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**Executive Summary of**  
**ENVIRONMENTAL IMPACT ASSESSMENT**

For  
Common Municipality Solid Waste Management  
Facility, Chikkanagamangala, Bengaluru,  
Karnataka

Submitted to  
Karnataka Urban Infrastructure Development  
and Finance Corporation

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# EXECUTIVE SUMMARY

## 1. INTRODUCTION

To sustainably manage the huge quantity of municipal waste, Bruhat Bangalore Mahanagara Palike (BBMP), who is the project proponent, has planned to establish Common Municipal Solid Waste Management Facilities (CMSWMFs) in and around Bengaluru. One of the proposed CMSWMFs is being developed at Village Chikkanagamangala, Bengaluru. The Government of Karnataka has appointed Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC) as the Nodal Agency to facilitate implementation of these waste management facilities in the BBMP area. KUIDFC engaged AECOM India Private Limited to carry out an Environmental Impact Assessment (EIA) study for the upcoming CMSWMF at village Chikkanagamangala.

The project has been categorized under Item 7(i) B as per Schedule of EIA Notification dated September 14, 2006. The proposed site is located at Survey. No. 31, Chiknagamangala Village, Sarjapur Hobli, Anekal Taluk, at N 12° 51' 32.21" and E 77° 41' 08.96". The proposed facility will handle and process about 500 TPD of municipal solid waste and will be spread over an area of 15.3 acre. The project components include the following:

- Weighbridge with control room
- Tipping floor for receiving mixed waste
- Pre-sorting / Segregation area (Handpicking and mechanical sorting)
- Closed windrow composting area
- Dry waste processing area (for recyclables - shredding, baling and stacking)
- Sanitary Landfill for inert waste
- Leachate collection system and Leachate Treatment Plant
- Belt conveyance systems for material transfer,
- Rainwater harvesting pond and sumps,
- Final Compost bagging machine,
- Vehicle parking, vehicle washing and maintenance,
- Transformer and DG set area,
- Green belt along the facility boundary,
- Internal roads,
- Security Gate

The Salient features of the project are presented below in **Table 1**.

**Table-1: Salient Features of the project**

Sl. No.	Item	Details
1	Project Type	Common Municipal Solid Waste Management Facility
2	Proposed waste treatment technology	Windrow composting in a closed shed Sanitary Landfill site for inert waste
3	Design Period	Designed for 10 years

Sl. No.	Item	Details
4	Water requirement	Approximately 49 KLD
5	Waste water generation	Approximately 114 KLD (completely utilized within the site)
6	Source of water	Construction water will be sourced from approved tankers (grey water) and bore wells. Water during operation phase will be sourced from bore wells, recycling of treated waste water and rain water harvesting.
7	Power requirement	1000 kilo-watt (kW) electrical connection which will be obtained from Bangalore Electricity Supply Company Limited (BESCOM). A DG set of 525 kilo volt amps (KVA) capacity is proposed (as a backup).
8	Project Accessibility	Doddanagamangala-Huskur road provides direct access to the project site. The site is at a distance of approximately 1.85 km from the Varanasi-Kanyakumari National Highway (NH-7).
9	Nearest Railway Station	Bengaluru Railway Station – 25km (Northwest)
10	Nearest Airport	HAL Airport – 10.2km (North) Kempegowda International Airport – 38km (North)
11	Nearest eco-sensitive area	The Bannerghatta National Park is at a distance of about 13km (Southwest)

## 2. DESCRIPTION OF THE ENVIRONMENT

The baseline assessment is based on project site assessment and reconnaissance survey of the study area of 10 km radius around the boundary of the site. Baseline data is also supplemented by secondary information collected from various literatures, documents, report of previous surveys and census data of the study area. Primary environmental baseline data was collected during mid December 2014 to mid January 2015. Secondary data and information on various environment aspects like site setting and topography, hydrogeology, hydrology, drainage pattern, meteorology, geology, ecology, land use and socio economic aspects were collected from various institutions, government offices and literatures etc.

