



# Legacy Waste Remediation in Mangaluru

Mangaluru City Corporation



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# Legacy Waste Management

- 1 KEY FACTORS
- 2 KEY EXECUTION CHALLENGES
- 3 KEY EXECUTION STRATEGY
- 4 MODEL FOR EXECUTION
- 5 PROJECT COSTING
- 6 SAFEGUARDS
- 7 USPs OF THE PROJECT
- 8 CONTROLLING VARIABLE COST

## LWR - Accelerating Factors

**The Mangaluru Legacy Waste Remediation project was accelerated by multiple factors from natural disaster, concerned citizen group, to judiciary.**

1. Landfill location selected many years ago in disadvantageous terrain
2. Heavy rainfall in August 2019 leading to a dumpsite landslide
3. Damage of around 17 acres - 24 houses, 2 small temples and commercial crops like areca nut and coconut.
4. WP 9367/2020 filed in Honourable High Court – compensation + remediation
5. Location of river stream beneath the slid area





## LWR - Accelerating Factors

### LADFILL SLIDE

Location : Pachanady & Kudupu Village  
Area under MCC : 77.93 Acres  
Capacity : 200 TPD  
Presently receiving : 350 TPD (MCC) + 40 TPD (2 ULB)  
Landfill Garbage Slide : Date: 07-08-2019  
Area affected : Approx. 17 Acres  
Present Facility Provided : 27 families shifted to Karnataka Housing Board Apartment at Kulashekara  
Properties Affected : Arecanut plantations, Coconut plantations, Tanks, open wells, Houses, Nagabhana, Daivagudi temple

### DAMAGES DUE TO GARBAGE LANDSLIDE

Sl. No.	Type of Damages	Details
1	Houses	4 Houses Completely Damaged 2 Houses under the Slided Garbage
2	Horticultural Corps	Field verification Report taken from Horticultural Department
3	Forest Trees	Forest Department Verification report on trees damage
4	Temples & Naga Bana	2 No's of Naga Bana and 2 No's of Daivasthana Completely Damaged
5	Shifted Families	Due to the garbage near the area and other health related issues, 23 families have been shifted to Karnataka Housing Board Apartment at Kulashekara, Mangaluru











## Key Execution Challenges

- Undulating terrain with variation in height upto 30 mtrs
- Availability of land to set up any kind of infrastructure
- Limited working days
- High Moisture content in the Waste
- Deployment of ideal machinery
- Possibility of further sliding
- RDF disposal
- Leachate Management



## Guideline Criteria

### “Bio- Remediation and Bio-Mining” – Why?

1. Suitable for Old Legacy Waste
2. Land is not occupied, rather it gets free over time
3. Maximum segregation and disposal & Resource Recovery
4. Most Economical Option
5. Reduces Environmental Hazards
6. Same set of processing infrastructure can be used in multiple sites or uses
7. Shortest possible tenure for the project





# Project Planning

- Cost Benefit Analysis of three options
  - Complete Outsourcing Model
  - Execution by MCC with Rented Equipment and Material handling vehicles
  - Controlled Outsourcing Model
- Location specific challenges and issues
- Financial feasibility and long term sustainability
- Time constraints



# Project Planning

<b>A</b>	<b>QUANTITY OF WASTE USED FOR CALCULATIONS</b>		
a	Total quantity of material to be processed	11,00,000	CuM
b	Assumed Bulk density of material	0.80	Tonne/CuM
c	Total material to be processed (In Tonnes)	9,00,000	MT
<b>B</b>	<b>TENURE ASSUMED</b>		
a	Number of Years	4	Years
b	Number of months available for working in a year	5.75	month/ annum
c	Number of days per annum	26	Days / Month
d	No. of Working days for Staff	1440	days
e	No. of Working days for Labour	598	days
<b>C</b>	<b>MATERIAL PROCESSING TARGETS</b>		
a	Yearly target (Volume)	2,75,000	CuM / Annum
b	Yearly target	2,25,000	Tonnes/ Annum
c	Monthly Targets (Volume)	47,826.09	CuM / Month
d	Monthly Targets	39,130.43	Tonne/Month
e	Daily Targets	1,839.465	CuM/Day
f	RDF percentage	15%	Per tonne
g	Inert Material & Bio Soil	35%	Per tonne
		1,505.017	Tonne/Day





