# Pre- Feasibility Report

# Integrated Solid Waste Management, Haryana

*For*

# Rewari Cluster

*Prepared By*

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# 1 EXECUTIVE SUMMARY

Rewari Cluster including Ateli Mandi, Bawal, Dharuhera, Kanina, Mahendragarh, Nangal Choudhary, Narnaul and Rewari ULB is generating all kinds of waste, which is becoming a serious health and sanitation hazard for its residents. Apart from MSW waste, Rewari, cluster generates a lot of e-waste (due to a huge corporate sector) as well as bio-medical waste (due to a growing hospital sector). Besides, industrial waste (including sludge etc.) is also generated in large quantities due to growing industrial base. The cluster has an urban area at about 1594 square km. and a resident population of about 322996 in 2017.It generates 197 metric tons of Municipal solid waste as per MCS officials every single day. The projected population in 2025 will be 387595 generating 236 metric tons municipal waste and in 2035 population will be 465114 generating 283 metric tons of municipal waste.

The Municipal Corporation of Rewari (MCB) is the apex body responsible for waste planning and management in the city. As far as its operational role is concerned, MCB is only responsible for waste generated in its municipal area. Waste management in HUDA sectors is undertaken by private contractors, RWAs as well as by permanent employees of HUDA.

The proposed integrated Municipal solid waste processing facility will cater to the needs of Rewari Cluster which comprises of Ateli Mandi, Bawal, Dharuhera, Kanina, Mahendragarh, Nangal Choudhary, Narnaul and Rewari Urban Local Bodies (ULB's). Estimated MSW generation in Rewari cluster is about 197 TPD. It is expected to reach 283TPD by 2035. Municipal Corporation Rewari is the designated ULB for Rewari cluster.

**Table 1-1: Details of the proposed project**

| S. No. | Information | Details |
|---|---|---|
| 1. | Project name | Integrated Solid Waste Management, Rewari cluster, Haryana |
| 2. | Area | Total Area- 19 acres |
| | **Location of Site** | |
| 3. | Villages | Near Ramsinghpura village |
| 4. | District | Rewari |
| 5. | State | Haryana |
| 6. | Water Requirement and its source | 80.06 KLD |
| 7. | Power Supply and its source | Construction Phase : D.G set 1x 250 KVA<br>Operation Phase : 250 KW, State electricity board |

| | | |
|---|---|---|
| 8. | Project Cost | 65 crore |
| 9. | Nearest Railway station | Bawal Railway Station, 3.19 Km |
| 10. | Nearest SH/NH | NH-8 |
| 11. | Nearest Air port | New Delhi 76 Km |

# 2 INTRODUCTION AND BACKGROUND

## 2.1 Identification of Project and Project Proponent

The state of Haryana generates about 4249Tonnes per day (TPD) of Municipal Solid Waste and this quantity is likely to be more than 7,675 TPD by 2035, assuming the rate of increase of per capita waste generation is in proportion to increase in urban population. Directorate of Urban Local Bodies (DULB), in its endeavor to provide people safe, clean and healthy environment, has proposed to set up cluster based integrated solid waste management facilities in the ULBs of Haryana in Public Private Partnership mode.

Based on factors such as existing treatment plants, free land pockets, optimal waste transport distance 15 cluster based MSW treatment plants have been proposed in Haryana. Rewari cluster comprises of ULBs of Ateli Mandi, Bawal, Dharuhera, Kanina, Mahendragarh, Nangal Choudhary, Narnaul and Rewari. Estimated MSW generation in Rewari Cluster is about 197 TPD. It is expected to reach 283 TPD by 2035.

The proposed integrated Municipal solid waste Processing facility will be set up in 19acres of new site in Rewari village capacity of 197 TPD.

## 2.2 Need of Project and its Importance to Region

Rewari is an ancient city and known as Brass City. Rewari has a variety of industries, from cottage industries to small-scale integrated units and automobiles and auto ancillary industries. The traditional industries are brass metalwork and ornamental shoes (Tilledar Jooti) Rewari has kept the traditional art of Tilledar Jooti alive and is famous for such ornamental local shoes. World's largest production of motor cycles is in Hero Moto Corp. Dharuhera plant. Due to rapid urbanization huge amount of waste is generated every year. So management of waste is of utmost importance. The project seeks to improve and develop a socially and environmentally sustainable system of solid waste management which will reduce the associated environmental and public health risks.

The project intends to create a socially, economically and environmentally viable solid waste management system to develop an environmentally and aesthetically sound MSW dumping site. The major objective is to reduce the solid waste generated in huge quantity and its associated health risks in Cluster.

In this regard, the Municipal Corporation of Rewari the designated ULB for Rewari cluster intends to obtain environmental clearance from the Ministry of Environment, Forest & Climate Change for Integrated Municipal Solid Waste Processing Facility for Ateli Mandi, Bawal, Dharuhera, Kanina, Mahendragarh, Nangal Choudhary, Narnaul and Rewari ULB's at Rewari village, in Rewari district, Haryana.

## 2.3 Employment Generation (Direct and Indirect) due to the project

Presently entire waste is being dumped at the site. For construction of processing facility there would be requirement of local semiskilled people and also during operation period there would be requirement of skilled and semi-skilled people. This will lead to generation of employment at local level. Also there would be requirement of unskilled people for door to door collection of waste. All these activities would generate employment. Thus the project shall have positive impact on the society and will enhance the socio-economic condition of all people who would be associated with this project directly or indirectly. Approx. 250 individuals will be benefitted directly and approx. 50 individuals will be involved indirectly (supply chain).

# 3 PROJECT DESCRIPTION

## 3.1 Type of Project

As per the EIA notification dated 14th September, 2006, as amended till date, the proposed project falls under the Project / Activity: 7 (i)– Common Municipal Solid Waste Management Facility (CMSWMF) under Category "A ".

## 3.2 Site Location and Connectivity

The proposed site is a fresh site. The proposed integrated Municipal solid waste Processing facility is situated in Near Ramsinghpura Village, Tehsil & District: Rewari in Haryana. The site is easily approachable by NH-8.The nearest railway station is Bawal Railway Station. Indira Gandhi International airport is the nearest airport at an aerial distance of 76 km. The location map is shown in

Figure 3-1.

The coordinate of the proposed project site are given in **Error! Reference source not ound.,** and the Google map of the project site is shown in

Figure 3-2.

***Table 3-1: Coordinate of the Project Site***

| Sr. No. | Latitude | Longitude |
|---|---|---|
| A. | 28°03'43"N | 76°32'31"E |

