BEFORE THE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH, NEW DELHI

Original Application No.606/2018

(In respect of State of Telangana)

Re: Compliance of Municipal Solid Waste Management Rules, 2016 and other Environmental Issues

ACTION TAKEN REPORT OF STATE OF TELANGANA

ADVOCATE FOR THE RESPONDET STATE : SRAVAN KUMAR KARANAM

IN THE HON'BLE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH AT NEW DELHI

ORIGINAL APPLICATION NO.606/2018

IN THE MATTER OF:

In Re: Compliance of Municipal Solid Waste Management Rules, 2016 and other environmental issues.

INDEX

Sl.No.	Particulars	Page Nos.
1	Affidavit by the Chief Secretary to Government of Telangana	1-22
2	Annexure I- Sample copy of the test certificate	23-41
3	Annexure II- Sample copy of in-house & 3rd party test certificates	42-55
4	Annexure III- Sample copy of compliance to CFO conditions	56-88
5	Annexure IV – TGPCB letter to CPCB	89-91
6	Annexure V- Particulars of Remediation of Solid Waste	92
7	Annexure VI-ULB wise Legacy Waste in Telangana	93-97
8	Annexure VII -Photographs of capped legacy dump	98-99
9	Annexure VIII - Copy of IIT Bombay's final report	100-180
10	Annexure IX - Copy of Minutes of meeting conducted by CPCB	181-193
11	Annexure X - Copy of Way Forward report submitted by IIT Bombay	194- 204
12	Annexure XI - Details of Existing STP's in the ULBs	205-206

Sl.No.	Particulars	Page Nos.
	outside ORR Under PH&MED	
13	Annexure XII - Details of under Construction STP's in the ULBs outside ORR Under PH&MED	207
14	Annexure XIII - Details of STP's taken up in the ULBs outside ORR under AMRUT 2.0 under PH&MED	208
15	Annexure IV - Details of STPs proposed in 101 ULBs outside ORR under SBM 2.0 Under PH&MED	209-212
16	Annexures XV – Details of under construction STPs in GHMC area	213
17	Annexures XVI – Details of each existing STP with utilization capacity under HMWSSB, GHMC, HMDA	214
18	Annexure XVII – copy of TGPCB documents amending the CFO	215-220
19	Annexure XVIII – Details of STPs with utilization capacities & final disposal points	221
20	Annexure XIX – Funds for SWM and Liquid waste management	222-243

Dated:

K. Ramakrishna Rao, I.A.S.

3635

6th Floor , Dr. B.R. Ambedkar
Telangana State Secretariat,
Hyderabad - 500 022.
☎ Off : 040-2345 2620
040-2345 5340
Fax: +91-40-2345 3700
Email : cs@telangana.gov.in

CHIEF SECRETARY
GOVERNMENT OF TELANGANA

Letter No. 1200/TP&E.2/2023, Dated: 22-11-2025

To
The Registrar General,
Hon'ble National Green Tribunal,
Faridkot House,
Copernicus Marg,
New Delhi - 110001.

Sir,

Sub: Government of Telangana - Hon'ble NGT, New Delhi - Original Application No. 606 of 2018 - Compliance of Municipal Solid Waste Management Rules, 2016 and Other Environmental issues - Hon'ble NGT order dated 01-05-2025 - Submission of Action Taken Report for the State of Telangana -Reg

Ref: Hon'ble NGT order dated 01-05-2025 in O.A. No. 606 of 2018.

<<>><<>>

In compliance to the Hon'ble National Green Tribunal order dated 01-05-2025 in Original Application No. 606 of 2018, the Action Taken Report and compliance report on Municipal Solid Waste Management Rules, 2016 and other Environmental issues of the State of Telangana is herewith submitted.

Yours faithfully,

CHIEF SECRETARY

Encl:
Report with Annexures.

Copy to:

The Advocate on Records,
Hon'ble NGT, New Delhi.

BEFORE THE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH, NEW DELHI

Original Application No.606/2018

(In respect of State of Telangana)

Re: Compliance of Municipal Solid Waste Management Rules, 2016 and other Environmental Issues

ACTION TAKEN REPORT OF STATE OF TELANGANA

I, K. Ramakrishna Rao, IAS, S/o. Sri K. Gurnatha Rao, aged about 59 years, Occ : Chief Secretary to Government, Government of Telangana, do hereby solemnly and sincerely affirm and state on oath as follows:

1. I submit that I am the Chief Secretary for the State of Telangana and as such, I am well acquainted with the facts of the case to depose this Affidavit.

2. I submit that the present action taken report is being filed as per the directions of this Hon'ble Tribunal in the above Application and also as

NOTARY
P. ANIL KUMAR
BAKARAM
Regd.No.5766
GOVT. OF INDIA

per the directions vide its order dated 01.05.2025 in the present O.A.No.606 of 2018.

3. I submit that in the said hearing on 01.05.2025, the Hon'ble Tribunal examined the report dated 03.03.2025 filed by the Principal Secretary, MA&UD, Government of Telangana disclosing the status of sewage and solid waste management and has directed the State of Telangana to file action taken report in the form of affidavit. Hence this affidavit:

4. **[A] Solid Waste Management**:

The Hon'ble Tribunal has observed that-

i. "The gap in waste processing is 2044.0 TPD which is targeted to be accomplished by 30.5.2025. We find such gap in each ULB shall be accounted as legacy waste."

- In response to the same, it is respectfully submitted that the unprocessed waste i.e., 2044 TPD of waste is being formed as windrows and bio-culture is being sprayed to initiate the degradation process. As a result of above activities, quantity of waste lying unprocessed is getting processed naturally on ad hoc

NOTARY P. ANIL KUMAR BAKARAM Regd.No.5766 GOVT. OF INDIA

basis. Further, scientific process for processing this waste has been prioritized by ULBs along with daily processing capacity.

ii. "Gap in biodegradable waste processing is 1101.5 TPD and this gap is 942.5 TPD for non-biodegradable waste. We find the gap is more prominent in smaller ULBs, therefore, standardized operational designs should be adopted/replicated rather losing time on each ULB."

- In response to the above observation, it is respectfully submitted that ULBs have been provided with capacity building program on waste processing and also a circular dated 28.08.2025 has been issued to ULBs to procure required machinery and equipment's to process the fresh waste. Detailed list of machinery required along with specifications for procuring the machinery based on quantity of waste generated was enclosed along with the circular. ULBs have already initiated procurement process.

iii. "Till waste processing facilities are set up, it is proposed to utilize services of the Agencies engaged for bio mining but, tie up of 141 ULB with this arrangement or with 9 clusters, is not disclosed and this should be clarified."

NOTARY
P. ANIL KUMAR
BAKARAM
Regd.No.5766
GOVT. OF INDIA

- Bio-mining agencies are extending technical guidance support to ULBs in laying windrows and usage of bio-culture for processing of waste in the existing dump yards.

iv. "We find from a tabulated statement on page 3213 that, out of 141 ULBs, 31 ULBs are disclosing zero gap and as per this disclosure, these ULBs should not be having legacy waste and if it is the factual and ground status then, statement to this effect be made in next affidavit. Further, we require executable plan on remaining 110 ULBs. The other ULBs (MO) should adopt the similar mechanism as done by 31 ULBs like Dharmapuri, Dhammaiguda, Nizampet, Jawaharnagar and others. However, for large ULBs, integrated approach with combination of processes like Warangal, Ramagundam, Nizamabad, Mahaboob Nagar, Khammam, Karimnagar, and others should be adopted."

- In response to the same, it is respectfully submitted that 18 ULBs falling within the Outer Ring Road of Hyderabad city are transporting their waste to the Jawahar Nagar MSW Processing & disposal facility for further treatment. A formal arrangement was made between these ULBs and with GHMC/ Re Sustainability Pvt

NOTARY
P. ANIL KUMAR
BAKARAM
Regd.No.5766
GOVT. OF INDIA

Ltd. Hence, these ULBs have been reported as zero gap. Further, in Narayanpet, the existing capacity of processing facility is more than what the ULB is generating. Further, larger ULBs also are tendering procurement of machinery/ equipment for integrated processing of waste. The State Government is planning to establish Integrated waste to Energy (WTE) plants across the state for processing of inerts and unprocessed waste thereby generating power for further utilization. All ULBs are grouped into clusters and assessment along with financial modelling is being prepared.

v. "With respect to GHMC, we find that 1272 TPD of inerts are disposed through landfill. At this stage, we direct to comply with SWM Rules and ensuring no leachable waste is deposited which should be checked through TCLP tests. Further, no information is disclosed on performance of waste to energy plants of 38.5 MW for compliance with the conditions of CTO and management of arrested fly and bottom and these details should be disclosed in next affidavit."

- In response to the same, it is respectfully submitted that, GHMC is disposing inerts (only the post processed residual solid waste) in compliance with SWM Rules 2016 wherein inerts are being

NOTARY P. ANIL KUMAR BAKARAM Regd.No.5766 GOVT. OF INDIA

disposed in sanitary landfills. Impermeable HDPE liner material laid at the bottom and on top of the sanitary landfill are quality tested at the supplier end for parameters such as thickness, yield & break strength, yield & break elongation, tear & puncture resistance etc for every batch of the material **(sample copy of the test certificate is enclosed as Annexure -I).** After the liners are laid, the liners joints are tested for their integrity through air pressure test, vacuum test, sheer test etc both in-house and by third party viz., Central Institute of Plastics Engineering & Technology **(sample copy of in-house & 3rd party test certificates are enclosed as Annexure –II).** This ensure no leakage of leachate to the ground. Further, perforated pipes are placed on top of the bottom liners for leachate collection and the same is treated in the zero liquid discharge leachate treatment plant operational at the site. TCLP tests are presently being conducted for fly & bottom ash and as directed by this Hon'ble Tribunal, GHMC shall ensure TCLP tests are conducted. The Concessionaire operating the plant was directed to conduct monthly TCLP tests which reports shall be submitted to this Hon'ble Tribunal by next hearing.

NOTARY
P. ANIL KUMAR
BAKARAM
Regd.No.5766
GOVT. OF INDIA

- The Waste to Energy Plants of 24 MW capacity operational from Aug' 2020 and 14.5 MW capacity operational from Mar'2024 have cumulatively utilized 27.25 Lakh Tons of Refuse Derived Fuel and generated 941.20 Million units of electricity upto October'2025.

- The operator of the plant submits half yearly report to Telangana Pollution Control Board (TGPCB) reporting compliance to the condition in the Consent to Operate which includes compliance on ash handling along with submission of 3rd party testing reports on emission from stack of boilers (apart from Online Continuous Emission Monitoring System (OCEMS) connected to TGPCB) and ambient air quality monitoring reports and tests **(sample copy of the Compliance letter is enclosed as Annexure -III).**
- The WTEs are disposing bottom ash at sanitary landfill at Jawaharnagar and fly ash is being disposed at the Hazardous waste secured landfill at Dundigal. A bottom ash recycling facility is also being established at Jawaharnagar. The report dated 31.07.2025 submitted by TGPCB to CPCB communicated that analysis reports of bottom and fly ash done through 3rd party

NOTARY P. ANIL KUMAR BAKARAM Regd.No.5766 GOVT OF INDIA

NABL accredited lab are regularly submitted to TGPCB by the plant operator in accordance with SWM Rules and that the TCLP test results confirm both fly ash and bottom ash are non-hazardous. Further it was submitted that TGPCB is ensuring annual monitoring and till date no exceedance in parameters is noticed **(copy enclosed as Annexure -IV)**. This report was placed before the Hon'ble NGT (PB) vide CPCB's report dated 18.08.2025 in OA 536 of 2024.

5. [B] Legacy Waste:

i. "On re-assessment, estimated legacy waste has been reported to be brought down to 21.56 lakh metric tons (LMT) from 38.46 LMT. On the query raised on the quantities processed per day along with residue management particularly other than GHMC, was not disclosed."

- In response to the same, it is respectfully submitted that out of the assessed 38.46 lakh MT of legacy waste, 16.90 Lakh **(list enclosed in Annexure-V)** was processed scientifically, and the output residues, such as Bio-soil, C&D waste inert, have been used for filling the low-lying areas in consultation with the MC. RDF has been disposed off at the tied up cement plants by the

NOTARY P. ANIL KUMAR BAKARAM Regd.No.5766 GOVT. OF INDIA

Concessionaire. Hence, the quantity remaining for processing was 21.56 lakh MT.

ii. "After finding gap in waste processing in 110 ULBs from tabulated statement disclosed on page 3213, correspondingly, legacy waste 4 for these ULBs, has not been disclosed and we direct to provide details in the next affidavit. Overall, land reclaimed should also be disclosed."

- In response to the above direction, it is respectfully submitted that the ULB wise status of Legacy waste and remediated quantity is **enclosed in Annexure-VI.**

iii. "Photographs along with the report indicate the legacy waste dumps being covered with soil and the dumps are consolidated and torfed. If so may indicate such legacy waste dumps covered and NOC Obtained from PCB. Ground water analysis of such sites are to be analyzed and reported."

- In response to the same, it is respectfully submitted that GHMC has scientifically capped its legacy dump with not only soil cover & turf but placing 30

NOTARY P. ANIL KUMAR BAKARAM Regd.No.5766 GOVT. OF INDIA

- 0 mm thick low permeability soil, geo synthetic clay liner (GCL), HDPE liner, Geo composite drainage liner (GDL), 450 mm vegetative soil and finally green cover (vegetation) in the above mentioned order from the top of the waste mass to arrest ingress of rain water. Further provisions were made for landfill gas (LFG) collection from the capped legacy waste and also leachate collection system (LCS) was proposed as mandated in the CPHEEO Manual (a manual on technical aspects in compliance with SWM Rules 2016). This design was given by Terra Consult, a UK based international consultant with renowned experience in the field. Capping was carried out as per Environmental Clearance issued by MoEF&CC in 2012, applicable Rules including MSW(M&H) Rules 2000 as well as SWM Rules 2016, various approvals and permissions obtained in accordance with above rules. **(Photographs of capped legacy dump are enclosed as Annexure –VII).**

- This Hon'ble Tribunal vide orders dated 29.09.2022 in OA 606 of 2018 directed CPCB to examine in consultation with experts and determine whether capping can be retained & if not what further

NOTARY P. ANIL KUMAR BAKARAM Regd.No.5766 GOVT. OF INDIA

course of action is to be taken for protection of the environment. The expert committee was constituted by CPCB and the committee inspected the site on 1st & 2nd September 2023. However, the report of the Expert Committee was not placed before this Hon'ble Tribunal.

- It is respectfully submitted further that while the submission of the report before this Hon'ble Tribunal was pending, the CPCB has reconstituted the Committee and submitted before the Hon'ble NGT (SZ) in OA 199 of 2021 that a study is proposed to be taken up by CPCB through IIT Roorkee. As, IIT Bombay has already conducted extensive studies on the capped legacy dump at Jawharnagar and submitted final report dated 05.07.2023 concluding that the Jawaharnagar landfill is not ready for biomining **(copy of IIT Bombay's final report enclosed as Annexure- VIII)**, the Hon'ble Tribunal SZ Bench directed CPCB to request IIT Bombay to revisit and furnish revised report if CPCB finds the IIT Bombay's report to be inclusive rather than engaging a new institution. Accordingly, CPCB has requested IIT Bombay to provide a solution to the problems faced in

NOTARY P. ANIL KUMAR BAKARAM Regd.No.5766 GOVT. OF INDIA

Jawharnagar dumpsite and directed GHMC to implement the same **(copy of Minutes are enclosed as Annexure- IX)**.

- In response, Prof D N Singh, IIT Bombay visited & inspected Jawaharnagar on 23.10.2025, deliberated with the representatives of GHMC, Telangana Pollution Control Board & Operator of the Processing plant and vide mail dated 27.10.2025, IIT Bombay has communicated the "Way Forward" on the issues prevailing at the MSW Processing & Disposal Facility, Jawaharnagar to CPCB & GHMC recommending short, intermediate & long term measures and further studies.
- With respect to ground water safeguards, it was communicated that no contamination is observed to date and periodic monitoring under supervision of TGPCB was recommended. **(copy of Way Forward report is enclosed as Annexure- X)**.

As such, it is respectfully submitted that GHMC is committed to implement the recommendations and way forward suggested by IIT Bombay in time bound manner.

NOTARY
P. ANIL KUMAR
BAKARAM
Regd.No.5766
GOVT. OF INDIA

6. [C] Sewage Management:

i. "We find that out of estimated sewage generation of 910.85 MLD by 116 ULBs, only 167.80 MLD is treated leaving huge gap (Annexure 14 page 3593). Except Karim Nagar, Warangal, Nagarkurnul and Vikarabad, no ULB is having sewage management facilities. Considering size of ULBs, standardized module should be adopted including Modular STPs. Next affidavit should give finalized workable plan with timelines."

- In response to the above direction, it is respectfully submitted that the Sewerage generation in ULBs outside ORR as on 29.09.2022 i.e., orders of Hon'ble NGT is 800.00 MLD and corresponding Gap in sewage treatment capacity was 646 MLD. Against the present 910.85 MLD estimated Sewage generation, the **present treatment capacity is 184.96 MLD** i.e., existing 10 STPs (of 132.75 MLD) and newly added 7 STPs (of 52.21 MLD) after orders of Hon'ble NGT dt: 29.09.2022 **(copy enclosed as Annexure-XI).**

NOTARY P. ANIL KUMAR BAKARAM Regd.No.5766 GOVT. OF INDIA

- Presently, Sewage treatment facility is available in 11 ULBs i.e., Karimnagar, Vikarabad, Nizamabad, Miryalaguda, Siddipet, Gajwel, Suryapet, GWMC, Deverakonda, Nagarkurnool and Nalgonda.

- Further it is respectfully submitted that, **Balance 4 STPs of 37.75 MLD** are expected to be completed by **Dec-2025 (copy enclosed as Annexure-XII).** Thus, there will be a gap of **556.04 MLD** (800.00-184.96-37.75-21.25(Private)) which will be nullified with STPs taken up under AMRUT 2.0, STPs proposed under SBM 2.0 and STPs proposed in GWMC. Agreements for **16 No's of STPs of combined capacity 170.30 MLD in three packages under AMRUT 2.0** were concluded and expected to be commissioned by **December-2027 (copy enclosed as Annexure-XIII).**
- The Govt. vide G.O.Rt.No.388, dated 21-08-2024 accorded Administrative Sanction for an amount of Rs.3769.34 Crores (including O&M and Annuity payments etc) for sewerage projects in **101 ULBS** with a capacity of **455.00 MLD** in the state of Telangana under SBM 2.0". *Tenders were invited 3 times and no*

NOTARY P. ANIL KUMAR BAKARAM Regd.No.5766 GOVT. OF INDIA

bidders participated in three calls. Further, permission also awaited from GoI for upfront payment duly utilizing central share.

- *Further, the Department vide letter dt:25-07-2025 requested the Government to accord Revised Administrative sanction for amount of Rs. 3705.75 crores (including Land Acquisition, O&M for 5 Years, Annuity Payments, GST etc) with permission to invite tenders in 3 packages instead of single package under LS contract system with Revised Hybrid Annuity Model and with latest SoR 2025-26 rates due to non - participation of the bidders in the tenders invited for 3 calls. Permission of the government is awaited.* ***STPs expected to be completed by December -2027 after approval from Govt (copy enclosed as Annexure-XIV).***

- It is to submit that Govt. vide G.O. Rt. No. 573, MA&UD (ENGG.2) Dept., dated 17-11-2024 accorded Administrative sanction "In-Principle approval" for Rs 4170.00 Crore for taking up UGD scheme in GWMC. Further, this office vide Lr.No. 4170/T1/GWMC/ UGD/2025-26, dated 01-09-2025 requested

Government to accord administrative sanction for the work "Comprehensive Underground Drainage Scheme in GWMC, Warangal – Phase-I" for an amount of Rs. **5257.20 Crore** from **Head of Account "Assistance to Warangal Municipal Corporation 2217-80-191-25-SH(90)-310-312"** duly allocating necessary funds to take up UGD scheme in GWMC on priority basis with concurrence of the finance department based on the proposal of the Commissioner, GWMC. In which, 21 No's of STPs of combined capacity 204.00 MLD was proposed. *Permission of the government is awaited.* ***Expected to be completed within 2 years after approval from Govt.***

- It is respectfully submitted that, any proposals required for compensating shortfall in treatment of waste water generation will be taken up to meet increased demand at the city level from time to time depending on availability of funds.
- Regarding consideration of adopting standardized module including Modular STPs, it is respectfully submitted that suitable STPs will be taken up based on the size of the ULBs keeping in view of the additional requirement of Land for future and increased demand.

ii. "We find that in a city like Hyderabad, there will remain a gap of 72 MLD which is expected to be treated by 2027. Tribunal while dealing the matter on Musi river, it was noted that this river is falling under the polluted stretches and large quantities of sewage were disclosed."

- In response to the same, it is respectfully submitted that against the 1950 MLD Sewage generation, the present treatment capacity is 1794.8 MLD i.e., existing STPs (772.3 MLD) and newly added 18 STPs (1022.50 MLD). The balance two STPs of capacity 83.5 MLD will be completed by Nov/Dec'2025. Thus there is a gap of 72 MLD (1950-1878 MLD) which is being taken up under AMURTI-2.0 and will be completed by 2027 **(copies enclosed as Annexure XV & XVI).**

- For prevention of sewage pollution to river Musi in GHMC area, apart from the existing 615 MLD capacity STPs along the banks of river Musi, the newly added STP capacity is 723 MLD totaling to 1338 MLD and will almost take care of sewage treatment and prevention of pollution along the Musi river stretch. Also in ORR areas, new STPs of 199.50 MLD capacity are being taken up on

NOTARY
P. ANIL KUMAR
BAKARAM
Regd.No.5766
GOVT. OF INDIA

either side of river Musi stretch under AMRUT-2.0 Scheme which are under grounding. Thus the total capacity of STPs on either side of river Musi in GHMC area and upto ORR would be 1537.50 MLD (615+723+199.5 MLD) to tackle the polluted river stretch at Hyderabad. Upon completion of STPs taken up under AMRUT-2.0, the sewerage disposal into the Musi river stretch will be achieved 100% treatment by 2027 for Hyderabad City.

iii. "We find from analytical reports (page 3441) that analysis of TC was done for samples collected from STPs whereas, standards of FC have been directed and reason for not analysis of FC should be explained. State PCB should provide performance of STPs in GHMC area for CTO conditions and FC comparing with standards directed by Tribunal in OA No.1069/2018."

- In response to the same, it is respectfully submitted that, Telangana Pollution Control Board (TGPCB) has addressed a letter dated 04.07.2025 to HMWS&SB to comply with the Hon'ble NGT directions with regard to standards of fecal coliform standards stipulated in the Hon'ble NGT order dated 30.04.2019 in OA No.1069/2018. Subsequently, TGPCB has issued

NOTARY
P. ANIL KUMAR
BAKARAM
Regd.No.5766
GOVT. OF INDIA

amendment to the Consent to Operate (CTO) stipulating the condition that the desirable level for the Fecal Coliform (FC) - Most Probable Number per 100 milliliter (MPN/100ml) as 100. Copies of the amendment issued on 11.10.2025 are placed as **Annexure- XVII.** TGPCB is also monitoring the STPs on monthly basis including Fecal Coliform parameters and it is observed from the analysis reports from February to September 2025 that Fecal Coliform is mostly in the range of 1.8 to 10 MPN/ 100 ml and are meeting the desirable standards.

iv. "We find no details on utilization of treated sewage particularly in Hyderabad. Upcoming STPs should have connectivity ensured and systems to utilize treated water."

- In response to the above observation, it is respectfully submitted that the treated waste water is being used for the purposes of gardening by Shilparamam (Tourism Dept.), GHMC, Hyderabad Metropolitan Development Authority (HMDA) for gardening & watering the plantations in medians of the roads and Construction & Demolition waste processing units of GHMC at Nagole &

NOTARY P. ANIL KUMAR BAKARAM Regd.No.5766 GOVT. OF INDIA

Khajaguda. The treated waste water is also being used for agriculture purpose along the Musi River.

- HMWSSB is providing 300 kLD of treated waste water to M/s Wipro office campus located at Manikonda and Gopanpally from STPs at Khajaguda and Gopanapally for Gardening purpose. The treated waste water is also being provided for other users from the STPs as per their requirement. So far 200 ML treated waste water has been reused. Further the treated water from STPs is also being let back into nearby lakes/ tanks and river Musi to maintain the hydrology and clean environs. **(copy enclosed as Annexure-XVIII).**

7. [D] Ring Fence Account:

"We find no disclosure on ring fencing of amount as per the gap on solid and liquid waste management. Next report should give funds allocated to each ULB and not be totally dependent on funding from Central Government."

NOTARY
P. ANIL KUMAR
BAKARAM
Regd.No.5766
GOVT. OF INDIA

- In response to the same, it is respectfully submitted that a separate account was created vide account name "Commissioner GHMC Ring Fenced" vide account no 42649272067, State Bank of India, MCH Tank bund branch for depositing the penalty amount. Payment towards addressing the gap in solid and liquid waste management shall be made from this account. However, the details of government facilities, government sanctions and status of STPs, equal to the amount of Environmental Compensation of Rs. 3,800 crores levied are once again submitted at **Annexure-XIX.**

8. It is therefore, prayed that this Hon'ble Tribunal may be pleased to consider this affidavit submitted by the State of Telangana in compliance of the directions dated 01.05.2025 of the Hon'ble Tribunal and may be pleased to pass such other order or orders as deemed fit and proper in the circumstances of the case and in the interest of justice.

NOTARY
P. ANIL KUMAR
BAKARAM
Regd.No.5766
GOVT. OF INDIA

DEPONENT
CHIEF SECRETARY
Govt. of Telangana
Telangana Secretariat,
Hyderabad - 500 022

Verification

I, the above-named deponent, do hereby solemnly affirm and state that the contents of the instant Counter Affidavit are true to the best of my knowledge and information derived from the records and I believed the same to be true.

Solemnly affirmed on this ____ day of November, 2025 at Hyderabad, Telangana.

DEPONENT

CHIEF SECRETARY
Govt. of Telangana
Telangana Secretariat,
Hyderabad - 500 022

NOTARY
P. ANIL KUMAR
BAKARAM
Regd.No.5766
TEN RUPEES
NOTARIAL
GOVT. OF INDIA

ATTESTED
P. ANIL KUMAR
B.Sc,B.L.,
ADVOCATE & NOTARY
Regd. No: 5766
Appointed by Govt. of India
1-7-181, BAKARAM, MUSHEERABAD,
HYDERABAD. TELANGANA

24 NOV 2025

Entered in Notarial Register on
Page No. 10 Serial No. 2697

3658

Annexure I

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149095	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.46	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.44	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.44	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.43	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	29	kN/m
Break Strength			21	30	kN/m
Yeild Elongation	GL - 33MM		12	14	%
Break Elongation	GL - 50MM		100	518	%
Tear Resistance	ASTM D1004	9,000 kg	187	243	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.16	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149095 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149096	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.44	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.52	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	33	kN/m
Yeild Elongation	GL - 33MM		12	17	%
Break Elongation	GL - 50MM		100	588	%
Tear Resistance	ASTM D1004	9,000 kg	187	239	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149096 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149097	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.42	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.44	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.51	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	33	kN/m
Yeild Elongation	GL - 33MM		12	17	%
Break Elongation	GL - 50MM		100	588	%
Tear Resistance	ASTM D1004	9,000 kg	187	239	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149097 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149098	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.43	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.52	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	33	kN/m
Yeild Elongation	GL - 33MM		12	17	%
Break Elongation	GL - 50MM		100	588	%
Tear Resistance	ASTM D1004	9,000 kg	187	239	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149098 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149099	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.44	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.51	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	33	kN/m
Yeild Elongation	GL - 33MM		12	17	%
Break Elongation	GL - 50MM		100	588	%
Tear Resistance	ASTM D1004	9,000 kg	187	239	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149099 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149100	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.44	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.43	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.52	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	33	kN/m
Yeild Elongation	GL - 33MM		12	17	%
Break Elongation	GL - 50MM		100	588	%
Tear Resistance	ASTM D1004	9,000 kg	187	239	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149100 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149101	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.43	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.44	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	33	kN/m
Yeild Elongation	GL - 33MM		12	17	%
Break Elongation	GL - 50MM		100	588	%
Tear Resistance	ASTM D1004	9,000 kg	187	239	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149101 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149102	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.47	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.40	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.44	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.46	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	33	kN/m
Yeild Elongation	GL - 33MM		12	17	%
Break Elongation	GL - 50MM		100	588	%
Tear Resistance	ASTM D1004	9,000 kg	187	239	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149102 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149103	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.45	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.52	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	30	kN/m
Yeild Elongation	GL - 33MM		12	15	%
Break Elongation	GL - 50MM		100	540	%
Tear Resistance	ASTM D1004	9,000 kg	187	248	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149103 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149104	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.43	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.44	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	30	kN/m
Yeild Elongation	GL - 33MM		12	15	%
Break Elongation	GL - 50MM		100	540	%
Tear Resistance	ASTM D1004	9,000 kg	187	248	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149104 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149105	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.46	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.46	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	30	kN/m
Yeild Elongation	GL - 33MM		12	15	%
Break Elongation	GL - 50MM		100	540	%
Tear Resistance	ASTM D1004	9,000 kg	187	248	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149105 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149106	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.46	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.46	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	30	kN/m
Yeild Elongation	GL - 33MM		12	15	%
Break Elongation	GL - 50MM		100	540	%
Tear Resistance	ASTM D1004	9,000 kg	187	248	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149106 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149107	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.46	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.46	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.45	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	30	kN/m
Yeild Elongation	GL - 33MM		12	15	%
Break Elongation	GL - 50MM		100	540	%
Tear Resistance	ASTM D1004	9,000 kg	187	248	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149107 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149108	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.45	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.44	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	30	kN/m
Yeild Elongation	GL - 33MM		12	15	%
Break Elongation	GL - 50MM		100	540	%
Tear Resistance	ASTM D1004	9,000 kg	187	248	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149108 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 23.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149109	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.44	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.40	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.45	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.44	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	27	kN/m
Break Strength			21	30	kN/m
Yeild Elongation	GL - 33MM		12	15	%
Break Elongation	GL - 50MM		100	540	%
Tear Resistance	ASTM D1004	9,000 kg	187	248	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.20	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	165	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149109 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 24.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149128	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.46	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.49	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	26	kN/m
Break Strength			21	28	kN/m
Yeild Elongation	GL - 33MM		12	15	%
Break Elongation	GL - 50MM		100	551	%
Tear Resistance	ASTM D1004	9,000 kg	187	217	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.17	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	160	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149128 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 24.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149129	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.47	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.46	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.47	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	26	kN/m
Break Strength			21	28	kN/m
Yeild Elongation	GL - 33MM		12	15	%
Break Elongation	GL - 50MM		100	551	%
Tear Resistance	ASTM D1004	9,000 kg	187	217	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.17	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	160	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149129 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 24.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149130	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.45	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.41	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.45	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.50	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	26	kN/m
Break Strength			21	28	kN/m
Yeild Elongation	GL - 33MM		12	15	%
Break Elongation	GL - 50MM		100	551	%
Tear Resistance	ASTM D1004	9,000 kg	187	217	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.17	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	160	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149130 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

شركة الرواد الدولية للأغشية الصناعية
Rowad International Geosynthetics Co. Ltd.
PRESERVING WATER FOR LIFE

Quality Control Certificate

Material Descriptiion	: HDPE D.Text Black 1.5mm x 8m x 90m	**Prod. Code**	: HDT150G8B090L
Date of Manufacture	: 24.12.2018	**Customer**	: RAMKY ENVIRO ENGINEERS LTD.
Roll Number	: 1149131	**Project**	: 7501906
Internal Resin Lot	: 1B72		

Property	Test Method	Frequency	GM 13 Specs	Average	Units
Thickness(min.avg)	ASTM D5994	Per roll	1.43	1.44	mm
Thickness(Lowest)	ASTM D5994	Per roll	1.35	1.40	mm
Aspirity Hight Top	ASTM D7466	Every Roll	0.40	0.45	mm
Aspirity Hight Bot	ASTM D7466	Every Roll	0.40	0.50	mm
Tensile Propertites	ASTM D6693	9,000 kg			
Yeild Strength			22	28	kN/m
Break Strength			21	32	kN/m
Yeild Elongation	GL - 33MM		12	16	%
Break Elongation	GL - 50MM		100	579	%
Tear Resistance	ASTM D1004	9,000 kg	187	238	N
Puncture Resistance	ASTM D4833	9,000 kg	400	514	N
Carbon Black Content	ASTM D1603	9,000 kg	2.00 - 3.00	2.21	%
Carbon Black Dispersion	ASTM D5596	9,000 kg	Cat 1 Or 2	Cat1	
Density	ASTM D792	90,000 kg	0.940	0.945	g/cm3
Stress Crack Resistance (SP NCTL)	ASTM D5397	90,000kg	500	650	hrs
Oxidative Induction Time	ASTM D3895	90,000kg	100	160	min

Roll Dimensions: L = 90.0 M W = 8.0 M

1. Testing frequencies are rounded to the nearest full roll.
2. Carbon Black Dispersion for 10 different views: all 10 in Categories 1 or 2

I Certify the Polyethylene geomembrane above identified Roll Number 1149131 meets or exceeds GM 13 Specs. Testing was performed according with the specific frequencies.

This is a System generated Certificate (SAP) which does not need any Sign or Stamp

HYDERABAD INTERAGATED MSW LIMITED

NON-DESTRUCTIVE LOG-AIR TEST

PROJECT NAME : HYDERABAD INTERAGATED MSW LtD, JAWAHARNAGAR.

LOCATION : LANDFILL - PHASE - II TYPE OF MATERIAL : HDPE LINER

Q.A TECHNICIAN : P. Bhushaiah SHEET THICKNESS : 1.50 mm

ASTM D 5820 :Standard Test Method For Pressurized Air Channel Of Duel Seamed Geomembranes

DATE / TIME	SEAM NUMBER	TESTER INITIALS	AIR TESTING PRESSURE		AIR TESTING TIME		TEST RESULT (P or F)	LOCATION / COMMENTS
			START	END	START	END		
31.08.2013	S - 51	P. Bhushaiah	2.2 bar	2.2 bar	16:10	16:15	P	Base towards South
31.08.2013	S - 52	P. Bhushaiah	2.4 bar	2.3 bar	16:23	16:28	P	Base towards South
31.08.2013	S - 53	P. Bhushaiah	2.4 bar	2.4 bar	16:37	16:42	P	Base towards South
02.09.2013	S - 1	P. Bhushaiah	2.3 bar	2.2 bar	17:20	17:25	P	South Bund Slope
02.09.2013	S - 2	P. Bhushaiah	2.6 bar	2.5 bar	17:32	17:37	P	South Bund Slope
02.09.2013	S - 3	P. Bhushaiah	2.4 bar	2.4 bar	17:49	17:54	P	South Bund Slope
03.09.2013	S - 4	P. Bhushaiah	2.2 bar	2.1 bar	16:32	16:37	P	South Bund Slope
03.09.2013	S - 5	P. Bhushaiah	2.4 bar	2.4 bar	16:41	16:46	P	South Bund Slope
03.09.2013	S - 6	P. Bhushaiah	2.6 bar	2.5 bar	16:53	16:58	P	South Bund Slope
03.09.2013	S - 7	P. Bhushaiah	2.4 bar	2.3 bar	17:10	17:15	P	South Bund Slope
03.09.2013	S - 8	P. Bhushaiah	2.6 bar	2.6 bar	17:28	17:33	P	South Bund Slope
03.09.2013	S - 9	P. Bhushaiah	2.5 bar	2.4 bar	17:40	17:45	P	South Bund Slope
04.09.2013	S - 10	P. Bhushaiah	2.3 bar	2.3 bar	17:08	17:13	P	South Bund Slope

36977

P. Bhushaiah
Welder / Technician

(P. Venkateswara)
Site In - Charge

Project Manager

HYDERABAD INTERAGATED MSW LIMITED

NON-DESTRUCTIVE LOG-AIR TEST

PROJECT NAME : HYDERABAD INTERAGATED MSW LtD, JAWAHARNAGAR.

LOCATION : LANDFILL - PHASE - II **TYPE OF MATERIAL** : HDPE LINER

Q.A TECHNICIAN : P. Bhushaiah **SHEET THICKNESS** : 1.50 mm

ASTM D 5820 :Standard Test Method For Pressurized Air Channel Of Duel Seamed Geomembranes

DATE / TIME	SEAM NUMBER	TESTER INITIALS	AIR TESTING PRESSURE		AIR TESTING TIME		TEST RESULT (P or F)	LOCATION / COMMENTS
			START	END	START	END		
04.09.2013	S - 11	P. BL seal	2.4 bar	2.2 bar	17:20	17:25	P	South Bund Slope
04.09.2013	S - 12	P. BL seal	2.5 bar	2.4 bar	17:32	17:37	P	South Bund Slope
04.09.2013	S - 13	P. BL seal	2.3 bar	2.3 bar	17:45	17:50	P	South Bund Slope
04.09.2013	S - 14	P. BL seal	2.4 bar	2.4 bar	18:05	18:10	P	South Bund Slope
04.09.2013	S - 15	P. BL seal	2.3 bar	2.3 bar	18:15	18:20	P	West Bund Slope
05.09.2013	S - 16	P. BL seal	2.4 bar	2.3 bar	16:32	16:37	P	West Bund Slope
05.09.2013	S - 17	P. BL seal	2.3 bar	2.3 bar	16:45	16:50	P	West Bund Slope
05.09.2013	S - 18	P. BL seal	2.4 bar	2.4 bar	17:02	17:07	P	West Bund Slope
05.09.2013	S - 19	P. BL seal	2.4 bar	2.3 bar	17:12	17:17	P	West Bund Slope
05.09.2013	S - 20	P. BL seal	2.5 bar	2.4 bar	17:28	17:33	P	West Bund Slope
05.09.2013	S - 21	P. BL seal	2.4 bar	2.3 bar	17:41	17:46	P	West Bund Slope
05.09.2013	S - 22	P. BL seal	2.5 bar	2.4 bar	17:52	17:57	P	West Bund Slope
05.09.2013	S - 23	P. BL seal	2.4 bar	2.4 bar	18:10	18:15	P	West Bund Slope

3678

P. BL seal
Welder / Technician

(P. Venkateswarlu)
Site In - Charge

Project Manager

HYDERABAD INTERAGATED MSW LIMITED

NON-DESTRUCTIVE LOG-AIR TEST

PROJECT NAME : HYDERABAD INTERAGATED MSW LtD, JAWAHARNAGAR.

