of Documents and Resource Material

Resource material containing details of the storage structure for dry waste, methods for treating wet waste and list of manufacturers supplying equipment related to SWM was prepared by the SWM cell of the Department of Science & Technology and distributed the same to various local bodies.

It is a common observation that any Amendments to Acts & Rules remain unknown to the local representatives and hence, a Frequently Asked Questions (FAQ) document has been prepared which includes important points of the Amendment in simple language. The same has been forwarded by the Directorate of Panchayats to all the Village Panchayats thereby informing them of the same.

Since it was observed that there was non-uniformity in the baling carried out by Municipal Councils/ Village panchayats, the SWM Cell developed a "Standard Operating procedures" document for baling and the same is distributed to the concerned organizations as applicable.

Also, Circulars have been issued by the Directorate of Panchayats and Municipal Administration which provide guidelines to the local authorities to undertake door-to-door collection of waste within their jurisdiction (attached as Annexures C & D)

#### 4.4 Workshops, Trainings, Meetings, Conferences on Solid Waste Management

Workshops, meetings and interactions form an integral part of the State's progress towards solid waste management.

In the month of December 2013, the then Chief Secretary of the State, Shri B. Vijayan conducted meetings in all 12 Talukas of Goa, explaining the importance of door-to-door collection of especially dry waste, funding arrangements, and the initiative of the McWC to the Sarpanch and Secretaries of Village Panchayats in the respective taluka.

Meetings have been conducted with the representatives of the Central, State Government Organizations and Autonomous bodies like Army, Navy, Airport Authority, Coast Guard, National Institute of Oceanography, National Centre for Antarctic and Ocean Research, BSNL, Kadamba Transport Corporation, Konkan Railway Corporation and Industrial Estates which are bulk generators of waste, encouraging them to segregate waste at their premises and to hand over the non-biodegradable dry waste to the McWC.

In addition, meetings were also conducted by the then Chief Secretary with the Hon'ble MLAs of various constituencies in the State, along with the representatives of village Panchayats in their constituency; highlighting the need and the details of the initiative taken up. Such meetings were important since they provided a platform for interactions, sharing of experiences, difficulties & handholding the Panchayats in their steps towards solid waste management.



The SWM Cell of the Department of Science & Technology has also addressed different audiences on varied platforms such as sessions organized by the People of Ponda, Mineral Foundation of Goa, capacity building workshop organized by TERI, TRASH Festival organized by TERI for School children, Bharatiya Vigyan Sammelan, Bal Mela, Session at Ravindra Bhavan, Sanquelim, etc.

#### **4.7 Site Inspection and Handholding with local bodies**

Site inspections and handholding w.r.t the technical and implementation aspects of Solid Waste Management are routinely carried out with the Panchayats and Municipal Councils. Practical suggestions and inputs regarding segregation of waste, the basic SOPs at any SWMF, baling, implementation aspects of the collection mechanism are given to the concerned technical staff at the respective Municipal Council/ Panchayat. Follow-up is also done by the SWM Cell regarding actual incorporation of the suggestions given in the system.

In addition, the SWM Cell also activity participants in meetings of the local bodies, wherein the roles & responsibilities of the local representatives such as Panchayat Secretary, Sarpanch, Chief Officers & Chairpersons of Municipal Council & other Panch/Ward members are explained, and they are made aware of the fact that solid waste management needs to be on their priority list owing to its environmental, health & social aspects.

#### **4.8 Activities in Schools**

A training program on solid waste management for 94 Schools in Goa had been conducted by the Monitoring-cum-Working Committee and a set of four bins was given to each of these Schools for practical implementation of segregation of waste at source. The local body (Panchayat/ Council) in whose jurisdiction the School falls is encouraged to undertake collection of such segregated waste from the School, owing to the low volumes of

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waste generated. Wherever the local body doesn't collect waste, the SWM Cell schedules a pick-up for such schools.