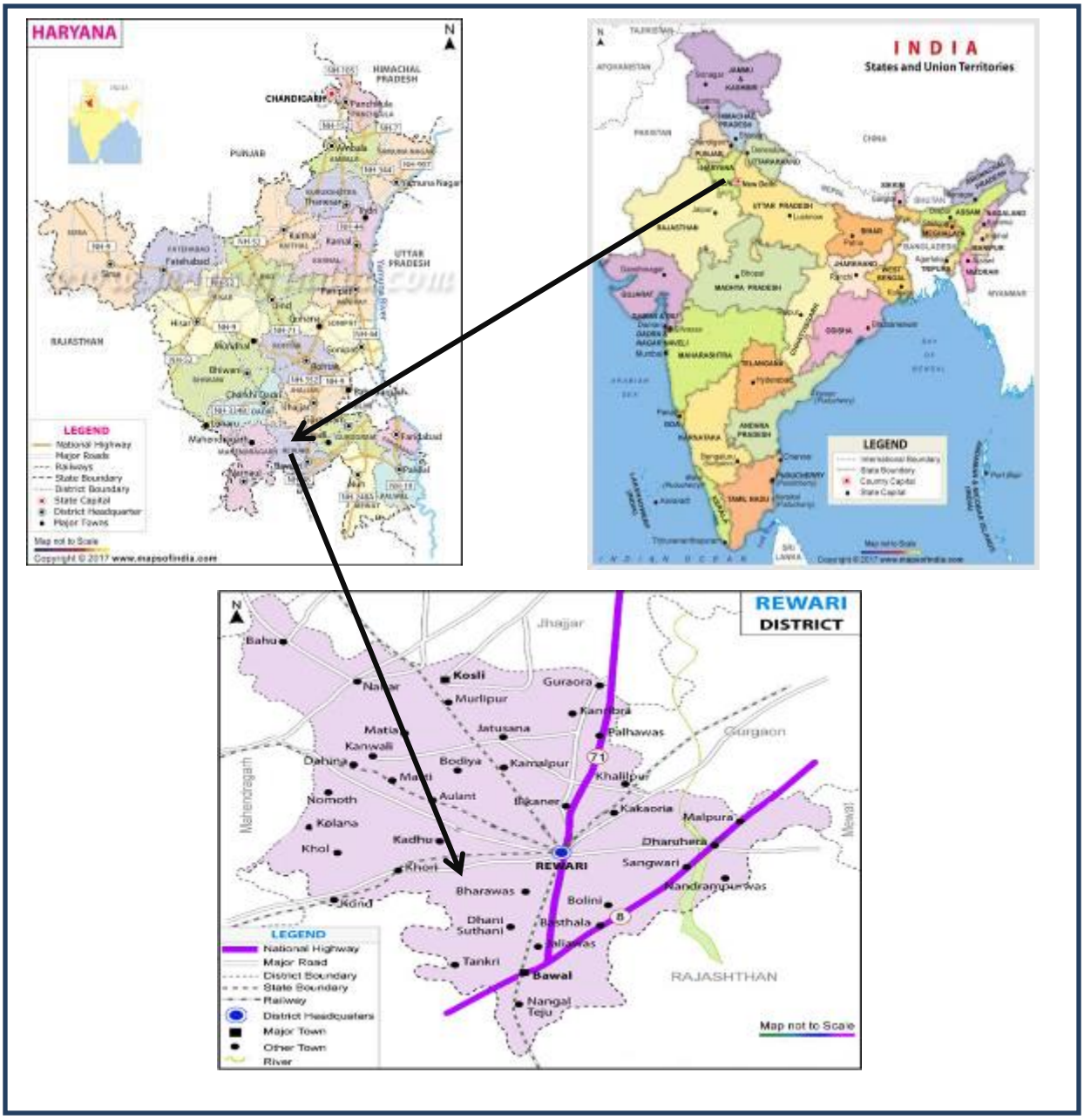


*Figure 3-1: Site Location*

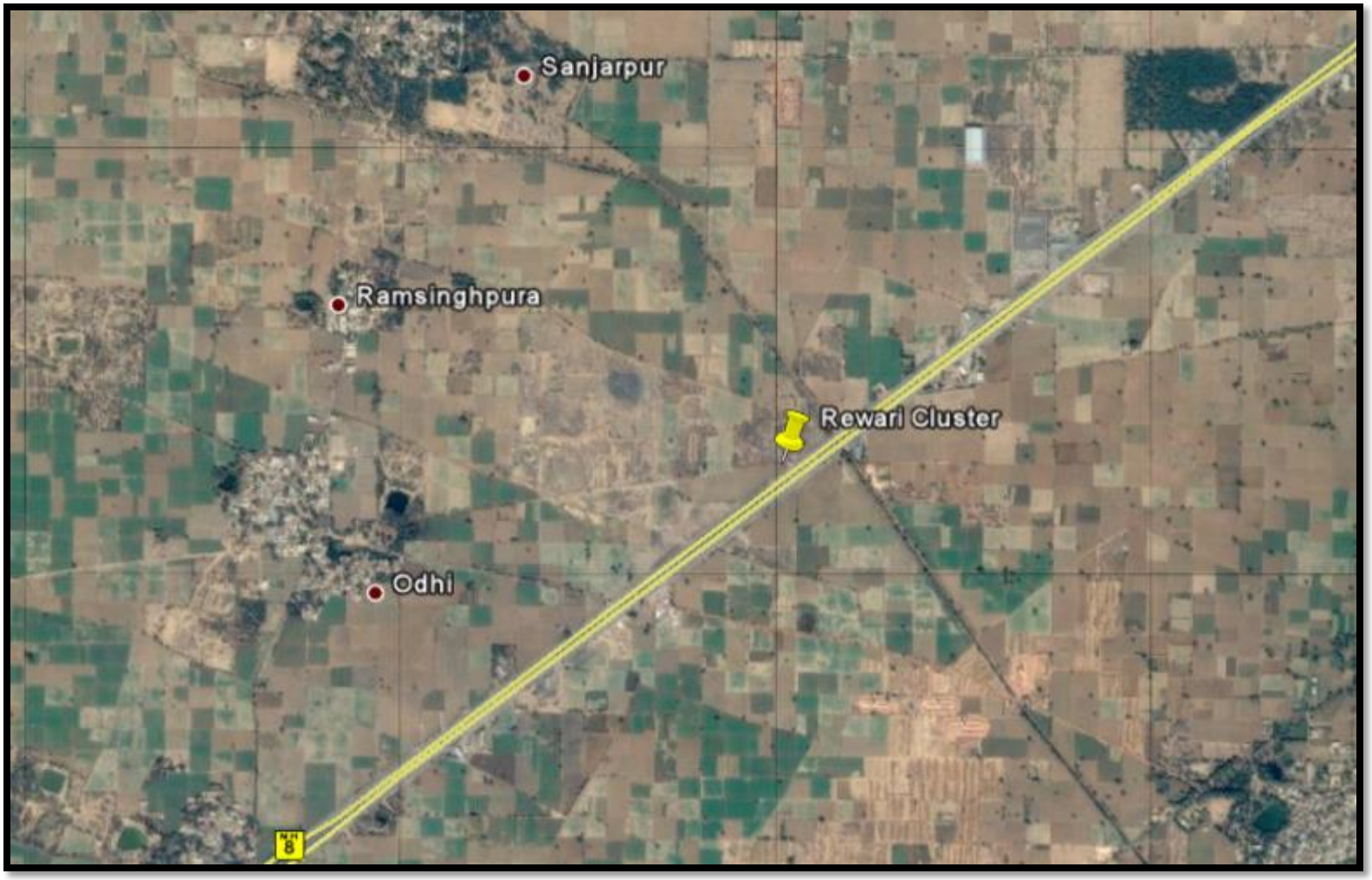


*Figure 3-2: Google Image of the Project Site*

*Figure 3-3: Proposed Project Site*

### 3.3 Details of Alternate Site Considered

As this is new project hence alternative sites were examined and the site at Rewari village was finalized based on the easy accessibility, approachability, transportation of waste etc.

### 3.4 Size and Magnitude of Operation

The proposed project is for design of integrated Municipal solid waste Processing facility of 197 TPD of MSW in an area of 19 Acres for 20 years.

### 3.5 Project Description with Project Details

- **Cluster Formation**

MSW can be managed through a centralized approach, a decentralized approach or a combination of the two. Waste management services under each approach in turn can be delivered by the ULBs themselves or in association with the private sector or the local community. The Integrated Municipal solid waste processing facility at Rewari village will be developed with Centralized approach.

- **Basis of cluster formation**

The quantity and composition of MSW generated in the ULB is essential for determining collection, processing and disposal options that could be adopted. They are dependent on the population, demographic details, principal activities in the city/ town, income levels and lifestyle of the community. In order to assess the sufficiency of the existing and potential MSW treatment capacity of the State of Haryana, the following step-wise process has been followed;

- Data on current MSW generation from non-industrial (domestic, commercial) and industrial sectors has been collected from ULBs
- Population projections have been made taking population of 2011 as the base figures and considering 3% YoY increase in urban areas (CPHEEO manual, 2015)
- Future MSW generation from domestic, commercial and industrial sectors is estimated using sector specific growth factors

- Treatment capacity of all functioning treatment plants and potential treatment capacity of identified land pockets have been estimated
- The optimal transport distance used to identify the cluster boundary is estimated to be 30 km. In addition, the maximum distance used to define any cluster boundary is 50 km.

➢ **Constitution of Rewari cluster**

Rewari cluster consists of five ULBs, Municipal Committee Rewari, Municipal Council Ateli Mandi, Municipal Committee Bawal, Municipal Council Dharuhera, Municipal Committee Kanina, Municipal Committee Mahendragarh, Municipal Committee Nangal Choudhary and Municipal Committee Narnaul Mandi ULBs. The cluster boundary is depicted in the following figure:-

➢ **Details of Participating ULBs**

The details of the ULBs constituting the Rewari cluster are as follows:

**1. Ateli Mandi**

Ateli is a Municipal Committee city in district of Mahendragarh, Haryana. The Ateli city is divided into 11 wards for which elections are held every 5 years. The Ateli Municipal Committee has population of 7,619 of which 4,040 are males while 3,579 are females as per report released by Census India 2011.

**2. Bawal**

Bawal is a Municipal Committee city in district of Rewari, Haryana. The Bawal city is divided into 13 wards for which elections are held every 5 years. The Bawal Municipal Committee has population of 16,776 of which 8,828 are males while 7,948 are females as per report released by Census India 2011.

**3. Dharuhera**

Dharuhera is a Municipal Committee city in district of Rewari, Haryana. The Dharuhera city is divided into 13 wards for which elections are held every 5 years. The Dharuhera Municipal Committee has population of 30,344 of which 16,414 are males while 13,930 are females as per report released by Census India 2011.

**4. Kanina**

Kanina is a village situated in Mahendragarh tehsil of Mahendragarh district in Haryana. As per the Population Census 2011 the total population of Kanina is 12989.

**5. Mahendragarh**

Mahendragarh district occupies 19th position in population size during 2011.In terms of density Mahendragarh ranks at 16th position with a density of 486. Whereas during 2001 the density was 428. As per the Population Census 2011 the total population of Mahendragarh is 29128.

**6. Nangal Chaudhary**

Nangal Choudhary is an important town and tehsil headquarters of District Mahendragarh at Narnaul. It holds the crown of being "First Cyber Village of Haryana". Now it has an assembly seat in Haryana government.

**7. Narnaul**

Narnaul is a Municipal Council city in district of Mahendragarh, Haryana. The Narnaul city is divided into 23 wards for which elections are held every 5 years. The Narnaul Municipal Council has population of 74,581 of which 39,569 are males while 35,012 are females as per report released by Census India 2011.

**8. Rewari**

Rewari city is governed by Municipal Corporation and is situated in Haryana State/UT.
As per provisional reports of Census India, population of Rewari in 2011 is 143,021; of which male and female are 75,764 and 67,257 respectively.

### 3.5.1 Salient Feature of Project

The proposed project is for design of integrated Municipal solid waste Processing facility of 197 TPD of MSW in an area of 19 Acres for 20 years. Project Details are given in **Error! Reference source not found.**.

*Table 3-2: **Project Details***

| Sr. No. | Particulars | Details |
|---|---|---|
| 1. | Land Area | 19 Acres |
| 2. | Life Span of Land Fill | 20Years |
| 3. | Power Requirement | 250 KW, State Electricity Board |

| | | |
|---|---|---|
| 4. | Proposed Capacity of D.G set in KVA | 1 D.G. Set of 250 KVA |
| 5. | Water Requirement | 80.06 KLD |
| 6. | Total Waste Generation | 197 TPD |

Environmental Settings of the Area of project are given in **Error! Reference source not ound.**.

*Table 3-3:* ***Environmental Settings of the Area***

| Sr. No. | Area | Place | Distance (km) |
|---|---|---|---|
| 1. | Nearest River | - | - |
| 2. | Nearest Road | NH-8 | - |
| 3. | Nearest Railway Station | Bawal Railway Station | 3.19 Km |
| 4. | Nearest Airport | Indira Gandhi International Airport | 76 Km |
| 5. | Nearest Town | Rewari | 16.1 Km |
| 8 | Seismic zone | Zone – IV | |

### 3.5.2 Processing Description

**MSW Treatment Technologies:**

The available technologies to treat MSW can be broadly categorized into 3 broad sections are as follows:

1. Thermal Process Technologies
2. Biological Processing Technologies
3. Physical Processing Technologies

### Thermal Process Technologies

The thermal processing technologies involve thermal decomposition of waste into gaseous, liquid and solid conversion products with release of heat energy. These technologies operate at temperatures greater than 200°C and have higher reaction rates. They typically operate in a temperature range of 375°C to 5,500°C. Thermal technologies include advanced thermal recycling (a state-of-the-art form of waste to-energy facilities) and thermal conversion (a process that converts the organic carbon based portion of the MSW waste stream into a synthetic gas which is subsequently used to produce products such as electricity, chemicals, or green fuels).

The main thermal processing technologies adopted internationally for the treatment of municipal waste are:

- **Incineration**

  Mass-burn systems are the predominant form of the MSW incineration. Mass-burn systems generally consist of either two or three incineration units ranging in capacity from 50 to 1,000 tons per day; thus, facility capacity ranges from about 100 to 3,000 tons per day. It involves combustion of unprocessed or minimally processed refuse. The major components of a mass burn facility include: (1) Refuse receiving, handling, and storage systems; (2) Combustion and steam generation system (a boiler); (3) Flue gas cleaning system; (4) Power generation equipment (steam turbine and generator); (5) Condenser cooling water system; and (6) Residue hauling and storage system.