LOCATION : LANDFILL - PHASE - II

TYPE OF MATERIAL : HDPE LINER

Q.A TECHNICIAN : P. Bhushaiah

SHEET THICKNESS : 1.50 mm

ASTM D 5820 :Standard Test Method For Pressurized Air Channel Of Duel Seamed Geomembranes

DATE / TIME	SEAM NUMBER	TESTER INITIALS	AIR TESTING PRESSURE		AIR TESTING TIME		TEST RESULT (P or F)	LOCATION / COMMENTS
			START	END	START	END		
05.09.2013	S - 24	P.B	2.3 bar	2.3 bar	18:22	18:27	P	North Bund Slope
06.09.2013	S - 25	P.B	2.4 bar	2.4 bar	17:02	17:07	P	North Bund Slope
06.09.2013	S - 26	P.B	2.3 bar	2.2 bar	17:13	17:18	P	Base towards West
06.09.2013	S - 27	P.B	2.5 bar	2.4 bar	17:25	17:30	P	Base towards West
06.09.2013	S - 28	P.B	2.4 bar	2.4 bar	17:40	17:45	P	Base towards West
06.09.2013	S - 29	P.B	2.4 bar	2.3 bar	17:52	17:57	P	Base towards West
06.09.2013	S - 30	P.B	2.4 bar	2.4 bar	18:06	18:11	P	Base towards West
10.09.2013	S - 31	P.B	2.4 bar	2.4 bar	17:10	17:15	P	North Bund Slope
10.09.2013	S - 32	P.B	2.3 bar	2.2 bar	17:23	17:28	P	North Bund Slope
10.09.2013	S - 33	P.B	2.5 bar	2.4 bar	17:35	17:40	P	North Bund Slope
10.09.2013	S - 34	P.B	2.4 bar	2.4 bar	17:48	17:53	P	North Bund Slope
10.09.2013	S - 35	P.B	2.3 bar	2.2 bar	18:10	18:15	P	North Bund Slope
11.09.2013	S - 36	P.B	2.4 bar	2.3 bar	17:10	17:15	P	North Bund Slope

P.B

Welder / Technician

(P. Venkateswarlu)

Site In - Charge

Project Manager

3679

HYDERABAD INTERAGATED MSW LIMITED

NON-DESTRUCTIVE LOG-AIR TEST

PROJECT NAME : HYDERABAD INTERAGATED MSW LtD, JAWAHARNAGAR.

LOCATION : LANDFILL - PHASE - II TYPE OF MATERIAL : HDPE LINER

Q.A TECHNICIAN : P. Bhushaiah SHEET THICKNESS : 1.50 mm

ASTM D 5820 :Standard Test Method For Pressurized Air Channel Of Duel Seamed Geomembranes

DATE / TIME	SEAM NUMBER	TESTER INITIALS	AIR TESTING PRESSURE		AIR TESTING TIME		TEST RESULT (P or F)	LOCATION / COMMENTS
			START	END	START	END		
11.09.2013	S - 37	P. Bhushaiah	2.5 bar	2.4 bar	17:22	17:27	P	North Bund Slope
11.09.2013	S - 38	P. Bhushaiah	2.3 bar	2.3 bar	17:38	17:43	P	North Bund Slope
11.09.2013	S - 39	P. Bhushaiah	2.2 bar	2.2 bar	17:52	17:57	P	North Bund Slope
18.09.2013	S - 40	P. Bhushaiah	2.4 bar	2.4 bar	17:18	17:23	P	Base towards East
18.09.2013	S - 41	P. Bhushaiah	2.4 bar	2.3 bar	17:30	17:35	P	Base towards East
18.09.2013	S - 42	P. Bhushaiah	2.2 bar	2.2 bar	17:42	17:47	P	Base towards East
18.09.2013	S - 43	P. Bhushaiah	2.4 bar	2.4 bar	18:12	18:17	P	Base towards East
18.09.2013	S - 44	P. Bhushaiah	2.4 bar	2.3 bar	18:26	18:31	P	Base towards East
24.09.2013	S - 45	P. Bhushaiah	2.3 bar	2.3 bar	16:35	16:40	P	Base towards East
24.09.2013	S - 46	P. Bhushaiah	2.4 bar	2.3 bar	16:48	16:53	P	Base towards East
24.09.2013	S - 47	P. Bhushaiah	2.4 bar	2.4 bar	17:08	17:13	P	Base towards East
24.09.2013	S - 48	P. Bhushaiah	2.3 bar	2.3 bar	17:22	17:27	P	Base towards East
24.09.2013	S - 49	P. Bhushaiah	2.5 bar	2.4 bar	17:38	17:43	P	Base towards East

P. Bhushaiah
Welder / Technician

(P. Venkateswarlu)
Site In - Charge

Project Manager

3680

HYDERABAD INTERAGATED MSW LIMITED

NON-DESTRUCTIVE LOG-AIR TEST

PROJECT NAME : HYDERABAD INTERAGATED MSW LtD, JAWAHARNAGAR.

LOCATION : LANDFILL - PHASE - II TYPE OF MATERIAL : HDPE LINER

Q.A TECHNICIAN : P. Bhushaiah SHEET THICKNESS : 1.50 mm

ASTM D 5820 :Standard Test Method For Pressurized Air Channel Of Duel Seamed Geomembranes

DATE / TIME	SEAM NUMBER	TESTER INITIALS	AIR TESTING PRESSURE		AIR TESTING TIME		TEST RESULT (P or F)	LOCATION / COMMENTS
			START	END	START	END		
24.09.2013	S - 50	P. Bhaskar	2.4 bar	2.4 bar	17:55	18:00	P	Base towards East
27.09.2013	S - 54	P. Bhaskar	2.4 bar	2.3 bar	16:55	17:00	P	North Bund Slope
27.09.2013	S - 55	P. Bhaskar	2.4 bar	2.4 bar	17:12	17:17	P	North Bund Slope
27.09.2013	S - 56	P. Bhaskar	2.3 bar	2.3 bar	17:23	17:28	P	North Bund Slope
27.09.2013	S - 57	P. Bhaskar	2.4 bar	2.3 bar	17:33	17:38	P	North Bund Slope

3681

P. Bhaskar
Welder / Technician

(P. Venkateswara)
Site In - Charae

Project Manager

HYDERABAD INTERAGATED MSW LIMITED

DESTRUCTIVE TEST LOG

Project Name : HYDERABAD INTERAGATED MSW LtD, JAWAHARNAGAR. Location : LANDFILL - PHASE - II

Type Of Material : HDPE Liner Sheet Thickness : 1.50 mm Fusion (N/mm)

Q.A TECHNICIAN : P. Bhushaiah Min.Peel : 400 N/mm Min.Sheer : 525 N/mm

ASTM D 6392 :Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane seams

DATE	SAMPLE I.D	SEAM NO.	MACH NO.	SEAMER INITIALS	PEEL VALUES N / mm				SHEER VALUES N / mm		PASS / FAIL	LOCATION / COMMENTS
03.09.2013	SAMPLE - 1	S - 7	0726072	P. Bhushaiah	523	602	600	612	707	821	P	Sounth Bund Slope
04.09.2013	SAMPLE - 2	S - 14	0726072	P. Bhushaiah	498	526	576	610	809	796	P	Sounth Bund Slope
05.09.2013	SAMPLE - 3	S - 21	0726072	P. Bhushaiah	535	557	581	573	818	825	P	West Bund Slope
06.09.2013	SAMPLE - 4	S - 28	0726072	P. Bhushaiah	512	527	538	560	671	680	P	Base towads West
11.09.2013	SAMPLE - 5	S - 36	0726072	P. Bhushaiah	534	548	567	554	661	657	P	North Bund Slop
18.09.2013	SAMPLE - 6	S - 41	0726072	P. Bhushaiah	557	542	550	541	671	660	P	Base towads East
18.09.2013	SAMPLE - 7	S - 44	0726072	P. Bhushaiah	547	552	558	549	632	649	P	Base towads East
24.09.2013	SAMPLE - 8	S - 49	0726072	P. Bhushaiah	538	549	559	548	645	670	P	Base towads East
31.08.2013	SAMPLE - 9	S - 53	0726072	P. Bhushaiah	549	552	570	558	670	648	P	Base towads South
27.09.2013	SAMPLE - 10	S - 57	0726072	P. Bhushaiah	539	528	550	545	661	672	P	North Bund Slop

3682

P. Bhushaiah
Welder / Technician

(P. Venkateshwarlu)
Site In-charge

Project Manager

HYDERABAD INTERAGATED MSW LIMITED

REPAIR LOG -VACUUM TEST

PROJECT NAME : HYDERABAD INTERAGATED MSW LtD, JAWAHARNAGAR.

LOCATION : LANDFILL - PHASE - II

Type of Material : HDPE Liner

Q.A.Technician : P. Bhushaiah

Sheet Thickness : 1.50 mm

ASTM D 5641: Standard Practice For Geomembrane Seam Evaluation By Vacuum Chamber

REPAIR NUMBER	WELD DATE	MACHINE NUMBER	TECH ID	TEST DATE	TEST P/F	LOCATION / COMMENTS
R - 1	03.09.2013	032	1115	03.09.2013	P	Sounth Bund Slope
R - 2	04.09.2013	032	1115	04.09.2013	P	Sounth Bund Slope
R - 3	05.09.2013	032	1115	05.09.2013	P	West Bund Slope
R - 4	06.09.2013	032	1115	06.09.2013	P	Base towads West
R - 5	11.09.2013	032	1115	11.09.2013	P	North Bund Slop
R - 6	18.09.2013	032	1115	18.09.2013	P	Base towads East
R - 7	18.09.2013	032	1115	18.09.2013	P	Base towads East
R - 8	24.09.2013	032	1115	24.09.2013	P	Base towads East
R - 9	31.08.2013	032	1115	31.08.2013	P	Base towads South
R - 10	27.09.2013	032	1115	27.09.2013	P	North Bund Slop

Welder / Technician

Site-In-charger

Project Manager

HYDERABAD INTERAGATED MSW LIMITED

SEAM LOG

Project Name : HYDERABAD INTERAGATED MSW LtD, JAWAHARNAGAR.

Location : LANDFILL - PHASE - II Material : HDPE LINER

Q.A.Technician : P. Bhushaiah Sheet Thickness : 1.50 mm

Seam Number	Date of Weld	Type of Weld	Length of Seam	Machine Number	Technician ID Number	Location
S - 1	02.09.2013	FUSION	16.50	0726072	1115	South Bund Slope
S - 2	02.09.2013	FUSION	18.00	0726072	1115	South Bund Slope
S - 3	02.09.2013	FUSION	19.00	0726072	1115	South Bund Slope
S - 4	03.09.2013	FUSION	20.00	0726072	1115	South Bund Slope
S - 5	03.09.2013	FUSION	22.00	0726072	1115	South Bund Slope
S - 6	03.09.2013	FUSION	23.00	0726072	1115	South Bund Slope
S - 7	03.09.2013	FUSION	25.50	0726072	1115	South Bund Slope
S - 8	03.09.2013	FUSION	21.00	0726072	1115	South Bund Slope
S - 9	03.09.2013	FUSION	21.00	0726072	1115	South Bund Slope
S - 10	04.09.2013	FUSION	21.00	0726072	1115	South Bund Slope
S - 11	04.09.2013	FUSION	20.50	0726072	1115	South Bund Slope
S - 12	04.09.2013	FUSION	20.50	0726072	1115	South Bund Slope
S - 13	04.09.2013	FUSION	20.00	0726072	1115	South Bund Slope
S - 14	04.09.2013	FUSION	20.00	0726072	1115	South Bund Slope
S - 15	04.09.2013	FUSION	21.00	0726072	1115	West Bund Slope
S - 16	05.09.2013	FUSION	22.50	0726072	1115	West Bund Slope
S - 17	05.09.2013	FUSION	22.50	0726072	1115	West Bund Slope
S - 18	05.09.2013	FUSION	22.00	0726072	1115	West Bund Slope
S - 19	05.09.2013	FUSION	21.00	0726072	1115	West Bund Slope
S - 20	05.09.2013	FUSION	20.00	0726072	1115	West Bund Slope
S - 21	05.09.2013	FUSION	18.50	0726072	1115	West Bund Slope
S - 22	05.09.2013	FUSION	22.00	0726072	1115	West Bund Slope
S - 23	05.09.2013	FUSION	22.50	0726072	1115	West Bund Slope
S - 24	05.09.2013	FUSION	22.50	0726072	1115	North Bund Slope
S - 25	06.09.2013	FUSION	23.00	0726072	1115	North Bund Slope
S - 26	06.09.2013	FUSION	23.00	0726072	1115	Base towards West
S - 27	06.09.2013	FUSION	11.50	0726072	1115	Base towards West
S - 28	06.09.2013	FUSION	8.00	0726072	1115	Base towards West
S - 29	06.09.2013	FUSION	10.00	0726072	1115	Base towards West

Welder / Technician

Site In-charge

Project Manager

HYDERABAD INTERAGATED MSW LIMITED

SEAM LOG

Project Name : HYDERABAD INTERAGATED MSW LtD, JAWAHARNAGAR.

Location : LANDFILL - PHASE - II Material : HDPE LINER

Q.A.Technician : P. Bhushaiah Sheet Thickness : 1.50 mm

Seam Number	Date of Weld	Type of Weld	Length of Seam	Machine Number	Technician ID Number	Location
S - 30	06.09.2013	FUSION	11.00	0726072	1115	Base towards West
S - 31	10.09.2013	FUSION	14.00	0726072	1115	North Bund Slope
S - 32	10.09.2013	FUSION	12.50	0726072	1115	North Bund Slope
S - 33	10.09.2013	FUSION	13.00	0726072	1115	North Bund Slope
S - 34	10.09.2013	FUSION	14.50	0726072	1115	North Bund Slope
S - 35	10.09.2013	FUSION	24.00	0726072	1115	North Bund Slope
S - 36	11.09.2013	FUSION	24.00	0726072	1115	North Bund Slope
S - 37	11.09.2013	FUSION	24.50	0726072	1115	North Bund Slope
S - 38	11.09.2013	FUSION	24.50	0726072	1115	North Bund Slope
S - 39	11.09.2013	FUSION	30.00	0726072	1115	North Bund Slope
S - 40	18.09.2013	FUSION	30.00	0726072	1115	Base towards East
S - 41	18.09.2013	FUSION	29.00	0726072	1115	Base towards East
S - 42	18.09.2013	FUSION	48.00	0726072	1115	Base towards East
S - 43	18.09.2013	FUSION	48.00	0726072	1115	Base towards East
S - 44	18.09.2013	FUSION	48.00	0726072	1115	Base towards East
S - 45	24.09.2013	FUSION	30.00	0726072	1115	Base towards East
S - 46	24.09.2013	FUSION	30.00	0726072	1115	Base towards East
S - 47	24.09.2013	FUSION	30.00	0726072	1115	Base towards East
S - 48	24.09.2013	FUSION	30.00	0726072	1115	Base towards East
S - 49	24.09.2013	FUSION	30.00	0726072	1115	Base towards East
S - 50	24.09.2013	FUSION	30.00	0726072	1115	Base towards East
S - 51	31.08.2013	FUSION	40.00	0726072	1115	Base towards South
S - 52	31.08.2013	FUSION	40.00	0726072	1115	Base towards South
S - 53	31.08.2013	FUSION	40.00	0726072	1115	Base towards South
S - 54	27.09.2013	FUSION	14.50	0726072	1115	North Bund Slope
S - 55	27.09.2013	FUSION	14.50	0726072	1115	North Bund Slope
S - 56	27.09.2013	FUSION	14.50	0726072	1115	North Bund Slope
S - 57	27.09.2013	FUSION	14.50	0726072	1115	North Bund Slope

Welder / Technician

Site In-charge

Project Manager

HYDERABAD INTERAGATED MSW LIMITED

PANEL PLACEMENT LOG

Project Name : HYDERABAD INTERAGATED MSW LtD, JAWAHARNAGAR.

Location : LANDFILL - PHASE - II Material : HDPE LINER

Q.A.Technician : P. Bhushaiah Sheet Thickness : 1.50 mm

Panel Number	Roll Number	Deployment Date	Width (Mtrs)	Length (Mtrs)	Location
P - 1	806531952	02.09.2013	7.00	16.50	South Bund Slope
P - 2	806531952	02.09.2013	7.00	18.00	South Bund Slope
P - 3	806531952	02.09.2013	7.00	19.00	South Bund Slope
P - 4	806531952	02.09.2013	7.00	20.00	South Bund Slope
P - 5	806531952	03.09.2013	7.00	22.00	South Bund Slope
P - 6	806531952	03.09.2013	7.00	23.00	South Bund Slope
P - 7	806531952	03.09.2013	7.00	25.50	South Bund Slope
P - 8	806531945	03.09.2013	7.00	21.00	South Bund Slope
P - 9	806531945	03.09.2013	7.00	21.00	South Bund Slope
P - 10	806531945	04.09.2013	7.00	21.00	South Bund Slope
P - 11	806531945	04.09.2013	7.00	20.50	South Bund Slope
P - 12	806531945	04.09.2013	7.00	20.50	South Bund Slope
P - 13	806531945	04.09.2013	7.00	20.00	South Bund Slope
P - 14	806531945	04.09.2013	7.00	20.00	South Bund Slope
P - 15	806539528	04.09.2013	7.00	21.00	West Bund Slope
P - 16	806539528	05.09.2013	7.00	22.50	West Bund Slope
P - 17	806539528	05.09.2013	7.00	22.50	West Bund Slope
P - 18	806539528	05.09.2013	7.00	22.00	West Bund Slope
P - 19	806539528	05.09.2013	7.00	21.00	West Bund Slope
P - 20	806539528	05.09.2013	7.00	20.00	West Bund Slope
P - 21	806539528	05.09.2013	7.00	18.50	West Bund Slope
P - 22	806539421	05.09.2013	7.00	22.00	West Bund Slope
P - 23	806539421	05.09.2013	7.00	22.50	West Bund Slope
P - 24	806539421	05.09.2013	7.00	22.50	North Bund Slope
P - 25	806539421	05.09.2013	7.00	23.00	North Bund Slope
P - 26	806539421	06.09.2013	7.00	23.00	Base towards West
P - 27	806539421	06.09.2013	7.00	11.50	Base towards West
P - 28	806539421	06.09.2013	7.00	8.00	Base towards West
P - 29	806539450	06.09.2013	7.00	10.00	Base towards West

Welder / Technician

Site In-charge

Project Manager

HYDERABAD INTERAGATED MSW LIMITED

PANEL PLACEMENT LOG

Project Name : HYDERABAD INTERAGATED MSW LtD, JAWAHARNAGAR.

Location : LANDFILL - PHASE - II Material : HDPE LINER

Q.A.Technician : P. Bhushaiah Sheet Thickness : 1.50 mm

Panel Number	Roll Number	Deployment Date	Width (Mtrs)	Length (Mtrs)	Location
P - 30	806539450	06.09.2013	7.00	11.00	Base towards West
P - 31	806539450	10.09.2013	7.00	14.00	North Bund Slope
P - 32	806539450	10.09.2013	7.00	12.50	North Bund Slope
P - 33	806539450	10.09.2013	7.00	13.00	North Bund Slope
P - 34	806539450	10.09.2013	7.00	14.50	North Bund Slope
P - 35	806539450	10.09.2013	7.00	24.00	North Bund Slope
P - 36	806539450	11.09.2013	7.00	24.00	North Bund Slope
P - 37	806539574	11.09.2013	7.00	24.50	North Bund Slope
P - 38	806539574	11.09.2013	7.00	24.50	North Bund Slope
P - 39	806539574	11.09.2013	7.00	30.00	North Bund Slope
P - 40	806539574	18.09.2013	7.00	30.00	Base towards East
P - 41	806539574	18.09.2013	7.00	29.00	Base towards East
P - 42	806539427	18.09.2013	7.00	48.00	Base towards East
P - 43	806539427	18.09.2013	7.00	48.00	Base towards East
P - 44	806539427	18.09.2013	7.00	48.00	Base towards East
P - 45	806539622	24.09.2013	7.00	30.00	Base towards East
P - 46	806539622	24.09.2013	7.00	30.00	Base towards East
P - 47	806539622	24.09.2013	7.00	30.00	Base towards East
P - 48	806539622	24.09.2013	7.00	30.00	Base towards East
P - 49	806539622	24.09.2013	7.00	30.00	Base towards East
P - 50	806539467	24.09.2013	7.00	30.00	Base towards East
P - 51	806539467	31.08.2013	7.00	40.00	Base towards South
P - 52	806539467	31.08.2013	7.00	40.00	Base towards South
P - 53	806539467	31.08.2013	7.00	40.00	Base towards South
P - 54	806531947	27.09.2013	7.00	14.50	North Bund Slope
P - 55	806531947	27.09.2013	7.00	14.50	North Bund Slope
P - 56	806531947	27.09.2013	7.00	14.50	North Bund Slope
P - 57	806531947	27.09.2013	7.00	14.50	North Bund Slope

Welder / Technician

Site In-charge

Project Manager

न्ट्रल इनस्टीट्यूट ऑफ प्लास्टिक्स
न्जीनियरिंग एण्ड टेक्नॉलाजी
सायन एवं उर्वरक मंत्रालय, भारत सरकार)
व.सी.एल. पोस्ट, आई.डी.ए.,
स - II, चेरलापल्ली, हैदराबाद - ५०० ०५१.
ाभाष : 040-27263750, 27263615,
क्स : 91-40-27264051
मेइल : cipethyderabad@yahoo.co.in
बसाइट : www.cipet.gov.in

CENTRAL INSTITUTE OF PLASTICS
ENGINEERING & TECHNOLOGY
(Ministry of Chemicals & Fertilizers, Govt. of India)
HCL Post, IDA - Phase - II,
Cherlapally, Hyderabad - 500 051.
Phone : 040-27263750, 27263615,
Fax : 91-40-27264051
E-mail : cipethyderabad@yahoo.co.in
Web : www.cipet.gov.in

सिपेट / हैदराबाद / एमपिओ / 2013–14
CIPET/HYD/PTC/2013-14

दिनांक : 10.10.2013
Date : 10.10.2013

सेवा मे,
To

M/s. Hyderabad Integrated MSW Ltd.,
5th Floor, TSR Towers, Door No.6-3-1090,
Somajiguda, Rajbhavan Road,
Hyderabad – 500 082

विशय :– परीक्षण प्रतिवेदन – संदर्भ मे ।

Sub : Issue of test report
Ref : letter No. nil dated 27.09.2013

प्रिय महोदय, / Dear Sir,

उपरोत्क विशय के संदर्भ में, कृपया इस पत्र के साथ परीक्षण प्रतिवेदन सं : 1301008 दि:10.10.2013 एतथा प्रतिपुष्टी प्रात्प संलग्नीय हैं । कृपया इसे भरकर हमें वापस लौटा दे ।

With reference to the above cited subject, we are enclosing herewith Test Report No.1301008 dated: 10.10.2013 and Invoice. We are also enclosing herewith feedback form. Kindly fill it and sent it back to us.

धन्यवाद तथा अच्छी सेवा के आश्तासन के साथ ।

Thanking you and assuring you of our best services.

आपका भवदिय, / Yours faithfully,

वि.किरण कूमार / (V.Kiran Kumar)
प्रबंधक परियोजना / Manager(Project)

संलग्न : यथोक्त / Encl : As above

सेन्ट्रल इनस्टीट्यूट ऑफ प्लास्टिक्स इन्जीनियरिंग एण्ड टेक्नॉलाजी
(रसायन एवं उर्वरक मंत्रालय, भारत सरकार)
एच.सी.एल. पोस्ट, आई.डी.ए., फेस - II, चेरलापल्ली, हैदराबाद - ५०० ०५१.

CENTRAL INSTITUTE OF PLASTICS ENGINEERING & TECHNOLOGY
(Ministry of Chemicals & Fertilizers, Govt. Of India)
HCL Post, IDA - Phase - II, Cherlapally, Hyderabad - 500 051.
Phone : 27263750, 27263615, Fax : 91-40-27264051
E-mail:cipethyderabad@yahoo.co.in, Web:www.cipet.gov.in

Plastics Testing Centre

0121301

Test Certificate

Issued to: *M/s.Hyderabad Integrated MSW Ltd.*,
5th Floor, TSR Towers, Door No.6-3-1090,
Somajiguda, Rajbhavan Road,
Hyderabad – 500 082

Date:10.10.2013

Ref : letter No. nil dated 27.09.2013

TEST REPORT AS PER :- Customer standard REPORT NO :1301008

PART A : PARTICULARS OF SAMPLE SUBMITTED

a) Name of the Sample	:	HDPE Liner (Geomembrane)
b) Grade/Variety/Type/Size/Class	:	1.5mm thick
c) Declared values, if any	:	Location : Jawahar Nagar, Landfill Phase-II
d) Code No.	:	Nil
e) Batch No. and Date of Manufacture	:	Nil
f) Quantity	:	As per layout
g) Mode of Packing	:	loose
h) Seal	:	Nil
i) Any other information	:	On site Test done on 30.09.2013

PART B : *SUPPLEMENTARY INFORMATION*

a) Reference to sampling Procedure	:	Nil
b) Supporting documents for the measurement taken and result derived	:	Nil
c) Deviation from the test method as prescribed in relevant work instructions, if any	:	Nil

सेन्ट्रल इनस्टीट्यूट ऑफ प्लास्टिक्स इन्जीनियरिंग एण्ड टेक्नॉलाजी
चेरलापल्ली, हैदराबाद - ५०० ०५१.
CENTRAL INSTITUTE OF PLASTICS ENGINEERING & TECHNOLOGY
Cherlapally, Hyderabad - 500 051.

Test Certificate

:0121301

Continuation Sheet

REPORT No. 1301008

PART – C

TEST RESULTS

SNO.	TEST	SEAM NO.	PRESSURE & TIME/ Force(lbs)	RESULT
1.	Air Pressure test	S-01	2.4 Bar / 5 mts.	PASSED
2.	Air Pressure test	S-04	2.5Bar / 5 mts.	PASSED
3.	Air Pressure test	S-08	2.4 Bar / 5 mts.	PASSED
4.	Air Pressure test	S-12	2.6 Bar / 5 mts.	PASSED
5.	Air Pressure test	S-15	2.4 Bar / 5 mts.	PASSED
6.	Air Pressure test	S-26	2.4 Bar / 5 mts.	PASSED
7.	Air Pressure test	S-27	2.3 Bar / 5 mts.	PASSED
8.	Air Pressure test	S-28	2.5 Bar / 5 mts.	PASSED
9.	Tensile Strength (Peel) N	S-13	672	PASSED
10.	Tensile Strength (Peel) N	S-26	638	PASSED
11.	Tensile Strength (Peel) N	S-21	795	PASSED
12.	Tensile Strength (Peel) N	S-28	644	PASSED
13.	Tensile Strength (Peel) N	S-28	543	PASSED
14.	Tensile Strength (Shear) N	S-13	767	PASSED
15.	Tensile Strength (Shear) N	S-26	700	PASSED
16.	Tensile Strength (Shear) N	S-21	857	PASSED
17.	Tensile Strength (Shear) N	S-28	677	PASSED

PART D: REMARKS : Nil

NB: 1. The results related only to items/samples tested.
2. The report shall not be reproduced in full/part without written approval of the laboratory.

QUALITY MANAGER
AUTHORISED SIGNATORY

ANNEXURE III

Sustainability
HMESPL

Date: 30.05.2025

T.G. POLLUTION CONTROL BOARD
31 MAY 2025
Parivesh Bhawan, A-3, Sanathnagar, Hyd-18

HMESPL/ TSPCB/CFO/RO-Medchal/HO/2020/442/09

To,
Telangana State Pollution Control Board,
A-3, Industrial Estate, Opposite Police Station,
Sanathnagar, Hyderabad, Telangana 500018.

Sub: Submission of Half Yearly Consent for Operation & HWA Compliance Report of Hyderabad MSW Energy Solutions Private Ltd. (by GHMC) at Sy. No. 173, Jawaharnagar Village, Kapra Mandal, Medchal-Malkajgiri Dist. in Telangana State.

Sir/Madam,
With reference to the above mentioned subject we are submitting the Compliance Report to stipulated conditions for the period (October 2024 - March 2025) vide Consent Order, HWA No.: TSPCB/CFO/RO-Medchal/HO/2020/442 Dated: 15.07.2020 and it's Amendment Consent Orders, HW No. 01/TSPCB/CFO/MDC/MSW/WtE/HO/2022 Dated: 10.03.2022 of M/s. Hyderabad MSW Energy Solutions Private Ltd for your kind records please.

Thanking You
Yours Faithfully
For Hyderabad MSW Energy Solutions Private Ltd

Authorized Signatory

T.G. Pollution Control Board, Regional Office, Medchal-Malkajgiri Dist.
No.
Date 31/05/25

Encl. – As above

CC to:

REGIONAL OFFICE- Medchal, T .G. PCB. H.No.6-3-1219, TS No.1 part, Block-C, Ward No.91, Begumpet, Umanagar, Near Country Club, Hyderabad - 500 016.

Subject: Half yearly Compliance Report to the Consent for Operation (CFO) of 24 MW Municipal Solid Waste (RDF) Based Power Plant for Power Generation by M/s Hyderabad MSW Energy Solutions Private Limited (by GHMC) at Sy. No. 173, Jawaharnagar (V), Shameerpet (M), Medchal - Malkajgiri District from October 2024 to March 2025.

Consent Order, HWA No.:
1. TSPCB/CFO/RO-Medchal/HO/2020/442 Dated: 15.07.2020,
2. Amendment Order No. 01/TSPCB/CFO/MDC/MSW/WtE/HO/2022 Dated: 10.03.2022.

Period: October 2024 to March 2025.

SCHEDULE - A

S.no	Conditions	Compliance status
1	The applicant Shall make applications through online for renewal of Consent (under Water & Air Acts) and Authorisation under HWM Rules at least 120 days before the date of expiry of this order, along with prescribed fee under Water and Air Acts for obtaining Consent & HW Authorisation of the Board.	Agreed and will be followed.
2.	This order is issued in line with Board's CFE order dated 23.09.2017. Concealing the factual data or submission of false information/fabricated data and failure to comply with any of the conditions mentioned in this order may result in with drawl of this order and attract action under the provisions of relevant pollution control acts. The industry shall comply with all other conditions of CFE order dated 23.09.2017 still applicable.	Agreed.
3.	Any person aggrieved by an order made by the state Board under Section 25, Section 26, Section 27 of Water Act, 1974 or Section 21 of Air Act, 1981 may within thirty days from the date on which the order is communicated to him, prefer an appeal as per Andhra Pradesh Water Rules, 1976 and Air Rules 1982, to such authority (hereafter referred as appellate authority), constituted under Section 28 of the Water (Prevention and Control of Pollution)	Agreed.

	Act, 1974 and section 31 of the Air (Prevention and Control of Pollution) Act, 1981.	
4.	The industry may explore the possibility of tapping solar energy for their energy requirements.	Agreed. The project itself is a renewable energy plant.
5	The board reserves its right to modify above conditions or stipulate any further conditions and to take action including revoke of this order in the interest of protection public health and environment.	Agreed

SCHEDULE – B

<table>
<tr><th>S. No</th><th>Condition</th><th>Compliance Status</th></tr>
<tr><td>1.</td><td>As per GHMC letter dated 29.04.2025, the surplus quantity of RDF unutilized and stored at Jawaharnagar is 57,96,758 TPD (restricting the RDF quantity generation to 2400 TPD) is sufficient for 14.64 years @1200 TPD for the operation of Phase-II 24 MW. Hence, the industry shall utilize this existing unutilized RDF only for the Phase-II 24MW power plant.</td><td>Agreed and followed.</td></tr>
<tr><td>2.</td><td>The industry shall take steps to reduce water consumption to the extent possible and consumption shall NOT exceed the quantities prescribed below:
<table>
<tr><th>S. No.</th><th>Purpose</th><th>Quantity (Total after Expansion)</th></tr>
<tr><td>1.</td><td>Boiler feed (DM Plant/ RO Plant feed permeates)</td><td>360 KLD</td></tr>
<tr><td>2.</td><td>Cooling tower</td><td>120 KLD</td></tr>
</table></td><td>Agreed and followed.

The following initiatives are taken to reduce Water consumption:

1. All the Boiler blow down, Auxiliary Cooling Tower Blowdown and WTP process rejects are being collected in neutralisation pit, after neutralisation of this water is being used for Ash quenching and preparation of Lime slurry which is being used in Flue Gas Cleaning System.
2. Adjacent MEE (Leachate Treatment Plant) Condensate water is also being used for reduction in net water consumption.</td></tr>
</table>

		makeup	
	3.	Domestic	40 KLD
	4.	Gardening Purpose	80 KLD
		Total:	**600 KLD**

The allowed quantity of Water consumption will not be exceeded.

3. The effluent discharged should not contain constituents in excess of the tolerance limits prescribed below:

Outlet	Parameter	Limiting Standards
1 & 3	pH	5.5 - 9.0
	Total Suspended Solids (at 103-105°C)	200 mg/L
	Total Dissolved Solids (TDS)	2100 mg/L
	Oil & Grease	10 mg/L
	Chemical Oxygen Demand (COD)	250 mg/L
	Bio-Chemical Oxygen Demand (BOD_3 at 27°C)	100 mg/L
	Ammonical Nitrogen	<50 mg/L
	Phenolic compounds	<1 mg/L

Agreed and followed.

The project implemented Zero Liquid Discharge. Hence, there is no discharge of liquid.

4. The emissions shall not contain constituents in excess of the prescribed limits mentioned below.

Chimney No.	Parameter and Emission Standards
1 & 4	Particulate Matter - 50mg/Nm^3, HCl - 50mg/Nm^3, SO2 - 200mg/Nm^3, CO - 100mg/Nm^3, Total organic carbon - 20mg/Nm^3, HF- 4mg/Nm^3, NO_x-

Agreed and Being complied with norms.

Air pollution control equipment like semi dry type Flue Gas Cleaning System consists of Reaction Tower by adding Lime and Activated Carbon; followed by Bag Filters. The above pollution control equipments are capable to control the PM within 115 mg/Nm3.

Stack Emission Monitoring Reports are enclosed

		400mg/Nm³, Total Dioxins and Furans-0.1ngTEQ/Nm³, Cd + Th + their compounds -0.05mg/ Nm³, Hg and its compounds-0.05mg/Nm³, and Sb+As+ Pb+Cr+Co+Cu+Mn+ Ni+V+ their compounds- 0.05 mg/Nm³ as prescribed in Schedule-II (C) of the Solid Waste Management Rules, 2016	as **Annexure -1.** Boiler Stack Emission Monitoring Results Values are in mg/Nm³ **Parameter**: SO_2 = 32.8; NO_x = 343; PM = 30.7; CO = 46.6; HCl = 14.9; HF = 0.68; TOC = 6.9
	2,3,5&6	Particulate Matter - 115mg/Nm³	
5	The industry shall comply with ambient air quality standards of PM_{10}(Particulate matter size less than 10µm)-100µg/m³, $PM_{2.5}$(Particulate Matter size less than 2.5µm)-60µg/m³, SO2- 80µm/m³ NOx-80µm/m³, outside the industry premises at the periphery of the industry. Standards for Ambient Air quality at the MSW landfill site and at the vicinity shall be complied. SO2-80 µm/m³, SPM-100 µm/m³, Methane not to Exceed 25% of explosive limit (650 mg/m³), Ammonia- 0.4 mg/m³, CO-2 mg/m³ (1 hour average) & CO-1 mg/m³ (8 hours average). **Noise Levels:** Day time – (6 AM to 10 PM) - 75 dB(A) Night time - (10 PM to 6 AM) - 70 dB(A)	Being complied with the norms. Ambient Air and Noise Level Reports are enclosed as **Annexure-2A & Annexure-2B.** **AAQM Results** For the period of October 2024 – March 2025 Values are in µg/m³

LOCATION : Near MSW Pit					
	SO_2	NO_2	PM10	PM2.5	CO
Min	13.9	28	53	25.7	1
Max	17.2	35	72	35.8	1.3
Avg	15.1	32.3	60.8	29	1.1
LOCATION : Near Air Cooling Condenser					
	SO_2	NO_2	PM10	PM2.5	CO
Min	13.4	28	55	24.6	1
Max	18.5	38	68	34.4	1.2
Avg	16.1	33.7	62.2	30.8	1.1

Noise Levels
For the period of October 2024 – March 2025
Values are in dB(A)

Month	Near MSW Pit		Near Air Cooling Condenser	
	Day	Night	Day	Night
Oct-25	65.7	54.1	70.8	66.2
Nov-25	66.8	55.1	70.3	67.5
Dec-25	69.9	62.3	71.6	66.8
Jan-25	70.4	65.2	72.6	64.5

		Feb-25	70.9	66.6	71.2	63.9
		March-25	69.8	64.6	70.5	62.2
6	The industry shall provide and maintain water flow meters for recording water consumption for various purpose and maintain the records for daily consumption.	Agreed and Being Complied. Separate water flow meters were installed for industrial & domestic water consumption and records are being maintained.				
7	The industry shall provide and operate ETP consisting of collection tank and neutralisation tank for treatment of RO rejects, boiler blow down , cooling bleed off and after neutralisation the treated water shall be used for ash quenching.	Rejects of the Water Treatment Plant, Cooling Tower Blowdown and Boiler Blowdown are being collected in Neutralisation Pit, after neutralisation the treated water is being reused for ash quenching. Hence there is no need of ETP at present.				
8	The industry shall ensure that combustion process is carried out at 950^{0}C and the flue gas shall have a residence time of 2 seconds minimum to destruct the dioxins and furans.	Combustion process is being carried out at >950^{0}C and the flue gas will be having a residence time of 2 seconds minimum to destruct the dioxins and furans.				
9	The industry shall use Hydrated Lime, Activated Carbon to remove Dioxins and Furans and Heavy Metals and finally by Bag Filter System for the treatment of flue gases.	Agreed and being complied. Hydrated Lime and Activated Carbon using to remove Dioxins and Furans and Heavy Metals and Bag Houses are also installed on each Boiler to collect the Particulate Matter.				
10	The industry shall provide Online Continuous Emissions Monitoring System (OCEMS) for stack attached to boilers for parameters SPM, SO2, NOx, HCl and CO.	Complied. Online Continuous Emissions Monitoring System (OCEMS) to monitor stack emissions has been installed & operational and data is being transmitted to TSPCB.				
11	The industry shall provide two AAQM stations within 6 months, as committed vide letter dated 26.04.2025.	Agreed				
12	The RDF shall be stored in	Complied.				

	closed tanker/pit. The bunker/pit shall be operated under negative pressure so as to control odorous gases and drawn into boiler	The RDF is being stored in closed pit and it is being operated under negative pressure to control the odours gases by drawing of those gases in to boilers.
13	The industry shall explore the possibility of burning the gases generated from the integrated Municipal Solid waste legacy dumpsite in the boilers to control odour in the area.	Complied. Exploration of usage Landfill gas (LFG) generated from legacy dumpsite is being carried out. LFG to CBG plant commissioned and its being operational.
14	The industry shall develop & maintain thick green belt all along the boundary of the industry and in all the vacant places within the industry with tall growing trees with wide leaf area.	Agreed and Being complied. Planting of the Saplings is being done for development of the thick green belt and it is being maintained with the 85% of survival rate. About 3000 saplings have been procured from GHMC & planted inside the Plant Premises.
15	The industry shall collect and store the ash generated in a closed shed and shall dispose into the secured landfill. The industry shall install bottom ash processing facility within 6 months, as committed vide letter dated 26.04.2025.	Agreed & Complied. Generated Ash is being collected & stored in a closed shed called Ash pit and is being disposed into the secured landfill.
16	The industry shall maintain good housekeeping.	Agreed and being complied. Good House Keeping practices are adopted and being implemented for keeping the plant clean.
17	The industry shall ensure that there shall not be any change in the process technology and scope of working without prior approval from the Board.	Agreed. We have taken prior permission from the board for enhancement of plant capacity from 24 MW to 48 MW on dated 05.05.2025.
18	The vehicle transporting municipal solid waste shall be covered with tarpaulin covers.	We are not doing the Transportation of MSW, we receive RDF from the Processing and Disposal facility.
19	The industry shall ensure to operate dust suppression system consisting of water sprinkling system, suction	Agreed

	hoods followed by odour extraction system at material, raw material handling areas and RDF storage bunkers to mitigate odour.	
20	The industry shall comply with Task Force directions issued by the Board from time to time.	Agreed
21	The industry shall comply with SWM Rules, 2016 for operation of the plant.	Agreed and followed.
22	The applicant shall submit Environment Statement in Form-V to the Regional office before 30th September of every year as per Rule. 14 of E(P) Rules, 1986 & amendments thereof.	Complied. Submitted Environmental Statement in Form- V to the State Pollution control Board authorities on 30th September 2024 for the financial year 2023 -24 vide letter no. HMESPL/EC/ES/2023 - 24 dated September 30th, 2024.
23	The conditions stipulated in this order are without any prejudice to rights and contentions of this Board in any Hon'ble court of Law.	Noted and Agreed.