#### **4.9 Existing Litigations w.r.t Solid Waste Management**

In Appeal no. 3 of 2015, Saligao Civic and Consumer Cell and Goa Foundation have challenged the grant of Environmental Clearance for the proposed Solid Waste Management Facility at Calangute/Saligao in North Goa. Hence, the operation of the plant will depend on the judgement of the case which is ongoing at the Principal Bench of the Hon'ble NGT at Delhi.

### **5 Solid Waste Management Plan for Goa: Collection and Disposal**

In view of the present Status of Solid Waste Management as outlined in the preceding Chapters, it is evident that the State has taken active steps towards solid waste management. In view of the Order of the Hon'ble NGT dated 20.03.2015 in the matter of O.A. No. 199 of 2015, and considering the present status of SWM in the State, an Action Plan for the State is outlined in the following paragraphs. The Action Plan covers various aspects of Solid Waste Management such as Collection, Transport, Treatment & Disposal, Financial Structures, Administrative Structure, Awareness, Monitoring of the waste management system, etc.

#### **5.1 Broad Overview**

Goa is the smallest State in India with an area of 3702 sq.mtr. Out of this area, around 40% of the area is under forest where the generation of waste is low. Goa has a population of 15 Lakhs along with a large floating population. Based on the population, it is estimated that on an average, around 400-450 Tons of waste are generated in the State per day. The State aims at handling waste scientifically, efficiency & economically. As per findings of various

studies, it is expected that the quantum of waste generation shall double by the year 2025. The Action Plan for the State is planned to consider this geographical variation and the expected increase of waste generation in the State across the years.

In tune with the directions of the Hon'ble High Court vide its Order dated 13.08.2013 w.r.t Suo Motu W.P. 2/2007, the State has resolved to set up two solid waste management facilities at Calangute/Saligao in North Goa and at Cacora in South Goa. The State has also approved the setting up of another Integrated SWMF at Bainguinim in Tiswadi Taluka.

The proposed solid waste management facilities have a capacity of 100 Tons/day. Coupled with the proposed SWMF at Bainguinim, the total capacity which three plants can cater to is 300 Tons/day. The proposed solid waste management facility at Calangute/Saligao has been planned bearing in mind the large volume of waste generated in the coastal and other villages of Bardez Taluka in North Goa District owing to the large tourist influx in this area.

The State of Goa will be divided into three zones namely North Goa, Central Goa and South Goa. The proposed Solid Waste Management Facilities at Calangute/Saligao, Bainguinim and Cacora will cater to the respective areas in North Goa, Central Goa and South Goa. The existing waste treatment plants at each municipal council/corporation shall continue to operate within the capacity till the three Integrated Solid Waste Management Facilities as per the Solid Waste Management Plan are functional to their full and optimum capacity.

Each of the plants has been designed to presently handle 100 tons per day on a one shift operation. These plants have been designed so that they can be upscale to handle the increase in waste as and when required. The up-scaling of these plants shall be taken once the

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collection system of the village panchayats and the municipalities is fully operational and shall be based on the waste being deposited at the plants.

The waste shall be brought to these Integrated Solid Waste Management Facilities through Transfer Stations at different municipal councils and village panchayats with all checks and balances to ensure there is no spillage, leakage etc. in properly enclosed and covered containerized vehicles. The farthest distance of any collection point to any Integrated Solid Waste Management Facility will not be more than 50 kilometers.

The State has also planned to set up a Plastic-to-Fuel Plant of 10 Tons/day capacity in the Pernem Taluka, through the Goa State Urban Development Agency (GSUDA) on PPP basis. This plant shall help the State in saving costs of transporting the plastic waste for co-processing out of the State, by creating an option for in-house treatment of such waste.

Tourism is a major source of revenue for the State & the Tourism Department has been mandated with the task of maintenance of the coastal region cleanliness being the main point for tourist, Since large volumes of waste are generated on the beaches, the Tourism Department has undertaken the activity of cleaning of beaches through a separate Contract for the same.