- **Pyrolysis**

  In pyrolysis, at high temperatures of 700°C to 1200 °C, thermal degradation of organic carbon-based materials is achieved through the use of an indirect, external source of heat, in the absence or almost complete absence of free oxygen. This thermally decomposes and drives off the volatile portions of the organic materials, resulting in a syngas composed primarily of hydrogen ($H_2$), carbon monoxide (CO), carbon dioxide ($CO_2$), and methane ($CH_4$). Some of the volatile components form tar and oil, which can be removed and reused as a fuel. Most Pyrolysis systems are closed systems and there are no waste gases or air emission sources (if the syngas is combusted to produce electricity, the power system will have air emissions through a stack and air emission control system). After cooling and cleaning in emission control systems, the syngas can be utilized in boilers, gas turbines, or internal combustion engines to generate electricity or used as raw stock in chemical industries. The balance of the organic materials that are non-volatile or liquid that is left as a char material, can be further processed or used for its adsorption properties (activated carbon). Inorganic materials form a bottom ash that requires disposal, although some pyrolysis ash can be used for manufacturing brick materials.

- **Gasification**

  In the gasification process, thermal conversion of organic carbon based materials is achieved in the presence of internally produced heat, typically at temperatures of 660°C to 1800°C, and in a limited supply of air/oxygen (less than stoichiometric, or less than what is needed for complete combustion) to produce a syngas composed primarily of H2 and CO. Inorganic materials are converted either to bottom ash

(low-temperature gasification) or to a solid, vitreous slag (high temperature gasification that operates above the melting temperature of inorganic components). Some of the oxygen injected into the system is used in reactions that produce heat, so that Pyrolysis (endothermic) gasification reactions can initiate; after which, the exothermic reactions control and cause the gasification process to be self-sustaining. Most gasification systems, like Pyrolysis, are closed systems and do not generate waste gases or air emission sources during the gasification phase. After cooling and cleaning in emission control systems, the syngas can be utilized in boilers, gas turbines, or internal combustion engines to generate electricity, or to make chemicals.

## Biological processing technologies

Biological treatment involves using microorganisms to decompose the biodegradable components of waste. Biological processing technologies operate at lower temperatures and lower reaction rates. Biological processing technologies are focused on the conversion of organics in the MSW. MSW consists of dry matter and moisture. The dry matter further consists of organics (i.e., whose molecules are carbon-based), and minerals, also referred to as the ash fraction. The organics can be further subdivided into biodegradables or refractory organics, such as food waste, and non-biodegradables, such as plastic. Biological technologies can only convert biodegradables component of the MSW. By-products can vary, which include: electricity, compost and chemicals.
Biological process can be aerobic and anaerobic. Biological technologies adopted for treatment of solid waste include:

- **Composting**

  Composting is a natural micro-biological process, where bacteria break down the organic fractions of the MSW stream under controlled conditions to produce a pathogen-free material called "Compost" that can be used for potting soil, soil amendments (for example, to lighten and improve the soil structure of clay soils), and mulch. The microbes, fungi, and macro-organisms that contribute to this biological decomposition are generally aerobic. A mixture of organic materials is placed into one or more piles (windrows), and the natural microbial action will cause the pile to heat up to 60 - 70°C, killing most pathogens and weed seeds. A properly designed compost heap will reach 70°C within 6 to10 days, and slowly cool off back to ambient temperatures as the biological decomposition is completed. Systematic turning of the material, which mixes the different components and aerates the mixture, generally accelerates the process of breaking down the organic fraction, and

a proper carbon/nitrogen balance (carbon to nitrogen or C/N ratio of 20:1) in the feedstock ensures complete and rapid composting. The composting process takes from 30 to 90 days.

There are two fundamental types of composting techniques: a.) open or windrow composting, which is done out of doors with simple equipment and is a slower process, and b.) enclosed system composting, where the composting is performed in some enclosure (e.g., a tank, a box, a container or a vessel).

- **Anaerobic digestion**

  In anaerobic digestion, biodegradable material is converted by a series of decomposition process by different bacterial groups into methane and CO2. A first group breaks down large organic molecules into small units like sugar. This step is referred to as hydrolysis. Another group of bacteria converts the resulting smaller molecules into volatile fatty acids, mainly acetate, but also hydrogen (H2) and CO2. This process is called acidification. The last group of bacteria, the methane producers or methanogens, produce biogas (methane and CO2) from the acetate and hydrogen and CO2. This biogas can be used to fuel boilers or reciprocating engines with minimal pre-treatment. In addition to biogas, anaerobic bioconversion generates a residue consisting of in-organics, non-degradable organics, and bacterial biomass. If the feedstock entering the process is sufficiently free of objectionable materials like colourful plastic, this residue can have market value as compost. Anaerobic digestion process is also referred to as Bio-methanation process.

- **Bioreactor landfill**

  A bioreactor landfill is a wet landfill designed and operated with the objective of converting and stabilizing biodegradable organic components of the waste within a reasonable time frame, by enhancing the microbiological decomposition processes. The technology significantly increases the extent of waste decomposition, conversion rates and process effectiveness over what would otherwise occur in a conventional wet landfill. Stabilization in this context means that landfill gas and leachate emissions are managed within one generation (twenty to thirty years) and that any failure of the containment system after this time would not result in environmental pollution. There is better energy recovery including increased total gas available for energy use and increased greenhouse gas reduction from reduced emissions and increase in fossil fuel offsets. These factors lead to increased community acceptance of this waste technology. Management of a bioreactor landfill requires a different operating protocol to conventional landfills. Liquid addition and recirculation is the

single most important operational variable to enhance the microbiological decomposition processes. Other strategies can also be used, to optimise the stabilization process, including waste shredding, pH adjustment, nutrient addition and temperature management.

## Physical processing technologies

Physical technologies involve altering the physical characteristics of the MSW feedstock. The MSW is subjected to various physical processes that reduce the quantity of total feedstock, increase its heating value, and provide a feedstock. It may be densified or palletized into homogeneous fuel pellets and transported and combusted as a supplementary fuel in utility boilers. These technologies are briefly described below.

- **Refused Derived Fuel (RDF)**

  The RDF process typically includes thorough pre-separation of recyclables, shredding, drying, and densification to make a product that is easily handled. Glass and plastics are removed through manual picking and by commercially available separation devices. This is followed by shredding to reduce the size of the remaining feedstock to about eight inches or less, for further processing and handling. Magnetic separators are used to remove ferrous metals. Eddy-current separators are used for aluminium and other non-ferrous metals. The resulting material contains mostly food waste, non-separated paper, some plastics (recyclable and non-recyclable), green waste, wood, and other materials. Drying to less than 12% moisture is typically accomplished through the use of forced-draft air. Additional sieving and classification equipment may be utilized to increase the removal of contaminants. After drying, the material often undergoes densification processing such as pelletizing to produce a pellet that can be handled with typical conveying equipment and fed through bunkers and feeders. The RDF can be immediately combusted on-site or transported to another facility for burning, alone or with other fuels. The densification is even more important when RDF is transported off-site to another facility, in order to reduce volume being transported. RDF is often used in waste to energy plants as the primary or supplemental feedstock, or co-fired with coal or other fuels in power plants, in kilns of cement plants, and with other fuels for industrial steam production.

- **Mechanical separation**

  Mechanical separation is utilized for removing specific materials or contaminants from the inlet MSW stream as a part of the pre-treatment process. Contaminants may include construction and demolition (C&D) debris, tires, dirt, wet paper, coarse materials, and fine materials. Generally, MSW reaching the dumping sites is unsegregated and mixed, containing C&D debris and other contaminants. Therefore, it is essential to remove these contaminants from the incoming MSW by mechanical separation before processing the waste further by either biological, physical and thermal technologies (except Plasma Arc Technology).

- **Size reduction**

  Size reduction is often required to allow for more efficient and easier handling of materials, particularly when the feed stream is to be used in further processes. Sizing processes include vibrating screens and trommels. In order to reduce the size of the entire stream, or portions of it, mechanical equipment, such as shredders, is utilized. This allows for other physical processes, such as dryers, magnetic and eddy current separators, and densification equipment to work more efficiently. Magnetic and eddy current separators may be installed both up- and down-stream of shredders to increase the recovery of metals.

The above technologies can be summarized as follows:

*Table 3-4: Summary of MSW processing technologies*

| | | Pros | Cons |
|---|---|---|---|
| **Thermal processing technologies** | | | |
| **Incineration** | **Waste incineration is a treatment process that involves the combustion of organic fraction of MSW to convert the same into ash, flue gas and heat.** | ❖ Reduction in volume of waste going to landfill<br>❖ Production of energy which could be used for various purposes<br>❖ Reduction in toxicity of waste and pathogens | ❖ Release of harmful emissions in the air<br>❖ Treatment of the by-products is imperative<br>❖ Skilled operators are required<br>❖ NIMBY syndrome |
| **Gasification** | **Gasification also involves the partial oxidation of carbon based feedstock to generate syngas, which can be used as a fuel or for the production of chemicals.** | ❖ Limited air requirement which leads to less volume of flue gas for treatment | ❖ Larger land requirement<br>❖ Requirement of pre-treatment of waste |

| | | | |
|---|---|---|---|
| **Pyrolysis** | **Pyrolysis is a thermal process that uses high temperatures to break down any waste containing carbon.** | ❖ Less quantity of waste going to landfill | ❖ Limited success stories |
| **Biological processing technologies** | | | |
| **Composting** | **Controlled decomposition of organic matter by micro-organisms into stable humus. It can be done by either open/windrow composting or enclosed/in vessel composting.** | ❖ Relatively cost effective | ❖ Discharge of leachate and phenols leading to water contamination<br>❖ Possible odour<br>❖ NIMBY syndrome |
| **Bio-methanation** | **Biodegradable material is broken down by bacteria into methane and CO2 in the absence of oxygen.** | ❖ Treatment at source<br>❖ Gas/ power generation | ❖ Only applicable to organic fraction of MSW |
| **Physical processing technologies** | | | |
| **Refuse Derived Fuel Technology** | **MSW may be separated, shredded and/or dried in a processing facility. The resulting material is referred to as Refuse Derived Fuel (RDF).** | ❖ Higher calorific value from for power generation<br>❖ Suitable for low input capacity | ❖ Stringent air pollution monitoring is required for burning |

The activities planned in the proposed project include collection, transportation, treatment & disposal of municipal solid waste in compliance to the MSW Handling Rules (2016).