SCHEDULE – C

[see rule 6(2)]

[CONDITIONS OF AUTHORISATION FOR OCCUPIER OR OPERATOR HANDLING HAZARDOUS WASTES]

S.no	Conditions	Compliance status
1	The industry shall give top priority for waste minimisation and cleaner production practices.	Agreed and being complied. Based on nature of the waste all the hazardous will be disposed through authorised recyclers. Ash is being disposed through secured landfill.
2.	The industry shall not store hazardous waste for more than 90 days as per the Hazardous wastes	Agreed.

	(Management, Handling and transboundary Movement) Rules, 2008 and amendments thereof. The facility shall maintain 6 copy manifest system for transportation of waste generated and copies of receipt of Consignee shall submitted to the Concerned regional office. The facility shall maintain proper records for hazardous Wastes stated in Authorisation in FORM-3 i.e. quantity of Incinerable waste, land disposal waste, recyclable waste etc. and file annual returns in FORM - 4 as per Rule 22(2) of Hazardous wastes((Management, Handling & transboundary Movement) Rules, 2008 and amendments thereof.	
3	The industry shall dispose /sell the Hazardous Waste to only industries /agencies authorised by the State Pollution Control Boards. The industry shall verify the authorisation of the Board given to the Party before disposing its waste to the External Party.	Agreed and will be complied, collected hazardous waste will be sold out to the SPCB authorized recycler only. After verification of the Authorization for recycling as per Hazardous and Other Wastes (Management and transboundary Movement) Rules, 2016.
4	The industry shall maintain proper records for Hazardous Wastes disposal and its concurrence with authorisation. In case of variation in generation, industry shall submit explanation and obtain amendment CFE/CFO in this regard.	We have noted and we are agreed to the condition given in the Consent. Hazardous Waste Generation & Disposal Records will be maintained.
5	The industry shall store Used / waste Oil and Used Lead Acid Batteries in a secured way in their premises till its disposal. Waste oils shall be disposed to the authorised Reprocesses / Recyclers and used Lead Acid Batteries shall be disposed to the manufacturers / Dealers on buyback basis. The industry shall take necessary practical steps for prevention of oil spillages and carry over of oil from the premises. The industry shall check the Certificate / Authorisation/order of MoEF issued to the Re-user/Recycle units	Agreed. Separate storage facility for hazardous Waste was demarcated, hazardous waste is not generated till now. Generated Hazardous Waste and Used Lead Acid Batteries will be

	while disposing the waste oil.	stored under covered shed at an isolated covered place; the floor will be concreted & person working at site will be provided with all required PPEs. Hazardous Waste (Waste oil) will be collected in drums and disposed to authorized re-processors / recyclers as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. Used Lead Acid Batteries will be returned to the Dealers on buyback basis. We ensure that there will be no spillages of Hazardous waste.
6	The industry shall dispose of e-waste to authorised recyclers only.	Agreed and followed.
7	The industry shall submit the condition wise compliance report of the conditions stipulated in Schedule B & C of this Order on half yearly basis to Board Office, Hyderabad and Concerned Regional Office.	Agreed and submitted through the tenure of the facility.

Vimta Labs Limited
Registered Office
142, IDA Phase II, Cherlapally
Hyderabad-500 051, Telangana, India
T : +91 40 2726 4141
F : +91 40 2726 3657

TC-5418

Vimta
Driven by Quality. Inspired by Science.

ISSUED TO:

M/S. Hyderabad MSW Energy Solutions Pvt Ltd,
Survey No: 173, Jawaharnagar,
CRPF Road, Near Army College of Dental Sciences,
Kapra Mandal, Medchal District,
Telangana State-500087.

Report Number	:	VLL/VLS/24/18421/001
Issued Date	:	2025.01.25
P.O. Number	:	0400107342
P.O. Date	:	10.01.2024

SAMPLE PARTICULARS : **STACK CONNECTED TO BOILER NO-1&2**

Sampling Date	:	2024.12.23	Sample Registration Date	:	2024.12.24
Analysis Starting Date	:	2024.12.24	Analysis Completion Date	:	2025.01.24
Test Required	:	Temperature,Velocity,Flow,O_2,CO2,CO,Moisture,HF,Hcl,PM,NOx, SO_2,and TOC.			

Sample Collected by Vimta Labs Ltd

TEST REPORT

Sr. No.	Parameters	UoM	Method of Testing	Results	Limits as per Solid Waste Management Rules, 2016
1	Diameter of stack	m	-	3.0	-
2	Flue gas temperature	°C	USEPA method -2	157	-
3	Velocity	m/sec		13.96	-
4	Volumetric flow rate	Nm^3/Sec		72.608	-
5	Oxygen as O_2	%	By Combustion Gas Analyzer	10.8	-
6	Carbon Dioxide as CO_2	%		8.9	-
7	Carbon Monoxide as CO	mg/Nm^3		72.8	-
8	Moisture Content	%,v/v	USEPA method -4	9.1	-
9	Hydrogen Fluoride as HF	mg/Nm^3	USEPA method- 26	0.41	< 4.0
10	Hydrogen Chloride as HCl	mg/Nm^3		16.2	< 50.0
11	Particulate Matter as PM	mg/Nm^3	USEPA method-5	25.56	< 50.0
12	Oxides of Nitrogen as NO_2	mg/Nm^3	USEPA method -07	237.0	< 400.0
13	Sulphur Dioxide as SO_2	mg/Nm^3	USEPA method -06	33.9	< 200.0
14	Total Organic Carbon	mg/Nm^3	USEPA method -40 & MM5(10)	4.7	< 20.0

All the Values are represented at 11% O_2

Dr. Subba Reddy Mallampati.
Manager-Environment

Vimta Labs Limited
Registered Office:
142, IDA Phase-II, Cherlapally,
Hyderabad-500 051, Telangana, India.
T: +91 40 2726 4141
F: +91 40 2726 3657

Vimta
Driven by Quality. Inspired by Science.

TC-5418

ISSUED TO:

M/S. Hyderabad MSW Energy Solutions Pvt Ltd,
Survey No: 173, Jawaharnagar,
CRPF Road, Near Army College of Dental Sciences,Kapra Mandal, Medchal District,
Telangana State-500087.

Report Number	:	VLL/VLS/24/18421/001
Issued Date	:	2025.01.25
P.O. Number	:	0400107342
P.O. Date	:	10.01.2024

SAMPLE PARTICULARS : **STACK CONNECTED TO BOILER NO-1&2**

Sampling Date	:	2024.12.23	Sample Registration Date	:	2024.12.24
Analysis Starting Date	:	2024.12.24	Analysis Completion Date	:	2025.01.24
Test Required	:	Hg & its compounds, Sb+As+Pb+Co+Cr+Cu+Mn+Ni+V+Their compounds			

TEST REPORT

Sr. No.	Parameters	UoM	Method of Testing	Results	Limits as per Solid Waste Management Rules, 2016
15	Mercury as Hg + their Compound	mg/Nm³	USEPA method -29	0.006	<0.05
16	Cadmium + Thorium (Cd + Th) +their Compound			<0.001	<0.05
	Chromium as Cr + their Compound			0.019	<0.5
	Manganese as Mn + their Compound			0.021	
	Arsenic as As + their Compound			0.014	
	Antimony as Sb + their Compound			0.006	
	Lead as Pb + their Compound			0.008	
	Cobalt as Co + their Compound			0.011	
	Copper as Cu + their Compound			0.02	
	Nickel as Ni + their Compound			0.003	
	Vanadium as V + their Compound			0.004	
	Zinc as Zn+ their Compound			0.033	
	Tin as Sn+ their Compound			0.012	
	Selenium as Se+ their Compound			0.005	
	Total Metals: Sb+ As+ Pb+ Co+ Cr+ Cu+ Mn+ Ni+ V+ Their compounds			0.156	

All the values are represented at 11% O2

Dr. Subba Reddy Mallampati.
Manager-Environment

Vimta Labs Limited
Registered Office
142, IDA Phase II, Cherlapally
Hyderabad-500 051,Telangana, India
T : +91 40 2726 4141
F : +91 40 2726 3657

Vimta
Driven by Quality. Inspired by Science.

ISSUED TO:
M/S. Hyderabad MSW Energy Solutions Pvt Ltd,
Survey No: 173, Jawaharnagar,
CRPF Road, Near Army College of Dental Sciences,
Kapra Mandal, Medchal District,
Telangana State-500087.

Report Number : VLL/VLS/24/18421/002
Issued Date : 2025.01.25
P.O. Number : 0400107342
P.O. Date : 10.01.2024

SAMPLE PARTICULARS : **STACK CONNECTED TO BOILER NO-1&2**

Sampling Date	:	2024.12.23	Sample Registration Date	:	2024.12.24
Analysis Starting Date	:	2024.12.24	Analysis Completion Date	:	2025.01.24
Test Required	:	Temperature, Velocity,Volumetric flow rate, Oxygen, Dioxin & Furans (PCDD& PCDF)			

TEST REPORT

Sr.No.	Parameters	UoM	Results	
Physical Parametersof stack				
1	Diameter of stack	m	3.0	
2	Flue gas temperature	°C	157	
3	Velocity	m/Sec	13.96	
4	Volumetric flow rate	Nm^3/Sec	72.608	
5	Oxygen as O_2	%	10.8	
Congeners of Dioxin & Furans		**Concentration**		
		Concentration(ng)	**TEF by WHO**	**TEQ(ng)**
1	2,3,7,8-TCDD	0.01048	1	0.0105
2	1,2,3,7,8-PeCDD	0.00600	0.5	0.0030
3	1,2,3,4,7,8-HxCDD	0.00300	0.1	0.0003
4	1,2,3,6,7,8-HxCDD	0.00900	0.1	0.0009
5	1,2,3,7,8,9-HxCDD	0.01000	0.1	0.0010
6	1,2,3,4,6,7,8-HpCDD	0.00559	0.01	0.0001
7	OCDD	0.03400	0.001	0.0000
8	2,3,7,8-TCDF	0.00500	0.1	0.0005
9	1,2,3,7,8-PeCDF	0.00910	0.05	0.0005
10	2,3,4,7,8-PeCDF	0.00670	0.5	0.0034
11	1,2,3,4,7,8-HxCDF	0.00500	0.1	0.0005
12	1,2,3,6,7,8-HxCDF	0.00500	0.1	0.0005
13	1,2,3,7,8,9-HxCDF	0.00500	0.1	0.0005
14	2,3,4,6,7,8-HxCDF	0.00500	0.1	0.0005
15	1,2,3,4,6,7,8-HpCDF	0.00907	0.01	0.0001
16	1,2,3,4,7,8,9-HpCDF	0.00289	0.01	0.0000
17	OCDF	0.08000	0.001	0.0001
			Total ng TEQ	0.0223
			Total ng/nm^3 TEQ	0.00405
			Vstd. (Nm^3)	5.50
			Total Furans & Dioxins (ng TEQ/Nm3 at 11 % O_2 Correction)	**0.00397**
			Limits as per S.O. 1357(E) ng TEQ/Nm3	< 0.1

Method of Testing: USEPA 23 A

Dr. SubbaReddy Mallampati
Manager-Environment

Vimta Labs Limited
Registered Office:
142, IDA Phase II, Cherlapally,
Hyderabad-500 051 Telangana, India
T : +91 40 2726 4141
F : +91 40 2726 3657

Vimta
Driven by Quality, Inspired by Science.

TC-5418

ISSUED TO:

M/S. Hyderabad MSW Energy Solutions Pvt Ltd,
Survey No: 173, Jawaharnagar,
CRPF Road, Near Army College of Dental Sciences,
Kapra Mandal, Medchal District,
Telangana State-500087.

Report Number	:	VLL/VLS/24/23895/001
Issued Date	:	2025.03.24
P.O. Number	:	0400107342
P.O. Date	:	10.01.2024

SAMPLE PARTICULARS	:	**STACK CONNECTED TO BOILER NO-1&2**			
Sampling Date	:	2025.03.08	Sample Registration Date	:	2025.03.10
Analysis Starting Date	:	2025.03.11	Analysis Completion Date	:	2025.03.24
Test Required	:	Temperature, Velocity, Flow, O_2, CO2, CO, Moisture, HF, Hcl, PM, NOx, SO_2, and TOC.			

Sample Collected by Vimta Labs Ltd

TEST REPORT

Sr. No.	Parameters	UoM	Method of Testing	Results	Limits as per Solid Waste Management Rules, 2016
1	Diameter of stack	m	-	3.0	-
2	Flue gas temperature	°C	USEPA method -2	171	-
3	Velocity	m/sec		16.08	-
4	Volumetric flow rate	Nm^3/Sec		80.98	-
5	Oxygen as O_2	%	By Combustion Gas Analyzer	12.3	-
6	Carbon Dioxide as CO_2	%		10.6	-
7	Carbon Monoxide as CO	mg/Nm^3		46.6	-
8	Moisture Content	%,v/v	USEPA method -4	9.3	-
9	Hydrogen Fluoride as HF	mg/Nm^3	USEPA method- 26	0.68	< 4.0
10	Hydrogen Chloride as HCl	mg/Nm^3		14.9	< 50.0
11	Particulate Matter as PM	mg/Nm^3	USEPA method-5	30.7	< 50.0
12	Oxides of Nitrogen as NO_2	mg/Nm^3	USEPA method-07	343	< 400.0
13	Sulphur Dioxide as SO_2	mg/Nm^3	USEPA method -06	32.8	< 200.0
14	Total Organic Carbon	mg/Nm^3	USEPA method -40 & MM5(10)	6.9	< 20.0

All the Values are represented at 11% O_2

Dr. Subba Reddy Mallampati.
Manager-Environment

Orginal Bills

Vimta Labs Limited
Registered Office
142, IDA Phase II, Cherlapally
Hyderabad-500 051,Telangana, India
T : +91 40 2726 4141
F : +91 40 2726 3657

TC-5418

Vimta
Driven by Quality. Inspired by Science.

ISSUED TO:
M/S. Hyderabad MSW Energy Solutions Pvt Ltd, Survey No: 173, Jawaharnagar, CRPF Road, Near Army College of Dental Sciences,Kapra Mandal, Medchal District, Telangana State-500087.

Report Number	:	VLL/VLS/24/23895/001
Issued Date	:	2025.03.24
P.O. Number	:	0400107342
P.O. Date	:	10.01.2024

SAMPLE PARTICULARS : **STACK CONNECTED TO BOILER NO-1&2**

Sampling Date	:	2025.03.08	Sample Registration Date	:	2025.03.10
Analysis Starting Date	:	2025.03.11	Analysis Completion Date	:	2025.03.24
Test Required	:	Hg & its compounds, Sb+As+Pb+Co+Cr+Cu+Mn+Ni+V+Their compounds			

TEST REPORT

Sr. No.	Parameters	UoM	Method of Testing	Results	Limits as per Solid Waste Management Rules, 2016
15	Mercury as Hg + their Compound	mg/Nm³	USEPA method -29	0.013	<0.05
16	Cadmium + Thorium (Cd + Th) +their Compound			<0.001	<0.05
	Chromium as Cr + their Compound			0.011	<0.5
	Manganese as Mn + their Compound			0.010	
	Arsenic as As + their Compound			0.012	
	Antimony as Sb + their Compound			0.007	
	Lead as Pb + their Compound			0.002	
	Cobalt as Co + their Compound			0.006	
	Copper as Cu + their Compound			0.016	
	Nickel as Ni + their Compound			0.005	
	Vanadium as V + their Compound			0.003	
	Zinc as Zn+ their Compound			0.009	
	Tin as Sn+ their Compound			0.006	
	Selenium as Se+ their Compound			0.004	
	Total Metals: Sb+ As+ Pb+ Co+ Cr+ Cu+ Mn+ Ni+ V+ Their compounds			**0.072**	

All the values are represented at 11% O_2

Dr. Subba Reddy Mallampati.
Manager-Environment

original Bills.

Vimta Labs Limited
Registered Office
142, IDA Phase II, Cherlapally
Hyderabad-500 051, Telangana, India
T : +91 40 2726 4141
F : +91 40 2726 3657

Vimta
Driven by Quality, Inspired by Science.

ISSUED TO:
M/S. Hyderabad MSW Energy Solutions Pvt Ltd.
Survey No: 173, Jawaharnagar,
CRPF Road, Near Army College of Dental Sciences,
Kapra Mandal, Medchal District,
Telangana State-500087.

Report Number : VLL/VLS/24/23895/001
Issued Date : 2025.03.24
P.O. Number : 0400107342
P.O. Date : 10.01.2024

SAMPLE PARTICULARS : **STACK CONNECTED TO BOILER NO-1&2** **Page No: 03 of 03**

Sampling Date : 2025.03.08 Sample Registration Date : 2025.03.10
Analysis Starting Date : 2025.03.11 Analysis Completion Date : 2025.03.24
Test Required : Temperature, Velocity,Volumetric flow rate, Oxygen, Dioxin & Furans (PCDD& PCDF)

Sample Collected by Vimta Labs Ltd.

TEST REPORT

Sr.No.	Parameters	UoM	Results		
Physical Parametersof stack					
1	Diameter of stack	m	3.0		
2	Flue gas temperature	°C	171		
3	Velocity	m/Sec	16.08		
4	Volumetric flow rate	Nm³/Sec	80.98		
5	Oxygen as O_2	%	12.3		
			Concentration		
Congeners of Dioxin & Furans			Concentration(ng)	TEF by WHO	TEQ(ng)
1	2,3,7,8-TCDD		0.00228	1	0.0023
2	1,2,3,7,8-PeCDD		0.00335	0.5	0.0017
3	1,2,3,4,7,8-HxCDD		0.00543	0.1	0.0005
4	1,2,3,6,7,8-HxCDD		0.00498	0.1	0.0005
5	1,2,3,7,8,9-HxCDD		0.00543	0.1	0.0005
6	1,2,3,4,6,7,8-HpCDD		0.00765	0.01	0.0001
7	OCDD		0.03453	0.001	0.0000
8	2,3,7,8-TCDF		0.00542	0.1	0.0005
9	1,2,3,7,8-PeCDF		0.00612	0.05	0.0003
10	2,3,4,7,8-PeCDF		0.00565	0.5	0.0028
11	1,2,3,4,7,8-HxCDF		0.00621	0.1	0.0006
12	1,2,3,6,7,8-HxCDF		0.00487	0.1	0.0005
13	1,2,3,7,8,9-HxCDF		0.00432	0.1	0.0004
14	2,3,4,6,7,8-HxCDF		0.00642	0.1	0.0006
15	1,2,3,4,6,7,8-HpCDF		0.00954	0.01	0.0001
16	1,2,3,4,7,8,9-HpCDF		0.00657	0.01	0.0001
17	OCDF		0.05210	0.001	0.0001
				Total ng TEQ	0.0117
				Total ng/nm³ TEQ	0.00223
				Vstd. [Nm³]	5.25
				Total Furans & Dioxins [ng TEQ/Nm3 at 11 % O_2 Correction]	0.00257
				limits as per S.O. 1357(E) ng TEQ/Nm3	< 0.1

Method of Testing: USEPA 23 A

Dr. SubbaReddy Mallampati
Manager-Environment

Sustainability

Report No: HWMP/ COM /ENV/24-1480
Name and address of the client:

M/s. HI-MSW Division,
Jawahar Nagar Site,
Hyderabad. Telangana

Date of Report	**: 30.10.2024**
Analysis Starting Date	**: 24.10.2024**
Analysis Completion Date	**: 28.10.2024**
Sample Collected by	**: HWMP-Laboratory**
Date of Sampling on	**: 23.10.2024**
Sample Description	**: Ambient Air Quality Samples (Core Zone)**
Subcontract Tests	**: Nil**

Sample Registration no/Location Details:

Sl. No's.	Reg. No's.	Locations	Parameters
1	AAQ-242312	Near MSW Pit	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, CO, Pb, As, Ni, C_6H_6, BaP.
2	AAQ-242313	Near Air Cooling Condenser	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, CO, Pb, As, Ni, C_6H_6, BaP.

Verified by
K.Ravi Kumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

Sustainability

TEST REPORT

Report No: HWMP/ COM /ENV/24-1480

TEST RESULTS FOR AMBIENT AIR QUALITY MONITORING SAMPLES

Samples are analyzed "as is where basis is"

Sl. No's.	Parameters	Units	Methods	Results		CPCB NAAQM Standards
				AAQ-242312	AAQ-242313	
				Near MSW Pit	Near Air Cooling Condenser	
1.	Sulfur Dioxide (SO_2)	µg/m³	IS 5182 (Part 2):2012	14.8	13.4	80
2.	Oxides of Nitrogen (NO_2)	µg/m³	IS 5182 (Part 6):2012	31	28	80
3.	Particulate Matter (PM_{10})	µg/m³	IS 5182 (Part 23):2012	56	55	100
4.	Particulate Matter ($PM_{2.5}$)	µg/m³	HWMP/SOP/LAB-339	26.5	24.6	60
5	Lead (Pb)	µg/m³	HWMP/SOP/LAB-343	<1.0	<1.0	1.0
6.	Arsenic (As)	ng/m³	HWMP/SOP/LAB-343	<1.0	<1.0	6.0
7.	Nickel (Ni)	ng/m³	HWMP/SOP/LAB-343	<0.5	<0.5	20.0
8.	Ozone (O_3)	µg/m³	IS 5182 (Part IX):1974	2.1	3.0	180
9.	Ammonia (NH_3)	µg/m³	IS:5182 (Part-25) 2018	6.08	7.04	400
10.	Carbon Monoxide (CO)	mg/m³	IS 5182 (part 10):1999	1.0	1.2	4.0
11.	Benzene (C_6H_5)	µg/m³	IS:5182 (Part-11) 2012	BDL	BDL	5.0
12.	Benzo(a)Pyrene (BaP)	ng/m³	IS:5182 (Part-12) 2014	BDL	BDL	1.0
13.	Methane (CH_4)	%	Multi Gas Analyzer	1.9	2.0	Should not exceed 25% of LEL (650mg/l)

Note: BDL limits for Benzene &Benzo (a) Pyrene (<0.2)

- SO_2, NO_2, PM_{10}, $PM_{2.5}$, and $NH_3$are 24 hourly and CO& O_3 is1 hour monitored values
- Reports pertained only to the collected sample.
- Test reports shall not be reproduced except in full, without written approval of the Laboratory.

Verified by
K.Ravi Kumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

1. Respirable Dust Sampler Model: APM 860, Sl. No.262-DTD-2017, PM10/2.5 Sampler, Model APM154 – S. No 246-DTD-2017
2. Respirable Dust Sampler Model: APM 860, Sl. No.382-DTJ-2019, PM10/2.5 Sampler, Model APM154 – S. No 308-DTJ-2019

Note: Calibrated On: 01.02.2024 &: Due Date: 31.01.2025 For RDS: Calibrated On: 02.02.2024 &: Due Date: 01.02.2025 For FPS
Calibrated by -LATA ENVIROTECH SERVICES

End of Report

Sustainability

Report No: HWMP/ COM /ENV/24-1596

Name and address of the client:

M/s. HI-MSW Division,
Jawahar Nagar Site,
Hyderabad. Telangana

Date of Report	: 30.11.2024
Analysis Starting Date	: 24.11.2024
Analysis Completion Date	: 28.11.2024
Sample Collected by	: HWMP-Laboratory
Date of Sampling on	: 23.11.2024
Sample Description	: Ambient Air Quality Samples (Core Zone)
Subcontract Tests	: Nil

Sample Registration no/Location Details:

Sl. No's.	Reg. No's.	Locations	Parameters
1	AAQ-242571	Near MSW Pit	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, CO, Pb, As, Ni, C_6H_6, BaP.
2	AAQ-242572	Near Air Cooling Condenser	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, CO, Pb, As, Ni, C_6H_6, BaP.

Verified by
K.Ravi Kumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

Sustainability

TEST REPORT

Report No: HWMP/ COM /ENV/24-1596

TEST RESULTS FOR AMBIENT AIR QUALITY MONITORING SAMPLES

Samples are analyzed "as is where basis is"

Sl. No's.	Parameters	Units	Methods	Results		CPCB NAAQM Standards
				AAQ-242571	AAQ-242572	
				Near MSW Pit	Near Air Cooling Condenser	
1.	Sulfur Dioxide (SO_2)	µg/m³	IS 5182 (Part 2):2012	13.9	14.3	80
2.	Oxides of Nitrogen (NO_2)	µg/m³	IS 5182 (Part 6):2012	34	31	80
3.	Particulate Matter (PM_{10})	µg/m³	IS 5182 (Part 23):2012	53	58	100
4.	Particulate Matter ($PM_{2.5}$)	µg/m³	HWMP/SOP/LAB-339	27.1	29.7	60
5.	Lead (Pb)	µg/m³	HWMP/SOP/LAB-343	<1.0	<1.0	1.0
6.	Arsenic (As)	ng/m³	HWMP/SOP/LAB-343	<1.0	<1.0	6.0
7.	Nickel (Ni)	ng/m³	HWMP/SOP/LAB-343	<0.5	<0.5	20.0
8.	Ozone (O_3)	µg/m³	IS 5182 (Part IX):1974	2.3	3.1	180
9.	Ammonia (NH_3)	µg/m³	IS:5182 (Part-25) 2018	6.06	7.01	400
10.	Carbon Monoxide (CO)	mg/m³	IS 5182 (part 10):1999	1.0	1.1	4.0
11.	Benzene (C_6H_6)	µg/m³	IS:5182 (Part-11) 2012	BDL	BDL	5.0
12.	Benzo(a)Pyrene (BaP)	ng/m³	IS:5182 (Part-12) 2014	BDL	BDL	1.0
13.	Methane (CH_4)	%	Multi Gas Analyzer	1.6	2.1	Should not exceed 25% of LEL (650mg/l)

Note: BDL limits for Benzene &Benzo (a) Pyrene (<0.2)

- SO_2, NO_2, PM_{10}, $PM_{2.5}$, and $NH_3$are 24 hourly and CO& O_3 is1 hour monitored values
- Reports pertained only to the collected sample.
- Test reports shall not be reproduced except in full, without written approval of the Laboratory.

Verified by
K.Ravi Kumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

1. Respirable Dust Sampler Model: APM 860, Sl. No.262-DTD-2017, PM10/2.5 Sampler, Model APM154 – S. No 246-DTD-2017
2. Respirable Dust Sampler Model: APM 860, Sl. No.382-DTJ-2019, PM10/2.5 Sampler, Model APM154 – S. No 308-DTJ-2019

Note: Calibrated On: 01.02.2024 &: Due Date: 31.01.2025 For RDS: Calibrated On: 02.02.2024 &: Due Date: 01.02.2025 For FPS
Calibrated by –LATA ENVIROTECH SERVICES

End of Report

Sustainability

TEST REPORT

CERTIFICATE NO.TC-14799

ULR.No:TC-147992400000233F

Report No: HWMP/ LAB /ENV/24-1773

Name and address of the client:

M/s. HI-MSW Division,
Jawahar Nagar Site,
Hyderabad. Telangana

Date of Report	: 30.12.2024
Analysis Starting Date	: 25.12.2024
Analysis Completion Date	: 28.12.2024
Sample Collected by	: HWMP-Laboratory
Date of Sampling on	: 24.12.2024
Sample Description	: Ambient Air Quality Samples (Core Zone)

Sample Registration no/Location Details:

Sl. No's.	Reg. No's.	Locations	Parameters
1	AAQ-242921	Near MSW Pit	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, Pb, As, Ni, BaP.
2	AAQ-242922	Near Air Cooling Condenser	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, Pb, As, Ni, BaP.

Verified by
D.Sanjeeva Reddy
Asst. Manager

Authorized Signatory
Y. Swathi
Quality Manager

Sustainability

TEST REPORT

CERTIFICATE NO.TC-14799

ULR.No:TC-147992400000233F

Report No: HWMP/ LAB /ENV/24-1773

TEST RESULTS FOR AMBIENT AIR QUALITY MONITORING SAMPLES

Samples are analyzed "as is where basis is"

Sl. No's.	Parameters	Units	Methods	Results		CPCB NAAQM Standards
				AAQ-242921	AAQ-242922	
				Near MSW Pit	Near Air Cooling Condenser	
1.	Sulfur Dioxide (SO_2)	$\mu g/m^3$	IS 5182 (Part 2):2012	14.3	15.6	80
2.	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	IS 5182 (Part 6):2012	35	33	80
3.	Particulate Matter (PM_{10})	$\mu g/m^3$	IS 5182 (Part 23) 2012	56	62	100
4.	Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	HWMP/SOP/LAB-339	25.7	30.8	60
5.	Lead (Pb)	$\mu g/m^3$	HWMP/SOP/LAB-343	<1.0	<1.0	1.0
6.	Arsenic (As)	ng/m^3	HWMP/SOP/LAB-343	<1.0	<1.0	6.0
7.	Nickel (Ni)	ng/m^3	HWMP/SOP/LAB-343	<0.5	<0.5	20.0
8.	Ozone (O_3)	$\mu g/m^3$	IS 5182 (Part IX):1974	2.0	3.6	180
9.	Ammonia (NH_3)	$\mu g/m^3$	IS:5182 (Part-25) 2018	7.16	6.08	400
10.	Benzo(a)Pyrene (BaP)	ng/m^3	IS:5182 (Part-12) 2014	BDL	BDL	1.0

Note: BDL limits for Benzene &Benzo (a) Pyrene (<0.2)

- SO_2, NO_2, PM_{10}, $PM_{2.5}$, and $NH_3$are 24 hourly and CO& O_3 is1 hour monitored values
- Reports pertained only to the collected sample.
- Test reports shall not be reproduced except in full, without written approval of the Laboratory.

Verified by
D.Sanjeeva Reddy
Asst. Manager

Authorized Signatory
Y. Swathi
Quality Manager

1. Respirable Dust Sampler Model: APM 860, Sl. No.262-DTD-2017, PM10/2.5 Sampler, Model APM154 – S. No 246-DTD-2017
2. Respirable Dust Sampler Model: APM 860, Sl. No.382-DTJ-2019, PM10/2.5 Sampler, Model APM154 – S. No 308-DTJ-2019

Note: Calibrated On: 01.02.2024 &: Due Date: 31.01.2025 For RDS: Calibrated On: 02.02.2024 &: Due Date: 01.02.2025 For FPS
Calibrated by -LATA ENVIROTECH SERVICES

End of Report

Sustainability

TEST REPORT

Report No: HWMP/ LAB /ENV/24-00115
Name and address of the client:

M/s. HI-MSW Division,
Jawahar Nagar Site,
Hyderabad. Telangana

Date of Report : **30.12.2024**
Analysis Starting Date : **25.12.2024**
Analysis Completion Date : **28.12.2024**
Sample Collected by : **HWMP-Laboratory**
Date of Sampling on : **24.12.2024**
Sample Description : **Ambient Air Quality Samples (Core Zone)**

TEST RESULTS FOR AMBIENT AIR QUALITY MONITORING SAMPLES

Samples are analyzed "as is where basis is"

Sl. No's.	Parameters	Units	Methods	Results		CPCB NAAQM Standards
				AAQ-242921	AAQ-242922	
				Near MSW Pit	Near Air Cooling Condenser	
1.	Carbon Monoxide (CO)	mg/m³	IS 5182 (part 10):1999	1.0	1.0	4.0
2.	Benzene (C_6H_6)	µg/m³	IS:5182 (Part-11) 2012	BDL	BDL	5.0
3..	Methane (CH_4)	%	Multi Gas Analyzer	1.3	2.1	Should not exceed 25% of LEL (650mg/l)

Note: BDL limits for Benzene

- CO is1 hour monitored values
- Reports pertained only to the collected sample.
- Test reports shall not be reproduced except in full, without written approval of the Laboratory.

Verified by
D.Sanjeeva Reddy
Asst. Manager

Authorized Signatory
Y. Swathi
Quality Manager

1. Respirable Dust Sampler Model: APM 860, Sl. No.262-DTD-2017, PM10/2.5 Sampler, Model APM154 – S. No 246-DTD-2017
2. Respirable Dust Sampler Model: APM 860, Sl. No.382-DTJ-2019, PM10/2.5 Sampler, Model APM154 – S. No 308-DTJ-2019
   Note: Calibrated On: 01.02.2024 &: Due Date: 31.01.2025 For RDS: Calibrated On: 02.02.2024 &: Due Date: 01.02.2025 For FPS
   Calibrated by -LATA ENVIROTECH SERVICES

End of Report

Sustainability

TEST REPORT

CERTIFICATE NO.TC-14799

ULR.No:TC-147992500000106F
Report No: HWMP/ LAB /ENV/2500172
Name and address of the client:

M/s. HI-MSW Division,
Jawahar Nagar Site,
Hyderabad. Telangana

Date of Report	: 05. 02.2025
Analysis Starting Date	: 31. 01.2025
Analysis Completion Date	: 02. 02.2025
Sample Collected by	: HWMP-Laboratory
Date of Sampling on	: 30.01.2025
Sample Description	: Ambient Air Quality Samples (Core Zone)

Sample Registration no/Location Details:

Sl. No's.	Reg. No's.	Locations	Parameters
1	AAQ-250270/1	Near MSW Pit	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, Pb, As, Ni, BaP.
2	AAQ-250270/2	Near Air Cooling Condenser	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, Pb, As, Ni, BaP.

Verified by
K.Ravikumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

Sustainability

TEST REPORT

CERTIFICATE NO.TC-14799

ULR.No:TC-147992500000106F

Report No: HWMP/ LAB /ENV/2500172

TEST RESULTS FOR AMBIENT AIR QUALITY MONITORING SAMPLES

Samples are analyzed "as is where basis is"

Sl. No's.	Parameters	Units	Methods	Results		CPCB NAAQM Standards
				AAQ-250270/1	AAQ-250270/2	
				Near MSW Pit	Near Air Cooling Condenser	
1.	Sulfur Dioxide (SO_2)	µg/m³	IS 5182 (Part 2):2012	14.6	16.4	80
2.	Oxides of Nitrogen (NO_2)	µg/m³	IS 5182 (Part 6):2012	28	36	80
3.	Particulate Matter (PM_{10})	µg/m³	IS 5182 (Part 23):2012	60	66	100
4.	Particulate Matter ($PM_{2.5}$)	µg/m³	HWMP/SOP/LAB-339	28.2	32.6	60
5.	Lead (Pb)	µg/m³	HWMP/SOP/LAB-343	<1.0	<1.0	1.0
6.	Arsenic (As)	ng/m³	HWMP/SOP/LAB-343	<1.0	<1.0	6.0
7.	Nickel (Ni)	ng/m³	HWMP/SOP/LAB-343	<0.5	<0.5	20.0
8.	Ozone (O_3)	µg/m³	IS 5182 (Part IX):1974	1.8	3.8	180
9.	Ammonia (NH_3)	µg/m³	IS:5182 (Part-25) 2018	6.82	6.12	400
10.	Benzo(a)Pyrene (BaP)	ng/m³	IS:5182 (Part-12) 2014	BDL	BDL	1.0

Note: BDL limits for Benzene &Benzo (a) Pyrene (<0.2)

- SO_2, NO_2, PM_{10}, $PM_{2.5}$, and $NH_3$are 24 hourly and CO& O_3 is1 hour monitored values
- Reports pertained only to the collected sample.
- Test reports shall not be reproduced except in full, without written approval of the Laboratory.