It is essential to take into consideration that generation of waste is limited in small pockets and such waste can be handed at the local body level in the plateau zone of Goa. Also, since major stretches of Highways pass through the State, the Goa State Infrastructure Development Corporation (GSIDC) has awarded a Contract for Highway cleaning activity in 3 zones (North, South and Central), totally covering 296.20 kms of the Highway stretch.

In addition, the Municipal Councils in the State have set up or are in the process of setting up infrastructure for solid waste management as directed by the Hon'ble High Court

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in the Suo Motu W.P. 2/2007 as well as the Municipal Solid Waste (Management & Handling) Rules 2000.

Thus, the State has already undertaken steps towards solid waste management; and this Action Plan basically outlines how the State envisages to link all the components of the SWM in an integrated manner, to improve efficiency of the SWM system, with maximum material and energy recovery.

The State has realized that collection and scientific disposal of the non-biodegradable garbage is a major issue to be tackled, the State has actively launched an initiative for collection of such waste from various locations across the State including Village Panchayats, Municipal Councils, Schools, Industrial Estates, NGOs etc. The collected segregated waste is baled at the baling stations set up in the State & transported for co-processing in cement kilns.

The Action Plan for solid waste management for Goa outlined in the following sections may be suitably modified from time to time based on the requirements in future, depending upon the need of the hour.

## **5.2 Solid Waste Management Facilities at Calangute/Saligao in North Goa and Cacora in South Goa**

### **5.2.1 Background**

Vide Order dated 13.08.2013 with respect to the Suo Motu Writ Petition 2/2007, the Hon'ble High Court of Bombay at Goa issued directions to the Municipal Councils/ Corporation, Village Panchayats and the State Government to take various measures to improve the solid waste management in the state of Goa. Specific Directions issued to the State Government under Clause 27(III) of the said Order include that the State Government

shall set up two or more sanitary landfills within a period of one year for accepting the residual/inert waste for Village Panchayats of North Goa and South Goa.

Since landfilling is the last option to be resorted to in waste management, the Government of Goa resolved to establish two Solid Waste Management Facilities, at Calangute, Saligao in North Goa and at Cacora in South Goa which shall ensure maximum material and energy recovery and wherein only the inert component of waste shall be landfilled.

### **5.2.2 Site Selection**

Site selection has been completed with both the selected sites being existing solid waste dump sites for the Calangute Panchayat and the Cacora-Curchorem Municipal Council respectively for more than 10 years. The sites comply with the selection criteria for setting up sanitary landfills as per the MSW 2000 Rules.

These SWM facilities are on the same lines as the Integrated Solid Waste Management Facilities in the Punjab plan as these are also proposed on degraded sites used for unscientific dumping of solid waste and are also proposed to generate electricity. Both the Sites are identified as Garbage Management Sites (GMS) in the Regional Plan 2021 after due consultations.

The selected sites are degraded due to unscientific dumping of waste for past several years & require to be remediated to prohibit further harm to the environment.

### **5.2.3 Land Acquisition**

Land Acquisition (LA) for both the sites has been undertaken with respect to the applicable Acts and Rules. Acquisition for the facility at Calangute/Saligao admeasuring a total of

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1,21,580 m<sup>2</sup> (1,13,500 m<sup>2</sup> from Calangute Village and 8,080 m<sup>2</sup> from Saligao Village) and for the facility at Cacora admeasuring a total of 82,750 m<sup>2</sup> (64,985 m<sup>2</sup> land acquired by the Cacora Curchorem M.C. and 17,765 m<sup>2</sup> from private owners) in Cacora village has been completed. The Land has been acquired along with payment of the corresponding LA compensation amounts outlined in the Award issued by the respective Land Acquisition Officers.