The baseline ambient air quality, water quality, soil quality, noise level and traffic density in the study area is based on the monitoring conducted. The baseline sampling and monitoring was done in compliance with applicable standards as prescribed by Central Pollution Control Board (CPCB). Information on the analysis of environmental attributes is presented in the EIA report.

**Table-2: Baseline Environmental Status**

Physiography	Bengaluru lies on top of the south Karnataka Plateau (Mysore Plateau) and its topology is almost flat with the highest point being at Doddabettahalli (954 m above Mean Sea Level). The Bangalore South district can be divided into rocky upland, plateau & flat topped hills at a general elevation of about 900 m above mean sea level (amsl) with its major part sloping towards south and south east forming Padi plains interspersed with hills all along the western part.
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	The project site is primarily a flat, barren land gently sloping from south to north. It has an average elevation of about 900 m.
Landuse	Approximately 38.27% of the total study area (area within 10 km radius) is under agricultural land, 24.10 % is built up area, 20.68% land under low vegetation, 9.94% land under dense vegetation and 7.02% is waterbodies. At the project site, built-up structures will be spread over 35 % of the total site area, greenbelt will cover about 36% of the site area and 29% will be open spaces.
Drainage	The major rivers of Bangalore Urban district are Arkavathi, South Pennar and Vrishabharathi. The Vrishabhavati is the only minor river which originates in Bengaluru City at Basavanagudi and flows in the Bangalore Urban district before joining the Arkavati River near Muduvadidurga.
Climate and Meteorology	Bengaluru enjoys a moderate climate with distinct wet and dry seasons throughout the year, with temperatures ranging between 16-33°C, with an average of 24°C. The coolest month is December with an average low temperature of 15.4° C and the hottest month is April with an average high temperature of 32.8°C. The summer heat is moderated by fairly frequent thunderstorms and squalls and causes power outages and local flooding. It receives adequate rainfall of about 860 mm from the northeast monsoon as well as the southwest monsoon. The wettest months are August, September and October.
Ambient Air Quality	Ambient Air Quality Monitoring (AAQM) stations were set up at 6 locations in downwind, cross wind and upwind direction of the proposed project location. The average PM-10 and PM2.5 concentration recorded at all the sampling locations were within the prescribed CPCB limits of 100µg/m <sup>3</sup> and 60 µg/m <sup>3</sup> respectively. The recorded values for PM 10 and PM2.5 were in the range of 45.5- 56.9µg/m <sup>3</sup> and 13.3- 16.6 µg/m <sup>3</sup> respectively. The concentrations of sulphur dioxide and NOx in the region were observed to be in the range of 6.2µg/m <sup>3</sup> – 8.5µg/m <sup>3</sup> and 12.1 -13.4µg/m <sup>3</sup> . The carbon monoxide concentrations were observed to be below NAAQS limits of 2000µg/m <sup>3</sup> at all the sampling locations.
Water Resources	Six groundwater samples and two surface water samples were collected from the study area for analysis of existing water quality in the area. The Total Hardness values exceed the desirable limit of 300 mg/l at 4 locations indicating presence of hard water. The presence of Total coliforms in the ground water samples indicates the potential presence of disease causing organisms. Total Dissolved Solids were observed to be high, exceeding the desirable limits of 500mg/l at 4 of the locations.
Soil Quality	The analytical results indicate that the soil texture in the study area is brownish silty sand with acidic to neutral pH. The porosity of the soil samples ranged from 33 - 43% and the electrical conductivity was observed to range between 0.02- 0.05 mS/cm. The soil samples have organic content ranging from 2% to 6% with Sodium Adsorption Ratio between 0.76 – 5.44.
Ecology	According to the Champion and Seth Classification of Indian Forests, the natural vegetation of the survey area represents tropical thorn and scrub forest. The ecological monitoring reveals that 66 species of plants belonging to 32 families were observed, of which species belonging to families-Fabaceae, Poaceae, and Malvaceae were the dominating species. There is no reserve forest, national park and wildlife sanctuary within the 10km radius of the site. The assessment of mammals was conducted by direct sightseeing and by using indirect techniques by establishing 10 × 100 m transects after spotting of fecal matter etc. A total 12 species of mammals were reported for the project stretch.