Verified by
K.Ravikumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

1. Respirable Dust Sampler Model: APM 860, Sl. No.262-DTD-2017, PM10/2.5 Sampler, Model APM154 – S. No 246-DTD-2017
2. Respirable Dust Sampler Model: APM 860, Sl. No.382-DTJ-2019, PM10/2.5 Sampler, Model APM154 – S. No 308-DTJ-2019

End of Report

Sustainability

TEST REPORT

Report No: HWMP/ LAB /ENV/2500173

Name and address of the client:

M/s. HI-MSW Division,
Jawahar Nagar Site,
Hyderabad. Telangana

Date of Report	: 05. 02.2025
Analysis Starting Date	: 31. 01.2025
Analysis Completion Date	: 02. 02.2025
Sample Collected by	: HWMP-Laboratory
Date of Sampling on	: 30.01.2025
Sample Description	: Ambient Air Quality Samples (Core Zone)

TEST RESULTS FOR AMBIENT AIR QUALITY MONITORING SAMPLES

Samples are analyzed "as is where basis is"

Sl. No's.	Parameters	Units	Methods	Results		CPCB NAAQM Standards
				AAQ-250270/1	AAQ-225270/2	
				Near MSW Pit	Near Air Cooling Condenser	
1.	Carbon Monoxide (CO)	mg/m³	IS 5182 (part 10):1999	1.1	1.0	4.0
2.	Benzene (C_6H_6)	µg/m³	IS:5182 (Part-11) 2012	BDL	BDL	5.0
3..	Methane (CH_4)	%	Multi Gas Analyzer	1.2	2.0	Should not exceed 25% of LEL (650mg/l)

Note: BDL limits for Benzene

- CO is1 hour monitored values
- Reports pertained only to the collected sample.
- Test reports shall not be reproduced except in full, without written approval of the Laboratory

Verified by
K.Ravikumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

1. Respirable Dust Sampler Model: APM 860, Sl. No.262-DTD-2017, PM10/2.5 Sampler, Model APM154 – S. No 246-DTD-2017
2. Respirable Dust Sampler Model: APM 860, Sl. No.382-DTJ-2019, PM10/2.5 Sampler, Model APM154 – S. No 308-DTJ-2019

End of Report

Sustainability

TEST REPORT

CERTIFICATE NO.TC-14799

ULR.No:TC-147992500000239F
Report No: HWMP/ LAB /ENV/250373

Name and Address of the Client:

M/s. HI-MSW Division,
Jawahar Nagar Site,
Hyderabad. Telangana

Date of Report	: 04.03.2025
Analysis Starting Date	: 28.02.2025
Analysis Completion Date	: 04.03.2025
Sample Collected by	: HWMP-Laboratory
Date of Sampling on	: 26.02.2025
Sample Description	: Ambient Air Quality Samples (Core Zone)

Sample Registration no/Location Details:

Sl. No's.	Reg. No's.	Locations	Parameters
1	AAQ-250615	Near MSW Pit	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, Pb, As, Ni, BaP.
2	AAQ-250616	Near Air Cooling Condenser	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, Pb, As, Ni, BaP.

Verified by
K.Ravi Kumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

Sustainability

TEST REPORT

CERTIFICATE NO.TC-14799

ULR.No:TC-147992500000239F

Report No: HWMP/ LAB /ENV/2500373

TEST RESULTS FOR AMBIENT AIR QUALITY MONITORING SAMPLES

Samples are analyzed "as is where basis is"

Sl. No's.	Parameters	Units	Methods	Results		CPCB NAAQM Standards
				AAQ - 250615	AAQ- 250616	
				Near MSW Pit	Near Air Cooling Condenser	
1.	Sulfur Dioxide (SO_2)	µg/m³	IS 5182 (Part 2):2012	15.8	18.5	80
2.	Oxides of Nitrogen (NO_2)	µg/m³	IS 5182 (Part 6):2012	32	38	80
3.	Particulate Matter (PM_{10})	µg/m³	IS 5182 (Part 23):2012	68	64	100
4.	Particulate Matter ($PM_{2.5}$)	µg/m³	HWMP/SOP/LAB-339	30.5	32.8	60
5.	Lead (Pb)	µg/m³	HWMP/SOP/LAB-343	<1.0	<1.0	1.0
6.	Arsenic (As)	ng/m³	HWMP/SOP/LAB-343	<1.0	<1.0	6.0
7.	Nickel (Ni)	ng/m³	HWMP/SOP/LAB-343	<0.5	<0.5	20.0
8.	Ozone (O_3)	µg/m³	IS 5182 (Part IX):1974	1.6	3.5	180
9.	Ammonia (NH_3)	µg/m³	IS:5182 (Part-25) 2018	6.98	6.62	400
10	Carbon Monoxide (CO)	mg/m³	IS 5182 (part 10):1999	1.2	1.0	4.0
11	Benzene (C_6H_6)	µg/m³	IS:5182 (Part-11) 2012	BDL	BDL	5.0
12	Benzo(a)Pyrene (BaP)	ng/m³	IS:5182 (Part-12) 2014	BDL	BDL	1.0

Note: BDL limits for Benzene &Benzo (a) Pyrene (<0.2)

- SO_2, NO_2, PM_{10}, $PM_{2.5}$, and $NH_3$are 24 hourly and CO& O_3 is1 hour monitored values
- Reports pertained only to the collected sample.
- Test reports shall not be reproduced except in full, without written approval of the Laboratory.

Verified by
K.Ravi Kumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

1. Respirable Dust Sampler Model: APM 860, Sl. No.262-DTD-2017, PM10/2.5 Sampler, Model APM154 – S. No 246-DTD-2017
2. Respirable Dust Sampler Model: APM 860, Sl. No.382-DTJ-2019, PM10/2.5 Sampler, Model APM154 – S. No 308-DTJ-2019

End of Report

Sustainability

TEST REPORT

Report No: HWMP/ LAB /ENV/2500374

Page No's. 1 of 1

Name and Address of the Client:

M/s. HI-MSW Division,
Jawahar Nagar Site,
Hyderabad. Telangana

Date of Report	:	04.03.2025
Analysis Starting Date	:	28.02.2025
Analysis Completion Date	:	04.03.2025
Sample Collected by	:	HWMP-Laboratory
Date of Sampling on	:	26.02.2025
Sample Description	:	Ambient Air Quality Samples (Core Zone)

TEST RESULTS FOR AMBIENT AIR QUALITY MONITORING SAMPLES

Samples are analyzed "as is where basis is"

Sl. No's.	Parameters	Units	Methods	Results		CPCB NAAQM Standards
				AAQ-250615	AAQ-250616	
				Near MSW Pit	Near Air Cooling Condenser	
1.	Methane (CH_4)	%	Multi Gas Analyzer	1.1	2.1	Should not exceed 25% of LEL (650mg/l)

Note: BDL limits for Benzene

- CO is1 hour monitored values
- Reports pertained only to the collected sample.
- Test reports shall not be reproduced except in full, without written approval of the Laboratory

Verified by
K.Ravi Kumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

1. Respirable Dust Sampler Model: APM 860, Sl. No.262-DTD-2017, PM10/2.5 Sampler, Model APM154 – S. No 246-DTD-2017
2. Respirable Dust Sampler Model: APM 860, Sl. No.382-DTJ-2019, PM10/2.5 Sampler, Model APM154 – S. No 308-DTJ-2019

End of Report

Sustainability

TEST REPORT

CERTIFICATE NO.TC-14799

ULR.No:TC-147992500000415F

Report No: HWMP/ LAB /ENV/250628

Name and Address of the Client:

M/s. HI-MSW Division,
Jawahar Nagar Site,
Hyderabad. Telangana

Date of Report	:	29.03.2025
Analysis Starting Date	:	26.03.2025
Analysis Completion Date	:	26.03.2025
Sample Collected by	:	HWMP-Laboratory
Date of Sampling on	:	25.03.2025
Sample Description	:	Ambient Air Quality Samples (Core Zone)

Sample Registration no/Location Details:

Sl. No's.	Reg. No's.	Locations	Parameters
1	AAQ-251110	Near MSW Pit	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, Pb, As, Ni, BaP.
2	AAQ-251111	Near Air Cooling Condenser	SO_2, NO_2, O_3, NH_3, PM_{10}, $PM_{2.5}$, Pb, As, Ni, BaP.

Verified by
K.Ravi Kumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

Sustainability

TEST REPORT

CERTIFICATE NO.TC-14799

ULR.No:TC-147992500000415F

Report No: HWMP/ LAB /ENV/250062

TEST RESULTS FOR AMBIENT AIR QUALITY MONITORING SAMPLE

Samples are analyzed "as is where basis is"

Sl. No's.	Parameters	Units	Methods	Results		CPCB NAAQM Standards
				AAQ - 251110	AAQ- 251111	
				Near MSW Pit	Near Air Cooling Condenser	
1.	Sulfur Dioxide (SO_2)	µg/m³	IS 5182 (Part 2):2012	17.2	18.2	80
2.	Oxides of Nitrogen (NO_2)	µg/m³	IS 5182 (Part 6):2012	34	36	80
3.	Particulate Matter (PM_{10})	µg/m³	IS 5182 (Part 23):2012	72	68	100
4.	Particulate Matter ($PM_{2.5}$)	µg/m³	HWMP/SOP/LAB-339	35.8	34.4	60
5.	Lead (Pb)	µg/m³	HWMP/SOP/LAB-343	<1.0	<1.0	1.0
6.	Arsenic (As)	ng/m³	HWMP/SOP/LAB-343	<1.0	<1.0	6.0
7.	Nickel (Ni)	ng/m³	HWMP/SOP/LAB-343	<0.5	<0.5	20.0
8.	Ozone (O_3)	µg/m³	IS 5182 (Part IX):1974	1.8	3.8	180
9.	Ammonia (NH_3)	µg/m³	IS:5182 (Part-25) 2018	6.45	6.82	400
10	Carbon Monoxide (CO)	mg/m³	IS 5182 (part 10):1999	1.3	1.0	4.0
11	Benzene (C_6H_6)	µg/m³	IS:5182 (Part-11) 2012	BDL	BDL	5.0
12	Benzo(a)Pyrene (BaP)	ng/m³	IS:5182 (Part-12) 2014	BDL	BDL	1.0

Note: BDL limits for Benzene &Benzo (a) Pyrene (<0.2)

- SO_2, NO_2, PM_{10}, $PM_{2.5}$, and $NH_3$are 24 hourly and CO& O_3 is1 hour monitored values
- Reports pertained only to the collected sample.
- Test reports shall not be reproduced except in full, without written approval of the Laboratory.

Verified by
K.Ravi Kumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

1. Respirable Dust Sampler Model: APM 860, Sl. No.262-DTD-2017, PM10/2.5 Sampler, Model APM154 – S. No 246-DTD-2017
2. Respirable Dust Sampler Model: APM 860, Sl. No.382-DTJ-2019, PM10/2.5 Sampler, Model APM154 – S. No 308-DTJ-2019

Note: Calibrated On: 16.02.2025 &: Due Date: 15.02.2026, For FPS: and Calibrated On17.02.2025 &: Due Date: 16.02.2026 For RDS
Calibrated by –LATA ENVIROTECH SERVICES

End of Report

Sustainability

TEST REPORT

Report No: HWMP/ LAB /ENV/2500629

Name and Address of the Client:

M/s. HI-MSW Division,
Jawahar Nagar Site,
Hyderabad. Telangana

Date of Report : 29.03.2025
Analysis Starting Date : 26.03.2025
Analysis Completion Date : 26.03.2025
Sample Collected by : HWMP-Laboratory
Date of Sampling on : 25.03.2025
Sample Description : Ambient Air Quality Samples (Core Zone)

TEST RESULTS FOR AMBIENT AIR QUALITY MONITORING SAMPLES

Samples are analyzed "as is where basis is"

Sl. No's.	Parameters	Units	Methods	Results		CPCB NAAQM Standards
				AAQ-251110	AAQ-251111	
				Near MSW Pit	Near Air Cooling Condenser	
1.	Methane (CH_4)	%	Multi Gas Analyzer	1.2	2.0	Should not exceed 25% of LEL (650mg/l)

Note: BDL limits for Benzene

- CO is1 hour monitored values
- Reports pertained only to the collected sample.
- Test reports shall not be reproduced except in full, without written approval of the Laboratory

Verified by
K.Ravi Kumar
Technical Manager

Authorized Signatory
Y.Swathi
Quality Manager

1. Respirable Dust Sampler Model: APM 860, Sl. No.262-DTD-2017, PM10/2.5 Sampler, Model APM154 – S. No.246-DTD-2017
2. Respirable Dust Sampler Model: APM 860, Sl. No.382-DTJ-2019, PM10/2.5 Sampler, Model APM154 – S. No.308-DTJ-2019

End of Report

TELANGANA POLLUTION CONTROL BOARD
Paryavarana Bhavan, A-III, Industrial Estate, Sanathnagar,
Hyderabad-500 018 .Phone : 040-23887500

Lr.No.91/TGPCB/MSW/2025 **Dt.31.07.2025**

To
The Member Secretary,
Central Pollution Control Board,
Parivesh Bhavan,C.B.D.Cum-Office Complex,
East Arjun Nagar, Shahdara,
Delhi-110032.

Sir,

Sub : TGPCB — OA No. 536 of 2024 Registered suo-motu basis by Hon'ble NGT on the news item titled "Waste to Energy: Smokescreen or solution?" appearing in the Indian Development Review dated 27.03.2025 and included CPCB as one of the respondents – Status of Waste to Energy Plants in Telangana – Compliance submitted— Reg.

Ref :
1. CPCB letter Dated 7.8.2024,11.11.2024 addressed to all SPCB's
2. TGPCB letters dt 16.08.2024, 08.01.2025.
3. Hon'ble National Green Tribunal (NGT) in OA No. 536 of 2024 order dated 13.01.2025.
4. Hon NGT Order Dated 16.04.2025.
5. CPCB directions dated 09.07.2025.

* * *

With reference to the directions issued by the Central Pollution Control Board (CPCB) and Hon'ble NGT regarding compliance by Waste-to-Energy (WtE) facilities, the status of compliance and actions taken by the Telangana State Pollution Control Board (TGPCB) is hereby furnished as follows:

Sl. No	Direction from CPCB	Compliance Status / Action Taken by TGPCB
1.	Submit reasons for non-submission of complete information as per CPCB and NGT directions	Comprehensive data collection involved coordination across multiple departments and verification processes. Some delay occurred due to pending submissions from respective WtE units and analytical laboratories. All required data has now been compiled and is enclosed herewith.
2.	Ensure all WtE plants operate with valid Consent and Authorization issued by TGPCB	There are 2 No. of WtE plants operating in the state 1. M/s. Hyderabad MSW Energy Solution Private Ltd., (by GHMC), Sy No: 173, Jawaharnagar(V), Shameerpet(M), Medchal District which has obtained CFO & HWA order dated 05.05.2025 valid upto 31.03.2030. **(Annexure-I)** 2. M/s Dundigal Waste 2 Energy Private Ltd., Sy. No. 684/1, Dundigal (V), Quthubullapur (M), Medchal-Malkajgiri District which has obtained CFO &HWA

		order dt:16.06.2023 which is valid upto 31.03.2028. **(Annexure-II)** ➢ Both the WtE plants are not involved in processing of Municipal Solid waste. Whereas they receive processed MSW i.e., Refuse Derived Fuel (RDF) from M/s. Hyderabad Integrated Municipal Solid Waste Management Project, Sy No: 173, Jawaharnagar (V), Shameerpet (M), Medchal-Malkajgiri District which is a separate entity and has obtained Consent Authorisation of the Board under SWM Rules, 2016 which is valid upto 31.07.2028. **(Annexure-III)**
3.	Ensure waste with calorific value ≥1,500Kcal/kg is processed for energy generation as per SWM Rule 21	During regular inspections of the Board, it was observed that the WtE plants are regularly analyzing the Calorific value of the RDF received and maintaining records of the same. As per records, the analysis results indicate the RDF received is having Calorific Value in the range of 1688 KCal/Kg to 1920 KCal/Kg which is ≥1,500 Kcal/kg
4.	Ensure analysis & appropriate disposal of bottom ash & fly ash (safe use or disposal in secured landfill)	The Board is being submitted monitoring reports of bottom ash and fly ash analysis carried out by respective WTE plants through NABL-accredited third-party laboratory in accordance with the Solid Waste Management (SWM) Rules, as the Board laboratory equipment is not functioning and repairs are being carried out, The analysis results are enclosed **(Annexure-IV).** The TCLP (Toxicity Characteristic Leaching Procedure) test results confirm that both fly ash and bottom ash are non-hazardous. However, the Waste-to-Energy (WTE) plants are currently disposing of the bottom ash to the sanitary landfill at M/s. Hyderabad Integrated Municipal Solid Waste Management Project, Sy No: 173, Jawaharnagar (V), Shameerpet (M), Medchal-Malkajgiri District and the facility is utilizing the bottom ash as a top layer for covering the Sanitary Landfill. The WTE plants are disposing the fly ash to the TSDF, Dundigal for Secured Land fill.
5.	Regular monitoring and action on non-compliance	The Board is undertaking regular monitoring of Waste-to-Energy (WTE) facilities as per the prescribed schedule under the SWM Rules. Sampling and analysis are carried out through NABL-accredited third-party laboratories to ensure credibility and transparency. Instances of non-compliance, if any, are addressed promptly through issuance of notices, directions under relevant provisions (including Environmental Protection Act, 1986), and follow-up inspections. **(Annexure-V)**

		Further, periodic review meetings are conducted with facility operators to ensure time-bound corrective actions. The Board also integrated real-time data monitoring systems with the TGPCB website to strengthen enforcement and ensure continuous compliance.
6.	Ensure online monitoring of Air Pollution Control Systems, linked with TGPCB & CPCB	The WtE plants have installed required air pollution control systems and have installed Online Continuous Emission Monitoring Systems (CEMS), with real-time data linked to TGPCB and CPCB servers. As per OCEMS data of last 6months, all the parameters are within stipulated standards as per SWM Rules, 2016. **(Annexure-VI)**
7.	Ensure annual monitoring as per Rule 16(4) and submit complete action taken/compliance reports in prescribed format	In compliance with this provision, TGPCB is ensuring that annual monitoring of all WtE facilities is carried out with respect to waste processing efficiency, emissions, ash management, and other environmental parameters. Till date no exceedence in parameters is noticed hence, action is not taken on the WtE plants. The compiled compliance report, in the prescribed format, to be submitted to CPCB is enclosed herewith for kind information.

This is submitted for favor of kind information.

Encl:As above

Yours faithfully,

MEMBER SECRETARY

Annexure-V

S. No	ULB Name	Total Qty	Remediated Qty	Balance
1	Jalpally	7,666	7,666	0
2	Zaheerabad	57,104	57,104	0
3	Bhongir	44,415	44,415	0
4	Naraynapet	17,713	9,352	8,361
5	Pocharam	2,953	2,953	0
6	Nizampet	12,605	12,605	0
7	Dharmapuri	470	470	0
8	Yellareddy	1,170	1,170	0
9	Bheemgal	350	350	0
10	Ameenpur	31,620	31,620	0
11	Sircilla	59,519	59,519	0
12	Jagityal	89,914	89,914	0
13	Medak	40,321	40,321	0
14	Gajwel	21,942	21,942	0
15	Mandamarri	37,364	37,364	0
16	Cherial	550	550	0
17	GWMC	4,00,000	3,75,000	25,000
18	Karimnagar	2,47,800	1,50,000	97,800
19	Suryapet	80,000	35,000	45,000
20	Mahabubnagar	1,50,000	1,05,000	45,000
21	Khammam	2,62,241	1,81,848	80,393
22	Adilabad	1,19,756	1,12,756	7,000
23	Mancherial	66,392	62,392	4,000
24	Korutla	65,103	61,471	3,632
25	Peddapalli	57,156	50,156	7,000
26	Nizamabad	3,51,532	55,114	2,96,418
27	Siddipet	43,550	43,550	0
28	Vikarabad	42,978	42,978	0
	Total	**23,12,184**	**16,92,580**	**6,19,604**

Annexure-VI

Sl. No.	Name of ULB	Total Qty to be remediated in MTs	Total Qty Remidiated in MTs	Balance to be Remediated in MTs	Total land area in acres	Reclaimed Area in acres
1	2	3	4	5	6	7
1	Dharmpuri	470	470	0	3	3
2	Huzurabad	25,738	0	25,738	4	4
3	Jagtial	89,914	89,914	0	14	14
4	Korutla	65,103	61,471	3,632	5.05	4
5	Kothapally	1,231	0	1,231	5.2	5.2
6	Metpally	32,343	5,762	26,581	11.2	0.5
7	Raikal	1,913	0	1,913	0.25	0.25
8	Sircilla	59,519	59,519	0	16.25	16.25
9	Wardanapet	1,711	0	1,711	1.8	1.8
10	Choppandandi	2,217	0	2,217	5	0
11	Jammikunta	12,772	0	12,772	2.16	0
12	Narsampet	2,162	0	2,162	1	0
13	Parkal	1,351	0	1,351	3	0
14	Vemulawada	44,372	0	44,372	5.03	0
15	Ibrahimpatnam	17,801	4,256	13,545	8.04	0.5
16	Jalpally	7,666	7,666	0	9	9
17	Pedda Amberpet	13,779	0	13,779	5	5
18	Shadnagar	32,550	8,757	23,793	5	1
19	Adibatla	1,363	0	1,363	2	0
20	Thukkuguda	8,205	0	8,205	2	0
21	Dornakal	320	0	320	3.5	3.5
22	Khammam	2,62,241	1,83,729	78,512	48	20
23	Kothagudem	1,12,117	28,913	83,204	24	5
24	Mahabubabad	62,685	39,648	23,037	25	18
25	Manuguru	16,410	0	16,410	6	6
26	Thorrur	14,008	0	14,008	5	5
27	Wyra	13,020	0	13,020	3.2	3.2

Sl. No.	Name of ULB	Total Qty to be remediated in MTs	Total Qty Remidiated in MTs	Balance to be Remediated in MTs	Total land area in acres	Reclaimed Area in acres
1	2	3	4	5	6	7
28	Yellandu	21,913	21,913	0	5	5
29	Madhira	23,725	0	23,725	5	0
30	Maripeda	2,524	0	2,524	5	0
31	Palwancha	39,914	0	39,914	3	0
32	Sattupalli	12,834	0	12,834	8	0
33	Bheemgal	350	350	0	4	4
34	Bodhan	43,906	28,093	15,813	22	12
35	Nizamabad	3,51,532	62,260	2,89,272	51	3
36	Yellareddy	1,170	1,170	0	10	10
37	Armoor	16,097	0	16,097	11	0
38	Banswada	17,409	0	17,409	8	0
39	Bhainsa	11,550	0	11,550	15.5	0
40	Kamareddy	77,269	2,041	75,228	12.4	0
41	Khanapur	5,444	0	5,444	2	0
42	Nirmal	33,468	0	33,468	13.22	0
43	Chandur	4,624	0	4,624	1.09	0
44	Chityal	3,681	0	3,681	2	0
45	Devarakonda	16,727	0	16,727	6.34	0
46	Haliya	4,446	0	4,446	1.2	0
47	Huzurnagar	12,344	0	12,344	10	0
48	Kodada	28,540	0	28,540	0.2	0
49	Miryalguda	33,639	0	33,639	6	0
50	Nalgonda	64,278	0	64,278	22	0
51	Nandikonda	4,341	0	4,341	3	0
52	Nerducherla	2,626	0	2,626	2.36	0
53	Tirumalagiri	1,648	0	1,648	1.15	0
54	Bhongir	44,415	44,415	0	5	5
55	Dundigal	20,872	20,872	0	10.34	10.34
56	Jangaon		17,740	3,381	10	7

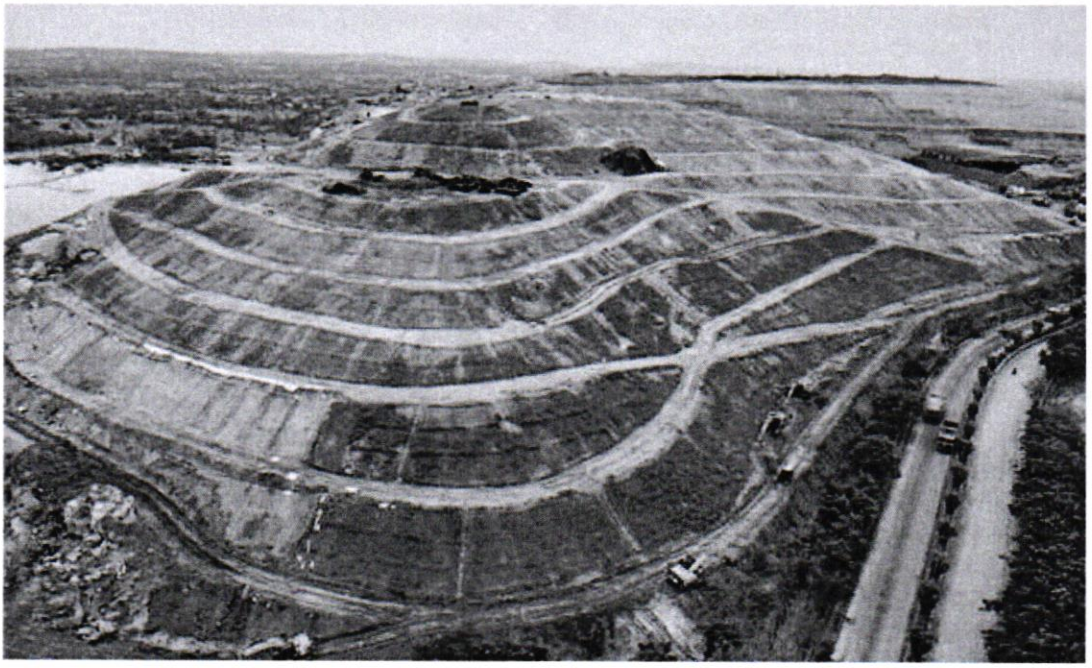
Sl. No.	Name of ULB	Total Qty to be remediated in MTs	Total Qty Remidiated in MTs	Balance to be Remediated in MTs	Total land area in acres	Reclaimed Area in acres
1	2	3	4	5	6	7
		21,121				
57	Nagaram	12,430	0	12,430	5	5
58	Nizampet	12,605	550	12,055	10	10
59	Pocharam	2,953	470	2,483	0.5	0.5
60	Thumkunta	15,203	15,203	0	0.16	0.16
61	Alair	1,185	0	1,185	1	0
62	Choutuppal	16,824	0	16,824	3	0
63	Ghatkesar	3,370	0	3,370	3	0
64	Mothkur	12,572	0	12,572	5	0
65	Pochampally	1,329	0	1,329	6	0
66	Yadagirigutta	2,196	0	2,196	5	0
67	Adilabad	1,19,756	1,19,756	0	36.2	30
68	Bellampally	34,170	0	34,170	10	10
69	Kagaznagar	34,810	28,952	5,858	16.15	14
70	Kyathanpally	34,092	34,092	0	7	7
71	Mancherial	66,392	66,392	0	21.07	15
72	Mandamarri	37,364	37,364	0	5	5
73	Manthani	11,870	0	11,870	1	1
74	Peddapalli	57,156	57,156	0	6	5
75	Ramagundam	14,609	0	14,609	10	10
76	Bhupallapally	6,151	0	6,151	3	0
77	Chennur	14,724	0	14,724	10	0
78	Luxettipet	10,153	0	10,153	1.2	0
79	Naspur	49,003	218	48,785	10	0
80	Sulthanabad	8,411	0	8,411	0.2	0
81	Narayanpet	17,713	9,352	8,361	2	1
82	Wanaparthy	22,338	4,511	17,827	5	1
83	Alampur	2,497	0	2,497	2	0
84	Amarchinta	2,150	0	2,150	0.1	0
85	Atchampet	8,816	0	8,816	6	0
86	Atmakur	1,447	0	1,447	0.1	0

Sl. No.	Name of ULB	Total Qty to be remediated in MTs	Total Qty Remidiated in MTs	Balance to be Remediated in MTs	Total land area in acres	Reclaimed Area in acres
1	2	3	4	5	6	7
87	Bhoothpur	1,719	0	1,719	1	0
88	Gadwal	7,179	590	6,589	5.19	0
89	Ieeja	7,686	0	7,686	4	0
90	Jadcherla	53,713	0	53,713	6	0
91	Kalwakurthy	8,712	0	8,712	3	0
92	Kollapur	11,113	0	11,113	5	0
93	Kothakota	7,651	0	7,651	1	0
94	Makthal	11,065	0	11,065	4	0
95	Nagarkurnool	8,592	0	8,592	5	0
96	Pebbair	2,820	0	2,820	4	0
97	Waddepalle	8,817	0	8,817	5.08	0
98	Cherial	550	550	0	0.8	0.8
99	Gajwel	21,942	21,942	0	10	10
100	Medak	40,321	40,321	0	7	7
101	Parigi	9,984	0	9,984	4	4
102	Siddipet	43,550	43,550	0	10	10
103	Tellapur	22,158	1,006	21,152	5	1
104	Vikarabad	42,978	42,978	0	10.03	10.03
105	Zaheerabad	57,104	57,104	0	5	5
106	Andole-Jogipet	1,746	0	1,746	2	0
107	Bollaram	16,414	0	16,414	1	0
108	Dubbaka	1,790	0	1,790	6.31	0
109	Husnabad	6,412	0	6,412	5	0
110	Kodangal	1,842	0	1,842	1	0
111	Kosgi	5,640	0	5,640	1.24	0
112	Narayankhed	9,291	0	9,291	8.39	0
113	Narsapur	7,238	0	7,238	5	0
114	Ramayampet	5,234	0	5,234	2	0
115	Sadasivpet	15,648	0	15,648	5	0
116	Sangareddy	40,000	0	40,000	4.18	0
117	Tandur	6,015	0	6,015	6	0
118	Thoopran	10,036	0	10,036	1.24	0
119	Ameenpur		31,620	0	10	10

Sl. No.	Name of ULB	Total Qty to be remediated in MTs	Total Qty Remidiated in MTs	Balance to be Remediated in MTs	Total land area in acres	Reclaimed Area in acres
1	2	3	4	5	6	7
		31,620				
120	GWMC	4,00,000	3,75,000	25,000	32	25
121	Karimnagar	2,47,800	1,20,000	1,27,800	7.5	3
122	Mahabubnagar	1,32,400	1,05,000	27,400	10	5
123	Suryapet	80,000	35,000	45,000	28.23	0
	Total	**38,46,456**	**19,37,636**	**19,08,819**	**900.35**	**387.03**

Annexure VII

Photographs taken during work in progress



भारतीय प्रौद्योगिकी संस्थान मुंबई
पवई, मुंबई-400 076, भारत
Indian Institute of Technology Bombay
Powai, Mumbai-400 076, India

दूरभाष/Phone : (+91-22) 2572 2545
फैक्स/Fax : (+91-22) 2572 3480
वेबसाईट/Website : www.iitb.ac.in

July 05, 2023

To,
The Municipal Commissioner
Greater Hyderabad Municipal Corporation
Hyderabad
Telangana

Subject: Providing Technical Advisory Services in the Bid Process for Biomining of Capped Legacy Dumpsite of GHMC at Jawaharnagar Including Assessment Studies on Suitability for Bio-mining by Retrieval and Characterization of Decomposed Municipal Solid Waste

Our Reference: DRD/CE/DNS-11/22-23 dated 15.06.2022

Dear sir,

It was a pleasure to be associated with you and your colleagues on this so very important project.

The proposed studies have been completed successfully, within the stipulated time, and I am submitting the final report **Studies on Suitability of Decomposed Municipal Solid Waste for Bio-mining at Jawaharnagar Capped Dumpsite, Hyderabad** to you for your kind perusal and records.

In case you have any queries/clarification, please contact the undersigned.

Also, as the project has been completed, please release the remaining 10% amount as per the MoU.

Regards!

d. n. singh

Dr. D. N. Singh FNAE, FASCE, FICE(UK)
D.L. Shah Chair Professor for Innovation
Department of Civil Engineering
Cell: +919820758508
Email: dns@civil.iitb.ac.in
www.civil.iitb.ac.in/~dns

A Report

on

Studies on Suitability of Decomposed Municipal Solid Waste for Bio-mining at Jawaharnagar Capped Dumpsite, Hyderabad

Submitted to

Greater Hyderabad Municipal Corporation (GHMC)

by

Goli Venkata Siva Naga Sai
Mrunal Sunil Bokade
Yogendra Narayanan
Sinny Manohar
Kamran Ilahi
Prithvendra Singh
(Research Scholars)

Pintu Kumar Saw
(Undergraduate student)

and

Prof. D. N. Singh
Principal Investigator
&
D.L. Shah Chair Professor for Innovation

ENVIRONMENTAL GEOTECHNOLOGY LABORATORY
DEPARTMENT OF CIVIL ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
MUMBAI- 400076, INDIA

July 5, 2023

Table of Contents

List of Figures ii
List of Plates iii
List of Tables iv
1. Background 1
2. Scope of work 1
3. Reconnaissance survey 2
4. Proposed Investigations 4
4.1 Geophysical Investigations 4
4.2 Retrieval of Decomposed MSW from JLH and Characterization 4
4.3 Characterization of the DMSW samples 5
4.3.1 Physical Characteristics 5
4.3.2 Chemical Characteristics 5
5. Details of the Investigations and Results 5
5.1 Geophysical Investigations 5
6. Details of the MSW sampling and on-site segregation 18
7. Processing and characterization of the DMSW @ IIT Bombay Laboratory 27
7.1 Characteristics of the fine fractions 29
7.1.1 Moisture Content 29
7.1.2 Organic Matter 30
7.1.3 Specific Gravity 31
7.1.4 Analysis of Leachates 32
7.2 The calorific value of the coarse fraction 36
8. Conclusions and the way forward 39
Appendix A 40
Appendix B 54
Appendix C 68
References 74

List of Figures

Figure 5.1 MASW analysis results of Line-1 7
Figure 5.2 MASW analysis results of Line-2 7
Figure 5.3 MASW analysis results of Line-3 8
Figure 5.4 MASW analysis results of Line-4 8
Figure 5.5 MASW analysis results of Lines-6 and 7 9
Figure 5.6 MASW analysis results of Line-8 9
Figure 5.7 MASW analysis results of Line-9 10
Figure 5.8 MASW analysis results of Line-10 10
Figure 5.9 MASW analysis results of Line-11 11
Figure 5.10 MASW analysis results of Line-12 11
Figure 5.11 MASW analysis results of Line-13 12
Figure 5.12 MASW analysis results of Line-14 12
Figure 5.13 2D- electrical resistivity imaging map for Line-1 13
Figure 5.14 2D- electrical resistivity imaging map for Line-2 14
Figure 5.15 2D- electrical resistivity imaging map for Line-3 14
Figure 5.16 2D- electrical resistivity imaging map for Line-4 14
Figure 5.17 2D- electrical resistivity imaging map for Line-6 15
Figure 5.18 2D- electrical resistivity imaging map for Line-7 15
Figure 5.19 2D- electrical resistivity imaging map for Line-8 15
Figure 5.20 2D- electrical resistivity imaging map for Line-9 16
Figure 5.21 2D- electrical resistivity imaging map for Line-10 16
Figure 5.22 2D- electrical resistivity imaging map for Line-11 16
Figure 5.23 2D- electrical resistivity imaging map for Line-12 17
Figure 5.24 2D- electrical resistivity imaging map for Line-13 17
Figure 5.25 2D- electrical resistivity imaging map for Line-14 17

List of Plates

Plate 3.1 Photographs depicting the site visit.....3

Plate 4.1 The Google Earth map of the JLH depicting the locations selected for Geophysical investigations.....4

Plate 5.1 The Google Earth map exhibiting the actual stretches of the MASW and ERT investigations.....6

Plate 6.1 Images depicting the flight auger and the sample collection procedure.....19

Plate 6.2 Images depicting the on-site segregation, weighing and packing of the samples being witnessed by the GHMC.....21

Plate 6.3 The photographs depicting the borehole and its closure.....26

Plate 6.4 The photographs depicting the leachate and bubble formation and bursting by landfill gas emission the release of foam/bubbles/liquid from a typical borehole.....26

Plate 7.1 Images depicting the laboratory segregation process of coarse fractions.....27

List of Tables

Table 5.1 Coordinates for start and end points of MASW and ERT investigations 6

Table 5.2 The expected lithology for corresponding shear wave velocities provided by FGTL 13

Table 6.1 Details of the boreholes and number of samples collected..... 20

Table 6.2 Details of the coarse- and fine- samples obtained from the in-situ segregation 22

Table 7.1 Results obtained for the coarse-fractions of the MSW..... 28

Table 7.2 The moisture content of the fine-fractions 30

Table 7.3 Borehole-wise variation in the organic matter of fine fractions 31

Table 7.4 Borehole-wise variation in the specific gravity of fine fractions 32

Table 7.5 The values of pH, EC, TDS, Salinity, Hardness and Chlorides for leachates of the representative samples from different bore-holes 33

Table 7.6 The concentration of leachable elements from the fine-fractions 34

Table 7.7 The calorific value and ash content of the coarse-fractions 36

Table A.1 Moisture content analysis results for Borehole-01..... 40

Table A.2 Moisture content analysis results for Borehole-02..... 41

Table A.3 Moisture content analysis results for Borehole-03..... 42

Table A.4 Moisture content analysis results for Borehole-04..... 43

Table A.5 Moisture content analysis results for Borehole-05..... 44

Table A.6 Moisture content analysis results for Borehole-06..... 45

Table A.7 Moisture content analysis results for Borehole-07..... 46

Table A.8 Moisture content analysis results for Borehole-08..... 47

Table A.9 Moisture content analysis results for Borehole-09..... 47

Table A.10 Moisture content analysis results for Borehole-10..... 47

Table A.11 Moisture content analysis results for Borehole-11..... 49

Table A.12 Moisture content analysis results for Borehole-12..... 50

Table A.13 Moisture content analysis results for Borehole-13..... 51

Table A.14 Moisture content analysis results for Borehole-14..... 52

Table A.15 Moisture content analysis results for Borehole-15..... 53

Table A.16 Moisture content analysis results for Borehole-16..... 53

Table B.1 Organic matter results for Borehole-01..... 54

Table B.2 Organic matter results for Borehole-02..... 55

Table B.3 Organic matter results for Borehole-03 56
Table B.4 Organic matter results for Borehole-04 57
Table B.5 Organic matter results for Borehole-05 58
Table B.6 Organic matter results for Borehole-06 59
Table B.7 Organic matter results for Borehole-07 60
Table B.8 Organic matter results for Borehole-08 61
Table B.9 Organic matter results for Borehole-09 61
Table B.10 Organic matter results for Borehole-10 62
Table B.11 Organic matter results for Borehole-11 63
Table B.12 Organic matter results for Borehole-12 64
Table B.13 Organic matter results for Borehole-13 65
Table B.14 Organic matter results for Borehole-14 66
Table B.15 Organic matter results for Borehole-15 66
Table B.16 Organic matter results for Borehole-16 67
Table C.1 Specific gravity results for fine fraction retrieved from Borehole-01 68
Table C.2 Specific gravity results for fine fraction retrieved from Borehole-02 68
Table C.3 Specific gravity results for fine fraction retrieved from Borehole-03 68
Table C.4 Specific gravity results for fine fraction retrieved from Borehole-04 69
Table C.5 Specific gravity results for fine fraction retrieved from Borehole-05 69
Table C.6 Specific gravity results for fine fraction retrieved from Borehole-06 70
Table C.7 Specific gravity results for fine fraction retrieved from Borehole-07 70
Table C.8 Specific gravity results for fine fraction retrieved from Borehole-08 70
Table C.9 Specific gravity results for fine fraction retrieved from Borehole-09 71
Table C.10 Specific gravity results for fine fraction retrieved from Borehole-10 71
Table C.11 Specific gravity results for fine fraction retrieved from Borehole-11 71
Table C.12 Specific gravity results for fine fraction retrieved from Borehole-12 72
Table C.13 Specific gravity results for fine fraction retrieved from Borehole-13 72
Table C.14 Specific gravity results for fine fraction retrieved from Borehole-14 73
Table C.15 Specific gravity results for fine fraction retrieved from Borehole-15 73
Table C.16 Specific gravity results for fine fraction retrieved from Borehole-16 73

1. Background

Landfill biomining (LFM) of existing dumpsites and landfills has been encouraged to avoid the contamination of the geoenvironment (soil, groundwater, and air), recover the precious land occupied by these facilities, and utilization of landfill-mined residues (LMRs) such as plastics, glass, metals and combustibles and soil-like materials for different applications. Nevertheless, to decide on the feasibility of LFM, it is crucial to ascertain the state of decomposition of the MSW in the landfill/dumpsite. This would not only help in understanding the utilization potential of LMRs but also help in finding the answers to questions such as whether the MSW in the landfill is suitable to be mined, ascertaining possible issues that can arise during mining operations, and the methodology to be adopted for landfill mining, etc. In this context, the state of MSW in a landfill/dumpsite can be determined easily by characterizing the samples of DMSW collected from a landfill for their physical and chemical characteristics. Based on these investigations, a further decision on LFM should be taken. Further, geophysical investigations such as Multi-channel Analysis of Surface Waves (MASW) and Electrical resistivity tomography (ERT) would help in understanding the subsurface properties of the landfill. This would also help to identify leachate and gas pockets that could become an issue during mining activity if not known in advance.