It was resolved that the acquired Land shall follow the change of possession as below:

- Transfer to Department of Science, Technology & Environment which is the Nodal Agency for the projects
- Handing over to the Goa Industrial Development Corporation (GIDC) from DSTE. Declaration of the acquired land as Notified Industrial Area following due procedures.
- Transfer to the Goa State Infrastructure Development Corporation (GSIDC) from GIDC which is the implementation Agency
- Sub-sub leasing the land to the Contractor for the purpose of Project Implementation

#### **5.2.4 Institutional Set-up**

As per the Cabinet Decision of the Council of Ministers in its XXXXIVth Meeting held on 14.08.2013, the Department of Science and Technology is designated to be the Nodal Agency for the projects, and the Goa State Infrastructure Development Corporation (GSIDC) is the executing agency for the same.

#### **5.2.5 Technology Selection**

Owing to the fact that land filling is the last option that the State should resort to for management & disposal of municipal solid waste, the proposed facilities are based on Recycle & Sorting Line, Segregation, Bio-methanation and In-vessel Composting. The facilities shall aim at maximum material and energy recovery, and only the inert component

of the waste shall be disposed in the sanitary landfills which are designed to be a part of the proposed facilities. Bio-methanation & in-vessel composting to be employed in the proposed facilities are approved technologies as per the CPCB Manual on Municipal Solid Waste Processing Technologies.

The technology selected for the projects has been approved by M/s NEERI, Nagpur. The Request for Proposal received from bidders were scrutinized by the Expert Committee constituted for technical evaluation of the bids. The Committee comprised experts, scientists from M/s NEERI, Environmental Engineer & Directors from Department of Science, Technology & Environment, Professor of Environment from BITS Pilani, Faculty from IIT Bombay and was headed by Dr. Sharad Kale, Professor at the Dr. Homi Bhabha Atomic Research Centre, Mumbai.

#### ***5.2.6 Completion of EIA Studies***

The DSTE, which is the Project Proponent, applied for Terms of Reference (TORs) for carrying out EIA studies for the plants. Accordingly, the Goa State Expert Appraisal Committee (G-SEAC) issued TORs for carrying out Rapid EIA studies and M/s NEERI, Nagpur was entrusted with the task of carrying out the Rapid EIA studies to be carried out in the post-monsoon season. A preliminary Status Report submitted by M/s NEERI, Nagpur highlighting the urgent need of setting up the proposed facilities.

On this background, owing to the degraded nature of the site, associated harmful environmental effects in case remediation measures were not taken up urgently and the fact that the proposed facilities were bound to create a positive impact on the environment, the Project Proponent applied for grant of prior Environmental Clearance for the facilities in order to commence with the activities on ground and to comply with the deadline of one year set out by the Hon'ble High Court in Suo Motu W.P. 2/2007. The G-SEIAA considering the



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recommendations of the G-SEAC granted prior Environmental Clearance for the said facilities, with certain conditions including a Specific Condition that the Environmental Clearance would be granted only on submission of the Rapid Site-specific EIA Report by M/s NEERI.

Thereafter, M/s NEERI has submitted a Rapid EIA Report for the said facilities, which includes data, monitoring, analysis and points in compliance with the Terms of Reference (TORs) and the same was submitted to the G-SEAC for presenting additional post EC monitoring compliance by the PP. The G-SEAC and G-SEIAA have appraised the Report for the proposed SWMF at Calangute/ Saligao and has been granted Prior Environmental Clearance by the G-SEIAA.

The Government has shortlisted the Concessionaire for setting up the facilities. It is expected that the plants will be commissioned and put in operation by December 2015. The Construction for the proposed Solid Waste Management Facility at Calangute/Saligao has started on ground. The construction of the Material Recovery Shed, Compost Shed, Administration Building, Facility Center and UG Tank is in progress.

#### ***5.2.7 Details of Plant Technology***

The Process Flow Diagram for the Facilities appears as Annexure E.