# Project Model - 1

## Turnkey Model

- Handover to one contractor for construction, installation and operation of the project.
  - Payment to the contractor on fixed time interval, based on milestones and deliveries.
  - No need to consider the capital costs.
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- In any situation that leads to a decision to part away with the contractor and in termination the contract, entire processing activity shall stop immediately.
  - At the end of the project, the contractors takes away with him all the plant and machinery.
  - Re-starting the project later is again time consuming and long drawn legal process.



## Project Model - 2

### Rental Mode on Service basis

- Multiple contractors are engaged for construction, installation and operation of the project.
  - Monthly rental payment of equipment and other machineries, civil construction cost.
  - Project Management and maintenance of all records.
  - There is no upfront investment.
- Disputes among different parties involved can hamper the process
  - Overhead of close and tight project management on all aspects, and operations.
  - All the revenue outflow is an expense, and no asset is created.





## Project Model - 3

### Hybrid

- Hybrid or controlled outsourcing model, where the entire Capital Cost of the project is borne by the City Corporation whereas the contractor is *responsible for supply, installation, and operation* of the project without any ownership.
- Contractor becomes a single point responsible for the delivery with no blame game for any delay or any other reasons.
- In case the contractor fails to provide satisfactory services; the authority can replace the contractor with a new one at a short period of time without big impact on the operation of the project.
- At the end of the project period asset is created, MCC is left with the ownership of the plant and complete infrastructure which can be utilized for processing fresh waste.



## Key Execution Strategy

- The ULB purchases necessary equipment and machinery having annual O&M contract with supplier.
- The plant and machinery will handed over to the contractor who will be engaged for providing the remediation services with all other operational vehicles, tools and consumables, including cost of fuel and utilities.
- Segregated material will be taken care by the Contractor, which includes, RDF, Bio- soil, and inert. The material recovery is estimated and accounted in the contract.
- The ULB owns and retains the plant and machinery to be used for processing of fresh waste in the future.





## Sourcing Risk Evaluation

- Lesser cost of Plant & Machinery, when separated from the tipping charges.
- Usually the the full cost of the Plant & Machinery is recovered in the tipping charges.
- Idle time of almost 50 percent in a year = high rent
- Having control over the quality of procurement
- Can avoid delays out of disputes/arbitrations with higher control



## Sourcing Risk Evaluation

### **Rental V/s Asset creation for MCC**

- From the breakup of the cost estimates and other bids, the cost of Plant & Machinery in rental mode would be much higher than purchase as Capital Asset.
- If the cost of Plant & Machinery is part of the tipping charges, by which it will be an asset of the contractor, the cost of the same is paid by MCC (as part of tipping charges), but the cost on MCC is a revenue expenditure, whereas in the model adopted by MCC is creation that too at a much lesser cost.



# Controlling Variable Cost

## CAPITAL COST TO MCC

1. Construction of Civil Structure at the Site required for the project – **NON VARIABLE ON QUANTITY OF WASTE**
2. Supply, Installation and Commissioning of Plant & Machinery - **NON VARIABLE ON QUANTITY OF WASTE**
3. Supply of IT/ MIS Tools for effective monitoring and reporting of project parameters and progress. – **NON VARIABLE ON QUANTITY OF WASTE**