As per the directions of the National Green Tribunal (NGT) Principal Bench, Greater Hyderabad Municipal Corporation (GHMC) is prepared to take up the biomining of capped Jawaharnagar Dumpsite, Hyderabad and called for tenders. However, as the dumpsite has been capped recently (i.e., 2018), the GHMC approached Prof. D. N. Singh, Department of Civil Engineering, Indian Institute of Technology Bombay, for help in several technical aspects such as evaluating the readiness of the capped dumpsite for biomining, evaluating the technical proposal received for biomining operation, establishing the methodology for biomining, etc. Keeping these in view, a scientific study on capped dumpsite at Jawaharnagar, Hyderabad, is planned by the Indian Institute of Technology Bombay under the supervision of Prof. D. N. Singh, IIT Bombay. In this regard, to evaluate the readiness of the capped dumpsite at Jawaharnagar, Hyderabad, for biomining, a study has been proposed by IIT Bombay. The technical aspects of the study proposed are mentioned below.

2. Scope of work

The broad scope of this proposal is to help GHMC in the bid process and carry out geophysical investigations, retrieval, and characterization of the decomposed MSW (DMSW) samples at Jawaharnagar landfill Hyderabad (referred to as JLH).

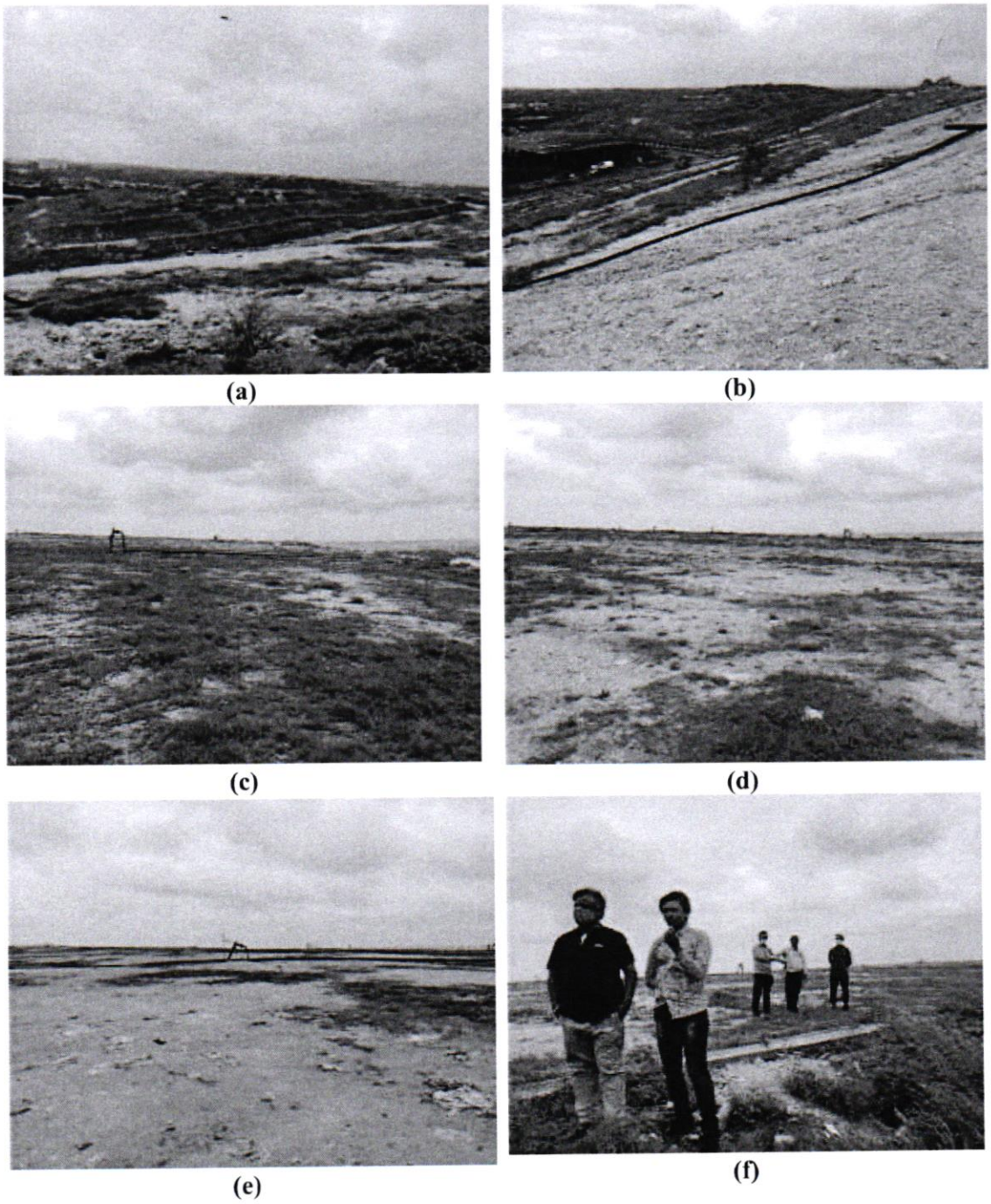
The detailed scope of the work is mentioned below:

- Guiding GHMC in the bidding process for the work of biomining of the capped legacy dumpsite.
- Conducting geophysical investigations, namely Multichannel Analysis of Surface Waves (MASW) and 2-dimensional Electrical Resistivity Tomography (2D-ERT) on the dumpsite at different locations to understand the subsurface features.
- Extensive sampling of DMSW samples from different locations.
- Segregation and characterization of the DMSW samples for their Physico-chemical parameters.
- Establishing the present state of the decomposition of the MSW.
- Characterization of leachate samples (if any) during the sampling of the DMSW from different boreholes.
- A critical analysis of the way forward.

3. Reconnaissance survey

Based on the data shared by GHMC on 22.04.2022, a proposal was prepared by IIT Bombay and shared to conduct the investigations within the scope mentioned above. The study broadly involves conducting geophysical (MASW and ERT) investigations and retrieving and characterizing the DMSW samples.

In this context, the IIT Bombay team, along with the representatives of **M/s. Ramky Enviro Engineers Ltd. (REEL)**, **Environmental Protection Training and Research Institute, Hyderabad (EPRTI)**, and **GHMC** visited the site to select the locations for conducting Geophysical investigations at the JLH site (refer to Plate 3.1). This exercise would help in selecting the subsequent locations for retrieving the samples from the landfill without causing much harm to the existing cover, gas and leachate collection systems.



(a) (b)

(c) (d)

(e) (f)

Plate 3.1 Photographs depicting the site visit

4. Proposed Investigations

4.1 Geophysical Investigations

Based on the site visit and the information given by the REEL, EPTRI and GHMC representatives, locations for the Geophysical investigations have been selected, as represented in

Plate ***4.1***. Please refer to Lines 1 to 5 (designated as L1 to L5). Lines L1 to L4 have been selected based on the maximum height of the landfill at these locations, whereas L5 has been selected to identify the presence/absence of leachate pockets as it is a low-lying area previously and close to leachate ponds. The preliminary site survey helped us estimate that each MASW and ERT investigation should be conducted for 3000 meters.

Plate 4.1 The Google Earth map of the JLH depicting the locations selected for Geophysical investigations

4.2 Retrieval of Decomposed MSW from JLH and Characterization

The top cover (including vegetative and clay cover) and other geotextile layers will be removed manually. Followed by a flight auger (diameter ranging between 100 and 300 mm), attached to a pile-driving unit, will be inserted in the capped landfill to drill a borehole using hydraulic equipment (Mohammad et al., 2021). The DMSW and leachates obtained at different borehole depths will be collected. Borehole drilling from the top of the landfill will be initiated by inserting a mild steel casing. The casing helps in stabilizing the borehole during the drilling operation. The drilling would be continued as deep as possible based on the site conditions, considering the safety of buried utilities. A sampling of MSW will be done every 2-3 m or

wherever changes in the strata. The landfill operator should seal the boreholes after the sampling is completed. The retrieved samples will be spread on a clean geomembrane (near the borehole on the two loops) and divided into four quarters with the help of a shovel. Furthermore, the MSW samples (≈5-10 kg) would be randomly collected for *three quarters* for laboratory testing. The leftover samples of MSW should be backfilled into the boreholes. Depending upon the state of the exhumed MSW samples, their storage at 4 °C, in a refrigerator at the site will be done. Subsequently, the samples will be transported to the IIT Bombay laboratory for their characterization, as mentioned in the following.

4.3 Characterization of the DMSW samples

4.3.1 Physical Characteristics

The DMSW was proposed to sieve through a 20 mm size sieve followed by the manual segregation of the retained portion into various fractions such as plastics, textiles, metals, glass, paper, etc. Further, the <20 mm fraction considered as soil-like materials was proposed to be tested for moisture content and specific gravity.

4.3.2 Chemical Characteristics

The biochemical processes involved in the decomposition of MSW in a landfill transform the organic matter (OM) present in it. With this in view, the chemical parameters of MSW, namely, volatile solids, elemental content, total organic carbon, ammonium and nitrate nitrogen and heavy metals, were proposed to be performed on the MSW samples retrieved from the landfill. In addition to the characterization of MSW, testing of a few leachate samples for their chemical parameters (viz., pH, EC, TOC, COD, sulfates, phosphates, nitrate-nitrogen, ammonium-nitrogen, and heavy metals) was proposed.

Based on the above-mentioned comprehensive testing protocol, the readiness of the JLH for booming will be established. If the dumpsite can be mined, the recommendations for initiating mining was proposed to be submitted to GHMC.

5. Details of the Investigations and Results

5.1 Geophysical Investigations

IIT Bombay engaged Fugro Geotech India Pvt. Ltd. (FGTL) to conduct MASW and 2-dimensional ERT as a part of geophysical investigations and the results are presented in the following. Please note that the results of geophysical investigations for Line-5 are not generated appropriately. So, data for line-5 is missing from the report.

Different representative locations and stretches on the JLH were selected, refer to Plate ***5.1***, and a total of 3000 m length was covered. The coordinates of the start and end points for each stretch are mentioned in Table 5.1.

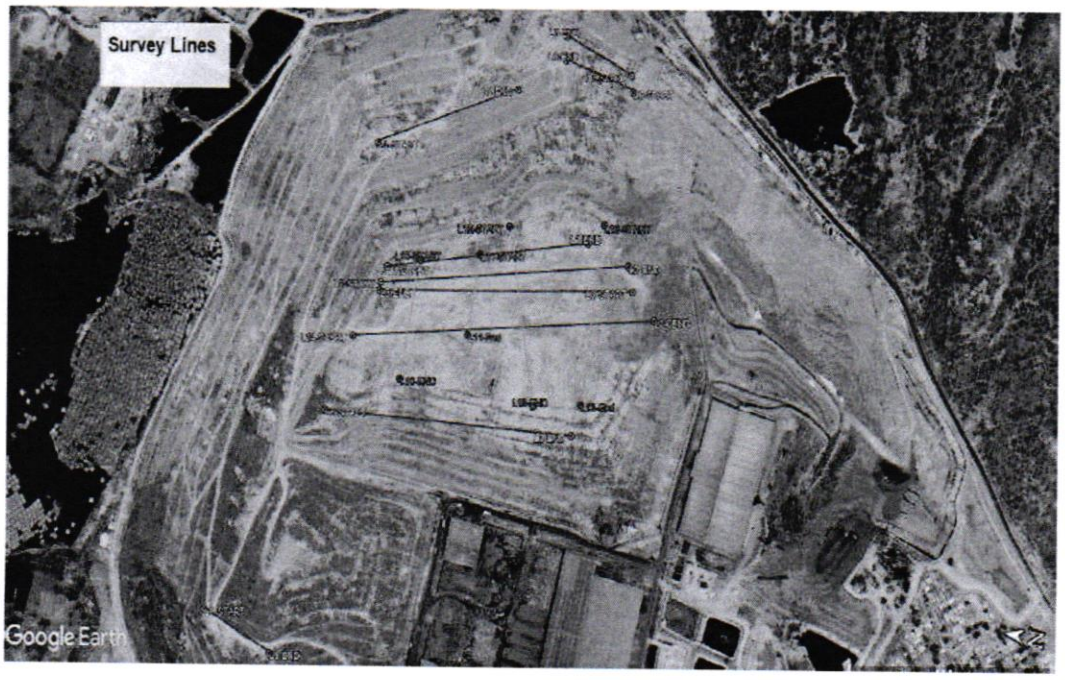


Plate 5.1 The Google Earth map exhibiting the actual stretches of the MASW and ERT investigations

Table 5.1 Coordinates for start and end points of MASW and ERT investigations

Line Name	Start Coordinates		End Coordinates		Line Length (m)
	Easting	Northing	Easting	Northing	
Line No 01	244483.17	1938999.8	244554.78	1938725.6	284
Line No 02	244463.67	1939005.7	244538.64	1938657.9	356
Line No 03	244509.12	1938654.7	244453.77	1939005.8	356
Line No 04	244627.65	1939043.2	244724.49	1938854.1	216
Line No 06	244747.97	1938687.1	244769.86	1938790.4	108
Line No 07	244768.09	1938692.5	244799.6	1938793.8	108
Line No 08	244303.79	1939060.6	244330.64	1938704.7	356
Line No 09	244041.55	1939193.8	244004.74	1939094.2	108
Line No 10	244498.79	1938955.8	244357.72	1938962.6	144
Line No 11	244518.41	1938875	244375.79	1938876.6	144
Line No 12	244557.57	1938838.2	244355.08	1938772.7	216
Line No 13	244580.39	1938707.8	244368.13	1938706.5	216
Line No 14	244395.78	1939035.7	244481.63	1938619.3	428

The results obtained from the analysis are depicted in Figure 5.1 to 5.12.

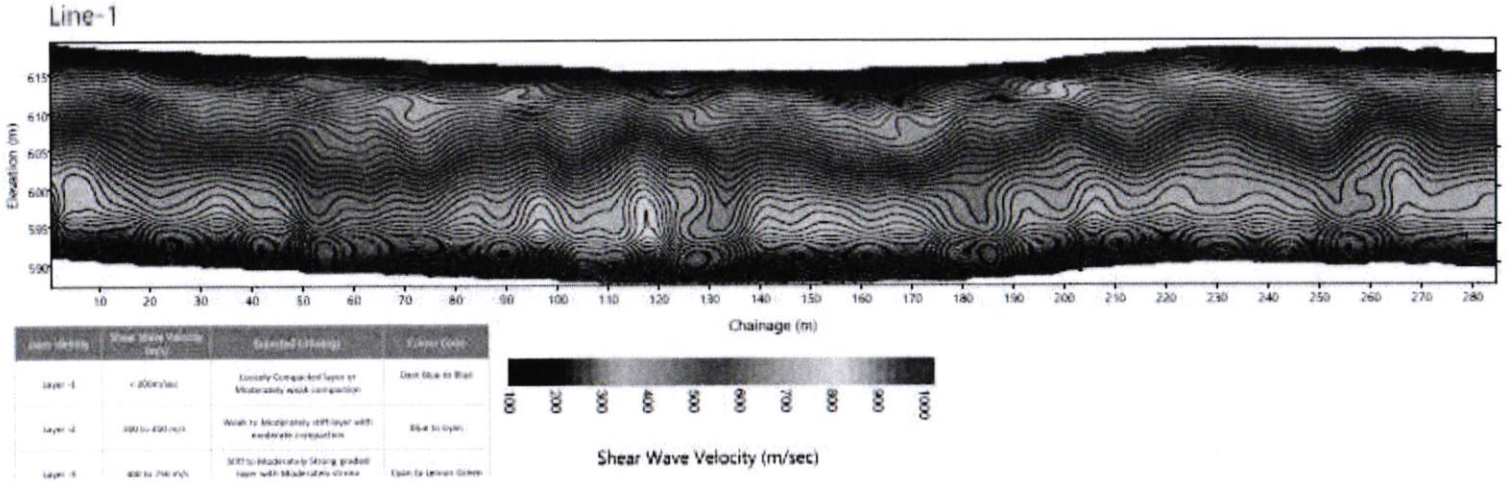


Figure 5.1 MASW analysis results of Line-1

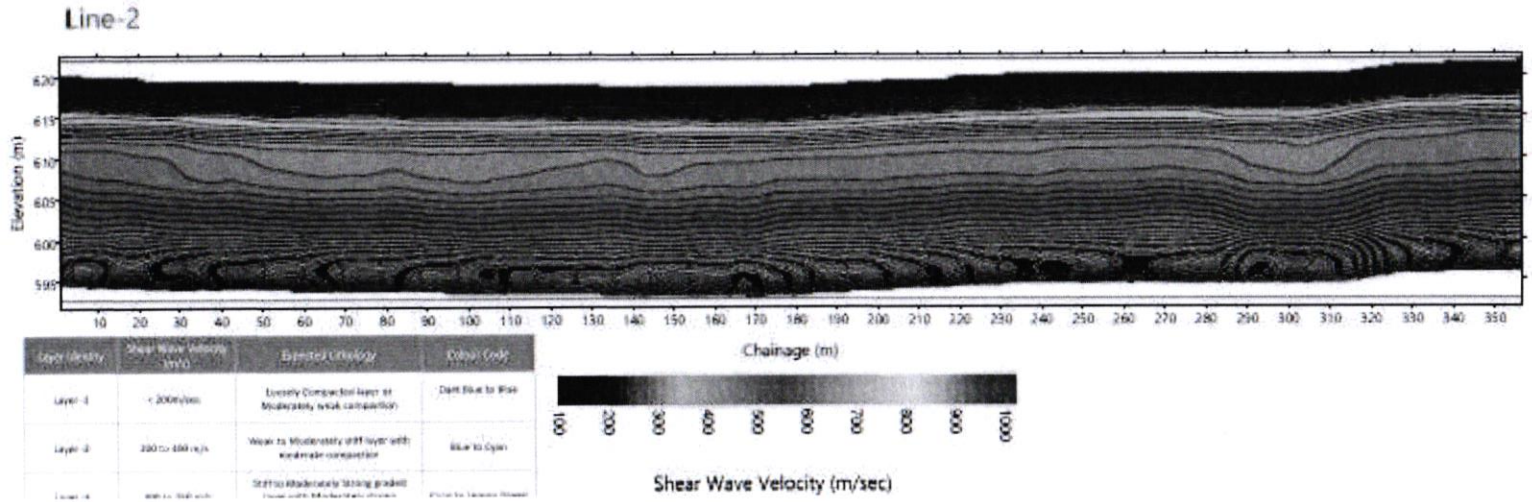


Figure 5.2 MASW analysis results of Line-2

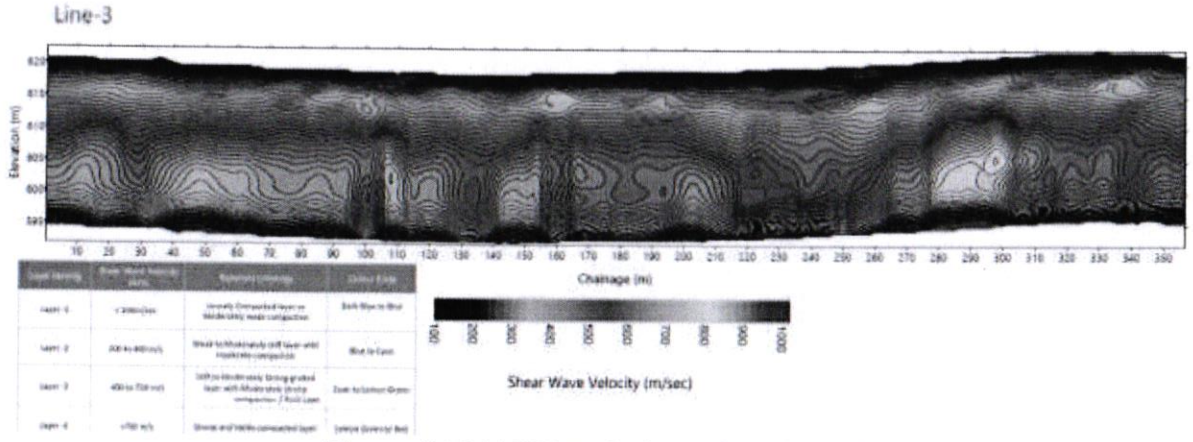


Figure 5.3 MASW analysis results of Line-3

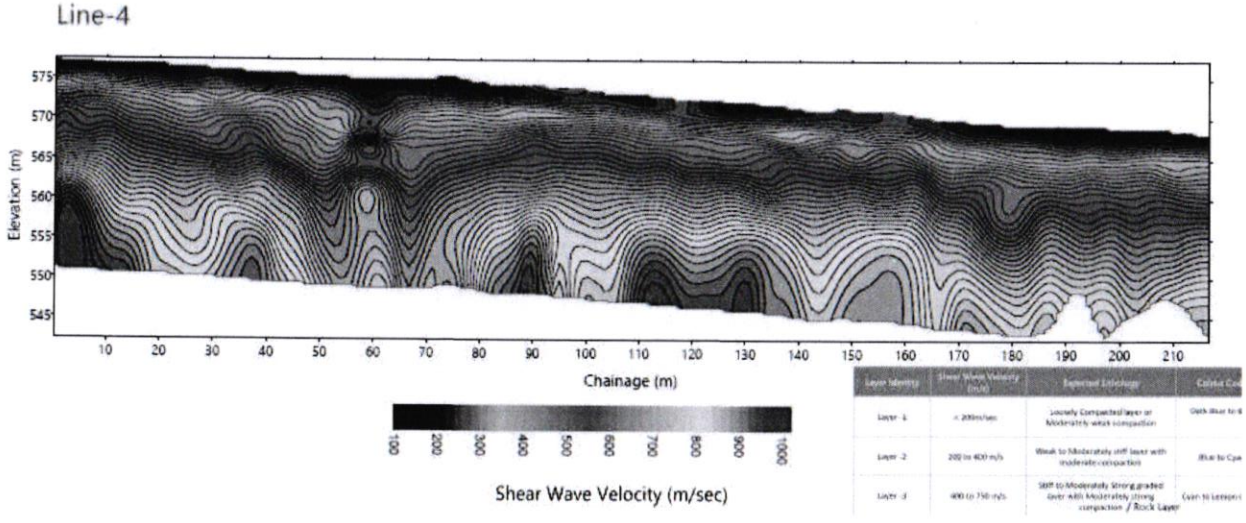


Figure 5.4 MASW analysis results of Line-4

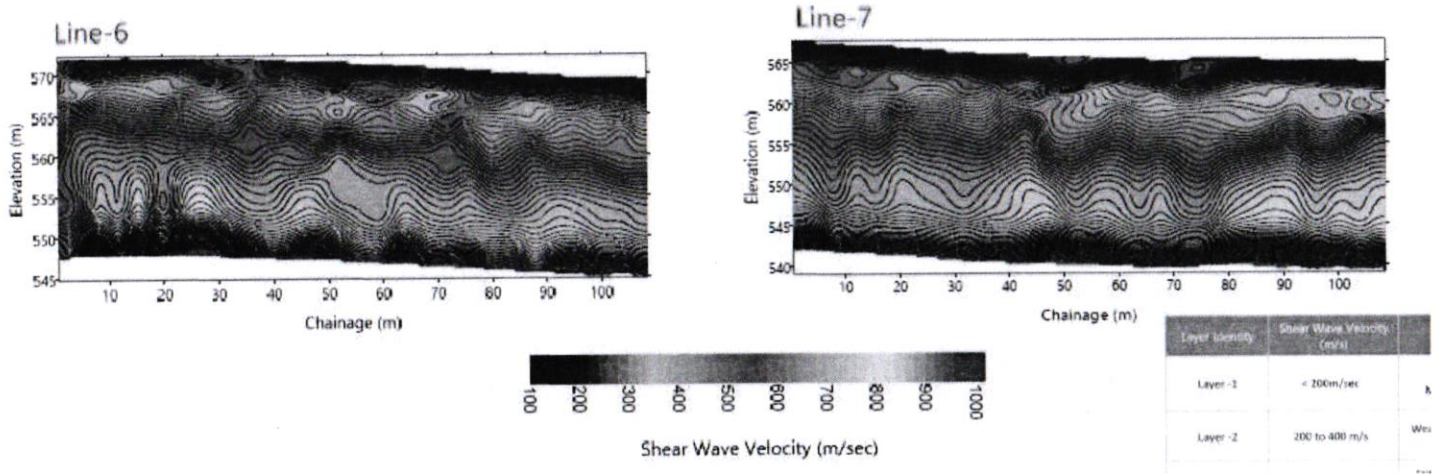


Figure 5.5 MASW analysis results of Lines-6 and 7

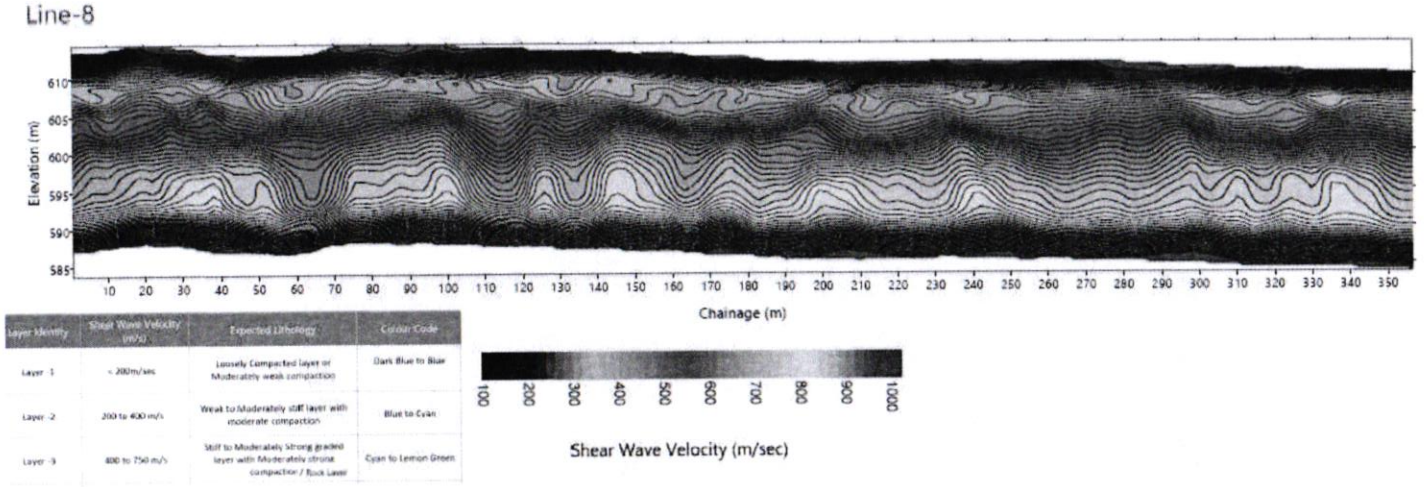


Figure 5.6 MASW analysis results of Line-8

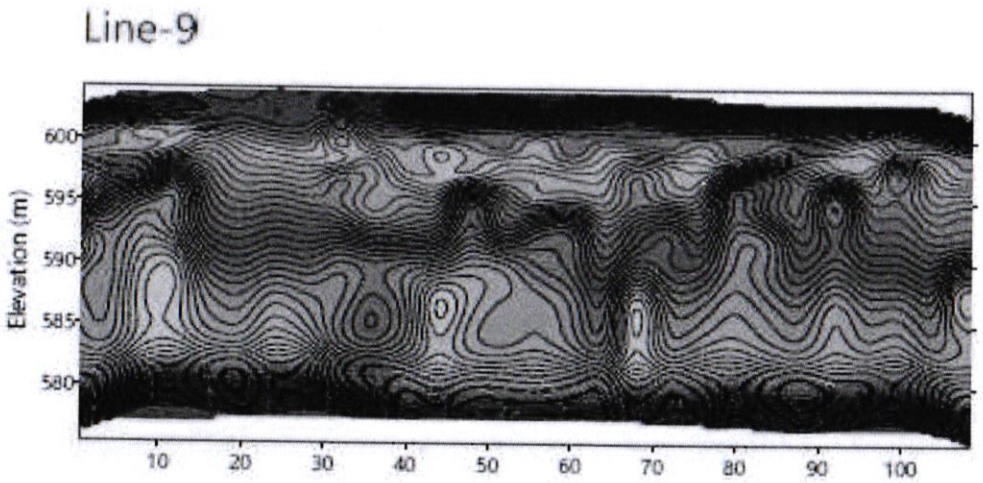


Figure 5.7 MASW analysis results of Line-9

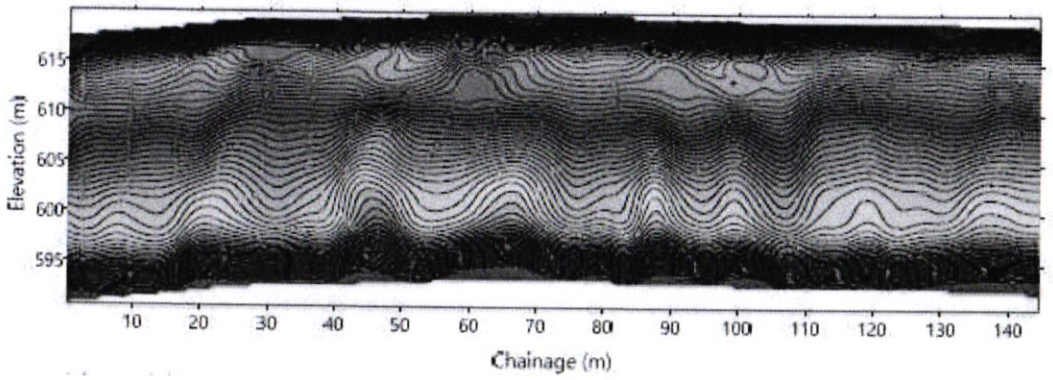


Figure 5.8 MASW analysis results of Line-10

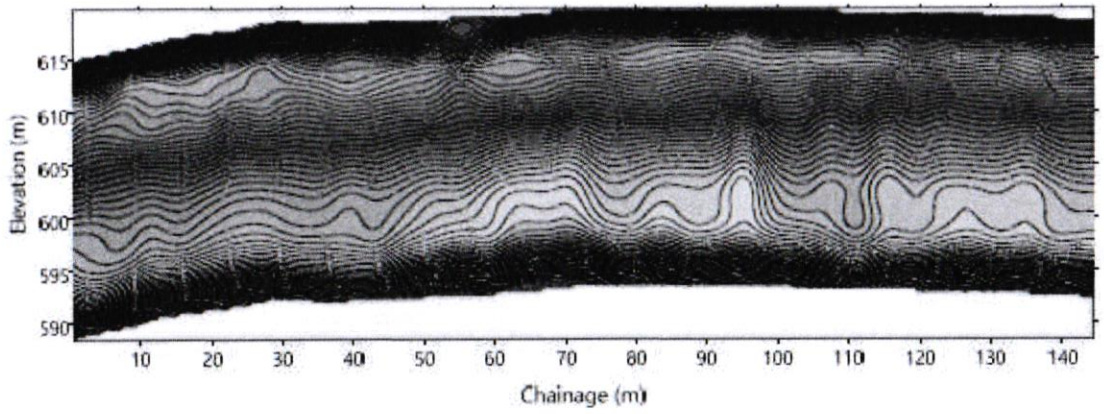


Figure 5.9 MASW analysis results of Line-11

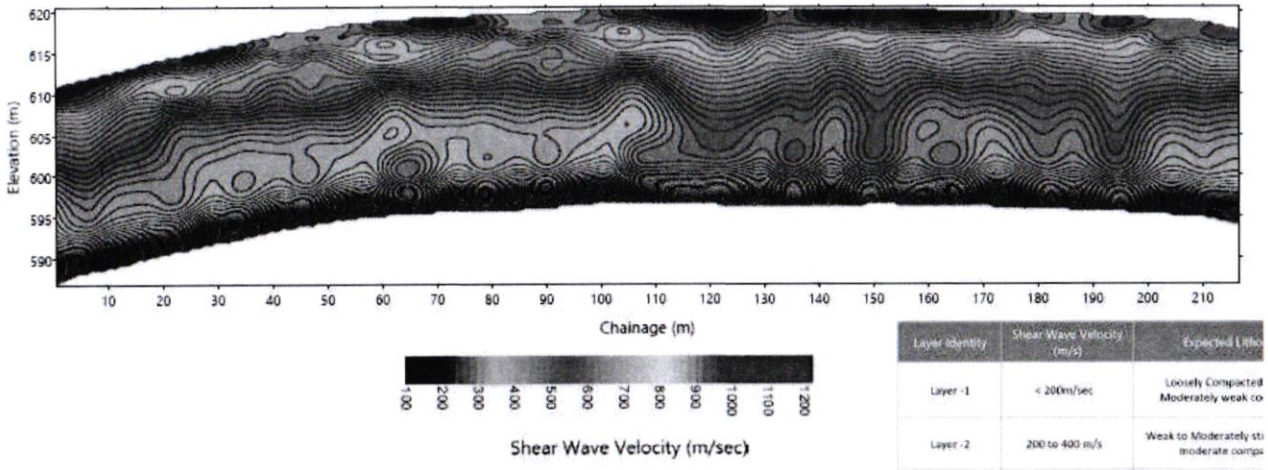


Figure 5.10 MASW analysis results of Line-12

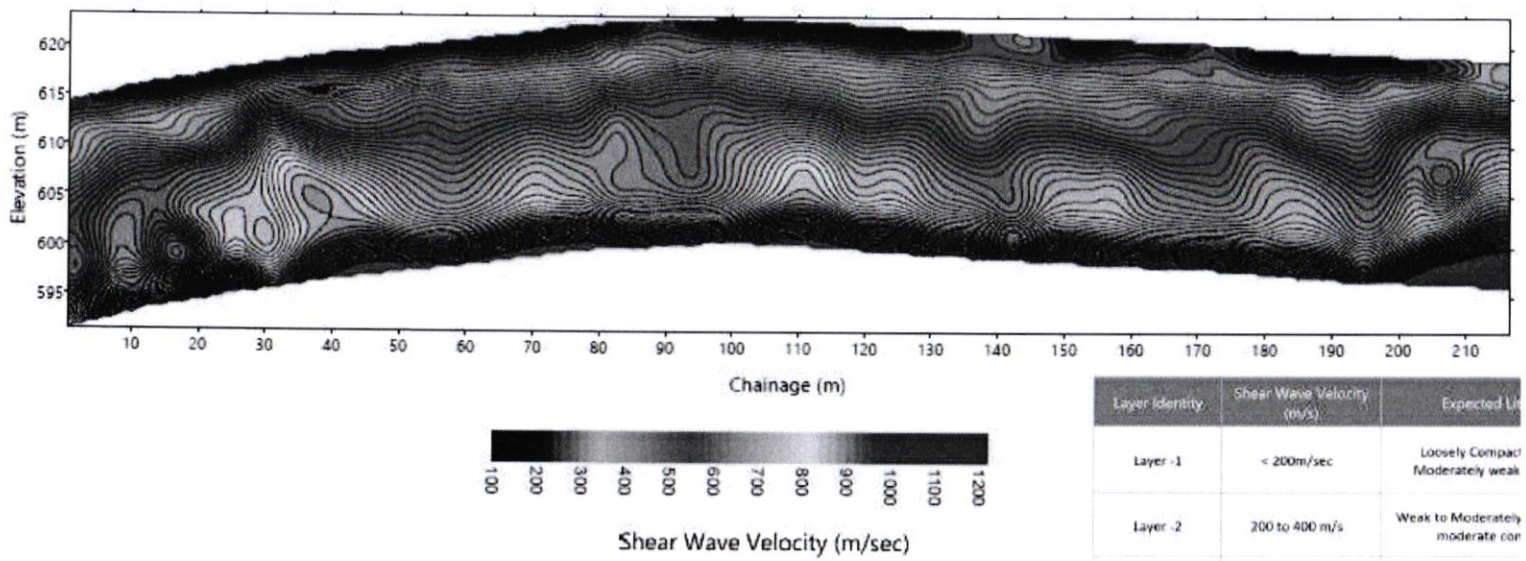


Figure 5.11 MASW analysis results of Line-13

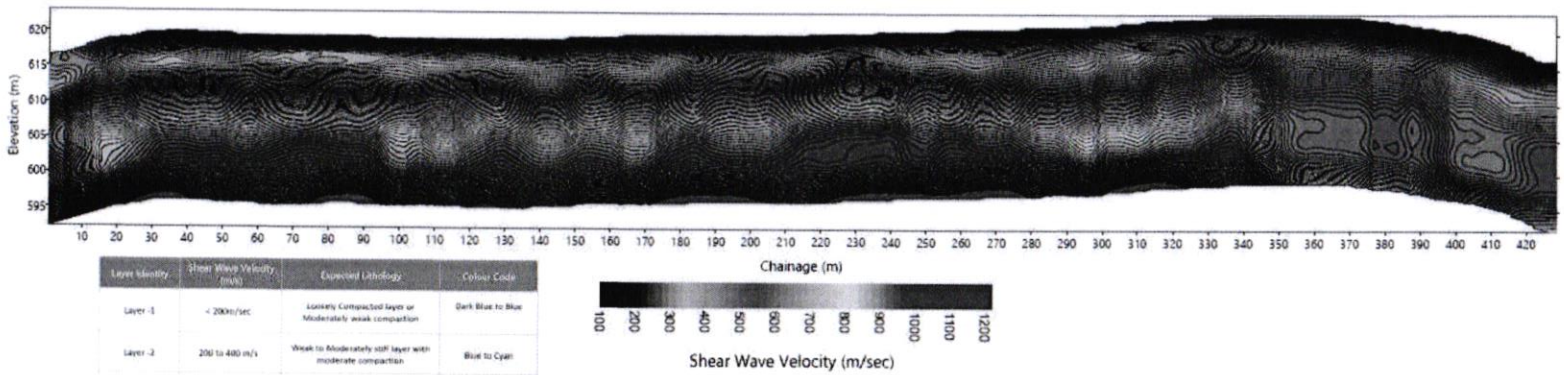


Figure 5.12 MASW analysis results of Line-14

Details of the subsurface properties obtained from the MASW are listed in Table 5.2. It can be observed from Table 5.2 and Figure 5.1 to Figure ***5.12*** that the majority portion of the JLH contains loosely compacted material, which can be due to the (i) presence of a high percentage of leachates and (ii) undecomposed MSW.