The proposed Municipal Solid Waste (MSW) Processing Facility shall be divided into Six (6) Sections as described below:

##### ***(a) Material Segregation & Recovery Facility (MSRF)***

Municipal Solid Waste (MSW) shall be delivered, segregated, recovered, processed and stored for later use in Material Segregation & Recovery Facility (MSRF). The main function

of the MSRF is recovery of recyclables and efficient segregation/processing of mixed waste into a feedstock for biological conversion or into a fuel source for the production of energy.

Mixed Municipal Solid Waste (MSW) collected in open trucks/compactors and delivered at the facility shall be taken to the Tipping Floor, housed in an enclosed Shed. The Shed shall be covered and have adequate height with proper arrangement for lighting and ventilation. The Tipping Floor area shall be provided with an Odour Control System comprising Centrifugal Fans, Air Ducting and Bio-filter to ensure that odorous gases are effectively sucked and adsorbed in the Bio-filter.

The main function of the MSRF is to segregate and recover maximum possible recyclables from the mixed waste such that they can be directly reused. Recyclable and sorted materials shall be baled and wrapped for reuse as per the Buyers'/Vendor's requirements. A part of the remaining waste left after sorting and recovering recyclables shall be shredded and/or compacted as Refuse Derived Fuel (RDF) and residual material which cannot be converted into RDF will be taken to the Sanitary Landfill Cells. Another part of the waste (based on size being less than 80 mm), shall not be taken to the manual sorting line but shall be taken to the organic extrusion press.

Electronic waste (e-Waste) e.g. Phones, Printer Cartridges, Compact Discs etc. coming into the facility from households shall be sorted at the Tipping Floor/Manual Sorting Station and taken to the e-Waste Storage Bin / Container from where it shall be disposed of suitably as per applicable statutory norms.

Hazardous waste e.g. Batteries, Bulbs/ Tube Lights etc. and Bio-medical waste, if received from households shall be stored and disposed as per applicable statutory norms. Main Units in this Section are as follows:

#### 1. Tipping Floor

The waste, after weighing and visual inspection at Weighbridge Station, shall be unloaded on a Tipping Floor where waste shall be visually inspected and bulking and disturbing materials (big stones, metal scrap, wood, cadaver etc.) shall be sorted out manually or by Wheel Loader

#### 2. Infeed Hopper cum Chain Belt Conveyor and Bag Opening Shredder

Mixed Municipal Solid Waste (MSW) from the Tipping Floor shall be loaded into the Infeed Hopper cum Chain Belt Conveyor with Wheel Loader / Skid Stir Loader. The purpose of the Infeed Hopper is to provide an adequate storage volume and automatically transfer the waste to the downstream Units. The Chain Belt Conveyor shall transfer the waste into the feed hopper of a Bag Opening Shredder which will ensure 100% of the bags are opened. The contents from the opened bags shall drop onto the downstream Conveyor leading to the Roller Screen.

#### 3. Roller Screen

The Roller Screen shall provide the first level of screening to screen out several types of material that are difficult to screen effectively. It shall have a screen deck of 80 mm opening. The underflow fraction having size  $<80$  mm shall be conveyed to the Organic Extrusion Press while the overflow fraction having size  $>80$  mm shall be conveyed to the Manual Sorting Station. A separate Infeed Hopper with Trough Conveyor shall be provided after the Roller Screen to directly feed pre-sorted material, if any, to the Manual Sorting Conveyor for further sorting.

#### 4. Manual Sorting Station

The Manual Sorting Station shall be in form of elevated structure with Handpicking Stations located at both sides of the Sorting Conveyor to remove valuable items like Glass, Metals, Wood, Paper, Plastic, Rubber and Textile etc. by handpicking. Glass and Metals shall be handpicked and stored into Bins / Containers placed besides the dedicated Handpicking Stations whereas all other recyclables shall be handpicked and thrown through the Chutes into the Compartments located beneath the Chutes by the sorting personnel. Materials which cannot be baled shall be collected / stored into Bins / Containers whereas all other recyclables that can be baled shall be pushed by Wheel Loader / Skid Steer Loader onto the under-floor Chain Belt Conveyor, on which they shall be transported to the Baler.