	The avian fauna was determined as per standard method by Sutherland (1996), wherein 10 minute observation was followed at each point during early morning hours (6.00 to 10.00 AM), bird calls, nesting etc and also on the basis of secondary data collection. A total of 102 species of birds were recorded within the habitat ranges from open agriculture field, scrub and semi-arid forest. Details have been provided in the EIA report.
Social Environment	The project comes under industrial area marked by BDA in their 2015 Master Plan. The project area is positioned in village Chikkanagamangala, in taluk Bengaluru South of Bengaluru Urban District of the State of Karnataka. The project site boundary is spread over 15.3 acre of land. There are about 8 villages falling within 2 km radius distance of project site.

### 3. ANTICIPATED ENVIRONMENTAL IMPACTS

The potential impacts likely to cause during construction phase and operation phase due to various developmental activities and operation phase while handling and management of municipal waste have been identified and discussed in the **Table 3** below.

**Table-3: Anticipated environmental and social impacts during construction and operation phase**

S.No	Parameter	Construction Phase	Operation Phase
1.	Air Quality	Dust emissions from site preparation, excavation, and material handling, fuel combustion, and vehicular movement.	Particulate emissions during waste tipping, windrows compost plant, RDF storage area, material handling, landfilling and daily soil cover activities, vehicular movement within the plant premises, truck movements on daily basis for carrying waste.
2.	Noise Quality	Noise generation from construction activities, construction equipment and vehicular movement.	Noise from facility operation such as shredders, rotators, compactors, balers and vehicular movement.
3.	Water Quality	Surface runoff from project site. Oil/fuel and waste spills.	Oil/fuel and waste spills. Potential Leachate contamination.
4.	Landuse and Aesthetics	Land development. Unaesthetic visual impact.	Permanent change in land use.
5.	Topography and Geology	Increase in soil erosion due to site clearance and development	Facility development
6.	Ecology	Habitat disturbance during construction activity	Change in landscape and aesthetics
7.	Soil Quality	Construction activity leading to topsoil removal and erosion. Improper material handling may lead to spilling of waste, chemicals, solvents, etc	Improper material handling may lead to spilling of waste, chemicals, solvents and leachate percolation. Improper storage of solid wastes. Fuel and material spills.
8.	Ground Water usage	Ground water will be used. Reduced ground water recharge surface area.	Ground water may be used after seeking appropriate approvals from concerned regulatory bodies
9.	Traffic Pattern	Haul Truck/construction vehicle and machinery movement	Slight increase in traffic on access road and NH-7 due to daily movement of

			closed compacted trucks.
10.	Socio-economy	<p>Increased job opportunity for locals.</p> <p>Occupation health issues to workers.</p> <p>Temporary discomfort to community.</p> <p>Accident potential.</p>	<p>Increased job opportunity for locals.</p> <p>Increased business prospects.</p> <p>Better management and disposal of city waste.</p>

#### 4. ENVIRONMENTAL MANAGEMENT PLAN

The EMP for the proposed Common Municipal Solid Waste Management Facility (CMSWMF) at Chikkanagamangala has been prepared to ensure that project implementation is carried out by taking appropriate mitigation measures to minimize impacts on the environment during construction and operational phase. A short summary of the EMP is listed below.