Table 5.2 The expected lithology for corresponding shear wave velocities provided by FGTL

Layer Identity	Shear Wave Velocity (m/s)	Expected Lithology	Colour Code
Layer -1	< 200m/sec	Loosely Compacted layer or Moderately weak compaction	Dark Blue to Blue
Layer -2	200 to 400 m/s	Weak to Moderately stiff layer with moderate compaction	Blue to Cyan
Layer -3	400 to 750 m/s	Stiff to Moderately Strong graded layer with Moderately strong compaction	Cyan to Lemon Green
Layer -4	>750 m/s	Strong and highly compacted layer	Lemon Green to Red

Further, to identify the presence of leachate and the state of the MSW, 2D-ERT investigations were conducted and the results are presented in the following (Lines 1 to 14 in Figure 5.13 to 5.25).

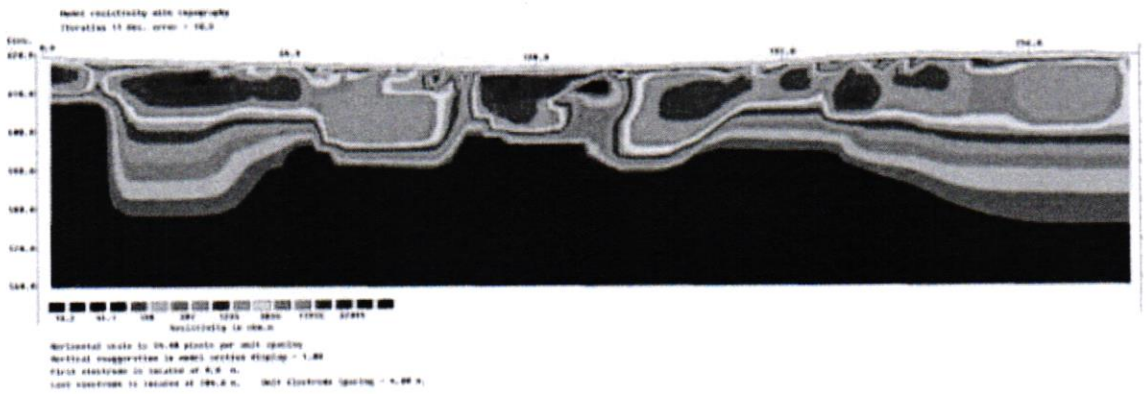


Figure 5.13 2D- electrical resistivity imaging map for Line-1

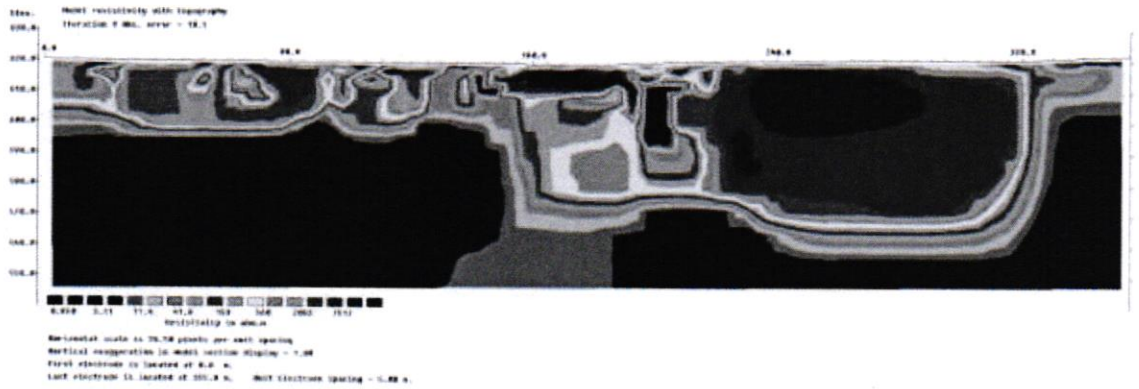


Figure 5.14 2D- electrical resistivity imaging map for Line-2

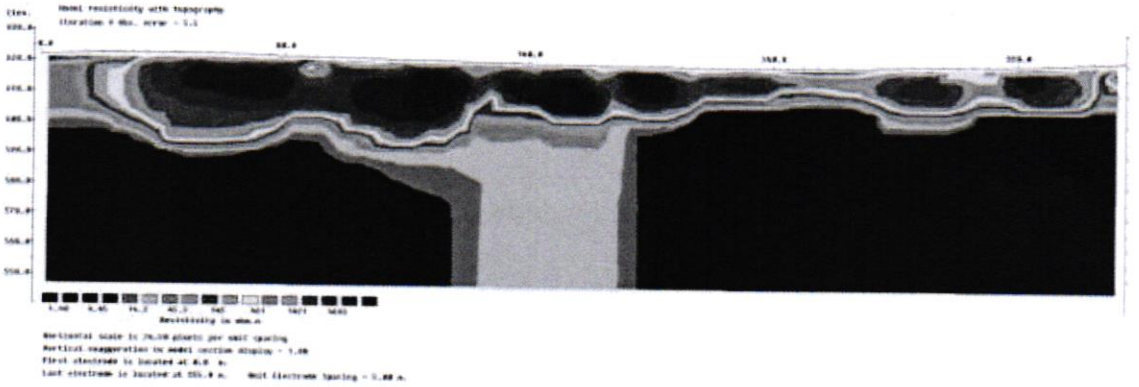


Figure 5.15 2D- electrical resistivity imaging map for Line-3

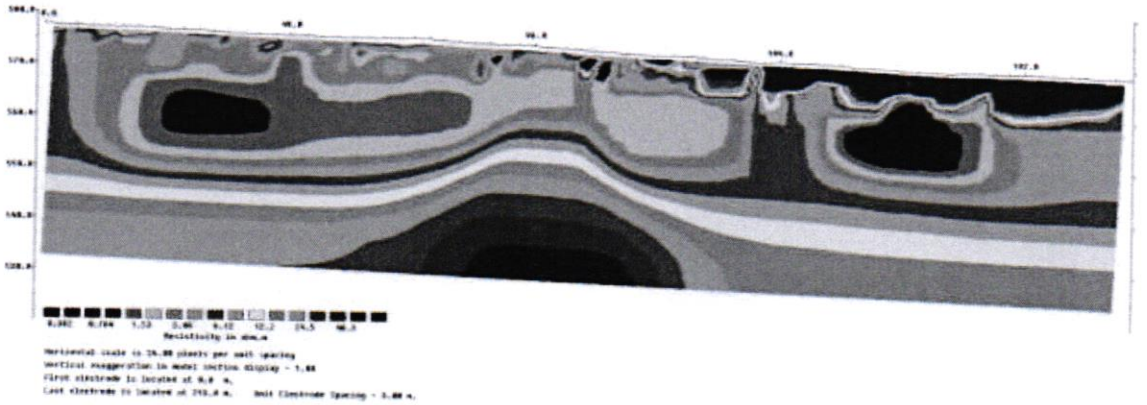


Figure 5.16 2D- electrical resistivity imaging map for Line-4

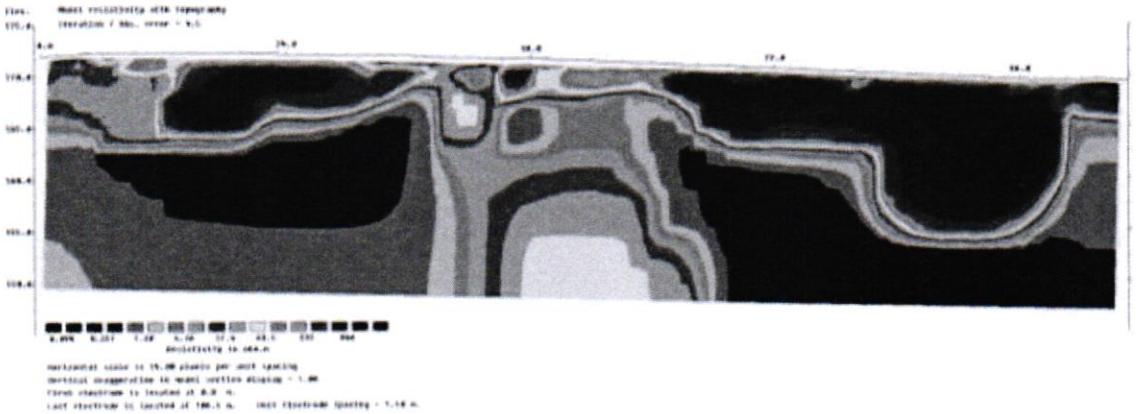


Figure 5.17 2D- electrical resistivity imaging map for Line-6

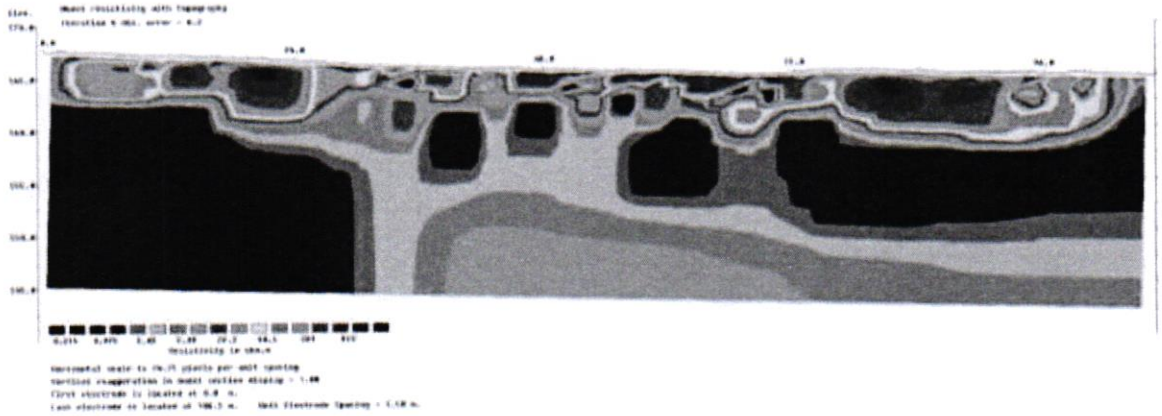


Figure 5.18 2D- electrical resistivity imaging map for Line-7

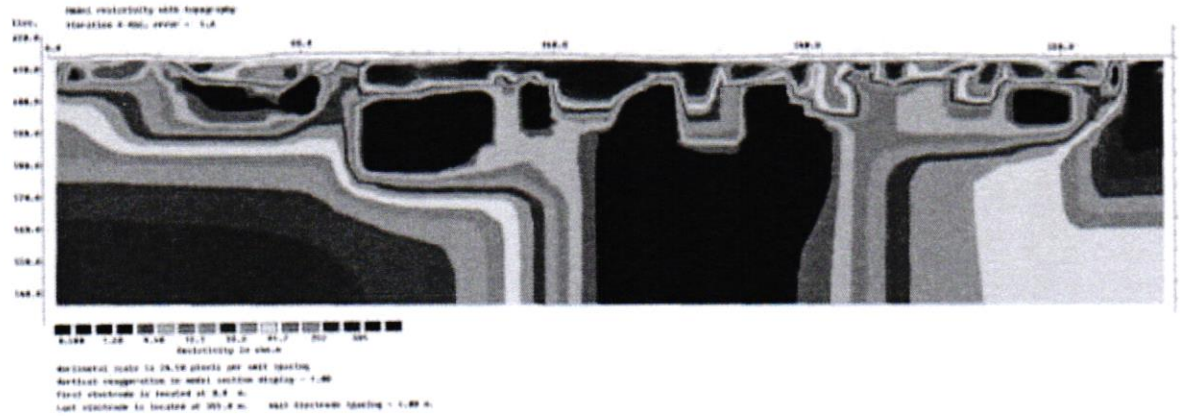


Figure 5.19 2D- electrical resistivity imaging map for Line-8

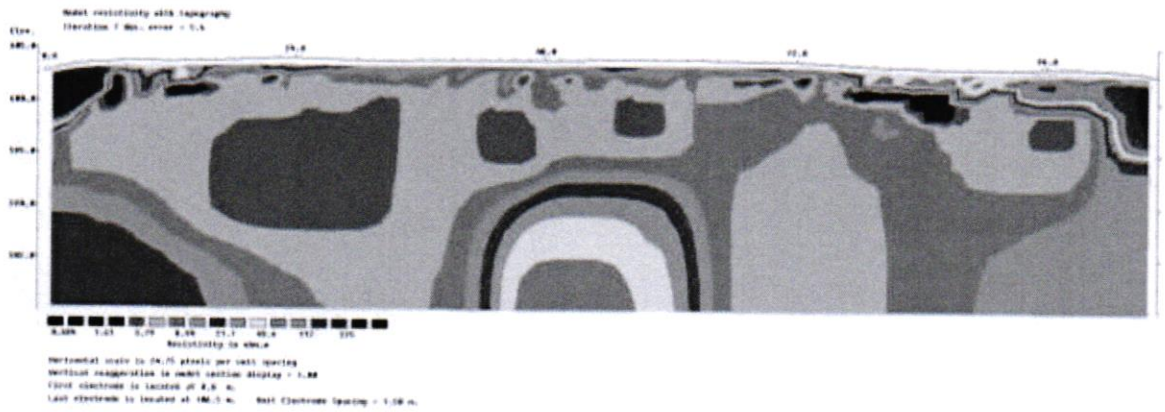


Figure 5.20 2D- electrical resistivity imaging map for Line-9

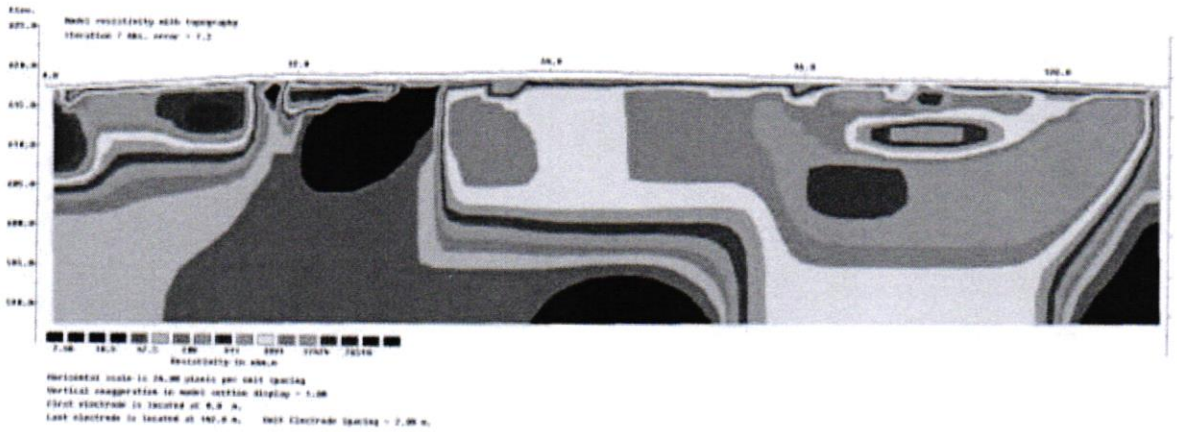


Figure 5.21 2D- electrical resistivity imaging map for Line-10

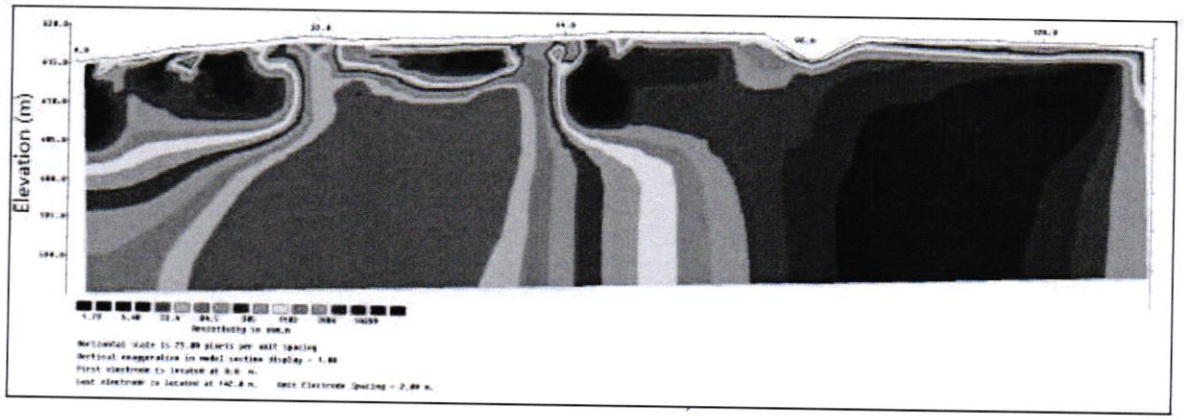


Figure 5.22 2D- electrical resistivity imaging map for Line-11

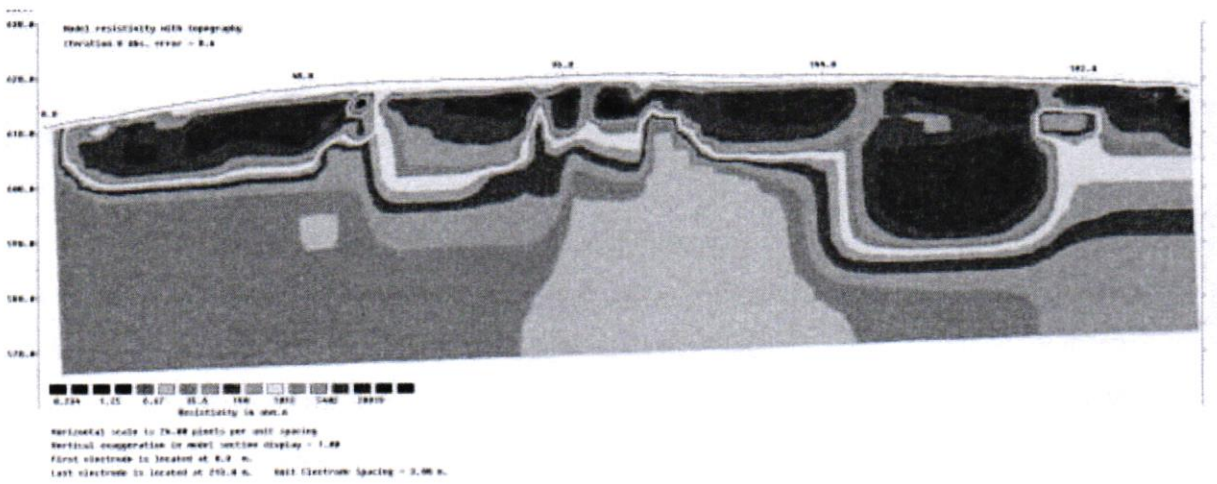


Figure 5.23 2D- electrical resistivity imaging map for Line-12

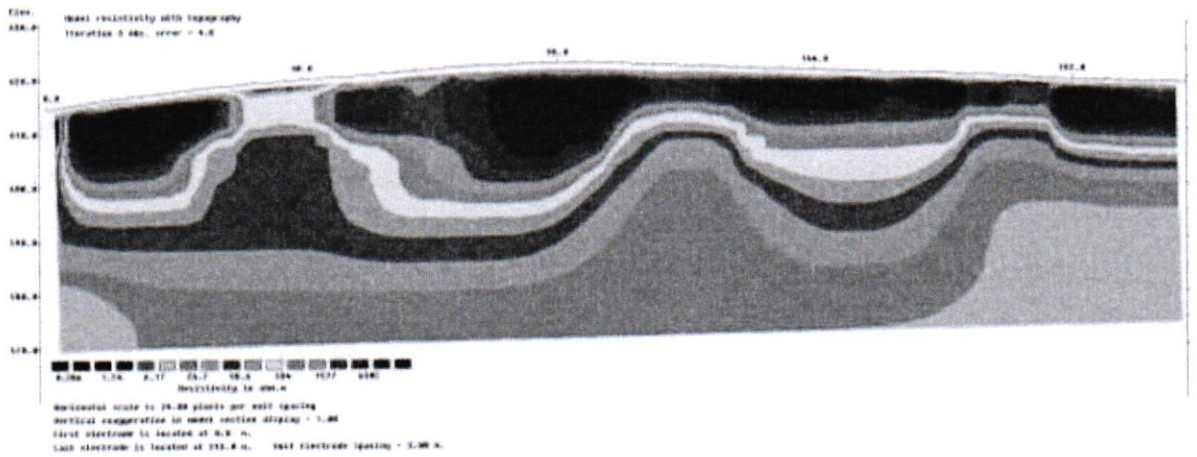


Figure 5.24 2D- electrical resistivity imaging map for Line-13

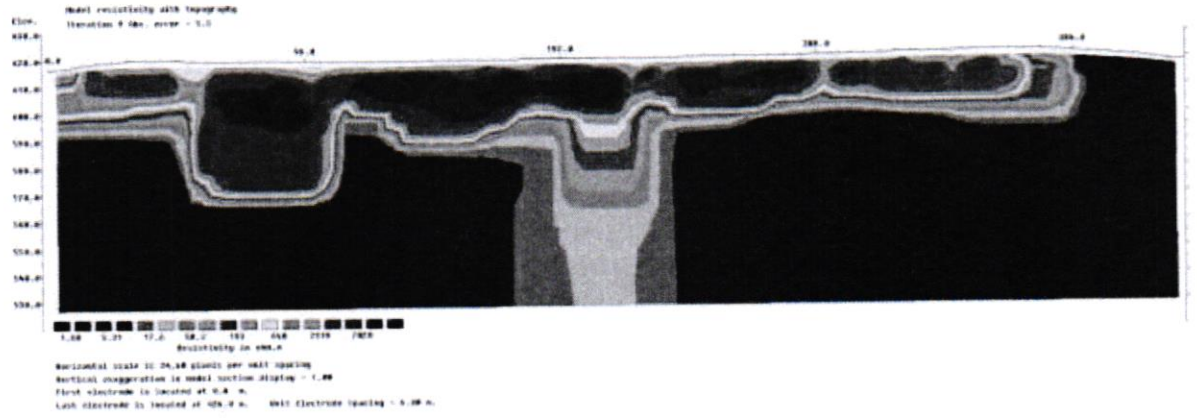


Figure 5.25 2D- electrical resistivity imaging map for Line-14

Based on the 2D ERT imaging results presented in Figures 5.13 to 5.25, it can be observed that the MSW at most of the locations of JLH possesses low electrical resistivity, which is indicative of the presence of saturated MSW with different salts and dissolved compounds. Moreover, Figures 5.12, 5.13, 5.15, 5.17 to 5.21 depict that the JLH consists of several isolated locations with extremely low electrical resistivity. Such isolated low-electrical resistivity locations could be due to the presence of saturated MSW, which is prone to decompose in due course, or conductive materials such as metals. This state of MSW will also be a root cause for the generation of combustible gases such as methane.

6. Details of the MSW sampling and on-site segregation

Before initiating sample collection, the soil cover, followed by geotextile, was removed carefully to avoid damage to the landfill cover system. Subsequently, a flight auger of ≈165 mm diameter attached to a drilling machine was inserted in the specific borehole location (refer to

Plate ***6.1***a). Samples were collected from different depths, until the hard strata or the presence of liquid interface is encountered. Details of the borehole location, termination depth, and the number of samples collected are mentioned in Table 6.1. A total of 16 boreholes were executed to retrieve 150 samples. The samples thus obtained were removed manually from the auger (refer to

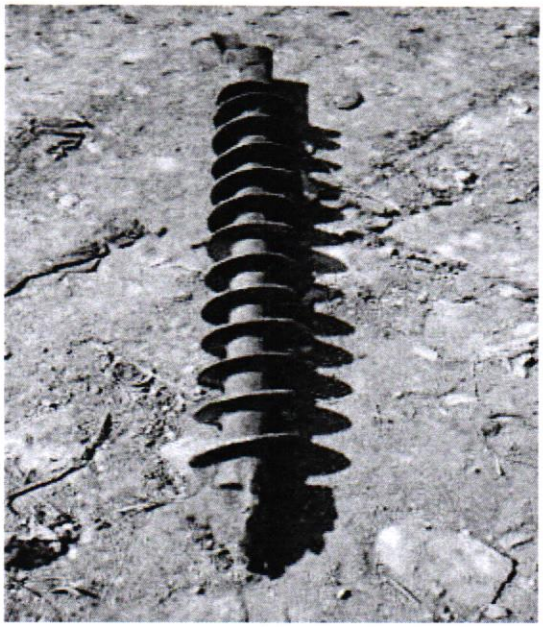
Plate ***6.1***b-d) and sieved through a 10 mm sieve (refer to

Plate ***6.2***a). Subsequently, the coarse- and fine- fractions were weighed and the data is tabulated in Table 6.2. These fractions were packed in airtight press-lock bags to prevent moisture loss, if any, (refer to

Plate ***6.2***b and c). Subsequently, the airtight bags were packed and transported to IIT Bombay for further testing/analyses (refer to

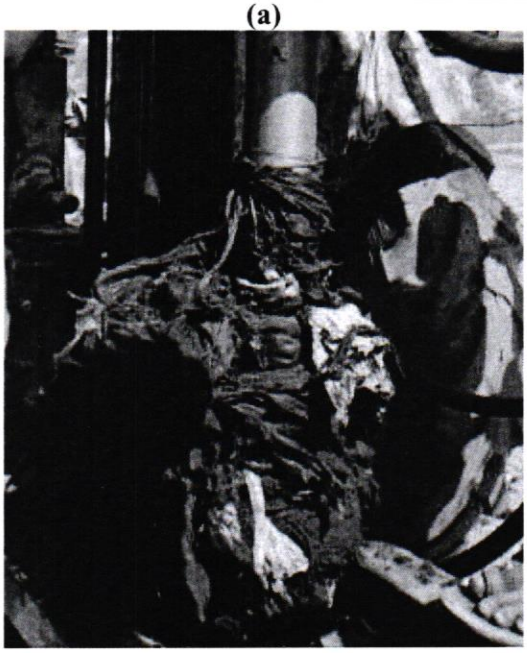
Plate ***6.2***d and f). Later, the boreholes were sealed by the landfill operator (refer to Plate 6.3).

Incidentally, during the sampling, a few of the boreholes released foam/bubbles/liquid (refer to Plate 6.4a to c), which are indicative of the presence of undecomposed MSW.



(a)

(b)



(c)

(d)

Plate 6.1 Images depicting the flight auger and the sample collection procedure

Table 6.1 Details of the boreholes and number of samples collected

BH	Location	Termination Depth (ft)	Depth till Sample Collected (ft)	Termination depth (m)	Nos. of Samples Retrieved
BH-1	Near Line 13 End	85.50	80	26.06	8
BH-2	Near Line 14 End	105.50	100	32.16	10
BH-3	Near Line 1 End	88.25	80	26.90	8
BH-4	Near Line 2 End	124.50	120	37.95	12
BH-5	Near Line 13 Start	104.50	100	31.85	10
BH-6	Near Line 12 Start	126.25	120	38.48	12
BH-7	Near Line 10 Start	127.50	120	38.86	12
BH-8	Near Line 14 Start	15.75	15	4.80	3
BH-9	Near Line 3 Start	15.50	15	4.72	3
BH-10	Near Line 2 Start / Centre	139.00	139	42.37	14
BH-11	Near Line 1 Start	138.50	130	42.21	13
BH-12	Near Line 10 End / Line 8 Centre	139.00	139	42.37	14
BH-13	Near Line 9 Centre	112.25	120	34.21	13
BH-14	Near Line 9 End	19.25	15	5.87	3
BH-15	Near Line 4 Centre	111.50	110	33.99	12
BH-16	Near Line 4 End	23.50	20	7.16	3
			Total depth	**449.96**	**150**

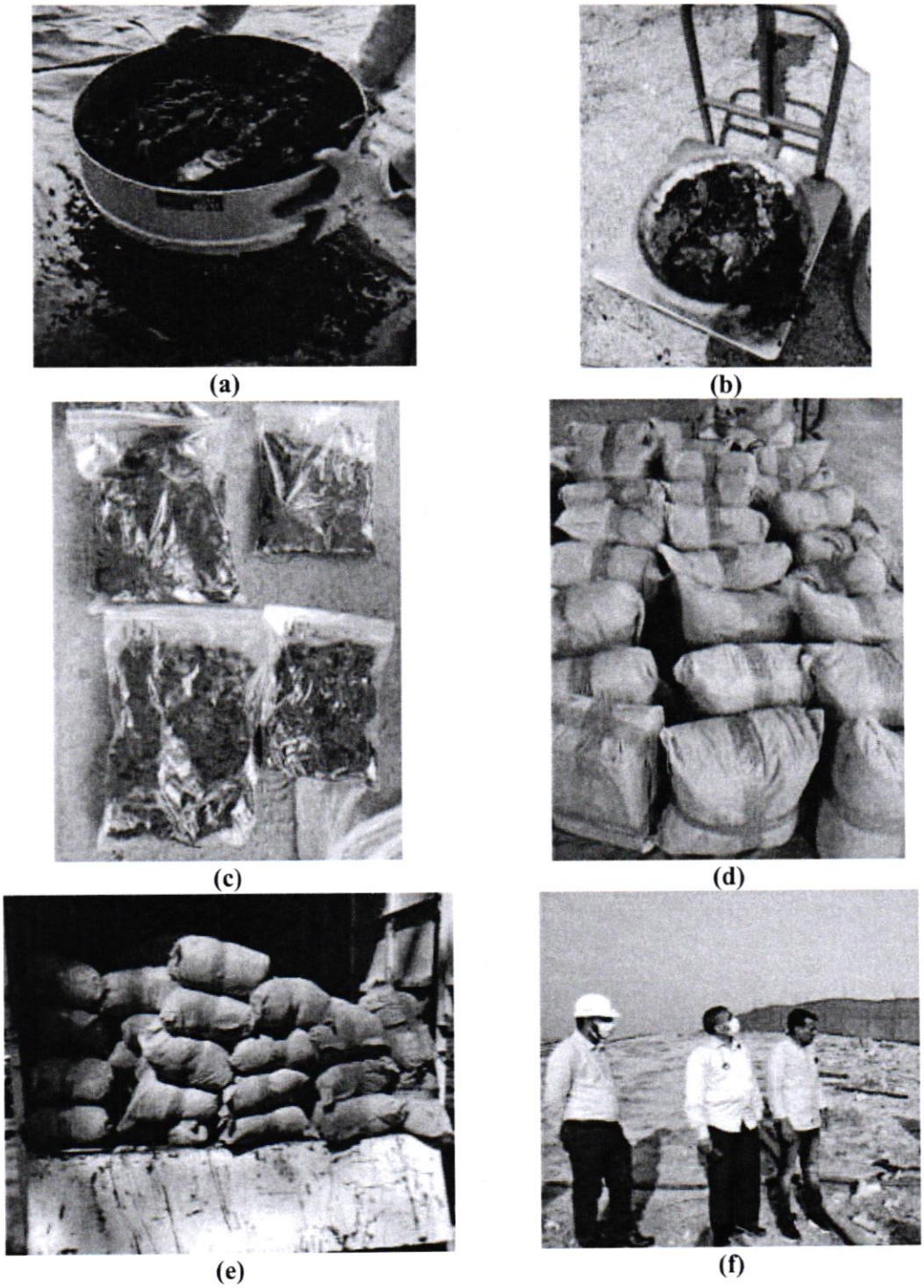


Plate 6.2 Images depicting the on-site segregation, weighing and packing of the samples being witnessed by the GHMC

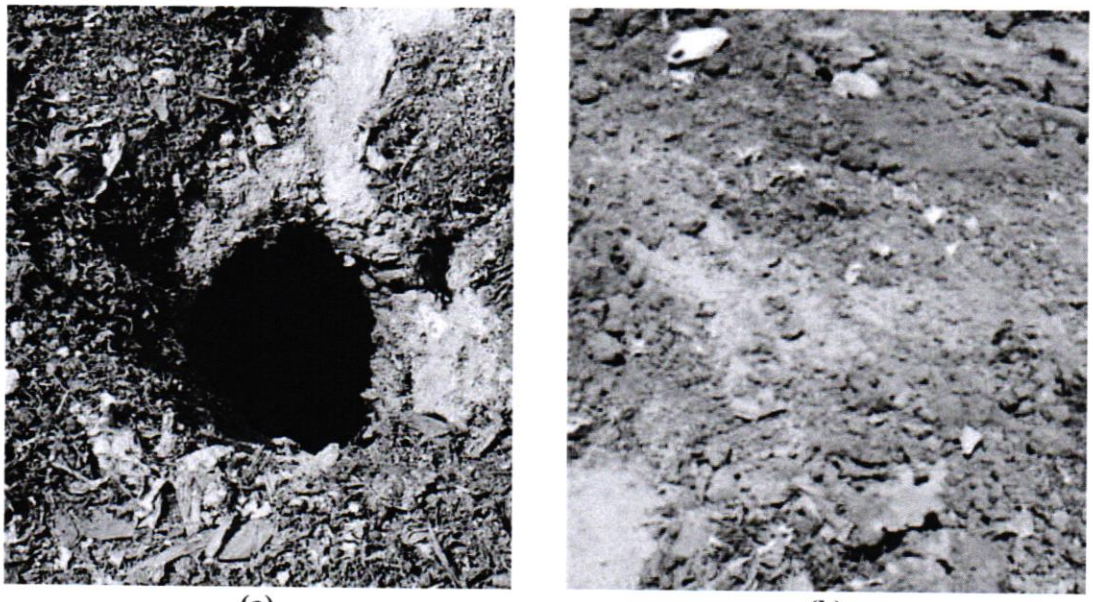
Table 6.2 Details of the coarse- and fine- samples obtained from the in-situ segregation