5. Baler with Wrapping Unit

Sorted recyclables that can be baled shall be pushed by Wheel Loader / Skid Steer Loader onto the under-floor Chain Belt Conveyor, on which they shall be transported to the Baler and baled into pallets. The pallets shall be wrapped, if required, in a Wrapping Unit and then stored in Containers for further transportation to the recycling Vendors / Buyers.

6. Shredder

A Shredder shall be provided to shred the overflow from Roller Screen as well as sorted recyclables so as to meet the requirement of prospective recycling Vendors / Buyers.

7. Organic Extrusion Press

The underflow from Roller Screen shall be conveyed to the Organic Extrusion Press. The hydraulically operated Organic Extrusion Presses will separate the waste into two fractions – an organic wet fraction and an inorganic dry fraction. It will squeeze out the waste through an extrusion matrix at a very high pressure. The mainly wet organic substances shall be, thereby,

squeezed out to form the wet fraction and transferred to the Wet Fraction Processing Line for production of Biogas as well Compost whereas the residue referred to as the dry fraction shall be conveyed to the Dry Fraction Processing Line for recovery of RDF.

**(b) Dry Fraction Processing Line**

The dry fraction from the Organic Extrusion Presses shall be conveyed onto a Wave Screen. The fraction which is < 15 mm shall be collected and disposed to the Sanitary Landfill Cells. The 10 – 300 mm fraction shall be passed to a Windsifter, where it will be separated into heavy and light fractions. The combustible materials that can be used as RDF shall be blown upward as the light weight fraction and materials which cannot be used remain in the heavy fraction. The light weight fraction shall be transported to the Baler whereas heavy fraction shall be collected and sent to the Sanitary Landfill Cells.

**(c) Wet Fraction Processing Line**

The wet fraction from the Organic Extrusion Presses shall be taken to the Bio-methanation System wherein organic substance shall be digested inside Fermenters and biogas as well as digestate shall be produced. The biogas shall be fed to the Biogas based Power Plant to generate electricity and waste heat. The electricity shall be utilized to run the Plant whereas waste heat is utilized to maintain thermophilic environment inside the Fermenters. The digestate shall be fed to the Sludge Dewatering Units for solids-liquid separation. The solids (dewatered sludge) shall be sent to In-vessel Composting Drums whereas liquid (centrate) shall be sent to the Effluent Treatment Plant for further treatment. Main Units in this Section are as follows:

1. Bio-methanation System

The wet fraction from the Organic Extrusion Presses shall be taken to the Bio-methanation Fermenters having Mixing System, Grit Removal System, Heating System and Biogas Extraction system. A thermophilic temperature range (i.e. 55 degree Celsius) is maintained inside Fermenters. During methanization process, the biogas shall be produced which is extracted and stored into Biogas Holders. After a residence time of 14 days, the digestate substrate shall be conveyed to the Sludge Dewatering System.

## 2. Sludge Dewatering System

The digested substrate shall be separated into solids (dewatered sludge) and liquid (centrate) phases in Sludge Dewatering System. The dewatered sludge shall be then transported to the In-Vessel Composting Drums whereas the centrate shall be sent to the Effluent Treatment Plant for further treatment before disposal.

### *(d) Composting Line*

The dewatered sludge from Sludge Dewatering System shall be transferred to the In-vessel Composting Drums. The bulking materials e.g. saw dust, wood chips etc. shall be added to improve moisture content, C:N ratio and bulk density of the feedstock and therefore to improve composting efficiency. The Drums shall be rotating continuously and the decomposition shall take place in an accelerated manner within 4 – 6 days' residence time.