**Table-4: Environment and Social Management plan/ mitigation measures during construction and operation phase**

Sl.No.	Component	Suggested Management Plan/ Mitigation Measures
<b>CONSTRUCTION PHASE</b>		
1.	Ambient Air Quality	<ul style="list-style-type: none"> <li>• The use of DG set to be limited for backup during power failure;</li> <li>• Sprinkling of water on earthworks, material haulage and transportation routes in the project area will be carried out at least twice a day.</li> <li>• Storage and handling of construction material, excavated top soil and debris shall be carried out carefully;</li> <li>• Transportation of raw materials like soil and fine aggregates in covered vehicles to prevent fugitive emissions;</li> <li>• Vehicle speed to be restricted to 25 km/h on unpaved roads;</li> <li>• Proper maintenance of machines and vehicles shall be undertaken;</li> <li>• Operate all equipment within specified design parameters. Ensure machinery is turned off when not in use.</li> </ul>
2.	Water Resources and Quality	<ul style="list-style-type: none"> <li>• Awareness on optimal water consumption shall be provided to the labourers;</li> <li>• Concrete structures shall be sprayed with water to allow curing and reduce flowing away. After curing, the concrete structures shall be painted with curing chemical to reduce further dependence of water for curing;</li> <li>• Adequate number of toilets shall be provided onsite with soak pit and septic tanks for disposal of sewage;</li> <li>• The workers shall be strictly instructed and informed to avoid random disposal of wastewater;</li> <li>• Garland drain shall be constructed to collect runoff water.</li> </ul>
3.	Soil Quality and Resources	<ul style="list-style-type: none"> <li>• Topsoil (upper 30 cm) shall be removed and stored prior to commencement of bulk earthwork and reused later for landscaping</li> <li>• The recyclable items like metal and plastic shall be stored separately and sent to recyclable industry</li> <li>• Potentially hazardous waste shall be segregated from non-hazardous construction site debris</li> </ul>
4.	Traffic and transport	<ul style="list-style-type: none"> <li>• Traffic and heavy machinery movement schedule will be communicated clearly to avoid disturbance to local community;</li> <li>• Proper signage around the construction areas to be put up to facilitate smooth traffic movement;</li> <li>• Dedicated entry and exit routes from the construction site will be provided for the construction vehicles;</li> <li>• Dedicated parking area for project vehicles;</li> <li>• Restricting speed of vehicles to 25 km/hr.</li> </ul>
5.	Ambient Noise Quality	<ul style="list-style-type: none"> <li>• The construction areas shall be provided with sheet barriers or temporary walls along the boundary close to any habitations;</li> <li>• Rubber padding shall be provided in the construction machinery for vibration control;</li> <li>• Acoustic enclosures and noise barriers will be provided in areas of high noise generating sources;</li> <li>• High noise generating activity shall not be permitted during night hours.</li> </ul>
6.	Socio-	<ul style="list-style-type: none"> <li>• No noise generating activity will be permitted during night hours. The greenbelt planned in the periphery of the proposed project</li> </ul>