Sample No.	Depth (m)	Weight of sample (kg)			Percentage weight	
		Total	>10mm	<10mm	>10 mm	<10 mm
Borehole-01						
1	3	4.64	3.89	0.75	83.84	16.16
2	6	4.86	4.02	0.84	82.72	17.28
3	9	4.06	3.60	0.46	88.67	11.33
4	12	7.28	6.30	0.98	86.54	13.46
5	15	4.28	3.52	0.76	82.24	17.76
6	18	6.24	5.02	1.22	80.45	19.55
7	21	3.88	2.99	0.89	77.06	22.94
8	24	6.80	5.35	1.45	78.68	21.32
Borehole-02						
9	3	8	6.89	1.11	86.13	13.88
10	6	8.96	7.62	1.34	85.04	14.96
11	9	6.22	5.4	0.82	86.82	13.18
12	12	6.2	5.36	0.84	86.45	13.55
13	15	6.56	5.58	0.98	85.06	14.94
14	18	6.72	6.05	0.67	90.03	9.97
15	21	6.82	5.55	1.27	81.38	18.62
16	24	6.4	4.95	1.45	77.34	22.66
17	27	6.31	4.68	1.63	74.17	25.83
18	30	4.88	3.79	1.09	77.66	22.34
Borehole-03						
19	3	6.18	5.35	0.83	86.57	13.43
20	6	5.95	4.88	1.07	82.02	17.98
21	9	3.16	2.55	0.61	80.70	19.30
22	12	3.68	2.98	0.7	80.98	19.02
23	15	4.82	3.85	0.97	79.88	20.12
24	18	5.13	4.05	1.08	78.95	21.05
25	21	3.95	3.09	0.86	78.23	21.77
26	24	3.96	3.05	0.91	77.02	22.98
Borehole-04						
27	3	3.1	2.75	0.35	88.71	11.29
28	6	3.05	2.56	0.49	83.93	16.07
29	9	5.31	4.51	0.8	84.93	15.07
30	12	5.22	4.39	0.83	84.10	15.90
31	15	3.82	3.25	0.57	85.08	14.92
32	18	4.48	3.69	0.79	82.37	17.63
33	21	5.04	4.05	0.99	80.36	19.64
34	24	6.02	4.96	1.06	82.39	17.61
35	27	5.25	4.22	1.03	80.38	19.62

36	30	4.32	3.52	0.8	81.48	18.52
37	33	4.25	3.32	0.93	78.12	21.88
38	36	5.92	4.55	1.37	76.86	23.14
Borehole-05						
39	3	6.11	5.15	0.96	84.29	15.71
40	6	5.75	4.78	0.97	83.13	16.87
41	9	3.25	2.68	0.57	82.46	17.54
42	12	3.78	3.05	0.73	80.69	19.31
43	15	4.25	3.35	0.9	78.82	21.18
44	18	5.03	3.96	1.07	78.73	21.27
45	21	5.02	4.01	1.01	79.88	20.12
46	24	4.15	3.29	0.86	79.28	20.72
47	27	4.6	3.58	1.02	77.83	22.17
48	30	5.78	4.48	1.3	77.51	22.49
Borehole-06						
49	3	5.88	4.98	0.9	84.69	15.31
50	6	3.09	2.58	0.51	83.50	16.50
51	9	3.11	2.56	0.55	82.32	17.68
52	12	4.88	3.98	0.9	81.56	18.44
53	15	5.08	4.25	0.83	83.66	16.34
54	18	3.96	3.23	0.73	81.57	18.43
55	21	5.07	4.09	0.98	80.67	19.33
56	24	4.89	3.88	1.01	79.35	20.65
57	27	5.42	4.29	1.13	79.15	20.85
58	30	5.02	4.05	0.97	80.68	19.32
59	33	3.65	2.88	0.77	78.90	21.10
60	36	4.36	3.41	0.95	78.21	21.79
Borehole-07						
61	3	4.25	3.69	0.56	86.82	13.18
62	6	5.12	4.38	0.74	85.55	14.45
63	9	5.88	5.04	0.84	85.71	14.29
64	12	5.16	4.36	0.8	84.50	15.50
65	15	4.55	3.79	0.76	83.30	16.70
66	18	3.89	3.25	0.64	83.55	16.45
67	21	5.88	4.85	1.03	82.48	17.52
68	24	4.96	4.01	0.95	80.85	19.15
69	27	4.02	3.25	0.77	80.85	19.15
70	30	5.95	4.68	1.27	78.66	21.34
71	33	5.68	4.49	1.19	79.05	20.95
72	36	4.25	3.35	0.9	78.82	21.18
Borehole-08						
73	1.5	3.52	2.17	1.35	61.65	38.35
74	3	5.18	1.25	3.93	24.13	75.87

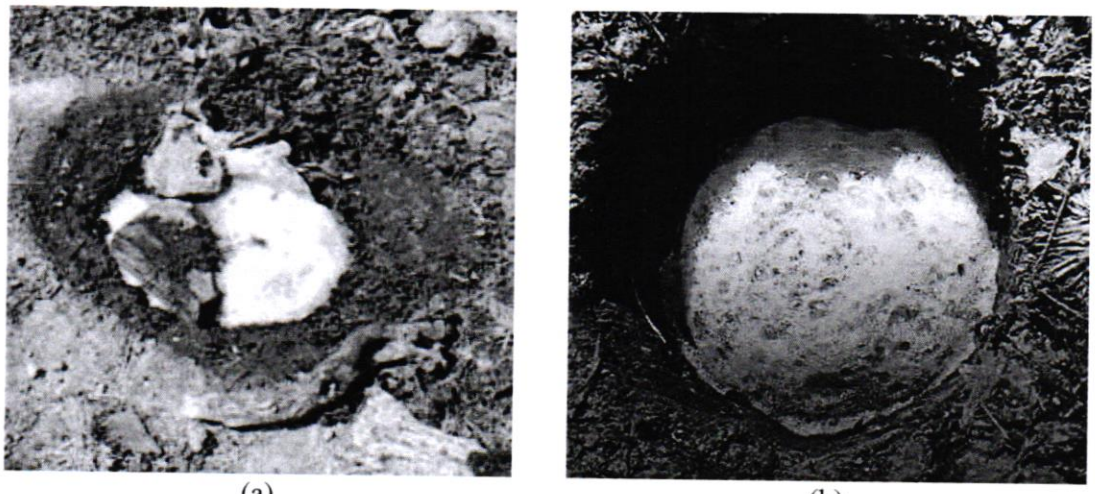
75	4.5	4.30	0.80	3.50	18.60	81.40
Borehole-09						
76	5	5.27	2.16	3.11	40.99	59.01
77	10	6.56	2.16	4.40	32.93	67.07
78	15	7.25	2.80	4.45	38.62	61.38
Borehole-10						
79	3	7.24	6.25	0.99	86.33	13.67
80	6	3.38	2.89	0.49	85.50	14.50
81	9	3.30	2.75	0.55	83.33	16.67
82	12	2.82	2.38	0.44	84.40	15.60
83	15	2.65	2.25	0.40	84.91	15.09
84	18	4.32	3.89	0.43	90.05	9.95
85	21	3.32	2.78	0.54	83.73	16.27
86	24	4.44	3.76	0.68	84.68	15.32
87	27	5.62	4.62	1.00	82.21	17.79
88	30	7.15	5.79	1.36	80.98	19.02
89	33	7.05	5.58	1.47	79.15	20.85
90	36	5.92	4.65	1.27	78.55	21.45
91	39	6.44	4.99	1.45	77.48	22.52
92	41.7	2.65	2.05	0.60	77.36	22.64
Borehole-11						
93	3	4.42	3.80	0.62	85.97	14.03
94	6	5.65	4.75	0.90	84.07	15.93
95	9	5.80	4.88	0.92	84.14	15.86
96	12	4.82	3.95	0.87	81.95	18.05
97	15	6.02	4.96	1.06	82.39	17.61
98	18	5.62	4.88	0.74	86.83	13.17
99	21	4.42	3.91	0.51	88.46	11.54
100	24	5.98	4.90	1.08	81.94	18.06
101	27	4.85	3.85	1.00	79.38	20.62
102	30	5.60	4.68	0.92	83.57	16.43
103	33	6.44	5.05	1.39	78.42	21.58
104	36	4.42	3.39	1.03	76.70	23.30
105	39	5.86	4.36	1.50	74.40	25.60
Borehole-12						
106	3	6.26	5.41	0.85	86.42	13.58
107	6	6.36	5.25	1.11	82.55	17.45
108	9	6.65	5.65	1.00	84.96	15.04
109	12	5.85	4.98	0.87	85.13	14.87
110	15	5.96	5.08	0.88	85.23	14.77
111	18	4.48	3.95	0.53	88.17	11.83
112	21	4.78	3.99	0.79	83.47	16.53
113	24	6.62	5.54	1.08	83.69	16.31

114	27	4.45	3.79	0.66	85.17	14.83
115	30	6.80	5.32	1.48	78.24	21.76
116	33	5.30	4.25	1.05	80.19	19.81
117	36	7.98	6.25	1.73	78.32	21.68
118	39	6.41	5.22	1.19	81.44	18.56
119	41.7	6.84	5.44	1.40	79.53	20.47
Borehole-13						
120	3	5.68	5.04	0.64	88.73	11.27
121	6	5.25	4.36	0.89	83.05	16.95
122	9	4.35	3.79	0.56	87.13	12.87
123	12	3.88	3.25	0.63	83.76	16.24
124	15	5.25	4.65	0.60	88.57	11.43
125	18	6.25	5.58	0.67	89.28	10.72
126	21	6.62	5.65	0.97	85.35	14.65
127	24	7.02	5.78	1.24	82.34	17.66
128	27	5.22	4.22	1.00	80.84	19.16
129	30	3.89	3.18	0.71	81.75	18.25
130	31.5	5.11	4.15	0.96	81.21	18.79
131	33	4.78	3.85	0.93	80.54	19.46
132	33.6	5.88	4.65	1.23	79.08	20.92
Borehole-14						
133	1.5	9.02	2.81	6.21	31.15	68.85
134	3	6.34	2.78	3.56	43.85	56.15
135	4.5	7.96	3.96	4.00	49.75	50.25
Borehole-15						
136	3	4.11	3.69	0.42	89.78	10.22
137	6	5.11	4.38	0.73	85.71	14.29
138	9	5.62	5.04	0.58	89.68	10.32
139	12	3.65	3.15	0.50	86.30	13.70
140	15	4.18	3.59	0.59	85.89	14.11
141	18	5.01	4.19	0.82	83.63	16.37
142	21	4.29	3.72	0.57	86.71	13.29
143	24	6.11	5.02	1.09	82.16	17.84
144	27	3.65	3.02	0.63	82.74	17.26
145	30	5.42	4.38	1.04	80.81	19.19
146	33	4.45	3.55	0.90	79.78	20.22
147	33.6	3.98	3.09	0.89	77.64	22.36
Borehole-16						
148	10	3.05	2.75	0.30	90.16	9.84
149	15	3.12	2.75	0.37	88.14	11.86
150	20	4.35	3.85	0.50	88.51	11.49

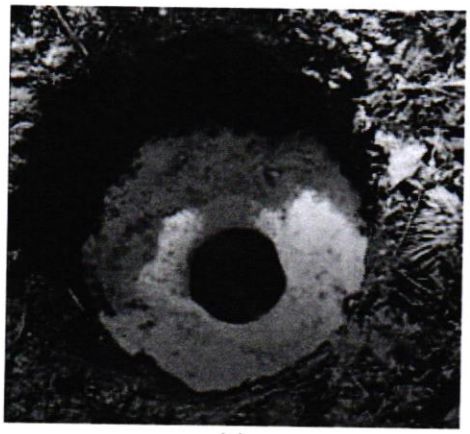


(a) (b)

Plate 6.3 The photographs depicting the borehole and its closure



(a) (b)



(c)

Plate 6.4 The photographs depicting the leachate and bubble formation and bursting by landfill gas emission the release of foam/bubbles/liquid from a typical borehole

7. Processing and characterization of the DMSW @ IIT Bombay Laboratory

The coarse fraction, i.e., >10 mm obtained from the site, was further segregated into plastics, textiles, residues (such as fine dirt and mixed waste) and stones, and the weight of each of these fractions was recorded. For this purpose, $1/3^{rd}$ of the total samples available from each borehole were selected randomly. The coarse-fraction is particularly useful for subsequent estimation of calorific values. The photographs depicting the laboratory segregation process are mentioned in Plate 7.1. Subsequently, each fraction's total weight and percentage are mentioned in Table 7.1. From Table 7.1, it can be observed that a significant fraction of the coarse fraction is plastics, followed by residues and stones. However, it can be observed that combining all together (i.e., coarse- and fine- fractions), fine fractions and residues will be a large fraction that is prone to decomposition. Hence, subsequent characterization of these fractions is a must.

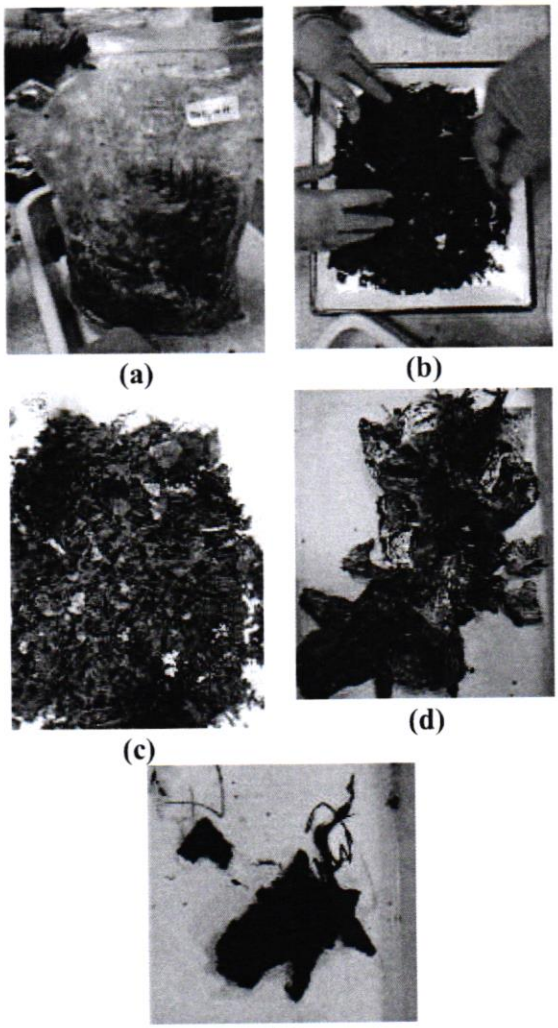


Plate 7.1 Images depicting the laboratory segregation process of the coarse-fractions

Table 7.1 Results obtained for the coarse-fractions of the MSW

BH	Depth (m)	Weight (g)					Percentage weight			
		Plastics	Textile	Residues	Stones	Total	Plastics	Textile	Residues	Stones
BH-01	12	234	157	772	0	1163	20.12	13.50	66.38	0.00
	15	308	163	890	0	1361	22.63	11.98	65.39	0.00
	24	445	177	1243	0	1865	23.86	9.49	66.65	0.00
	Avg	**329**	**166**	**968**	**0**	**1463**	**22.20**	**11.66**	**66.14**	**0.00**
BH-02	3	158	100	679	0	937	16.86	10.67	72.47	0.00
	6	263	202	858	0	1323	19.88	15.27	64.85	0.00
	9	437	104	463	0	1004	43.53	10.36	46.12	0.00
	12	411	104	333	0	848	48.47	12.26	39.27	0.00
	Avg	**317**	**128**	**583**	**0**	**1028**	**32.18**	**12.14**	**55.68**	**0.00**
BH-03	3	284	32	283	32	631	45.01	5.07	44.85	5.07
	21	364	108	30	0	502	72.51	21.51	5.98	0.00
	24	274	221	115	0	610	44.92	36.23	18.85	0.00
	Avg	**307**	**120**	**143**	**11**	**581**	**54.15**	**20.94**	**23.23**	**1.69**
BH-04	15	259	99	298	7	663	39.06	14.93	44.95	1.06
	27	333	79	6	0	418	79.67	18.90	1.44	0.00
	30	226	98	490	79	893	25.31	10.97	54.87	8.85
	36	194	385	87	0	666	29.13	57.81	13.06	0.00
	Avg	**253**	**165**	**220**	**22**	**660**	**43.29**	**25.65**	**28.58**	**2.48**
BH-05	15	245	96	322	0	663	36.95	14.48	48.57	0.00
	27	270	243	315	0	828	32.61	29.35	38.04	0.00
	30	292	57	58	0	407	71.74	14.00	14.25	0.00
	33	361	0	29	0	390	92.56	0.00	7.44	0.00
	Avg	**292**	**99**	**181**	**0**	**572**	**58.47**	**14.46**	**27.07**	**0.00**
BH-06	6	320	20	623	4	967	33.09	2.07	64.43	0.41
	9	244	30	667	149	1090	22.39	2.75	61.19	13.67
	18	659	34	56	0	749	87.98	4.54	7.48	0.00
	36	460	0	56	8	524	87.79	0.00	10.69	1.53
	Avg	**421**	**21**	**351**	**40**	**833**	**57.81**	**2.34**	**35.95**	**3.90**
BH-07	3	227	126	190	0	543	41.80	23.20	34.99	0.00
	12	362	37	822	52	1273	28.44	2.91	64.57	4.08
	18	329	84	723	141	1277	25.76	6.58	56.62	11.04
	27	606	87	152	0	845	71.72	10.30	17.99	0.00
	Avg	**381**	**84**	**472**	**48**	**985**	**41.93**	**10.75**	**43.54**	**3.78**
BH-08	15	22	7	315	431	775	2.84	0.90	40.65	55.61
BH-10	3	231	194	467	16	908	25.44	21.37	51.43	1.76
	6	24	816	23	0	863	2.78	94.55	2.67	0.00
	9	273	29	190	25	517	52.80	5.61	36.75	4.84
	15	178	53	264	41	536	33.21	9.89	49.25	7.65
	18	214	66	130	0	410	52.20	16.10	31.71	0.00

	Avg	**184**	**232**	**215**	**16**	**647**	**33.29**	**29.50**	**34.36**	**2.85**
BH-11	15	204	21	533	85	843	24.20	2.49	63.23	10.08
	18	167	189	475	0	831	20.10	22.74	57.16	0.00
	33	211	49	595	0	855	24.68	5.73	69.59	0.00
	36	232	80	715	0	1027	22.59	7.79	69.62	0.00
	Avg	**204**	**85**	**580**	**21**	**889**	**22.89**	**9.69**	**64.90**	**2.52**
BH-12	9	316	158	347	0	821	38.49	19.24	42.27	0.00
	15	340	59	169	0	568	59.86	10.39	29.75	0.00
	18	188	293	73	6	560	33.57	52.32	13.04	1.07
	24	189	212	354	0	755	25.03	28.08	46.89	0.00
	42	395	182	147	0	724	54.56	25.14	20.30	0.00
	Avg	**286**	**181**	**218**	**1**	**686**	**42.30**	**27.03**	**30.45**	**0.21**
BH-13	6	208	12	462	56	738	28.18	1.63	62.60	7.59
	21	427	61	111	0	599	71.29	10.18	18.53	0.00
	30	309	241	99	0	649	47.61	37.13	15.25	0.00
	39	483	110	223	0	816	59.19	13.48	27.33	0.00
	Avg	**357**	**106**	**224**	**14**	**701**	**51.57**	**15.61**	**30.93**	**1.90**
BH-14	6	270	92	255	3	620	43.55	14.84	41.13	0.48
	9	342	50	296	0	688	49.71	7.27	43.02	0.00
	21	433	64	111	0	608	71.22	10.53	18.26	0.00
	Avg	**348**	**69**	**221**	**1**	**639**	**54.82**	**10.88**	**34.14**	**0.16**
BH-15	12	164	432	137	29	762	21.52	56.69	17.98	3.81
	33	401	100	90	4	595	67.39	16.81	15.13	0.67
	Avg	**283**	**266**	**114**	**17**	**679**	**44.46**	**36.75**	**16.55**	**2.24**
BH-16	6	298	26	273	32	629	47.38	4.13	43.40	5.09
	9	330	56	31	0	417	79.14	13.43	7.43	0.00
	Avg	**314**	**41**	**152**	**16**	**523**	**63.26**	**8.78**	**25.42**	**2.54**
Avg							**42.74**	**16.68**	**37.80**	**2.78**

7.1 Characteristics of the fine-fractions

7.1.1 Moisture Content

Moisture content was determined by keeping the sample in an oven at 110±5°C and its weight loss was recorded intermittently. This procedure was followed until no further weight loss was observed as per the guidelines reported in the literature (ASTM International, 2020; Goli et al., 2022). The results obtained for different samples are listed in Table 7.2 (and in Tables A1 to A16).

Table 7.2 The moisture content of the fine-fractions

BH	Moisture content (%)		
	Avg (±SD)	Maximum	Minimum
BH-01	73.6±38.7	107.6±111.4	48.7±10.7
BH-02	62.4±28.3	75.7±22.2	43.4±7.3
BH-03	40.5±7.4	49.6±3.3	33.2±2
BH-04	50.4±12.3	72.6±2.6	34.7±2.2
BH-05	33.8±11.4	54.7±1.2	19.1±0.9
BH-06	30.7±12.1	55±1.2	20.6±1.1
BH-07	47.0±12.8	63.5±9.0	23.5±0.1
BH-08	10.50±5.80	15.6±1.20	4.30±0.30
BH-09	4.6±0.6	5.1±0.4	4.2±0.4
BH-10	42.5±11.5	60.9±3.6	29.4±3.5
BH-11	43.9±4.9	51.2±2.3	39.0±0.6
BH-12	50.5±7.5	63.1±6.3	41.6±8.7
BH-13	54.9±12.4	67.9±5.2	43.5±2.6
BH-14	20.6±9.3	25.8±0.9	7.4±9.6
BH-15	31.5±6.1	24.4±1.6	39.3±3.8
BH-16	31.2±10.2	42.0±1.6	21.7±9.4

From Table 7.2, it can be observed that the average moisture content of the fine-fractions varies between ≈ 4 and 74%, which is pretty high. In fact, the maximum moisture content of some of the samples is noticed to vary between 54 % to 108 %, which can be attributed to the presence of a very high amount of organic matter. It should be noted that the samples with such high moisture content will be prone to subsequent decomposition (Patil et al., 2017).

7.1.2 Organic Matter

The organic matter (OM) present in fine fractions was determined by resorting to the loss-on-ignition (LOI) test, as suggested by Goli et al. (2022). For this purpose, approx. 25 g of the oven-dried fine fraction was taken in a ceramic crucible and placed in a muffle. The muffle temperature was increased gradually to 440°C and maintained until no further change in the weight of the residue was observed. The results obtained from moisture content determination for all samples are mentioned in Table 7.3. Further, detailed experimental results were mentioned in Tables B1 to B16.

Table 7.3 Borehole-wise variation in the organic matter of fine fractions

Borehole No	Organic matter (%)		
	Avg (±SD)	Max	Min
BH-01	23.49±5.51	33.27±9.47	18.10±1.38
BH-02	25.28±4.63	31.13±0.62	19.64±0.71
BH-03	16.29±2.84	11.29±1.65	18.80±1.83
BH-04	20.53±2.96	17.55±1.49	25.54±3.28
BH-05	15.05±6.27	23.06±4.63	6.26±0.64
BH-06	12.49±4.08	20.65±1.50	8.08±1.83
BH-07	17.82±4.28	22.78±2.29	12.22±1.27
BH-08	4.46±0.81	5.45±0.17	3.89±0.18
BH-09	3.17±0.53	3.21±0.34	3.13±0.77
BH-10	16.83±7.27	36.46±4.51	9.74±0.48
BH-11	16.94±4.03	24.49±4.70	12.26±0.51
BH-12	17.31±3.08	20.32±1.15	14.04±2.56
BH-13	20.74±3.99	30.10±1.99	16.42±0.96
BH-14	8.22±3.61	11.26±1.98	1.63±0.23
BH-15	12.90±3.02	17.31±1.38	10.07±0.80
BH-16	14.58±2.12	15.94±1.02	12.88±2.23

Table 7.2 shows that the organic matter (OM) in fine fractions varied from 1.63±0.23 and 36.46±4.51%, with an average value of ≈20%. Such higher OM suggests that the DMSW is prone to further decomposition when exposed to an external environment. Moreover, the values suggest that the fine fraction is unsuitable for their utilization as structural fill material applications (Goli et al., 2022).

7.1.3 Specific Gravity

The specific gravity of the oven-dried fine fraction of the DMSW was measured by employing a helium gas pycnometer, as per the ASTM standard (ASTM D 5550, 2006). Approximately 20 g of the oven-dried sample was transferred into a pycnometer cell and He gas was purged to measure the volume of the solids. The average specific gravity of the fine fraction collected from each borehole is listed in Table 7.4, while the results for each sample are given in Tables C1 to C10.

Table 7.4 Borehole-wise variation in the specific gravity of fine fractions

Borehole No	Specific gravity		
	Average (±SD)	Max	Min
BH-01	2.26±0.03	2.36±0.02	2.15±0.04
BH-02	2.18±0.02	2.38±0.02	1.92±0.01
BH-03	2.23±0.01	2.34±0.01	2.07±0.01
BH-04	2.21±0.01	2.30±0.00	2.05±0.01
BH-05	2.31±0.02	2.47±0.02	2.13±0.04
BH-06	2.36±0.01	2.47±0.01	2.17±0.04
BH-07	2.28±0.01	2.41±0.02	2.17±0.02
BH-08	2.61±0.02	2.65±0.02	2.58±0.02
BH-09	2.67±0.01	2.69±0.01	2.66±0.01
BH-10	2.32±0.01	2.47±0.00	1.92±0.04
BH-11	2.30±0.01	2.37±0.00	2.18±0.01
BH-12	2.23±0.02	2.30±0.01	2.17±0.02
BH-13	2.26±0.01	2.31±0.02	2.19±0.01
BH-14	2.48±0.01	2.63±0.00	2.40±0.01
BH-15	2.48±0.00	2.46±0.00	2.38±0.00
BH-16	2.33±0.00	2.39±0.01	2.29±0.01

It can be observed that the overall average specific gravity of the fine fraction is 2.30±0.13, which is much lower as compared to the sands, silty clays, and moorum that are being used for structural fill applications. As such, the utilization of fine fractions as structural fill for the low-lying areas is not recommended. The reason being this material will not be getting properly compacted and will always be prone to long-term degradation.

7.1.4 Analysis of Leachates

The characteristics of leachates would help in evaluating the environmental suitability of the fine-fractions for different applications. In this context, the leaching characteristics were established by adopting the methodology developed by Goli et al. (2022). In this context, 10 g of sample was mixed with 200 mL of deionized water to attain a liquid-to-solid (*L/S*) ratio of 20 and stirred for 24 h on a magnetic stirrer. The supernatant was filtered through Whatman No. 42 ashless paper and the filtrate was tested for parameters like pH, electrical conductivity (EC), total dissolved solids (TDS) and salinity. Subsequently, the samples were analyzed for hardness, chlorides and other elements to test their concentrations. The leachate analysis was performed on 34 representative samples and the results are listed in Tables 7.5 and Table ***7.6***.

Table 7.5 The values of pH, EC, TDS, Salinity, Hardness and Chlorides for leachates of the representative samples from different bore-holes

BH	Depth (m)	Parameter							
		pH	EC (ms/cm)	TDS (mg/L)	Salinity (mg/L)	Hardness (mg/L)	Chlorides (mg/L)	TOC (mg/L)	TN (mg/L)
BH-01	12	7.56	1.754	968.5	983.1	400	496.51	144.58	38.97
BH-01	24	7.24	1.607	886.6	895.7	426.67	426.67	120.80	34.19
BH-02	15	7.30	1.261	795.9	695.4	413.33	331.97	107.45	29.96
BH-02	30	7.18	1.731	955.0	969.6	466.67	436.67	127.21	40.13
BH-03	12	7.26	1.142	630.9	627.8	600	280	92.32	36.87
BH-03	24	7.28	1.349	744.9	746.5	426.67	256.67	92.92	35.99
BH-04	12	7.22	1.118	617.1	613.1	506.67	396.70	83.63	32.93
BH-04	24	7.27	1.288	711.4	711.8	446.67	313.33	134.45	40.80
BH-04	36	7.33	1.239	683.6	683.2	400	346.67	116.25	33.92
BH-05	15	7.34	1.121	617.5	612.6	540	290	91.39	30.42
BH-05	30	7.50	0.933	515.4	509	346.67	296.67	79.92	28.89
BH-06	12	7.18	0.799	441.2	432.7	446.67	353.33	68.55	25.74
BH-06	24	7.08	1.507	832.7	838.5	486.67	363.33	92.22	37.14
BH-07	12	7.11	1.424	786	790.1	460	263.33	81.38	37.10
BH-07	24	7.14	1.021	563.7	558.7	340	280	104.84	28.93
BH-07	36	7.37	1.278	705.6	705.7	366.67	210	79.30	22.25
BH-08	06	7.38	0.610	337.2	328.4	466.67	140	38.19	27.76
BH-09	06	7.44	0.457	252.5	243.9	186.67	90	37.87	31.08
BH-10	15	7.37	0.972	563.3	530.4	480	180	76.91	39.89
BH-10	30	7.46	1.012	558.9	553.4	353.33	226.67	83.07	39.26
BH-10	42	7.33	1.592	879.1	888.2	466.67	430	120.83	43.86
BH-11	12	7.68	1.198	661.5	660.4	486.67	280	81.10	35.54
BH-11	24	7.36	1.720	645.4	644.2	480	267.67	54.32	30.69
BH-11	39	7.29	1.284	707.5	707.1	433.33	356.67	54.01	27.16
BH-12	15	6.98	1.293	714.4	715.3	313.33	396.67	85.65	29.16
BH-12	30	7.23	1.300	717.7	718.6	460	436.67	90.28	29.06
BH-12	42	7.25	1.426	787.8	792.5	393.33	530	121.70	39.17
BH-13	12	7.38	0.900	496.8	489.6	226.67	410	69.25	30.46
BH-13	24	7.42	1.366	753.5	755.1	513.33	413.33	93.72	31.49
BH-13	39	7.3	1.376	759.2	762.9	426.67	373.33	94.37	31.86
BH-14	09	7.6	0.636	351.1	342.7	160	167.67	36.81	29.71
BH-15	09	7.29	0.809	446.4	438.9	260	230	53.08	28.88
BH-16	06	7.36	1.110	612.6	609.6	406.67	260	100.29	46.38

Table 7.6 The concentration of leachable elements from the fine-fractions

BH	Depth (m)	Leachable elements concentration (in mg/L)												
		Al	Ba	Ca	Cr	Cu	Fe	K	Mg	Mn	Na	Ni	Zn	S
BH-01	12	0.08	0.01	16.74	BDL	0.16	0.24	101.29	6.79	0.03	320.25	0.04	0.09	21.68
BH-01	24	0.02	0.03	44.08	BDL	0.07	0.12	45.69	8.08	0.07	78.24	0.05	0.07	16.28
BH-02	15	BDL	0.04	25.89	BDL	0.03	0.04	15.41	4.61	BDL	28.38	BDL	0.04	12.98
BH-02	30	BDL	0.01	11.53	BDL	0.15	0.17	73.92	4.74	BDL	108.93	0.02	0.07	15.43
BH-03	12	0.02	0.02	30.02	0.01	0.33	0.22	234.88	9.65	0.05	204.98	0.05	0.21	29.20
BH-03	24	0.05	0.02	23.59	0.01	0.12	0.34	130.92	9.38	BDL	298.98	0.06	0.13	34.22
BH-04	12	0.01	0.03	29.99	0.01	0.13	0.23	116.84	10.01	BDL	222.14	0.04	0.09	37.73
BH-04	24	0.12	0.02	18.45	BDL	0.08	0.08	37.57	3.62	BDL	64.26	0.02	0.04	15.80
BH-04	36	0.02	0.05	63.62	BDL	0.04	0.08	69.41	10.96	0.01	110.59	0.04	0.07	37.43
BH-05	15	0.01	0.02	32.58	BDL	0.13	0.15	86.44	9.63	0.03	207.34	0.04	0.12	33.61
BH-05	30	0.04	0.02	25.53	0.01	0.12	0.30	115.58	7.69	0.02	301.89	0.04	0.12	25.99
BH-06	12	0.07	0.02	22.46	BDL	0.13	0.24	69.54	7.07	0.04	118.81	0.03	0.09	17.86
BH-06	24	0.03	0.03	36.29	BDL	0.08	0.09	64.25	7.89	BDL	101.40	0.03	0.10	19.77
BH-07	12	0.05	0.02	31.61	0.01	0.24	0.34	240.16	10.64	BDL	225.09	0.05	0.12	33.71
BH-07	24	0.06	0.02	36.70	BDL	0.06	0.09	84.07	11.70	0.05	125.90	0.03	0.10	38.28
BH-07	36	0.08	0.01	17.73	BDL	0.25	0.29	88.03	5.28	BDL	130.96	0.04	0.08	24.18
BH-08	06	0.06	0.02	24.06	0.01	0.12	0.37	117.23	7.56	0.03	153.11	0.04	0.12	14.78
BH-09	06	0.07	0.03	36.01	0.01	0.18	0.35	107.11	10.33	0.03	178.62	0.05	0.13	29.21
BH-10	15	0.04	0.03	55.16	BDL	0.22	0.17	109.47	8.67	0.02	199.06	0.04	0.09	40.08
BH-10	30	0.10	0.01	19.22	BDL	0.14	0.21	53.00	5.19	0.03	94.766	0.03	0.08	18.80
BH-10	42	0.03	0.04	39.93	BDL	0.04	0.07	89.45	11.89	BDL	247.20	0.03	0.05	34.41
BH-11	12	0.03	0.03	25.55	BDL	0.10	0.14	61.60	8.09	0.02	113.85	0.03	0.12	18.94
BH-11	24	0.04	0.02	18.48	BDL	0.13	0.24	124.15	5.88	0.02	222.82	0.04	0.11	14.22
BH-11	39	0.03	0.02	37.28	0.01	0.15	0.30	155.45	10.74	BDL	224.47	0.05	0.21	34.09
BH-12	15	0.03	0.02	37.68	BDL	0.17	0.28	110.55	11.10	BDL	218.72	0.06	0.16	21.06
BH-12	30	0.09	0.02	21.13	BDL	0.17	0.45	110.77	6.87	BDL	275.71	0.04	0.32	22.86
BH-12	42	0.03	0.03	40.33	BDL	0.10	0.16	92.18	9.08	0.04	282.03	0.04	0.14	31.92

BH-13	12	0.02	0.02	36.04	0.01	0.13	0.22	114.72	11.87	0.02	229.52	0.04	0.13	31.05
BH-13	24	0.02	0.03	43.54	BDL	0.08	0.18	83.37	9.82	0.01	242.62	0.04	0.09	24.14
BH-13	39	0.04	BDL	20.61	BDL	0.06	0.21	97.20	7.50	BDL	271.77	0.04	0.07	27.53
BH-14	09	0.05	0.02	24.36	BDL	0.28	0.35	111.48	7.84	0.04	232.84	0.05	0.08	22.79
BH-15	09	0.05	0.02	24.68	BDL	0.28	0.35	112.12	7.80	0.04	194.93	0.05	0.08	22.76
BH-16	06	0.03	0.02	18.20	0.01	0.16	0.16	77.34	7.71	0.04	317.39	0.04	0.09	17.37

Note:

- BDL represents *below detection limit* (i.e., 0.01 mg/L)
- Concentrations of Ag, Co, Cd, Hg, Pb, Ti and Mo in all samples is BDL

From these results, it can be observed that the concentrations of the leachable heavy metals are within the permissible limits as far as their disposal in land surface waters is concerned. However, the concentrations of metals like Na, K and Cl are high, indicating that the fine-fractions are contaminated with salts. Moreover, the higher concentration of S in all the samples can be attributed to the presence of decomposable organic matter in these fractions, which corroborates the findings from the organic matter determination test. Similarly, the TOC and TN concentrations also indicate the presence of leachable organic matter, which has a potential for further biological degradation due to microbial activities. Based on the characteristics of the leachate obtained from these fractions and the foam/bubble formation, it can also be opined that the leachate present in the JLH is yet to decompose. Hence, treating the leachates obtained from landfills using an appropriate treatment technique becomes mandatory.

7.2 The calorific value of the coarse-fractions

The calorific value of the coarse-fractions was obtained using a portable bomb calorimeter. For this purpose, 2 g of the oven-dried sample was shredded to a size of <10 mm and placed in the sample holder. Subsequently, the experiment was performed following the guidelines proposed in the literature (Goli et al., 2022). Approximately 75 randomly collected samples were tested to get a representative calorific value and ash content and the results are presented in Table 7.7.

Table 7.7 The calorific value and ash content of the coarse-fractions

BH	Depth (m)	Ash content (%)	Calorific Value (kCal/kg)
BH-01	03	37.77	2888.33
	09	37.59	1833.61
	12	54.03	3692.96
	15	28.90	1812.09
	18	41.09	2774.04
	21	36.32	1299.90
BH-02	03	57.93	1554.83
	06	32.70	2145.12
	09	41.07	2462.62
	12	42.05	2554.88
	15	53.18	5828.55
	18	40.02	3280.21
	24	24.67	3653.43
	27	38.27	756.91
	30	41.54	1056.45

BH-03	03	29.29	3198.43
	06	43.27	1292.39
	09	11.25	4579.96
	12	45.80	3344.65
	15	31.94	3528.52
	18	35.17	3184.88
	21	33.72	3288.56
	24	28.28	3328.54
BH-05	03	45.69	2704.60
	06	29.62	3707.45
	09	36.79	1954.29
	12	40.52	4083.77
	15	33.83	1457.86
	18	38.67	4743.62
	21	57.29	2253.79
	27	47.26	4974.84
	30	44.33	3361.18
	33	53.35	2209.93
BH-08	1.5	69.81	3989.55
	3.0	55.33	2142.39
	4.5	50.72	3796.90
BH-09	1.5	38.91	3092.25
	4.5	27.24	2393.13
BH-10	03	28.77	1147.96
	06	42.12	934.39
	09	44.06	3411.75
	12	28.13	2701.66
	15	30.41	3144.37
	18	38.79	5300.08
	21	35.24	2948.88
	24	11.86	1363.64
	27	25.27	3391.50
	30	37.15	3250.11
	33	42.18	1163.73
	36	43.07	2947.22
	39	53.36	2651.48
	41.7	44.46	2039.41
BH-12	03	33.49	3034.28
	09	47.78	3574.57
	15	40.63	3994.90
	18	37.35	3386.92
	21	23.21	4291.47

	24	42.78	4024.64
	27	33.39	1126.19
	30	48.88	2491.54
	33	38.00	2600.81
	36	45.45	2998.08
	39	45.95	2489.12
	41.70	39.28	3168.18
BH-13	03	30.26	4747.82
	06	39.12	1039.74
	09	26.18	1484.19
	15	23.37	3165.62
	18	13.39	3982.31
	21	11.62	4479.63
	24	42.79	5556.29
	27	54.31	3184.01
	30	21.80	3697.30
	31.5	31.68	3361.36
	33	50.42	2182.17
	33.6	50.97	4838.59

The data presented in Table 7.7 indicates that the calorific value of the coarse-fractions varies between 934 to 5556 kCal/kg and for most of the samples, this value is >1500 kCal/kg, which indicates their suitability as a refuse-derived fuel. However, it's noteworthy that the ash content of these samples is >20%, which is a big concern as per the guidelines laid down by the Ministry of Urban Affairs (2018).