The basic concept for the solid waste management of the Rewari Cluster project site is presented in the form of the flow chart in shown in **Error! Reference source not found.**4

Source segregation is already adopted in some wards in all the ULBs. This may be replicated across all the wards of all the ULBs in the cluster. Waste should be segregated by waste generators into two fractions – wet fraction (green container) and dry fraction (blue container). The list of different waste bins is provided below:

*Table 3-5:* **Waste bins for source segregation of waste**

| **Wet Waste (Green Bin)** | **Dry Waste (Blue bin)** | | | |
|---|---|---|---|---|
| | **With further sub-segregation** | | | |
| Food wastes of all kinds, | Paper, | Containers and | Rags, rubber, | Metals, glass |

| | | | | |
|---|---|---|---|---|
| cooked and uncooked, including eggshells and bones, flower and fruit wastes including juice peels and house plant wastes, soiled tissues, food wrappers, paper towels | cardboard and cartons | packaging of all kinds, excluding those containing hazardous material, compound packaging of all kind | wood, discarded clothing, furniture | (all kinds), Inert, house sweeping, |

- **Primary Collection**

Primary collection refers to the process of collecting waste from households, markets, institutions and other commercial establishments and taking the waste to a storage depot/ transfer station. Primary collection may be accomplished through the use of containerized push carts/tri-cycles, small mechanized vehicles, compactors and/or tipping vehicles.

- **Secondary Storage**

Secondary collection includes picking up waste from community bins, waste storage depots or transfer stations and transporting it to waste processing sites or to the final disposal site. It comprises of both activities – secondary storage and secondary transportation

- **Transfer Station**

The transfer stations have been proposed so as to receive MSW from nearby ULBs coming in smaller vehicles and then transfer the MSW to a larger vehicle for transporting it to the processing facility (in refused compactor / larger transportation vehicle). MSW from the nearby locations are either to be delivered to the transfer stations or directly to the Processing Plant site depending, whichever is nearer. This method of transporting waste in bulk would help in reduction of the overall transportation cost and also substantially reduce the traffic and environmental nuisance associated with a large number of small refuse collection vehicles moving on the road.

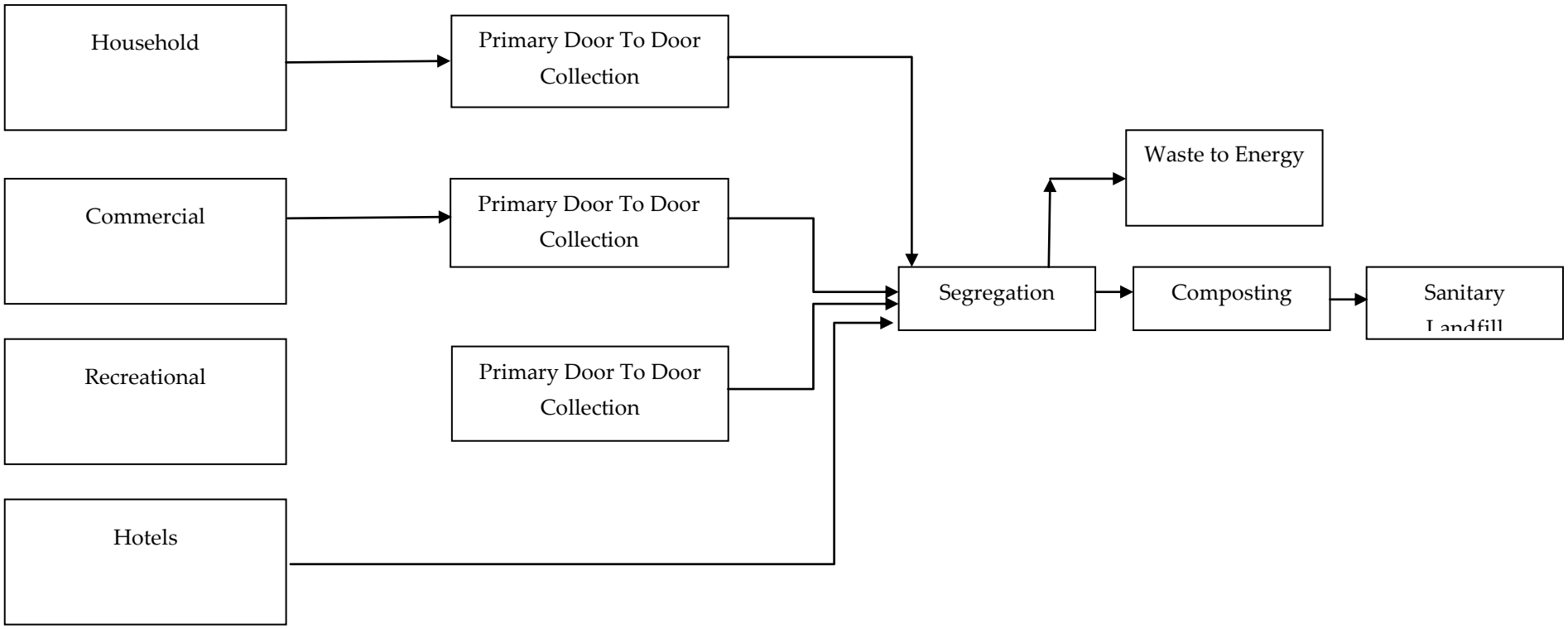


Figure 3-4: Methodology for Proposed Waste Collection

## 3.6 Landfill development strategy

Deposition of waste in conical heaps over the landfill site and spreading these heaps using a tracked bull dozer is a low cost and easy option. However this practice will lead to highly unacceptable environmental conditions. The lower levels of waste are permanently saturated and free flow of water into and out of the dumped waste will lead to the migration of leachate into the surrounding surface and sub-surface water and thereby contaminating the ground water aquifers.

The other major issue of simple deposition waste will be the formation of anaerobic conditions at the site as the waste deposition thickness increases, giving rise to the generation of landfill gas and thereby creating serious safety concerns in the immediate project influence area.

Considering these aspects, the landfill development strategy for Rewari cluster is formulated, to satisfy the regulatory requirements of MoEFCC and the guidelines of CPHEEO, with the following objectives.

- Environmental protection and protection from the flooding
- Physical acceptability
- Technical standards of site engineering required
- Operational and management standards desirable
- Appropriateness and sustainability of the method
- Volumetric capacity of the site
- Longevity of the method and
- Cost effectiveness of the recommended measures

The sections below describe various measures that are recommended for developing a sanitary landfill to fulfil the above objectives.

### 3.6.1 Recommended measures of containment engineering

Protection of surrounding environment of the landfill site shall be effectively achieved through segregation and isolation of potentially polluting waste from the surrounding strata of surface water and ground water. The principle means of achieving this are, provision of sealing layers at the base, side walls and top of the landfill. Appropriate and secure operational management of the site to minimize the following aspects will further supplement these measures.

- Water ingress into the landfill
- Leachate generation and uncontrolled dispersion
- Accumulation and uncontrolled release of landfill gas into the surrounding



atmosphere

A number of alternative methods are available for constructing sealing and containment layers with varied demands for expertise levels both for liner formation and installation.

These include:

a) The use of in situ strata with a very low permeability, typically specified as less than 1.0x $10^{-9}$ m / sec
b) Excavation and /or importing low permeability natural clay
c) Improvement of in situ material, to achieve the minimum required permeability characteristics by bentonite enrichment or natural soils or other means and
d) Use of an engineered artificial lining system such as flexible synthetic geo-membrane, geo-synthetic clay liner or composite geo-membrane.

The use of single or multiple synthetic liners, in combination with an in situ mineral liner or improved in situ soil will provide high levels of site containment. Considering the capital cost and containment levels required, it is recommended to have:

a) A single mineral liner formed in situ and re-compacted clay on the base of the landfill
b) A capping layer of re-compacted clay above the final lift of solid waste
c) A core clay in peripheral phase to form lateral containment and
d) A maximum permeability of sealing layers will no greater than 1x 10-9 m / sec

While the above measures are expected to provide desired levels of containment and environmental safety, it is to be noted that no industrial or biomedical wastes are allowed to mix with the solid waste being disposed of at the site. The mix of any of these wastes will render the waste hazardous thereby requiring the use of highly expensive synthetic liners for containment.

### 3.6.2 Leachate generation and treatment

Water that percolates through the placed solid waste is known as leachate. During its progress through the waste, the water entrains suspended solids, extracts soluble constituents of the waste and soluble products of the waste degradation process. The composition of leachate depends up on the stage of waste degradation and the types of waste within the landfill. The main components of leachate will comprise:

- Major elements and ions including calcium, magnesium, iron, potassium, sodium, ammonia, carbonates, sulphates, chlorides, etc.

- Trace metals including manganese, chromium, nickel, lead, cadmium, etc.
- Organic compounds including phenols, Poly aromatic hydrocarbons, etc.
- Microbiological components

The quantity of leachate generated will depend on the annual precipitation rates and active area of the landfill. This requires preparation of complete water balance of the landfill site, in accordance with the development phases of the project. It is now too early to anticipate a detailed phasing of the landfill site and hence it is assumed that an area equivalent to the total waste generated in a year would be the active area for the landfill site in the particular year.

However, it is to be noted that the leachate generation trends vary drastically depending upon the quantity of waste deposited everyday and the actual quantity shall be estimated by considering the cumulative quantity of waste deposited in the landfill. The quantity estimated here will just give an idea for the area requirements of leachate treatment.

### 3.6.3 Landfill gas generation, control and management

Landfill gas is generated due to the degradation of the organic matter in the wastes. Since the landfill material will be basically inert, the landfill gas generation will be minimal. However, a minor portion of uncomposted material may also go to the landfill and therefore adequate gas ventilation system has to be provided as a part of the design.

### 3.6.4 Storm water control and management

The drains of storm water from the active landfill area and processing plant area, adequate drainage facilities are recommended for landfill area. As a part of this, drainage arrangements in each phase of the landfill will have to be constructed and drain towards the existing ravine side of the disposal site. Temporary and permanent drainage ditches would be installed in waste reception area, topsoil storage plant, haul roads, floor preparation areas and waste placement areas.

Clean and contaminated waters will be segregated and discharged to the nearby ravine and treatment facility respectively.

### 3.6.5 Specifications of landfill development, operation and management

Development of a landfill site should be subjected to rigorous planning. Key elements in developing a common scientific landfill site for the Rewari cluster will comprise:



a) Organizing the waste/ processing rejects and inert transportation practices
b) Detailed plans outlining the site development activities and
c) Detailed designs of all the engineering works
d) The overall control on the development and operation of landfill site will be the requirement to adopt a cellular approach to landfilling. The landfill development activities will comprise:
   - Site clearance
   - Sub-division of site into major operational phases
   - Progressive excavation for landfill earthworks
   - Ordered development of operational phases in working land filling cells
   - Advance preparation of the lining system on the landfill base
   - Sequential infilling of land filling cells and operational phases and
   - Early and timely capping of land filled cells

The following sections explain the specifications of developing each of the landfill components.

### 3.6.6 Buffer zones

A vegetative cover will have to be provided as buffer zone between the landfill site and the nearby localities. In addition to the buffer zone, a compound wall/rigid fencing all around the landfill site to a height of 3 m or as suitable, shall also to be constructed, to totally seclude the site from outside activities.