## Controlling Variable Cost

### REVENUE EXPENDITURE TO MCC -

1. Providing Comprehensive 5-year AMC for the Plant and Machinery and other equipment as per the RFP – **NON VARIABLE ON QUANTITY OF WASTE**
2. Training and Capacity Building for 4 years – **NON VARIABLE ON QUANTITY OF WASTE**
3. Operation and Maintenance of the project including Material Handling, Mobilization of Staff & Labour, Supply of Consumables for Operation, RDF Disposal (or reuse & incineration), Inert Material & Bio-soil Disposal, using all required additional equipment / machinery and vehicles –**VARIABLE ON QUANTITY OF WASTE**



# Safeguards

1. Payments for Machinery is made only 50% at delivery.
  1. 10% after commissioning and
  2. 10% after 3 month of operations.
  3. 15% after 1 year of operations
  4. 10% after 2nd year of operations
  5. 5% retained till end of the project.
2. Payments for Operation is made based on progress and actual quantity of material processed.
3. Complete project is backed by IoT based automation to check quantities and all other parameters.
4. Stringent targets, methodology and execution process.
5. Third Party Inspections to check Plant and Machinery.
6. Continuous monitoring by PMC.



## Project O&M

O&M and preventive maintenance are periodically carried out to minimize breakdown of machineries resulting in optimizing the productivity.

Following steps will be taken to minimize the downtime of machineries.

- 1) Comprehensive AMC agreement of all machines
- 2) Accessories and spare parts which may require frequent replacement will be stored at site
- 3) Machinery manufacturers will be asked to train the on site mechanic and machine operators, both for repair/replacements and preventive maintenance.
- 4) Quality machines will be purchased from reputed manufacturers
- 5) Since, only 150 working days/annum is considered in the RFP, there will be ample time for maintenance.





## Abstract of Costs - EST

Sl. No.	Cost Component	In INR (Lakhs)
1.	Fixed Cost in Civil & IT/MIS	590.00
2.	Total Fixed Cost in Plant and Machinery	1,326.08
<b>Total Fixed Cost - (A)</b>		<b>1,916.08</b>
3.	Material Handling Vehicle Expenses	2,436.85
4.	Manpower Cost - Staff	322.56
5.	Manpower Cost - Labourers	114.08
6.	Consumables	553.15
7.	Comprehensive 5-year AMC for Plant and Machineries	448.00
8.	Cost of RDF Disposal	607.50
9.	Operating Cost of Inert Material and Bio Soil Disposal	945.00
10.	Training and Capacity Building - 4 Years	30.00
<b>Total Operation Cost - (B)</b>		<b>5,457.14</b>
<b>Total Cost (A+B)</b>		<b>7,373.22</b>
<b>Cost of Recyclable Material @3% of 900,000 tonnes for Rs.8500/Ton</b>		<b>-2,295.00</b>
<b>Total Cost (A+B-C)</b>		<b>5,078.22</b>

## Contract Price

Sl. No.	Scope of Work	DPR		Contract Price	
		Estimate amount	Per Mt	Amount	Per Mt
1A 1B	Supply, Installation, and Commissioning of Plant and Machinery including all Civil Works MIS/IT Works as per BOQ, Total Fixed Cost (I)	19,16,08,000	213	19,14,90,000	212.77
2A	Operating Cost/Charges for Remediation of Legacy Waste through Bio-mining, Material recovery, Rejects Disposal & Land Reclamation at Landfill Site – Pachanady – Mangaluru, including AMC of Plant and Machineries and all other expenditure. [for processing 9,00,000 MT] (II)	54,57,14,000	606	42,63,62,700	473.74
3B	Revenue from Sale of Recyclables [Retained by CONTRACTOR] (III)* to be deducted from 2A	22,95,00,000	255	5,40,00,000	60
2B	Total Operating Cost [for processing 9,00,000 MT] (II)	31,62,14,000	351	37,23,62,700	413.74
<b>PROJECT COST</b>		<b>50,78,22,000</b>	<b>564.25</b>	<b>56,38,52,700</b>	<b>626.50</b>