After In-vessel Composting Drums, the compost shall be further stored for a period of minimum 14 days in a Shed. Afterwards, the compost shall be screened to separate bulking materials using Star Screen of 10 – 30 mm screening capacity. The large sized fraction (>30 mm), basically the bulking material shall be separated here and recycled to be added with the dewatered sludge to prepare feedstock for the In-vessel Composting Drums whereas the finer

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fraction (<10 mm) shall be bagged in a Bagging Machine and stored for further sale as per requirement.

**(e) Biogas Genset based Power Plant**

The fermentation of organic residues in an anaerobic atmosphere in the Bio-methanation Fermenters shall generate biogas, 50% – 70% of which shall be methane. The biogas shall be stored in double membrane type Biogas Holders. This biogas shall be cleaned for removal of H<sub>2</sub>S and moisture to suit the operation of Biogas Gensets/Micro Turbines for generation of electricity. Electricity shall be utilized to run the entire processing facility including various auxiliaries of Biogas Gensets. A part of thermal energy (waste heat) generated shall be used for heating the contents of the Fermenters and excess heat shall be exhausted.

**(f) Sanitary Landfill**

The dry fraction (< 15 mm) screened out from Wave Screen, heavy fraction separated out from Windsifter, the residue from Manual Sorting Station which cannot be converted into RFD and other inert residue which is generated during the processing of the waste shall be collected, transported in Wheel Loaders / Tipper Trucks to the designated Landfill Cells and landfilled. The landfilling of the organic waste shall not be permitted and no organic fraction shall be disposed in the Landfill.

The Landfill Cells shall be constructed as per The Municipal Solid Wastes (Management and Handling) Rules, 2000 by Ministry of Environment and Forests. Adequate access and approach shall be provided along the Landfill Cells for easy transport and landfilling operation.

Landfilled material shall be weighed daily on the Weighbridge prior to disposal into Landfill Cells and date shall be logged.

### **5.2.8 Selection of Contractor & Details of the Business Model**

The Goa State Infrastructure Development Corporation (GSIDC), which is the implementing agency for the projects, undertook the Tender Process by following all due procedures. The Request for Proposals were for "Design, Engineering, Financing, Construction, Supply, Installation, Commissioning, Performance Run and Operation and Maintenance for a period of ten (10) years of 100 tons/day (TPD) / 36,500 tons/annum (TPA) capacity Municipal Solid Waste (MSW) Processing Facility based on Recycle & Sorting Line, Segregation, Bio-methanation and In-vessel Composting at Calangute / Saligao in North Goa District, Goa and for Cacora in South Goa District, Goa." The Contract is on "Design-Finance-Build-Operate-Transfer (DFBOT)" basis.

After following the due procedures, M/s SMC Infrastructure Pvt. Ltd. has been awarded the Contract for setting up both the Solid Waste Management Facilities at Calangute/Saligao in North Goa and Cacora in South Goa.

### **5.2.9 Expected Timelines for completion of project**

As per the Work Order issued by the GSIDC, the expected time frame for completion of the two proposed SWMFs is 450 days i.e. 15 months on handover of the project site to the Contractor.

## **5.3 Primary Collection Mechanism for Waste**

### **5.3.1 Collection of waste in Village Panchayats/ Municipal Councils**

The responsibility of door-to-door collection of waste from all sources of waste generation in its jurisdiction is and shall be continue to be the mandate of the local authority, as outlined in the MSW 2000 Rules. The door-to-door collection can be done by hiring of daily wages workers or through contractors. The collection should be structured as below:



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1. Collection for biodegradable waste shall be done everyday of the week.
2. Collection for non-biodegradable waste shall be done everyday or once or twice a month as deemed appropriate based on the quantum of generation of dry waste.

Special collection shall be held for E-waste, & other kinds of waste. The waste shall be collected through tricycles/garbage cycles & where the terrain is undulating, motorized vehicles may be used. This has already been enforced and may be seen from the various circulars issued by Department of Panchayats and Department of Municipal Administrative from time to time. Some circulars are attached as Annexure C & D. The local monitoring shall be carried out through the Garbage Management Committee set up at every local as mandated by the Goa non-biodegradable Garbage (Control) Act 1996 & Rules 1997.