The proposed vegetative cover shall comprise trees and shrubs that improve the visual and aesthetic appearance of the site. In addition the waste reception area, administrative area and segregation areas shall also be provided with vegetative cover to the extent possible.

### 3.6.7 Site infrastructure

In addition to the landfill area, the site shall be provided with the following infrastructure:

A. Waste reception facilities
B. Haul roads
C. Weigh bridge
D. Site office
E. Top soil storage
F. Support services such as electricity, water supply telephones etc.
G. Site security

H. Vehicles and equipment
I. Vehicle and equipment maintenance workshops and
J. Site staff

**A. Waste reception facilities**

The waste reception facilities shall comprise of the following

- An approach road to permit two way traffic, metalled and of adequate length to permit the queuing of vehicles
- Site notice board displaying license conditions, hours of operation and site regulations
- Secure and lockable gates at the entrance to the site.
- Cattle grid at the entrance to the waste reception area
- A weigh bridge of 20 ton capacity capable of weighing 20 -25 vehicles per hour
- Weigh booking office with all amenities and preferably computer logging facilities
- By pass lane for non-waste vehicles and emergency services
- Site administration office for site management with all support services
- Amenity block with dining room, toilets and washing facilities
- Small testing laboratory with first aid facilities
- Designated car park area
- Adequate store room
- Work shop for the first line on-site maintenance with all spares and support services
- Adequate site lighting covering all traffic routes

**B. Haul roads**

The entire stretch of access road shall be upgraded / paved to a minimum of 8 m width (for two way traffic). All the primary haul roads from the public high way to the waste reception area and the landfill operational area shall be treated as permanent roads and should be constructed as per the standards.

The secondary arterial roads and temporary roads within the site can be of lesser standards, as the locations of these roads will be changing, following the landfill development.

**C. Support services**

The entire area of waste reception area and landfill site shall be provided with electricity and backup generators, potable water supply, communication facilities such as phones and efficient surface water drainage. The exact requirements of all these facilities shall be worked out during the detailed engineering phase of the project, before execution.

**D. Site security**

Security to the whole of landfill area shall be provided for all 24 hours the day. A compound wall all around the site shall be constructed to provide integrity to the site and also serve as noise barrier to the adjoining areas. The wall can be of masonry or any other suitable material / rigid fence. As unauthorized access to the site may pose significant health and safety risks, warning notices and access control shall be provided at the following locations of the site.

- Plant and equipment compounds
- Waste receipt point
- Leachate and Land fill gas collection and treatment locations and
- Parts of site undergoing construction Vehicles and Equipment

The vehicle and equipment envisaged for the plant operations are as listed below. The number of pumps required shall be estimated as per the pumping needs of the facility operator.

- Weigh Bridge
- Tracked Bulldozer
- Tracked Loading Shovel
- Tracked Backhoe / loader
- Grader
- Compactor
- Dump Truck
- Tractor and Bowser / Sweeper
- Van / Pick up
- Pumps

In addition to the above, adequate firefighting equipment shall also be installed to meet the unforeseen fire accident

**E. Vehicle and equipment maintenance and spares**

In keeping with good working practice, regular machinery inspections shall be undertaken on weekly basis and preventive maintenance should be practiced. Workshop facilities will be provided on site, for routine maintenance and servicing as required. Sufficient holding of spare parts should be maintained, to keep each landfill facility operational on a continuous basis.

**F. Site staff**

Adequate manpower is required to ensure that the site is constructed and operated successfully. The staff employed shall be sufficiently qualified, trained, competent and adequately supervised, to ensure efficient functioning of the plant. The type of staff requirement anticipated for the study is presented below.

- Site manager supervising all aspects of construction and operation
- Supervisors overseeing the landfill operations and maintenance
- Resident engineers supervising landfill construction
- Unit Cashiers
- Clerk / Typists
- Weigh bridge clerks
- Stores in-charges
- Vehicle drivers
- Vehicle fitters and mechanics
- Electricians
- Lab technicians
- Environmental monitoring technicians
- Medical and first aid personnel
- Security guards and
- General labour

### 3.6.8 Landfill foundation level

Landfill foundation is one of the most critical aspects of the landfill development activities. This exerts fundamental control over the

a. Measures required for site engineering
b. Stability of landfill foundations
c. Provision of materials on site for site engineering and
d. Overall gross and net capacity of the site

However, detailed geo-technical investigations shall be carried out to confirm the

stability and design appropriate foundation for the landfill site.

### 3.6.9 Containment of potential pollutants

Containment measures such as double liners at the bottom and lateral sides of the landfill, and surface capping after the land filling is completed, are required to control the pollutants and mitigate subsequent impacts on environment.

#### I. Basal and lateral containment

The basal and lateral containment at the site shall be provided by using in situ natural soils and geological strata of permeability less than 1x $10^{-9}$ m/sec. detailed geo-technical investigations, by excavating top soil should be carried out to assess the permeability of the soil. The site preparation and construction of liner will comprise of

a. Site clearance
b. Grading and dozing of the floor at foundation level to provide suitable slope for gravity drainage of leachate
c. Placement and compaction of excavated clay in minimum of four lifts of 250 mm thick with clay placed at or within +4% of optimum moisture content
d. Within each major phase the mineral liner will be laid, as to be continuous at foundation level and will form as the primary containment layer

If the geo-technical investigations conclude soil permeability, not suitable for liners, clay either has to be imported or in situ sandy materials, has to be improved though addition of bentonite under controlled application rates.

#### II. Surface capping

To minimize the ingress of water into the site after completion, it is proposed to form an engineered capping layer. This will comprise a multilayer system comprising:

a. A protective layer of graded fine granular material of 100 mm thick and free from objects larger than 10 mm size, placed above the gas drainage layer over the last lift of waste
b. Sealing layer with a maximum permeability and an equivalent layer of clay 1m thick with a permeability of 1 x $10^{-9}$ m/sec and
c. A second protective layer with same specifications as mentioned above, placed above the sealing layer

### 3.6.10 Ground and surface water interception and drainage

Conventional dewatering measures shall be employed within the landfill area to discharge and maintain groundwater levels below landfill foundation level. This will be ensured through

a. Pumping from perimeter trench drains installed on the bunds or from sumps installed below the landfill foundation level for areas undergoing preparation
b. Installation of temporary or permanent surface water interception drainage ditches to carry peak rainfall runoff and prevent flooding of landfill site

### 3.6.11 Leachate collection and removal

The leachate collection shall be achieved through the following measures:

a. Gravity drainage and grading of the floor of the landfill cell to fall into a sump, located at the lowest point of the cell. The gradients shall be 2 per cent for main drainage with 1 per cent cross fall.
b. Installation of leachate drainage blanket above the basal mineral liner over the floor of each cell and partially up the side walls, constructed of free drainage coarse granular fill comprising of graded 50mm crushed rock laid to a depth of 400mm with a permeability of 1 x 10-4 cm/sec.
c. Inclusion of perforated HDPE pipes in the drainage blanket to facilitated leachate flow with pipes laid on a typical spacing of 50m.
d. Overlaying granular drainage blanket with 100m thick free draining fine granular fills of medium to coarse sand to act as a filter and protective layer.
e. Removal of leachate is effected by leachate collection chambers built up with successive lifts of waste and side slope risers located on the site perimeter.
f. The submersible pumps or adductor pumps should be used to remove leachate from the sumps and the collection chambers should be linked by permanent pipe work to the treatment plant.
g. The precise methods and degree of treatment shall accommodate the fluctuations in leachate generation. However the following steps shall be followed to meet the standards prescribed by the ministry.
    - Balancing of leachate flows and volumes
    - Redistribution and recirculation of leachate to dry absorptive waste to reduce volume and to enhance the rates of stabilization
    - Aerobic processing through lagoons

### 3.6.12 Landfill gas and management

The primary measures to restrict the uncontrolled migration of landfill gas from the site will comprise,

a. Low permeability containment layers and systems installed on the base and side walls
b. Permeable gas drainage blanket of 0.3 m thickness laid beneath the capping layer and
c. Vertical gas chimneys vents and extraction wells

The gas drainage blanket will be formed of a layer of fines free, graded granular fill overlain by a layer of fine sand 100 mm thick and provide protection to the capping layer. Chimneys, vents and extractions wells shall be constructed by drilling from the surface of the capping layer. The extraction wells will have an outer diameter of 0.3 m to 1 m and a HDPE well pipe of 0.1 to 0.15 m within well body.

### 3.6.13 Surface restoration

The landfill will be brought up to its pre-settlement level in stages and capped off in a program of progressive restoration, to limit the ingress of water into the site and to facilitate the control of landfill gas. The capping will be a composite structure comprising of four layers of an engineered seal designed to prevent water ingress and egress of landfill gas and an agricultural cap comprising of subsoil drainage layer.

A suitable vegetative cover will have to be established on the closed site to ensure slow surface runoff, promote evapo-transpiration of rainfall, retain moisture in the cap and enhance the formation of a soil structure in the agriculture soil.

### 3.6.14 Other measures

Specific attention shall be paid to mitigate the following undesirable and potentially deleterious effects of:

a) Litter blown from the disposal / tipping area
b) Scavenging animals, vermin and insects attracted to the sites
c) Flies and Bird attraction
d) Odour arising out of waste deposition and degradation
e) Dust from landfill operations
f) Mud generated from waste, cover, capping materials and site excavation works
g) Fire and smoke control
h) Noise of operating plant

These effects can be minimized by providing local litter, arrestor, fencing, strategically placed in relation to the discharge point, erecting site security fencing for excluding scavenging animals, bird scaring techniques for avoiding bird nuisance, etc.

## 3.7 Availability of Water Resources/ Power, Energy Requirement and Source

### 3.7.1 Water Balance

The source of water supply is Municipal Corporation/Nagar Nigam Rewari (Fresh/Treated waste water). During construction phase, water requirement will be 6-8KLD and during operation phase total water requirement will be 80.06 KLD.

Water balance during operation phase is given in **Error! Reference source not found.**.