Sl.No.	Component	Suggested Management Plan/ Mitigation Measures
	economics	<p>will limit noise reaching outside the premises;</p> <ul style="list-style-type: none"> <li>• Adequate drainage shall be provided so that water does not become stagnant around the site.</li> </ul>
7.	Site Security	<ul style="list-style-type: none"> <li>• No person will be allowed to enter the construction site without a gate pass. Security Personnel shall be appointed to restrict entry of unwanted people to the site round the clock. Proper signages will be provided around construction site. Proper fencing will be done to avoid any cattle entering the construction site.</li> </ul>
8.	Occupational Health and Safety	<ul style="list-style-type: none"> <li>• Good housekeeping practices shall be followed;</li> <li>• Manual transfer of heavy loads will be minimized;</li> <li>• Measures such as job rotations and stretch breaks to be adopted;</li> <li>• Proper signage to be provided around construction site;</li> <li>• Use of Personal Protection Equipment (PPEs) to be mandated at work site;</li> <li>• Workers to be provided with health and safety training;</li> <li>• First aid and essential medical services to be provided at site.</li> </ul>
9.	Ecology	<ul style="list-style-type: none"> <li>• Project to ensure that no activity is undertaken in the reserve forest and workers are clearly instructed</li> </ul>
<b>OPERATION PHASE</b>		
10.	Odour control	<ul style="list-style-type: none"> <li>• An odour control system is also proposed to be set up over the compost sheds, which will comprise of ventilation ducts and exhaust fans;</li> <li>• A set of biofilters will be provided for odour control over areas such as waste reception pit, pre-sorting area, windrow composting pads and curing sheds and screening and packing;</li> <li>• Turning of compost will be done twice a week to ensure aerobic conditions;</li> <li>• Use of windrow turning equipment that is specially designed to minimize air emissions;</li> <li>• Moisture content of the windrow will be maintained at 40-60% and temperature will be maintained at 60-70 °C. The leachate generated will be re-circulated onto to the compost pads for this purpose;</li> <li>• Closed shed for Compost Plant is planned to minimise generation of leachate during rainy season and containment of any odour</li> <li>• Green belt of 5m width in 3 rows around the periphery of the Site.</li> </ul>
11.	Air Quality	<ul style="list-style-type: none"> <li>• Stack heights for DG sets to be maintained as per CPCB/MoEF norms;</li> <li>• Covered transportation of segregated waste and paving the disposal routes for dust control;</li> </ul>
12.	Potential Fire hazard in windrow pads	<ul style="list-style-type: none"> <li>• Maintenance of the moisture content will be done to control windrow compost temperature and prevent fires.</li> <li>• Properly designed fire suppression system with sufficient water capacity and at sufficient pressures;</li> <li>• Portable fire extinguishers and fire control equipment in proper working condition, will be installed at the facility</li> </ul>

Sl.No.	Component	Suggested Management Plan/ Mitigation Measures
13.	Greenhouse effect	<ul style="list-style-type: none"> <li>Aerobic environment will be maintained with proper moisture content to encourage aerobic decomposition of the organics and prevent production of methane.</li> </ul>
14.	Ambient Noise Quality	<ul style="list-style-type: none"> <li>Proper maintenance of machineries to be carried out. High noise activities shall not be permitted during night hours.</li> <li>Acoustic enclosures shall be provided for all noise producing equipments such as shredders, DG sets generator etc.</li> <li>Working hours of the workers employed in high noise areas will be rotated.</li> <li>Earplugs/muffs, or other hearing protective wear will be provided to those working very close to the noise generating machinery.</li> <li>Provision of peripheral green belt will also attenuate noise</li> </ul>
15.	Water Resources and Quality	<ul style="list-style-type: none"> <li>Provisions for rainwater harvesting from rooftop, paved areas and landscaping areas;</li> <li>The domestic waste water will be sent to septic tank followed by soak pit;</li> <li>Storm water Management Plan to be implemented;</li> <li>Runoff from the tipping areas will be collected separately and managed as leachate, conveyed via leachate collection drain upto leachate collection sump.</li> </ul>
16.	Soil Quality	<ul style="list-style-type: none"> <li>Windrow areas will be provided with an impermeable concrete base. Installation and maintaining effective run-off controls, Drip trays to be used during vehicular/equipment maintenance and during refuelling operations.</li> </ul>
17.	Ecology	<ul style="list-style-type: none"> <li>A green belt will be developed along the periphery of the proposed project;</li> <li>Native species and healthy seedlings will be planted at intervals of 4 × 4-m in 60 × 60 × 60-cm size pits filled with topsoil;</li> <li>Attempts will be made to ensure that all open spaces, where tree plantation may not possible, will be covered with shrubs and grass to prevent erosion of topsoil.</li> </ul>
18.	Traffic and Transport	<ul style="list-style-type: none"> <li>A well defined schedule and route will be followed by the waste carrying trucks;</li> <li>Proper signages will be put up near the proposed facility giving route directions;</li> <li>No parking will be allowed outside the facility premises;</li> <li>Vehicles will be parked in the designated slots within the premises;</li> <li>Entry and exit routes from the premises will be clearly marked;</li> <li>Adequate lighting and reflective boards will be put up for night time safety.</li> </ul>
19.	Socio-economic aspect	<ul style="list-style-type: none"> <li>Maximum efforts will be made to provide job opportunities to local residents during construction and operation phase.</li> <li>Training to Rag Pickers and Workers;</li> <li>Awareness campaigns for surrounding villages.</li> </ul>