The local body shall collect all the waste at a single point which is identified, notified and appropriately sheltered. Non-biodegradable waste, shall be handled through the existing collection mechanism of the McWC and the biodegradable waste shall be transported to the transfer station assigned to the local body by the SWM Cell.

The details & guidelines of the internal collection mechanism for waste along with the necessary infrastructure, funding, timelines, etc. shall be worked out by the Directorate of Panchayats (DoP) with respect to the Village Panchayats and the Directorate of Municipal Administration (DMA) in the case of the Municipal Councils/ Corporation.

It has been resolved that attempts shall be made to rope in the rag pickers into the formal system of door-to-door collection of waste. It shall be the responsibility of the DMA & DoP to ensure this.

**5.3.2 Collection of waste in Industrial Estates**

Since the Industrial Estates can be bulk generators of solid waste, it is the responsibility of the GIDC which is the notified agency to handle the Solid Waste Management of the Industrial Estates. The GIDC which has been given powers as the local body of the Industrial Estates was directed to submit an Solid Waste Management Plan for all Estates in Goa. The GIDC has identified sites for handling solid waste & the infrastructure requirements for every Industrial Estate. These points shall be integrated into the Solid Waste Management collection spots of the State Government. The Industrial Estates are also generators of hazardous waste & it shall the responsibility of the GIDC/respective Industrial Estate Association to ensure that no hazardous waste enters the Municipal Solid Waste Management stream.

**5.3.3 Collection of waste in Forest Areas**

The Forest Department shall be responsible for collection of waste from the Forest Areas, which cover almost 40% of the State's geographical area, considering the fact that forests are hubs of biodiversity, the Forest Department should ensure that the SWM plan for forest areas is effective & suitably linked with the SWM system in place in the state.

**5.3.4 Collection of waste from the Highways**

Presently 268 kms of Highway and few major district roads are already covered under the Highway Cleaning Activity undertaken by the Goa State Infrastructure Development Corporation. Monitoring of the activity as per Tender conditions & proper segregation & disposal in tune with the Solid Waste Management system in the State shall be the responsibility of the GSIDC.

**5.2.5 Collection of waste in State, Central Government & Autonomous Organizations**

Organizations like Army, Navy, Airport Authority, Kadamba Transport Corporation, Konkan Railway Corporation, NIO, NCAOR, Coast Guard, etc. shall be responsible for collection of waste within their own areas of jurisdiction. The collection and disposal mechanism within these organizations shall be in line with the SWM system operational in the entire State, and the Acts & Rules as applicable. The Kadamba Transport Corporation has set up shed for storing garbage at the Panaji bus stand and it is planned to construct such sheds at certain other bus stands as well.

#### **5.4 ULB Level Pre-processing Centres/ Transfer Stations**

Since Land Acquisition is a tedious process and as sites for garbage management within the Municipal Bodies have already been identified and acquired (List attached as Annexure F), a designated area should be earmarked in the present treatment facilities of the Municipal Councils/Corporation/Village Panchayats. This earmarked area shall host the modern Transfer Station fully compatible with the system of the proposed Solid Waste Management Facilities; and shall transfer the waste from the neighbouring areas to the main SWMFs. However, the Municipality shall continue to treat waste generated within its jurisdiction as per Directions of the Hon'ble High Court w.r.t Suo Motu W.P. 2/2007.

After studying the Solid Waste Management system & waste generation patterns, it is also proposed to set-up strategically located manned drop-box/collections centres. These shall be designed in a drive-in fashion. The aim of this collection system would be to give an opportunity/locations for voluntary deposition of non-biodegradable waste including E-waste, batteries etc. It will be the endeavour of the Government to fund this system under EPR. Some of initial locations are a long Highway of Panaji, Ponda, Mapusa and Vasco.

#### **5.4 Identification of Hardware**