*Table 3-6: Water Balance during Operation Phase*

| Sr. No. | Description | Fresh Water Requirement (KLD) | Treated Water (KLD) | Total Water Requirement (KLD) | Waste Water Generation (KLD) |
|---|---|---|---|---|---|
| 1. | Employees (300)<br>45 LPD/per Employee | 13.5 | - | 13.5 | 8 |
| 2. | Tier Washing | - | 2.5 | 2.5 | 2.5 |
| 3. | Dust Suppression | - | 5 | 5 | - |
| 4. | Green Belt Development | - | 9 | 9 | - |
| 5. | Bio-methanation/composting | - | 50 | 50 | 38 |
| **Total** | | 13.5 | 66.5 | 80.06 | 48.5 |

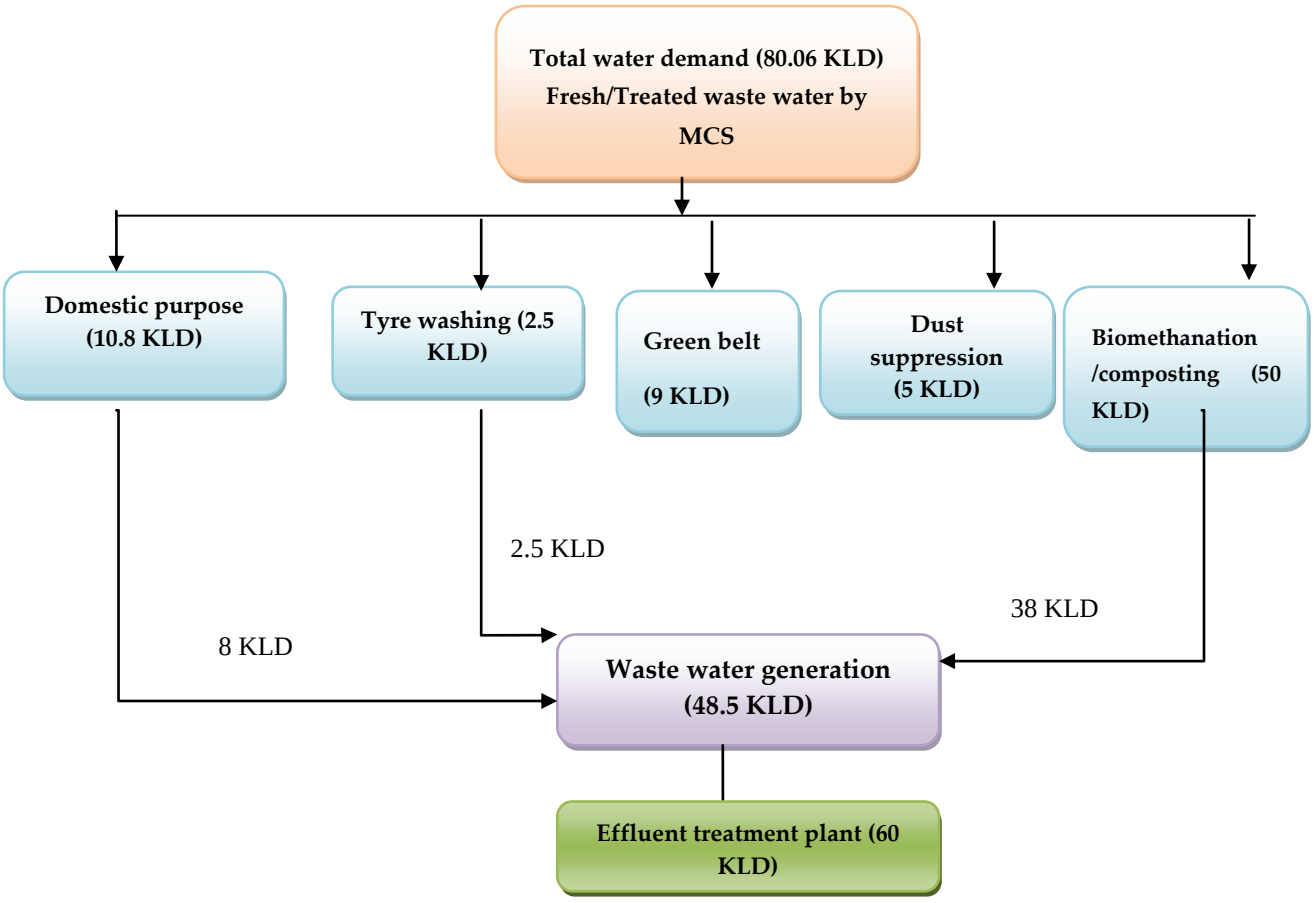


*Figure 3-5: Water Balance for Operational Phase*

### 3.7.2 Power Requirement

Power will be sourced from 1 DG sets of 250 KVA during construction phase. Afterwards required power 250 KW will be supply from state electricity board cater to the needs of the MSW processing facility, also 1 D.G set of 250 KVA capacity will be kept on standby.

## 3.8 Quantity of Waste to be generated

The details about the population and waste generation for Proposed Cluster are given in **Error! eference source not found.**.

*Table 3-7: Waste generation from proposed cluster*

| ULBs | Area of the ULB Sq.Km | Population projection for 2017 | Waste generation in 2017 (tons per day) | Population Projection for 2025 | Estimated waste generation in 2025 | Population projection for 2035 | Estimated waste generation in 2035(Tons per day) |
|---|---|---|---|---|---|---|---|
| Ateli Mandi, Bawal, Dharuhera, Kanina, Mahendragarh, Nangal Choudhary, Narnaul and Rewari | 1594 | 322996 | 197 | 387595 | 236 | 465114 | 283 |

### 3.8.1 Leachate/Effluent/sewage Generation

During operation phase Leachate generation will be 25-30 KLD. Leachate will be collected in leachate collection pit and treated in treatment plant and effluent will be generated to the tune of 48.5 KLD which will be treated in 60 KLD Effluent treatment plant. During construction phase 1.9 KLD of sewage will be generated which will be disposed off through soak pit.

### 3.8.2 Hazardous Waste Generation

Only used oil (category 5.1) will be generated and collected and will be handed over to authorized recyclers. 300 liter/year used oil will be generated.

### 3.7.3 Site Staff

Adequate manpower is required to ensure that the site is constructed and operated successfully. The staff employed shall be sufficiently qualified, trained, competent and adequately supervised, to ensure efficient functioning of the plant. The type of staff requirement anticipated for the study is presented below.

- Site manager supervising all aspects of construction and operation
- Supervisors overseeing the landfill operations and maintenance
- Resident engineers supervising landfill construction
- Unit Cashiers
- Clerk / Typists
- Weigh bridge clerks
- Stores in-charges
- Vehicle drivers
- Vehicle fitters and mechanics
- Electricians
- Lab technicians
- Environmental monitoring technicians
- Medical and first aid personnel
- Security guards and
- General labour

# 4 SITE ANALYSIS

## 4.1 Connectivity

### 4.1.1 By Road

The project site is situated near NH-8 which will cater to the need of transportation of MSW treatment & Disposal facility to the integrated solid waste management site.

### 4.1.2 By Air

Nearest airport from project site is Indira Gandhi International Airport New Delhi situated at an aerial distance of 76.0 km.

### 4.1.3 By Water

The site is landlocked and away from sea or waterways.

## 4.2 Land form, Land Use and Land Ownership

Currently landuse of the site is agricultural and belongs to the Municipal Corporation of Rewari. The application for conversion of land use from agriculture to industrial is in process.

## 4.3 Topography along with Map

Rewari district of Haryana state lies between 27o 46'; 28o 28' North latitudes and 76o 15' ; 76o 51' East longitudes. Total geographical area of the district is 1594 sq.km. The Rewari district is divided into three sub-divisions (tehsils) namely Bawal, Kosli and Rewari comprising five-community development blocks viz. Bawal, Jatusana, Khol, Nahar and Rewari for the purpose of administration .The district headquarter, Rewari town falls in Rewari Tehsil.

The district broadly forms part of Indo-Gangetic alluvial plain of Yamuna sub basin. It has vast alluvial and sandy tracts and is interspersed strike ridges which are occasionally covered with blown sand. The Sand dunes attain a height of 30m but on an average they have height of 7 m with respect to surroundings. Some of the dunes support light vegetation where as others are of shifting nature depending upon the direction of wind. The hill ranges are part of great Aravalli chain and contain valuable

mineral deposits and natural meadows. The elevation of land in the area varies from 232 m in the north to 262 m above mean sea level in south. The master slope of the area is towards the north.

The topographic map of the study area is given in Fig. No. 4.1

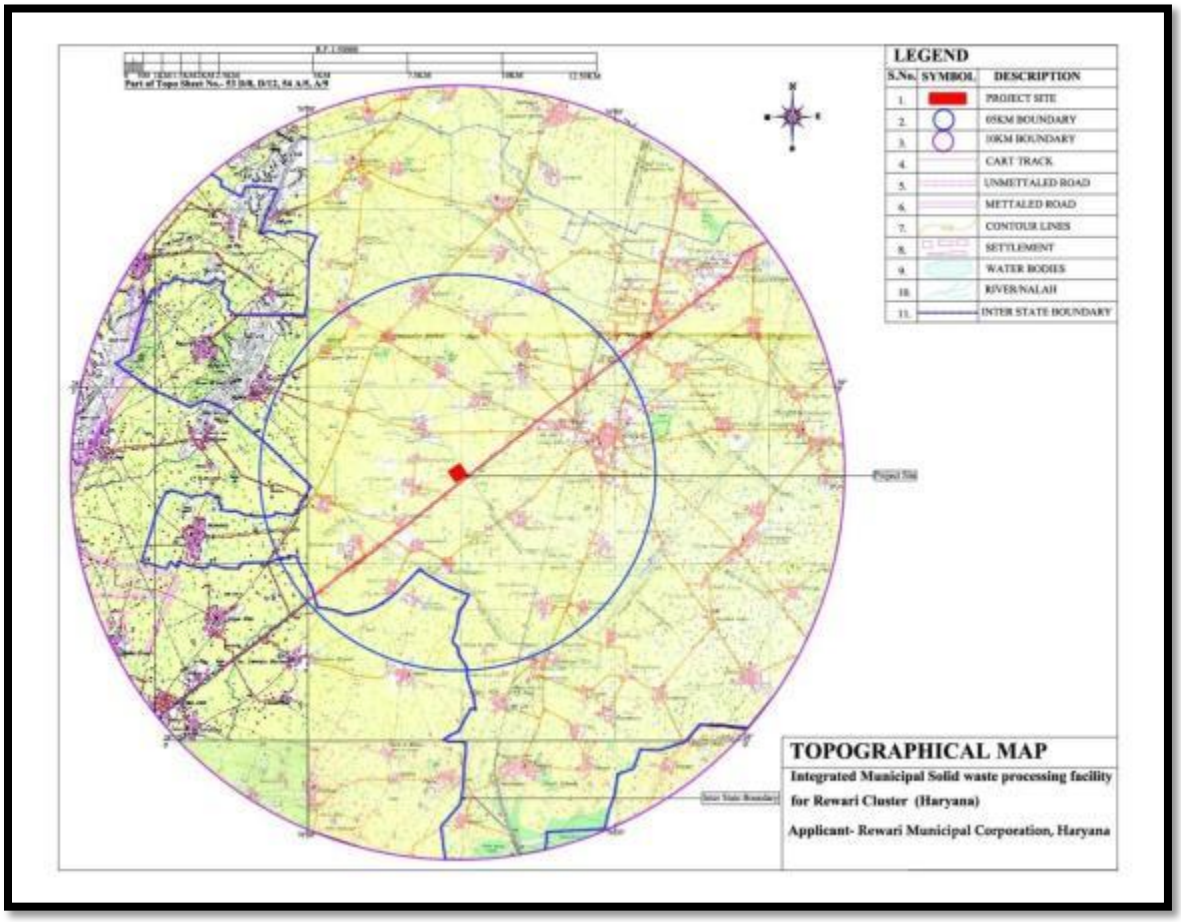


*Figure 4-1: Topographical Map*

## 4.4 Existing Land Use Pattern

The existing land is vacant and will be developed as Integrated Municipal solid waste processing facility with the combination of following technologies:

1. Power Plant (RDF)
2. Bio Methanation
3. Compost
4. Sanitary Landfill

## 4.5 Existing Infrastructure

### 4.5.1 Environment Sensitivity

*Table 4-1: Environment Setting of the Study Area*

<table>
<tr><th>Sr. No.</th><th>Particulars</th><th>Details</th></tr>
<tr><td>A.</td><td>Nature of the Project</td><td>Integrated Solid Waste processing Facility</td></tr>
<tr><td>B.</td><td colspan="2">Size of the Project</td></tr>
<tr><td>1.</td><td>Expected Waste Quantity</td><td>197 TPD</td></tr>
<tr><td>C</td><td colspan="2">Location Details</td></tr>
<tr><td>1.</td><td>Village</td><td>Near Ramsinghpura</td></tr>
<tr><td>2.</td><td>Tehsil</td><td>Bawal</td></tr>
<tr><td>3.</td><td>District</td><td>Rewari</td></tr>
<tr><td>4.</td><td>State</td><td>Haryana</td></tr>
<tr><td>5.</td><td>Latitude & Longitude</td><td>
<table>
<tr><th>Sr. No.</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td>A.</td><td>28°03'47"N</td><td>76°32'31"E</td></tr>
</table>
</td></tr>
<tr><td>6.</td><td>Toposheet No.</td><td></td></tr>
<tr><td>D</td><td colspan="2">Environmental Settings of the Area</td></tr>
<tr><td>1.</td><td>Ecological Sensitive Areas</td><td>-</td></tr>
<tr><td>2.</td><td>River / water body</td><td>
<table>
<tr><th>River/ water body</th><th>Distance</th><th>Direction</th></tr>
<tr><td>-</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>3.</td><td>Nearest Town / City</td><td>Rewari, 16.1 Km</td></tr>
<tr><td>4.</td><td>Nearest Railway Station</td><td>Bawal, 3.19 Km</td></tr>
<tr><td>5.</td><td>Nearest Airport</td><td>Delhi 76.0 Km</td></tr>
<tr><td>6.</td><td>State Boundary</td><td>-</td></tr>
<tr><td>7.</td><td>Seismic Zone</td><td>Zone – IV</td></tr>
<tr><td>D</td><td colspan="2">Cost Details</td></tr>
<tr><td>1.</td><td>Total Project Cost</td><td>65 crore</td></tr>
<tr><td>E</td><td colspan="2">Requirements of the Project</td></tr>
<tr><td>1.</td><td>Water Requirement</td><td>88.06 KLD</td></tr>
<tr><td>3.</td><td>Man Power Requirement ( Skilled and unskilled persons)</td><td>300</td></tr>
</table>

## 4.6 Climate Data from Secondary Source

The climate in the region shows broadly four seasonal variations, namely:

Winter: December - February

Summer: March – May

Monsoon: June - September

Post-monsoon: October - November

Information presented in subsequent paragraphs is from the Indian Meteorological Department (IMD), Long Term Climatological Tables, 1971 -2000. These tables give useful information about a region's weather, since they are collected over a 30-year period. The temperature of the district is found to be varying between 1.7°C to 43.3°C, and average annual rainfall observed to be 461.6 mm.

## 4.7 Social Infrastructure

**Health**

Rewari district is served by number of private and Government hospitals;

**Fire and Emergency**

Fire Brigade in Rewari district is equipped with high technique and advance feature to tackle all kind of problem during the time of panic. Fire fighter is centrally placed in the city placed to reach every area within seconds to control the situation.

# 5 ENVIRONMENTAL MITIGATION MEASURES

In consideration to the prevailing site features and the proposed Integrated Municipal Solid Waste Management Facilities, outlined in earlier Chapters, it is necessary to ensure that the proposed plant and facilities would be adequately designed with necessary environment protection measures. This Chapter accordingly outlines the environment protection measures for the proposed Integrated Municipal Solid Waste management at Rewari site comprising of Compost Plant and Sanitary Landfill. During project implementation period special emphasis would be made on measures to minimize leachate / effluent generation and dust control at source. The sources and types of pollution with broad level mitigation measures is outlined in the following sections.

## 5.1 Air pollution control measures

Air environment including Ambient Air Quality and odour generation due to the proposed project during construction and operational phases would be accounted. The principal sources of air pollution are construction activities, truck movement with construction materials and municipal solid waste, loading and unloading of materials, vehicular exhaust.

The impact is generally confined to the project area and is expected to be negligible outside the project site boundaries. The pollutants their sources and mitigation measures to be adopted are presented in Table 5-1.

## 5.2 Water pollution control measures

The water demand for the project which would be in the range of 80.06 KLD. No surface water would be tapped. The source of water would be the Municipality.

The main wastewater generation sources during construction phases would be equipment washed water and other surface run-off with suspended solids loading and sewage from temporary sanitary facilities with BOD loading.

During construction activity the surface run-off would be diverted to working pit to arrest the suspended solids if any and the settled water would be reused for construction purposes, and for sprinkling on roads to control the dust emission, etc.

During operation phase, the wastewater would be from drinking and sanitary use, leachate from compost plant and secured land fill area. The domestic wastewater would

be treated in septic tank followed by Soak pit. Maximum leachate generation from the operating cell of landfill pit and other areas including compost pads would be in the tune of 6 cum/hr.

Leachate generated at various places in the plant would be collected in a pond and properly treated in an ETP of capacity of about 2 cum/hr. The treated leachate would be sprayed on windrow to maintain suitable temperature and moisture. Leachate generated during precipitation period would be stored in evaporation pond.

Based on the rainfall intensity of the plant area, separate storm water drainage system would be properly designed. Storm water would be collected in a centralized pit to arrest the silt particulates and clear water would be used locally for landscaping and fountains. Surplus water would be released into public drains or adjacent nala. The pollutants their sources and mitigation measures to be adopted are presented in Table 5-1.

### 5.3 Solid waste disposal

During the construction phase, the solid waste would be different types of raw materials such as coarse aggregate, fines aggregate, bricks, steel etc. being used during construction stage. The solid waste generated during this period would be predominantly inert in nature.

During operation phase no solid waste would be generated as such except ETP sludge or particulates settled in evaporation ponds of nominal quantity. Appropriate management of solid rejects from different processing activity would be undertaken. Sanitary landfilling would be adopted for rejects generated from processing, ETP sludge and evaporation pond settled particulates. The total generation of solid waste would be in the range of 8-10 TPD. The pollutants, their sources and mitigation measures to be adopted are presented in Table 5-1.

***Table 5-1: Environmental Mitigation Measures***

| Sl.No | Pollution Source | Pollution Emitted | Mitigation Measures |
|---|---|---|---|
| **Air pollution Mitigation Measures** | | | |
| 1. | Construction activities | SO2, NOX, Particulates, Odour etc. | • Dust suppression by water sprinkling.<br>• Bitumen covered internal roads.<br>• Wheel Washing Bay at the entry point.<br>• Vehicles carrying of construction materials and waste to be covered with |
| 2. | Vehicular Movement | | |
| 3. | Loading and | | |

| | | | |
|---|---|---|---|
| | unloading of Trucks | | tarpaulin / plastic sheet.<br>• Proper ventilation and moisture in the compost plant and windrow area to be maintained and herbal insecticides to be sprayed around odour generation areas at regular intervals.<br>• Secured landfill except the current waste handling area rest to be covered by polyethylene sheets<br>• Green belt would be provided along the internal roads and plant boundary |
| 4. | DG Set | | |
| 5. | Processing of waste | | |
| **Water Pollution Mitigation Measures** | | | |
| 6. | Domestic Waste | Suspended Solids, BOD etc | • Septic Tank/Soak Pit.<br>• ETP for recycling.<br>• Impermeable liner in the landfill pit.<br>• Storm water drainage system for recycling |
| 7. | Leachate from Windrow Compost Plant | | |
| 8. | Leachate from landfill | | |
| **Solid Waste Management** | | | |
| 9. | Construction | Construction materials e.g. coarse aggregate, fines aggregate, bricks, steel etc | • Recycled or used for filing/ levelling of low-lying areas within the site or transported outside. |
| 10. | ETP sludge or evaporation pond | ETP sludge or evaporation pond settled Particulates | • Sanitary Landfilling |

### 5.4 Noise

Noise pollution would be resulted from transportation and during construction phase. To reduce noise pollution, high-grade machinery would be used. There would not be any major noise-causing activity during operational phase. DG set operation would have proper in-built noise control measures.

### 5.5 Ecology of the Area

Site clearing or operational activities would not impact the ecology of the area adversely, since there are no known rare, endangered or ecologically significant animal and plant

species in the area. There is no wildlife sanctuary located within 10km radius of the project site. In fact the scientific processing and landfilling would have a beneficial impact on the surrounding terrestrial and aquatic ecology.

### 5.6 Green belt development

In order to arrest wind borne fugitive dusts around the plant boundary with about 3-5 m wide green coverage based on locally available plant species. An area of 10-12% would be earmarked for development of greenbelt/greenery along the boundary, roads, and in open places available. The green belt developed would help to capture the fugitive emissions, attenuate the noise generation and improve the aesthetics. All open spaces, where tree plantation may not be possible, would be covered with shrubs and grass to prevent erosion of topsoil. Apart from green belt all around the site, also on the top of capped landfills greenery would be developed.

### 5.7 Environmental Monitoring

Monitoring for air quality parameters as per NAAQS 2009 and surface water quality would be carried out on a six monthly basis. The ground water quality monitoring carried out quarterly once. Programs would be conducted on a regular basis for monitoring safety and health protection of workers with specific reference to improving rag pickers quality of life, health concerns, etc.