For effective implementation of environmental mitigation measures and management plans, an Environmental Management Cell (EMC) will be established for the project. The proposed structure of this Cell has been presented in the EIA report. During the construction phase, this Cell will include staff representatives from BBMP, KUIDFC and KRIDL and from the civil contractor company hired by KRIDL undertaking construction work at site. During the plant operation phase, the Environment and Social Management Cell will have representatives from BBMP and the private plant operator agency.

A significant portion of the project activities will be undertaken by contractors. BBMP will ensure that the contractual documentation with the private Operator Agency emphasizes on compliance to all relevant national and state HSE legal requirements, project specific Environment Management Plan and Monitoring Plan.

The overall management of the project will be undertaken through coordination between BBMP and project site team.

A **monitoring programme/plan** has been developed for each environmental attributes like air, water, noise, soil, etc. with monitoring parameters, location, frequency along with who is responsible to implement environment management plan for both construction activities during construction phase and for Common Solid Waste Management Facility during operation phase.

## 5. RISK ASSESSMENT

As part of the Common Municipal Solid Waste Management project, it is important to identify associated safety hazards and carry out a basic risk assessment. The potential hazards associated with operations of a CMSWMF may be categories as below:

- Physical hazards
  - Fire hazard in windrow composting
  - Heavy equipment and machinery for waste tipping
  - Turning windrows
  - Pre-screening, processing of waste for RDF
  - Rough sharp waste items
  - Trip Hazards due to pipes/ hoses
  - Overhead Transmission Lines
- Chemical hazards
  - Confined spaces/ covered compost pads
  - Inhalation/ ingestion/ skin contact
  - Chemical reactions within the stored mixed waste or waste windrow
- Biological hazards
  - Allergies from pathogen and airborne dust
  - Pests/ bugs at site

## 6. DISASTER MANAGEMENT PLAN

Disruption to the proposed project can be caused due to occurrence of frequent hazards like fires, electrical accidents and less frequent hazards like earthquakes, dust storm, and chemical spill or explosions.

Emergency prevention through good design, operation, maintenance and inspection are essential to reduce the probability of occurrence and consequential effect of such eventualities. However, it is not possible to totally eliminate such eventualities and random failures of equipment or human errors, omissions and unsafe acts cannot be ruled out. An essential part of major hazard control has therefore, to be concerned with mitigating the effects of such Emergency and restoration of normalcy at the earliest.

The overall objective of a disaster management plan is to make use of the combined resources at the site and outside services to

- Localize the emergency and if possible eliminate it;
- Minimize the effects of the accident on people and property;
- To rescue and provide medical treatment of casualties;
- Safeguard other people;
- Evacuate people to safe areas;
- Informing and collaborating with statutory authorities;
- Provide authoritative information to news media;
- Initially contain and ultimately bring the incident under control;
- Preserve relevant records and equipment for the subsequent enquiry into the cause and circumstances of the emergency;
- Investigating and taking steps to prevent reoccurrence

## 7. PROJECT BENEFITS

The proposed project designed to handle and manage municipal waste in an environmentally sustainable manner with an emphasis on maximizing resource use efficiency. Apart from a few insignificant impacts, there are also several project benefits due to commissioning of project as enlisted below.

- Compliance to the Municipal Solid Waste (Handling and Management) Rules, 2000 and amendments thereof
- Reduction in Greenhouse Gas Emissions
- Improved sanitation in the city
- Energy Conservation
- Usable Compost Product
- Supply of Refuse Derived Fuel (RDF)
- Economic Benefits to Local Municipality
- Increase in Business Opportunities

On commissioning, the project will contribute in improving sanitation conditions of the city, in compliance with the Municipal Solid Waste (Handling and Management) Rules, 2000 and amendments thereof.