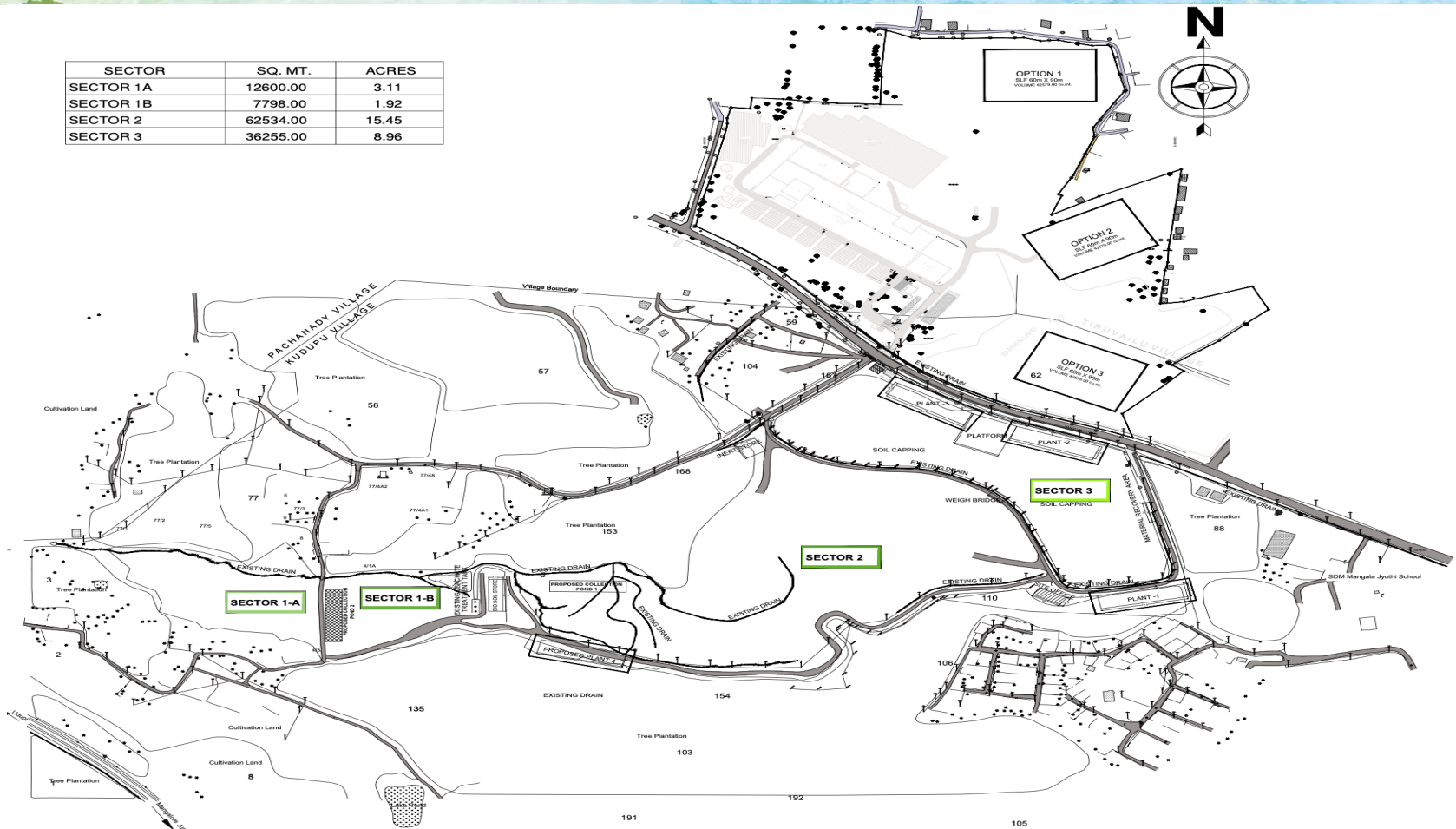
## USPs of the Project

1. Cheapest project at 413.74 / MT in Karnataka and with the same scope, cheapest in the Country.
2. Without any option to dispose RDF to any Cement Plant or similar consumer's the project is designed to have
  1. PYROLYSIS
    1. RDF Solution attempts to separate, by volatilization, as much of the organic portion of a solid waste stream as possible and then to clean and process the resulting mixture of gases to produce a high-grade pyro fuel.
3. Multiple micro projects with Material Recovery & RDF planned
4. Real Term biomining and bio-remediation with maximum segregation and scientific disposal of rejects with LOW CARBON FOOTPRINT.