# 6 PLANNING BRIEF

## 6.1 Planning Concept

The proposed project is an Integrated Municipal solid waste processing facility. As this is a fresh site basic facilities of infrastructure like admin building, processing area, Laboratory, Leachate treatment system Landfill vehicle parking, Staff vehicle parking, Panel room, Weigh bridge with cabin, Circulation area , internal roads etc. will be developed at the site .Transportation of Solid waste will be carried out through existing road network around the site.

## 6.2 Assessment of Infrastructure Demand (Physical &Social)

Key infrastructure such as hospitals, schools, bank, places of worship and social/ community facilities such as park, market, playground etc. education, health care and community development are available in Rewari. Internal roads, canteen, office, laboratory and parking facilities will be provided at the site. Temporary shelters will be provided to workers.

## 6.3 Amenities/ Facilities

Basic Amenities like public transport, water supply, telecommunications, educational institutions, hospitals etc. are available in Rewari.

The following facilities/amenities will be extended by the proposed project:

- Arrangements for safe and healthy working conditions & temporary rest shelters
- Provision of drinking water
- Provision of PPE
- First-aid facilities and health check-up camps for the workers
- Conducting medical camps for workers and nearby villagers at regular interval
- Provision of firefighting system

# 7 PROPOSED INFRASTRUCTURE

In addition to the landfill area, the site shall be provided with the following infrastructure

K. Waste reception facilities

L. Haul roads

M. Weigh bridge

N. Site office

O. Top soil storage

P. Support services such as electricity, water supply telephones etc

Q. Site security

R. Vehicles and equipment

S. Vehicle and equipment maintenance workshops

**A. Waste Reception Facilities**

The waste reception facilities shall comprise of the following

- An approach road to permit two way traffic, metalled and of adequate length to permit the queuing of vehicles
- Site notice board displaying license conditions, hours of operation and site regulations
- Secure and lockable gates at the entrance to the site.
- Cattle grid at the entrance to the waste reception area
- A weigh bridge of 20 ton capacity capable of weighing 20 -25 vehicles per hour
- Weigh booking office with all amenities and preferably computer logging facilities
- By pass lane for non-waste vehicles and emergency services
- Site administration office for site management with all support services
- Amenity block with dining room, toilets and washing facilities
- Small testing laboratory with first aid facilities
- Designated car park area
- Adequate store room
- Work shop for the first line on-site maintenance with all spares and support services
- Adequate site lighting covering all traffic routes

**B. Haul Roads**

The entire stretch of access road shall be upgraded / paved to a minimum of 8 m width (for two way traffic). All the primary haul roads from the public high way to the waste reception area and the landfill operational area shall be treated as permanent roads and should be constructed as per the standards.

The secondary arterial roads and temporary roads within the site can be of lesser standards, as the locations of these roads will be changing, following the landfill development.

**C. Support services**

The entire area of waste reception area and landfill site shall be provided with electricity and backup generators, potable water supply, communication facilities such as phones and efficient surface water drainage. The exact requirements of all these facilities shall be worked out during the detailed engineering phase of the project, before execution.

**D. Site security**

Security to the whole of landfill area shall be provided for all 24 hours the day. A compound wall all-round the site shall be constructed to provide integrity to the site and also serve as noise barrier to the adjoining areas. The wall can be of masonry or any other suitable material / rigid fence. As unauthorized access to the site may pose significant health and safety risks, warning notices and access control shall be provided at the following locations of the site.

- Plant and equipment compounds
- Waste receipt point
- Leachate and Land fill gas collection and treatment locations and
- Parts of site undergoing construction Vehicles and Equipment

The vehicle and equipment envisaged for the plant operations are as listed below. The number of pumps required shall be estimated as per the pumping needs of the facility operator.

- Weigh Bridge
- Tracked Bulldozer
- Tracked Loading Shovel
- Tracked Backhoe / loader
- Grader
- Compactor
- Dump Truck
- Tractor and Bowser / Sweeper

- Van / Pick up
- Pumps

In addition to the above, adequate firefighting equipment shall also be installed to meet the unforeseen fire accident

**E. Vehicle and equipment maintenance and spares**

In keeping with good working practice, regular machinery inspections shall be undertaken on weekly basis and preventive maintenance should be practiced. Workshop facilities will be provided on site, for routine maintenance and servicing as required. Sufficient holding of spare parts should be maintained, to keep each landfill facility operational on a continuous basis.

## 7.1 Green Belt

Around 33 % of the total project area i.e. 6.2 acres (19 acres) of land will be developed as green belt. The green belt will be developed considering the native species and CPCB guidelines will be followed

## 7.2 Connectivity (Road/Rail/Waterways)

SH 20 will be used for transportation of MSW; the site boundary is approximately 500 meters from the highway.

## 7.3 Drinking Water Management

During operational phase the water for domestic purpose to the tune of 13.5 KLD will be sourced from Ground water/ Municipal water supply. Water requirement for other than domestic purposes i.e. 66.5 KLD will be sourced from treated waste water by Municipal co-operation, Rewari. During construction phase 8 KLD water will be required will be supplied by Municipal Corporation of Rewari.

## 7.4 Solid and Industrial Waste Management

The solid waste from Rewari will consists of three main constituents i.e. compostable, recyclable and miscellaneous. Compostable and recyclable wastes are very valuable so far as the composting is concerned, while the miscellaneous waste will be disposed off into landfill. The municipal solid wastes generated during operation phase will consist

of papers, cartons, Thermocol, plastics, polythene bags, Glass, etc. Solid waste will be generated from households, restaurants, and markets located in Rewari. The quantity of solid wastes generated will be approximately 197 ton/ day in 2017 and it will reach upto 283 ton/day by year 2035. Life of landfill will be twenty years. Biodegradable waste will be treated at camp site. The recyclable waste will be sold to recyclers.

### 7.5 Hazardous Waste Generation

Generated Spent oil from D.G sets (category 5.1) will be collected and handed over to authorized recyclers. Approximately 300 liter/year used oil will be generated.

### 7.6 Power Requirement and Supply Source

1 D.G set of 250 KVA will be utilized for power during construction phase. During operation phase 250KW power will be taken from of State Electricity Board and for emergency 1 D.G set of 250 KVA will be utilized as backup.



# 8 REHABILITATION AND RESETTLEMTN PLAN

Not applicable as this is an existing site and the ownership of the land is with Municipal Corporation Rewari.

# 9 PROJECT SCHEDULE AND COST

## 9.1 Project Cost

Total capital cost is INR 65 Cores and operation and maintenance cost is proposed to be 6% of Capital Cost i.e. approximately 3.9 Crores.

## 9.2 Likely Date of Start of Construction

The construction work will begin after obtaining statutory clearance from Ministry of Environment Forest and Climate Change and Consent from State Pollution Control Board.

## 9.3 EMP Budget

*Table 9-1: EMP Budget*

| Sr. No. | Particulars | Budget in lacs |
|---|---|---|
| 1. | Air Pollution Control | 8.00 |
| 2. | Water Pollution Control | 8.00 |
| 3. | Noise Pollution Control | 2.00 |
| 4. | Environment Monitoring | 12.00 |
| 5. | Occupation | 4.00 |
| 6. | Green Belt | 22.00 |
| **Total** | | **56.00** |

## 9.4 Budgetary Break up for Labour

*Table 9-2: Budgetary Break up for Labour*

| Sr. No. | Activity | Budget in lacs/Year |
|---|---|---|
| 1. | Safe Drinking Water | 0.50 |
| 2. | Urinal , Latrine and Bathrooms | 1.00 |
| 3. | PPE and Safety equipment will be Provided | 0.20 |
| 4. | First Aid facility | 0.20 |
| 5. | Regular Health checkup and provision of medicine | 0.30 |
| 6. | Educational and awareness programme for safety measures & Recreational program | 0.30 |
| **Total** | | **2.5** |

## 9.5 Budget for CSR activities

*Table 9-3: Budgetary for CSR Activities*

| Sr. No. | Activity | Capital cost in lacs/Year | Recurring Cost in Lacs |
|---|---|---|---|
| 1. | Education welfare: scholarship for students in nearby govt. school | 2.5 | 1.2 |
| 2. | Medical/ Health Camp: organize health check-up camps | 3.0 | 0.8 |
| 3. | Area development: provide assistance to nearby village panchayat for area development. | 5.0 | -- |
| **Total** | | **10.5** | **2.0** |

# 10 ANALYSIS OF PROPOSAL (RECOMMENDATION)

## 10.1 Social benefits Better living conditions

No open dumping will be carried out. This will reduce the chances of air, water & soil contamination and also will reduce emission odour. This will improve the living standard of society & will provide safe & hygienic surroundings.

**Improved health conditions**

Efficient waste collection & disposal of waste will made the living & health condition in the area better. Littering waste creates nuisance due to unpleasant view and emission of mal odour. It also provides ground for breeding of mosquitoes & disease causing pathogens. Solid waste management project will ensure timely collection of waste, efficient treatment & disposal in scientific & environment friendly manner. This will reduce the chances of spread of diseases. Project will improve the health condition of the area

**Enhancement of aesthetic value of area**

Cattles & other stray animals roam around the existing open dump site. This creates disturbance to society. Scavenging birds hover above the open dump site which may pose significant threat to aircrafts. Open dumping of waste also creates an unpleasant view and leads to emission of mal odour.

A scientific technology of waste management is developed. This will reduce bird menace. An entry gate & wired fence will be provided around the project site to prevent entry of stray animals & cattle. A thick green belt will also be developed around project site. The project will lead to improvement in aesthetic value of the area.

**Direct & indirect employment opportunities**

Development of project will provide employment opportunity to local skilled, unskilled & semi-skilled people during both construction & operation phase.

Indirect employment may also generate during construction phase of project. Tea stalls, and food joints may come up around project site for workers.

## 10.2 Economic Benefits Revenue from waste

Waste is material that is being rejected as it has no use for the people. Project comprises of collection of waste, waste processing & safe disposal. From waste following products will be recovered, which can generate revenue:

1) Recyclables
2) Compost
3) Inert waste as filler material.

**Improved economic status**

Project will generate both direct & indirect employment. Local people will be preferred for giving employment. This will improve economic status of the area. Emigration of local people to other parts of state/country due to unavailability of employment will be reduced.

**Conservation of natural resource**

Compost produced is rich in nutrient & serve as organic manure. Application of this manure saves fertilizers. This is cost effective for farmers as it is cheaper than fertilizers& also prevents soil salinity & Eutrophication.

## 10.3 Environmental Benefits

**Prevention of air, water & soil contamination**

No open dumping of waste will be carried out, which leads to soil, water & air pollution. Also littering waste is ground for breeding mosquitoes, which become agents of various deadly diseases.

This project involves scientific management of waste which will prevent environmental pollution & spread of disease.

**Development of green belt**

Green belt developed along with lawns & green buffer at site. This will help in attenuating dust & noise level at site.