SECTOR	SQ. MT.	ACRES
SECTOR 1A	12600.00	3.11
SECTOR 1B	7798.00	1.92
SECTOR 2	62534.00	15.45
SECTOR 3	36255.00	8.96



## Cost Cutting Measures

Polyhouse Windrows for increased work time and output



Conveyor system for material movement reducing diesel consumption, movement delays, congestions, and reducing carbon foot print.



## Present Status

SL.NO.	ACTIVITY	STATUS
1	Site: Topographical Survey	<ol style="list-style-type: none"> <li>1. Detailed Topographic Survey using Total Station for the utilities, Roads, drains, boundaries etc.</li> <li>2. Drone Survey completed.</li> <li>3. Cadastral Survey of the Project area is carried to identify the property Nos and its boundary.</li> <li>4. Fixing of DGPS Primary Control Points across the site.</li> </ol>
2	Site: Excavation in Sector 3 for Plant	<ol style="list-style-type: none"> <li>1. Suitable site selection for setting out the plants are carried by field inspection, referring survey details and by on site ground investigations for best available options. Plant 1,2 and 3 finalised.</li> <li>2. Site Identified for plant -2 &amp;3 along the existing Vamanjur- Pachanady road in the capping area.</li> </ol>
3	Site: Leachate Management	<ol style="list-style-type: none"> <li>1. Regular bioremediation on the excavated waste and fresh waste being carried out.</li> </ol>
4	Site: Road strengthening and formation	<ol style="list-style-type: none"> <li>1. 1465 meters of road formation with 7 m width works commenced.</li> <li>2. Back filling and levelling for construction of embankment of Road up to 0.457mm filling.</li> <li>3. Construction of sub-grade and earthen shoulders</li> </ol>
5	LMP: Leachate Collection Pond - 1	





## Works so far



*Pit Excavation for Geo Technical investigation in progress.*





## Works so far





DRAIN CLEANING – READINESS FOR MONSOON & LEACHATE





## MAJOR WORKS & ACTIVITIES – SHOWN IN YELLOW BOXES





## MAJOR WORKS & ACTIVITIES – SHOWN IN YELLOW BOXES





## EXCAVATION FOR LEACHATE COLLECTION POND NO.1





## LEACHATE COLLECTION POND NO.1



GEOMEMBRANE  
LINER IN THE  
BOTTOM OF THE  
POND.



## LEACHATE COLLECTION POND NO.1



LAYING OF HUMEPİPES

FOR INLET  
AND  
OUTLET

TO AND FROM THE  
DRAINS



## DATA COLLECTION AT THE SITE USING DRONE



## SITE OFFICE READY FOR OPERATIONS

PROJECT SITE OFFICE





## LEACHATE MANAGEMENT



SPRAYING OF BIO CULTURE  
REGULARLY ON FRESH WASTE  
AND EXCAVATED WASTES

A photograph showing a white truck dumping a large pile of waste onto a dirt road. A person in a light-colored shirt and dark pants is standing on the road, holding a long hose and spraying a fine mist of bio-culture onto the waste. The background is a lush green hillside.

Screenshot



BAFFLE WALL ON THE DRAIN  
AND COLLECTION TANK FOR  
LEACHATE TREATMENT

A photograph showing a concrete baffle wall and a collection tank for leachate treatment. The wall is made of concrete and has a series of bags (white and yellow) stacked on top of it. A person is standing near the wall, and another person is carrying a bag. The background is a lush green hillside.







**THANK YOU**