8. Conclusions and the way forward

- MASW results indicate the presence of saturated and loosely compacted MSW up to greater depths, which confirms the presence of yet to stabilize MSW.
- ERT results indicate the presence of low-resistivity pockets in the MSW, which can be attributed to the presence of saturated or moist MSW (read the yet-to-decompose waste).
- The segregation of DMSW samples indicates the dominance of plastics and fine-fractions (<10 mm) of the waste matrix up to ≈40 % (each) by weight.
- The organic matter (up to 35%) and moisture content (>100%) of the fine-fractions are very high, which indicates their susceptibility to get decomposed in the long run.
- The specific gravity of the fine fractions is around 2.30, which makes it an unpreferred, if not unsuitable, material for infrastructural development (viz., making foundation pads, reclamation, etc.).
- The emission of foam/gas/leachate from the JLH indicates the ongoing decomposition of the MSW. **Hence, the biomining of JLH at this point in time is not recommended.**
- Though the calorific value of most of the samples of the coarse-fractions is >1500 kCal/kg, their ash content is also about 60%. Such a situation makes these fractions **unsuitable for their application as refuse-derived fuel**.
- Higher Na^+ concentration in fine-fractions would form sodic soil when used as a soil amending agent for agricultural applications.
- Higher TOC, TN and S concentrations in leachate generated from the fine-fractions indicate their potential for subsequent degradation. Hence, it becomes mandatory to **treat the leachates generated in the JLH** appropriately.
- Based on the present state of the decomposed MSW and foam observed during borehole drilling, it can be concluded that the waste is **yet to decompose**. **Hence, the JLH is not ready for biomining.**

Disclaimer

Results from these investigations are not valid forever, and hence cannot be employed to determine the time for initiation of biomining at the JLH. Periodic sampling followed by extensive testing should be performed to ascertain the threadiness of the JLH for biomining.

Appendix A

Table A.1 Moisture content analysis results for Borehole-01

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	23.01	28.50	26.39	62.5	58.8±8.8
	1B	24.73	30.38	28.53	48.8	
	1C	22.70	26.66	25.10	65.1	
6	2A	22.88	28.98	25.97	97.5	89.8±11.4
	2B	23.86	29.32	26.95	76.7	
	2C	22.68	26.38	24.57	95.3	
9	3A	20.99	28.31	25.42	65.3	64.7±14.5
	3B	35.23	40.19	38.00	78.8	
	3C	19.95	24.87	23.23	49.9	
12	4A	22.53	26.71	24.97	71.3	72.0±12.5
	4B	22.18	25.44	24.22	59.9	
	4C	22.72	26.92	24.99	84.8	
15	5A	21.64	25.66	23.82	84.4	85.9±6.3
	5B	24.80	29.70	27.34	92.8	
	5C	24.63	26.83	25.85	80.5	
18	6A	21.73	26.94	25.55	36.4	48.7±10.7
	6B	22.44	26.40	24.99	55.3	
	6C	25.90	29.87	28.47	54.4	
21	7A	21.99	27.66	25.36	68.3	61.2±11.7
	7B	21.88	26.00	24.67	47.7	
	7C	22.41	25.73	24.39	67.6	
24	8A	22.93	27.77	26.36	41.0	107.6±111.4
	8B	21.49	26.62	25.01	45.7	
	8C	22.97	29.48	24.91	236.3	
				Avg (±SD)	**73.6±38.7**	

Table A.2 Moisture content analysis results for Borehole-02

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	22.75	28.08	26.32	49.5	57.0±10.9
	1B	22.60	30.24	27.63	52.1	
	1C	22.27	28.08	25.70	69.5	
6	2A	34.76	42.58	37.68	167.2	74.5±84.2
	2B	33.25	39.87	39.69	2.8	
	2C	35.29	44.82	41.50	53.5	
9	3A	35.35	56.75	51.99	28.7	53.4±24.0
	3B	37.08	62.36	53.40	54.9	
	3C	34.16	61.30	49.53	76.6	
12	4A	36.09	57.41	48.91	66.3	73.8±10.2
	4B	36.59	59.36	48.87	85.4	
	4C	22.98	35.27	30.23	69.7	
15	5A	23.85	37.29	32.79	50.3	52.6±2.5
	5B	23.32	40.84	34.60	55.3	
	5C	20.46	36.47	30.97	52.2	
18	6A	22.62	37.26	30.22	92.7	75.7±22.2
	6B	22.11	39.53	33.68	50.5	
	6C	23.62	40.12	32.59	83.9	
21	7A	27.31	44.12	35.16	114.3	73.4±35.6
	7B	16.07	26.33	22.92	49.7	
	7C	16.75	33.51	27.47	56.2	
24	8A	22.47	41.63	36.64	35.2	43.4±7.3
	8B	22.73	41.30	35.50	45.4	
	8C	22.56	47.08	38.97	49.4	
27	9A	22.34	37.85	31.95	61.4	63.5±9.1
	9B	21.02	33.43	28.18	73.4	
	9C	24.83	42.31	36.06	55.7	
30	10A	16.89	36.27	29.61	52.4	56.5±4.7
	10B	23.03	42.73	35.69	55.6	
	10C	20.52	35.55	29.82	61.7	
				Avg (±SD)	**62.4±28.3**	

Table A.3 Moisture content analysis results for Borehole-03

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	21.75	35.08	30.65	49.7	49.1±2.1
	1B	24.79	38.93	34.42	46.8	
	1C	23.89	36.42	32.20	50.8	
6	2A	19.97	32.04	28.07	49.1	45.8±3.0
	2B	21.51	35.99	31.64	43.0	
	2C	22.21	35.87	31.59	45.5	
9	3A	22.91	38.08	34.74	28.2	32.1±4.8
	3B	22.72	32.72	29.99	37.4	
	3C	22.03	34.96	31.94	30.6	
12	4A	22.95	39.30	34.88	37.0	37.2±1.6
	4B	22.71	35.07	31.82	35.7	
	4C	22.44	33.90	30.69	38.9	
15	5A	21.01	38.93	33.91	38.9	41.5±2.3
	5B	23.03	40.16	34.99	43.2	
	5C	24.75	40.38	35.72	42.5	
18	6A	21.66	41.15	36.35	32.6	33.2±2.0
	6B	22.99	39.98	35.90	31.6	
	6C	22.46	40.74	35.95	35.5	
21	7A	22.74	37.35	32.86	44.4	35.5±7.7
	7B	22.55	41.92	37.36	30.7	
	7C	25.92	42.24	38.33	31.5	
24	8A	24.65	45.31	38.16	52.9	49.6±3.3
	8B	21.91	37.42	32.29	49.3	
	8C	35.25	58.45	51.09	46.4	
				Avg (±SD)	**40.5±7.4**	

Table A.4 Moisture content analysis results for Borehole-04

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	23.62	42.48	38.46	27.1	27.7±0.5
	1B	22.76	39.44	35.80	27.9	
	1C	22.98	38.17	34.85	28.0	
6	2A	20.46	37.22	32.29	41.7	39.9±1.6
	2B	27.31	45.15	40.19	38.5	
	2C	16.78	35.71	30.35	39.5	
9	3A	22.10	39.56	35.27	32.6	34.7±2.2
	3B	22.59	40.11	35.61	34.6	
	3C	23.84	40.85	36.26	36.9	
12	4A	37.09	64.48	56.36	42.1	43.3±1.1
	4B	35.29	71.27	60.24	44.2	
	4C	36.09	63.85	55.42	43.6	
15	5A	34.16	66.94	55.14	56.3	56.8±5.5
	5B	33.27	64.61	52.55	62.5	
	5C	36.60	69.77	58.49	51.5	
18	6A	34.76	65.86	54.91	54.3	52.0±2.0
	6B	35.35	73.00	60.37	50.5	
	6C	16.09	28.72	24.44	51.3	
21	7A	23.35	42.28	35.98	49.9	54.1±3.6
	7B	22.30	41.74	34.77	55.9	
	7C	22.64	40.07	33.77	56.6	
24	8A	21.76	38.63	33.09	48.8	48.9±1.8
	8B	24.82	44.24	37.70	50.8	
	8C	23.92	48.55	40.65	47.3	
27	9A	21.53	41.90	35.03	50.9	54.4±5.1
	9B	23.04	42.56	35.87	52.2	
	9C	21.95	42.31	34.65	60.3	
30	10A	24.68	49.60	40.71	55.5	60.0±4.5
	10B	22.08	42.42	34.44	64.5	
	10C	23.37	49.06	39.43	60.0	
33	11A	23.88	45.71	36.59	71.7	72.6±2.6
	11B	22.51	50.59	38.97	70.6	
	11C	22.81	51.78	39.31	75.6	
36	12A	27.34	50.11	41.33	62.8	60.0±2.4
	12B	25.95	46.73	39.08	58.3	
	12C	23.07	52.56	41.62	58.9	
				Avg (±SD)	**50.4±12.3**	

Table A.5 Moisture content analysis results for Borehole-05

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	22.71	39.56	33.64	54.1	54.7±1.2
	1B	21.01	38.62	32.29	56.1	
	1C	22.21	40.40	34.03	53.8	
6	2A	24.76	46.00	39.00	47.9	46.4±2.5
	2B	23.91	40.38	35.38	43.6	
	2C	22.72	42.68	36.22	47.8	
9	3A	21.51	38.75	33.95	38.6	38.5±3.2
	3B	24.65	45.14	39.80	35.2	
	3C	23.03	41.35	35.97	41.6	
12	4A	22.92	39.89	35.47	35.2	38.2±3.7
	4B	22.04	38.97	34.08	40.6	
	4C	22.94	42.09	36.75	38.7	
15	5A	25.92	43.32	38.19	41.8	39.5±2.6
	5B	19.97	39.56	34.31	36.6	
	5C	22.54	38.56	33.98	40.1	
18	6A	22.44	49.01	44.03	23.1	24.1±1.4
	6B	21.91	43.04	38.72	25.7	
	6C	22.99	49.06	44.08	23.6	
21	7A	22.44	48.62	44.59	18.2	19.1±0.9
	7B	21.69	54.95	49.59	19.2	
	7C	21.75	50.21	45.48	19.9	
24	9A	22.46	46.91	42.24	23.6	21.8±2.5
	9B	24.79	49.05	45.18	18.9	
	9C	35.25	69.05	62.78	22.8	
27	10A	36.17	84.42	72.45	33.0	29.6±7.4
	10B	35.31	82.59	74.36	21.1	
	10C	35.35	85.64	72.70	34.6	
30	11A	36.67	79.40	70.79	25.3	26.0±0.8
	11B	34.80	79.29	69.89	26.8	
	11C	37.14	81.61	72.48	25.9	
				Avg (±SD)	**33.8±11.4**	

Table A.6 Moisture content analysis results for Borehole-06

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	22.78	48.04	40.40	43.3	41.2±2.0
	1B	27.32	47.22	41.59	39.4	
	1C	23.63	46.74	40.04	40.8	
6	2A	34.18	73.99	64.92	29.5	26.5±2.9
	2B	35.31	75.45	67.74	23.8	
	2C	37.10	75.70	67.72	26.1	
9	3A	23.00	49.37	43.95	25.9	24.7±1.2
	3B	20.48	43.92	39.28	24.7	
	3C	22.65	48.72	43.75	23.6	
12	4A	35.37	83.99	75.53	21.1	21.1±0.2
	4B	33.29	78.75	70.91	20.8	
	4C	34.78	82.16	73.83	21.3	
15	5A	22.12	46.67	42.44	20.8	20.7±0.4
	5B	23.34	51.88	47.07	20.3	
	5C	22.31	46.82	42.57	21.0	
18	6A	36.11	82.60	74.32	21.7	21.6±0.0
	6B	36.62	85.59	76.89	21.6	
	6C	16.10	35.70	32.21	21.7	
21	7A	16.81	44.65	39.88	20.6	20.6±1.1
	7B	23.85	54.12	49.20	19.4	
	7C	22.62	47.07	42.73	21.6	
24	8A	33.33	66.72	54.79	55.6	55.0±1.2
	8B	35.41	78.58	63.51	53.6	
	8C	34.21	79.52	63.31	55.7	
27	9A	21.69	49.83	43.24	30.6	30.4±1.4
	9B	22.14	46.70	41.18	29.0	
	9C	22.72	42.66	37.86	31.7	
30	10A	22.23	45.35	41.66	19.0	20.8±5.4
	10B	16.15	31.42	29.26	16.5	
	10C	22.65	45.24	40.47	26.8	
33	11A	20.00	45.51	38.43	38.4	43.8±4.9
	11B	23.67	45.43	38.69	44.9	
	11C	22.67	47.28	39.29	48.1	
36	12A	22.69	54.11	43.63	50.1	48.2±1.8
	12B	22.99	49.30	40.95	46.5	
	12C	22.67	39.29	33.89	48.1	
				Avg (±SD)	**31.2±12.3**	

Table A.7 Moisture content analysis results for Borehole-07

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	22.78	37.38	31.77	62.4	59.2±3.0
	1B	22.99	40.24	33.85	58.9	
	1C	24.65	41.21	35.24	56.3	
6	2A	19.97	34.25	28.71	63.4	56.3±7.0
	2B	24.76	41.70	35.59	56.3	
	2C	20.99	43.78	36.25	49.3	
9	3A	22.54	41.08	34.79	51.3	48.4±2.6
	3B	24.79	41.99	36.49	47.0	
	3C	21.76	41.08	34.93	46.7	
12	4A	21.51	37.83	31.80	58.5	51.9±5.9
	4B	22.93	40.93	34.95	49.7	
	4C	22.20	37.74	32.74	47.4	
15	5A	21.67	43.93	36.72	47.9	45.6±2.0
	5B	22.05	37.64	32.84	44.5	
	5C	22.44	44.17	37.48	44.5	
18	6A	23.05	43.45	39.59	23.5	23.5±0.1
	6B	23.90	40.11	37.01	23.7	
	6C	21.92	42.90	38.91	23.4	
21	7A	22.71	40.97	35.81	39.4	41.2±2.6
	7B	22.70	45.20	38.78	40.0	
	7C	25.93	47.77	41.07	44.2	
24	8A	22.94	46.05	37.01	64.2	58.7±5.8
	8B	22.46	39.77	33.33	59.3	
	8C	35.25	70.35	58.26	52.6	
27	9A	25.95	53.94	46.44	36.6	36.4±0.6
	9B	23.93	49.80	42.99	35.8	
	9C	21.01	45.79	39.11	36.9	
30	10A	22.74	43.38	35.16	66.1	63.5±9.0
	10B	22.51	44.56	36.88	53.5	
	10C	24.69	46.41	37.39	70.9	
33	11A	23.07	51.34	45.11	28.3	28.2±1.9
	11B	23.39	44.50	39.63	30.0	
	11C	22.81	44.62	40.08	26.3	
36	12A	22.48	45.34	37.12	56.2	51.3±5.4
	12B	22.73	48.22	40.25	45.5	
	12C	24.84	46.54	39.09	52.2	
				Avg (±SD)	**47.0±12.8**	

Table A.8 Moisture content analysis results for Borehole-08

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
1.5	1A	23.86	30.54	29.63	15.8	11.5±6.0
	1B	22.77	46.31	45.26	4.7	
	1C	22.63	34.07	32.65	14.2	
3	2A	34.19	49.28	47.16	16.3	15.6±1.2
	2B	35.32	46.04	44.55	16.2	
	2C	35.26	47.93	46.36	14.2	
4.5	3A	22.06	35.13	34.63	4.0	4.3±0.3
	3B	22.99	34.07	33.58	4.6	
	3C	21.67	30.67	30.29	4.3	
				Avg (±SD)	**10.5±5.8**	

Table A.9 Moisture content analysis results for Borehole-09

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
1.5	1A	23.02	45.84	44.84	4.6	4.2±0.4
	1B	20.50	30.48	30.08	4.2	
	1C	34.78	47.90	47.42	3.8	
4.5	2A	23.65	31.93	31.50	5.5	5.1±0.4
	2B	22.32	30.77	30.39	4.7	
	2C	23.35	36.92	36.27	5.0	
				Avg (±SD)	**4.6±0.6**	

Table A.10 Moisture content analysis results for Borehole-10

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	22.74	27.39	25.58	64.1	60.9±3.6
	1B	24.66	31.71	29.15	57.0	
	1C	37.12	44.00	41.37	61.7	
6	2A	21.76	30.38	28.23	33.2	43.7±9.1
	2B	22.97	30.36	27.89	50.2	
	2C	23.01	29.11	27.15	47.5	
9	3A	22.20	29.04	27.22	36.4	41.7±5.1
	3B	22.44	40.07	34.47	46.5	
	3C	23.91	38.65	34.28	42.1	
12	4A	22.67	43.88	38.35	35.2	36.0±1.9
	4B	22.12	43.24	37.81	34.6	
	4C	19.98	42.30	36.14	38.1	

15	5A	22.55	48.68	42.61	30.3	29.5±0.6
	5B	24.79	51.79	45.71	29.0	
	5C	23.06	47.53	41.98	29.3	
18	6A	21.01	39.65	34.95	33.7	33.1±0.9
	6B	27.33	46.18	41.46	33.4	
	6C	25.93	45.33	40.63	32.0	
21	7A	22.48	45.56	38.47	44.3	42.3±4.8
	7B	21.92	45.59	39.21	36.9	
	7C	16.84	32.75	27.75	45.8	
24	8A	21.52	44.11	38.63	32.1	29.6±3.3
	8B	22.71	45.80	40.33	31.0	
	8C	24.78	53.66	47.74	25.8	
27	9A	16.13	34.65	28.19	53.5	45.7±10.3
	9B	36.64	56.30	49.78	49.6	
	9C	33.32	55.61	49.95	34.1	
30	10A	36.14	62.46	56.74	27.8	29.4±3.5
	10B	35.38	64.01	56.84	33.4	
	10C	22.71	45.31	40.52	26.9	
33	11A	22.34	43.35	35.99	53.9	41.9±12.7
	11B	14.84	40.40	34.72	28.5	
	11C	24.68	44.25	38.34	43.3	
36	12A	23.08	48.21	40.26	46.3	59.5±11.5
	12B	20.55	33.51	28.41	64.9	
	12C	22.52	40.56	33.30	67.4	
39	13A	22.82	43.89	36.67	52.1	50.0±5.2
	13B	23.39	42.32	35.70	53.8	
	13C	22.09	41.12	35.30	44.0	
41.7	14A	21.02	40.67	34.19	49.1	51.1±11.7
	14B	23.88	41.32	35.32	52.5	
	14C	21.54	41.33	34.59	51.6	
				Avg (±SD)	**42.5±11.5**	

Table A.11 Moisture content analysis results for Borehole-11

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	22.34	46.22	39.56	38.7	40.5±2.1
	1B	23.37	48.29	40.82	42.8	
	1C	22.72	39.23	34.50	40.1	
6	2A	23.08	48.80	41.47	39.9	39.0±0.8
	2B	20.51	39.62	34.28	38.8	
	2C	25.93	46.29	40.64	38.4	
9	3A	23.92	41.87	36.14	46.8	46.2±1.0
	3B	21.03	40.49	34.30	46.6	
	3C	22.23	43.45	36.87	45.0	
12	4A	21.95	40.23	34.32	47.8	46.8±2.1
	4B	22.07	42.11	35.95	44.3	
	4C	16.89	33.89	28.37	48.1	
15	5A	22.13	47.43	39.60	44.8	39.2±5.0
	5B	21.76	45.70	39.50	34.9	
	5C	24.80	48.37	41.88	38.0	
18	6A	22.47	40.01	35.10	38.9	39.0±0.6
	6B	23.68	46.39	40.07	38.5	
	6C	22.65	43.73	37.75	39.7	
21	7A	20.00	41.45	35.49	38.4	39.7±1.8
	7B	23.02	41.89	36.33	41.8	
	7C	24.81	43.32	38.12	39.0	
24	8A	23.67	44.46	38.07	44.4	43.7±0.9
	8B	21.55	42.15	35.98	42.7	
	8C	22.34	45.35	38.33	43.9	
27	9A	37.14	65.43	55.82	51.4	50.6±4.5
	9B	34.31	63.15	54.09	45.8	
	9C	35.41	67.61	56.23	54.6	
30	10A	34.81	65.65	55.35	50.1	48.2±1.9
	10B	35.32	60.47	52.31	48.0	
	10C	36.49	71.76	60.59	46.3	
33	11A	22.09	43.82	37.21	43.7	42.3±1.7
	11B	23.04	46.52	39.50	42.6	
	11C	20.01	38.04	32.84	40.5	
36	12A	21.76	39.92	34.69	40.4	44.6±5.7
	12B	22.95	46.92	38.81	51.1	
	12C	35.35	63.81	55.35	42.3	
39	13A	36.18	70.78	59.09	51.0	51.2±2.3
	13B	25.39	45.93	39.17	49.0	
	13C	36.67	77.32	63.15	53.6	
				Avg (±SD)	**43.9±4.9**	

Table A.12 Moisture content analysis results for Borehole-12

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	22.72	40.65	35.01	45.9	49.5±4.0
	1B	23.00	39.88	34.35	48.8	
	1C	21.68	38.91	32.89	53.7	
6	2A	23.76	38.70	33.49	53.5	50.5±2.6
	2B	24.81	40.46	35.33	48.7	
	2C	22.23	45.17	37.60	49.3	
9	3A	21.02	41.49	34.38	53.2	50.6±2.3
	3B	21.53	42.09	35.31	49.2	
	3C	19.98	42.50	35.06	49.3	
12	4A	22.49	43.63	37.15	44.2	44.8±1.6
	4B	24.66	46.75	39.72	46.7	
	4C	22.34	43.22	36.88	43.6	
15	5A	22.13	42.40	35.97	46.5	48.3±4.2
	5B	23.07	44.99	37.39	53.0	
	5C	23.66	51.47	42.80	45.3	
18	6A	22.94	46.41	39.20	44.4	51.5±6.4
	6B	21.76	41.72	34.79	53.2	
	6C	22.72	42.85	35.55	56.9	
21	7A	22.81	42.86	36.22	49.5	47.4±2.1
	7B	23.87	47.18	39.92	45.2	
	7C	16.14	29.74	25.36	47.5	
24	8A	34.20	70.72	59.59	43.8	43.4±1.2
	8B	35.34	69.07	58.71	44.3	
	8C	36.68	79.15	66.60	42.0	
27	9A	23.93	46.47	39.05	49.1	51.4±2.5
	9B	23.67	45.97	38.44	50.9	
	9C	25.95	50.85	42.11	54.0	
30	10A	22.99	45.56	37.47	55.8	63.1±6.3
	10B	22.73	46.77	37.24	65.7	
	10C	22.69	46.59	36.95	67.6	
33	11A	21.76	41.75	34.39	58.3	62.0±5.5
	11B	22.73	40.67	33.39	68.3	
	11C	22.56	44.46	36.31	59.3	
36	12A	27.34	44.80	38.01	63.7	59.2±4.6
	12B	21.68	47.84	38.62	54.5	
	12C	20.00	38.43	31.57	59.4	
39	13A	35.32	68.30	58.98	39.4	41.6±8.7
	13B	37.14	70.69	62.15	34.1	
	13C	34.80	73.89	60.65	51.2	
41.7	14A	33.33	75.21	62.25	44.8	44.6±0.9
	14B	35.35	72.61	60.99	45.4	
	14C	35.41	73.78	62.14	43.5	
				Avg (±SD)	**50.5±7.5**	

Table A.13 Moisture content analysis results for Borehole-13

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	23.00	44.74	37.98	45.1	44.0±1.0
	1B	23.35	48.16	40.69	43.0	
	1C	22.55	44.24	37.62	44.0	
6	2A	25.93	46.31	39.57	49.5	45.6±3.4
	2B	22.68	45.41	38.52	43.5	
	2C	22.64	45.16	38.30	43.8	
9	3A	20.51	41.11	34.91	43.0	43.5±2.6
	3B	24.73	44.57	38.31	46.3	
	3C	22.07	46.16	39.13	41.2	
12	4A	21.93	43.54	36.75	45.8	45.5±1.6
	4B	22.46	39.85	34.56	43.8	
	4C	23.03	43.27	36.81	46.9	
15	5A	16.85	38.47	32.06	42.2	45.0±2.8
	5B	27.33	47.18	40.75	47.9	
	5C	23.91	43.46	37.42	44.8	
18	6A	33.32	78.35	63.91	47.2	47.5±1.0
	6B	37.12	80.07	66.02	48.6	
	6C	35.29	81.71	66.94	46.7	
21	7A	35.39	74.99	63.13	42.7	46.1±3.1
	7B	35.79	71.83	60.39	46.5	
	7C	36.16	76.79	63.45	48.9	
24	8A	22.99	44.41	35.33	73.7	67.9±5.2
	8B	16.93	43.99	33.21	66.2	
	8C	22.15	38.82	32.33	63.7	
27	9A	22.57	43.69	35.51	63.1	64.0±1.0
	9B	23.02	43.96	35.79	63.9	
	9C	23.54	57.68	44.22	65.1	
30	10A	23.88	56.88	44.66	58.8	56.2±5.7
	10B	27.34	60.69	49.63	49.6	
	10C	20.54	44.50	35.51	60.1	
31.5	11A	22.65	49.39	39.89	55.1	55.6±2.4
	11B	34.20	75.96	60.58	58.3	
	11C	35.84	67.59	56.52	53.5	
33	12A	21.94	38.07	30.69	84.4	80.0±4.8
	12B	22.82	41.73	33.28	80.8	
	12C	24.81	61.91	46.03	74.9	
33.6	13A	16.15	38.96	29.15	75.4	72.3±2.8
	13B	21.68	50.30	38.53	69.9	
	13C	22.24	53.75	40.61	71.6	
				Avg (±SD)	**54.9±12.4**	

Table A.14 Moisture content analysis results for Borehole-14

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
1.5	1A	34.19	93.09	88.01	9.4	22.6±12.8
	1B	35.39	99.19	82.64	35.0	
	1C	33.32	88.88	78.37	23.3	
3	2A	37.13	91.48	79.99	26.8	25.8±0.9
	2B	36.18	94.94	83.00	25.5	
	2C	34.80	94.76	82.72	25.1	
4.5	3A	35.40	87.20	77.99	21.6	21.7±0.4
	3B	36.68	93.11	83.17	21.4	
	3C	35.29	92.80	82.38	22.1	
6	4A	21.69	49.80	44.18	25.0	25.6±0.8
	4B	23.87	49.20	43.90	26.5	
	4C	22.68	48.14	42.99	25.3	
9	5A	27.34	57.13	56.68	1.5	7.4±9.6
	5B	22.98	48.07	44.16	18.5	
	5C	22.77	61.59	60.77	2.2	
				Avg (±SD)	**20.6±9.3**	

Table A.15 Moisture content analysis results for Borehole-15

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	36.49	90.92	80.05	25.0	24.4±1.6
	1B	35.84	84.40	74.49	25.6	
	1C	34.31	89.28	79.12	22.7	
6	2A	25.39	54.47	48.69	24.8	27.3±2.5
	2B	22.83	52.18	45.91	27.1	
	2C	20.63	46.91	40.86	29.9	
9	3A	23.54	52.12	45.10	32.5	30.5±1.8
	3B	22.95	49.64	43.52	29.8	
	3C	22.77	52.99	46.19	29.1	
12	4A	21.94	46.67	40.45	33.6	36.2±2.2
	4B	22.48	46.98	40.33	37.3	
	4C	22.08	44.27	38.19	37.7	
15	5A	23.02	47.02	40.70	35.7	39.3±3.8
	5B	16.92	41.96	34.94	38.9	
	5C	23.03	45.18	38.48	43.4	
				Avg (±SD)	**31.5±6.1**	

Table A.16 Moisture content analysis results for Borehole-16

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Moisture content (%)	Avg. (±SD) Moisture content (%)
3	1A	22.50	48.28	43.60	22.2	21.7±9.4
	1B	23.04	50.46	47.51	12.1	
	1C	22.95	47.18	41.45	30.9	
4.5	2A	21.54	40.29	34.73	42.1	42.0±1.6
	2B	22.56	46.48	39.23	43.5	
	2C	22.81	48.94	41.43	40.4	
6	3A	22.74	46.04	41.10	26.9	29.9±3.2
	3B	24.67	49.79	43.53	33.2	
	3C	16.15	32.97	29.12	29.7	
				Avg (±SD)	**31.2±10.2**	

Appendix B

Table B.1 Organic matter results for Borehole-01

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	93.86	97.84	97.08	19.04	21.52±2.92
	1B	105.87	108.98	108.21	24.74	
	1C	101.33	105.48	104.62	20.79	
6	2A	93.96	97.13	96.43	22.22	22.15±1.02
	2B	101.33	105.60	104.70	21.09	
	2C	105.86	108.22	107.67	23.13	
9	3A	96.32	100.25	99.52	18.46	18.10±1.38
	3B	102.42	105.47	104.88	19.28	
	3C	109.74	113.36	112.76	16.58	
12	4A	102.42	105.37	104.72	21.92	22.05±2.61
	4B	96.33	99.87	99.00	24.72	
	4C	109.74	114.12	113.26	19.51	
15	5A	96.32	100.03	99.10	25.12	25.17±1.45
	5B	102.42	106.19	105.19	26.65	
	5C	109.74	113.32	112.47	23.75	
18	6A	101.33	104.68	103.68	29.81	33.27±9.47
	6B	93.96	96.42	95.34	43.98	
	6C	105.87	111.13	109.76	26.02	
21	7A	102.43	106.60	105.78	19.77	22.14±5.71
	7B	96.32	100.12	99.44	18.00	
	7C	109.74	111.91	111.29	28.65	
24	8A	101.33	104.69	103.85	24.97	23.57±1.26
	8B	105.87	108.72	108.06	23.20	
	8C	93.97	98.50	97.48	22.54	
				Avg (±SD)	**23.49±5.51**	

Table B.2 Organic matter results for Borehole-02

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	93.96	96.40	95.93	19.35	19.64±0.71
	1B	101.33	103.48	103.07	19.11	
	1C	105.87	107.99	107.56	20.45	
6	2A	102.43	105.33	104.74	20.20	21.05±2.14
	2B	96.33	98.98	98.47	19.46	
	2C	109.75	112.50	111.85	23.48	
9	3A	93.97	97.03	96.22	26.30	28.13±4.04
	3B	101.33	104.00	103.13	32.76	
	3C	105.87	108.87	108.11	25.33	
12	4A	109.74	113.03	112.09	28.54	26.881.98
	4B	96.33	99.41	98.65	24.68	
	4C	102.43	105.99	105.01	27.42	
15	5A	101.33	105.21	104.44	19.71	22.92±4.84
	5B	105.86	109.67	108.88	20.56	
	5C	93.96	97.23	96.30	28.49	
18	6A	105.86	108.63	107.85	28.15	30.75±2.25
	6B	93.96	96.57	95.74	32.02	
	6C	101.33	104.39	103.40	32.07	
21	7A	93.96	97.37	96.56	23.92	25.68±2.55
	7B	101.33	104.06	103.28	28.61	
	7C	105.88	107.97	107.46	24.51	
24	8A	101.33	104.17	103.57	21.10	19.87±1.45
	8B	105.87	109.40	108.69	20.23	
	8C	93.97	97.64	96.97	18.27	
27	9A	102.42	105.37	104.64	24.62	26.80±2.20
	9B	96.33	99.83	98.89	26.77	
	9C	109.75	112.38	111.61	29.01	
30	10A	105.87	109.33	108.23	31.84	31.13±0.62
	10B	101.33	103.85	103.08	30.69	
	10C	93.96	97.53	96.43	30.87	
				Avg (±SD)	**25.28±4.63**	

Table B.3 Organic matter results for Borehole-03

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	93.97	97.74	97.03	18.64	17.31±1.16
	1B	101.34	105.12	104.49	16.50	
	1C	105.87	109.62	108.99	16.80	
6	2A	109.75	113.55	112.84	18.57	19.10±0.89
	2B	102.43	106.60	105.83	18.60	
	2C	96.36	100.19	99.42	20.13	
9	3A	93.97	98.05	97.44	14.76	14.88±1.66
	3B	105.87	109.16	108.72	13.29	
	3C	101.34	105.15	104.51	16.60	
12	4A	109.75	113.51	112.85	17.54	18.81±1.83
	4B	102.43	105.64	104.97	20.90	
	4C	96.32	99.72	99.11	17.97	
15	5A	102.43	105.99	105.39	16.88	17.12±0.87
	5B	109.75	113.43	112.83	16.40	
	5C	96.33	100.60	99.83	18.08	
18	6A	101.34	105.26	104.75	13.14	11.30±1.65
	6B	105.87	111.06	110.50	10.81	
	6C	93.97	98.70	98.23	9.94	
21	7A	102.43	106.42	105.93	12.33	13.96±1.41
	7B	109.75	113.93	113.32	14.72	
	7C	96.33	100.27	99.69	14.84	
24	8A	105.87	109.44	108.83	17.06	17.81±1.71
	8B	101.34	105.75	105.02	16.60	
	8C	93.97	98.71	97.78	19.77	
				Avg (±SD)	**16.29±2.84**	

Table B.4 Organic matter results for Borehole-04

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	105.87	109.28	108.68	17.68	17.55±1.49
	1B	93.96	96.84	96.38	16.00	
	1C	101.33	104.49	103.89	18.97	
6	2A	102.42	105.94	105.20	21.04	20.94±0.62
	2B	109.74	112.63	112.01	21.51	
	2C	96.32	100.19	99.41	20.28	
9	3A	93.96	97.21	96.58	19.51	19.23±1.94
	3B	101.33	104.23	103.73	17.16	
	3C	105.87	109.49	108.73	21.01	
12	4A	102.43	106.21	105.53	17.88	18.98±0.95
	4B	96.33	100.15	99.40	19.58	
	4C	109.74	113.83	113.03	19.49	
15	5A	109.75	112.99	112.18	25.15	22.34±2.52
	5B	96.33	100.05	99.25	21.62	
	5C	102.43	106.71	105.84	20.27	
18	6A	102.42	105.25	104.64	21.80	25.54±3.28
	6B	96.32	99.52	98.66	26.89	
	6C	109.75	112.90	112.02	27.93	
21	7A	105.87	109.28	108.55	21.60	22.52±2.37
	7B	93.97	97.59	96.67	25.21	
	7C	101.34	105.93	104.98	20.74	
24	8A	105.87	109.60	108.92	18.06	17.66±2.06
	8B	93.97	97.38	96.72	19.49	
	8C	101.33	106.96	106.09	15.43	
27	9A	96.33	100.18	99.35	21.55	20.01±1.94
	9B	102.43	107.31	106.44	17.82	
	9C	109.75	113.40	112.64	20.65	
30	10A	93.96	99.35	98.52	15.34	20.06±4.24
	10B	105.87	109.00	108.27	23.57	
	10C	101.33	105.69	104.76	21.27	
33	11A	102.43	106.68	105.88	18.82	20.59±2.05
	11B	96.33	100.79	99.77	22.83	
	11C	109.75	114.80	113.78	20.12	
36	12A	102.42	106.81	105.72	24.81	20.88±3.44
	12B	109.75	114.39	113.53	18.47	
	12C	96.31	100.14	99.40	19.36	
				Avg (±SD)	**20.53±2.96**	

Table B.5 Organic matter results for Borehole-05

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	102.42	104.88	104.26	25.12	22.53±2.31
	1B	96.32	99.57	98.86	21.79	
	1C	109.74	113.26	112.53	20.68	
6	2A	109.74	112.71	112.09	20.73	23.07±4.63
	2B	96.32	100.29	99.49	20.08	
	2C	102.43	105.94	104.94	28.40	
9	3A	105.87	108.68	108.02	23.36	20.83±2.64
	3B	93.96	96.28	95.79	21.03	
	3C	101.33	105.41	104.68	18.09	
12	4A	96.32	99.71	99.11	17.78	18.58±1.39
	4B	102.42	105.71	105.05	20.19	
	4C	109.74	113.18	112.57	17.77	
15	5A	93.97	97.09	96.54	17.52	18.52±0.86
	5B	101.33	104.17	103.63	18.98	
	5C	105.87	109.92	109.15	19.05	
18	6A	93.96	98.62	98.11	10.83	10.72±0.67
	6B	101.33	105.68	105.24	10.00	
	6C	105.87	110.70	110.15	11.32	
21	7A	96.32	100.78	100.49	6.46	6.26±0.64
	7B	102.42	107.61	107.26	6.77	
	7C	109.74	114.78	114.50	5.53	
24	9A	102.43	107.93	107.44	8.97	9.15±0.21
	9B	96.33	102.45	101.88	9.39	
	9C	109.74	115.35	114.84	9.10	
27	10A	102.42	106.66	106.32	7.94	9.46±1.89
	10B	96.31	102.03	101.37	11.58	
	10C	109.75	117.03	116.38	8.87	
30	11A	93.96	99.70	99.04	11.40	11.43±0.02
	11B	101.33	106.77	106.14	11.44	
	11C	105.87	110.54	110.00	11.45	
				Avg (±SD)	**15.05±6.27**	

Table B.6 Organic matter results for Borehole-06

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	109.74	113.86	113.14	17.46	16.34±1.15
	1B	102.43	106.48	105.87	15.16	
	1C	96.33	100.57	99.87	16.39	
6	2A	101.33	106.63	106.01	11.77	10.58±1.80
	2B	93.96	98.47	98.09	8.51	
	2C	105.86	110.43	109.91	11.47	
9	3A	109.74	114.95	114.38	10.86	10.68±0.72
	3B	96.32	99.95	99.59	9.89	
	3C	102.42	107.67	107.08	11.30	
12	4A	93.96	100.08	99.48	9.73	8.08±1.83
	4B	101.33	105.62	105.36	6.11	
	4C	105.86	112.63	112.06	8.41	
15	5A	96.32	100.36	99.97	9.60	8.79±0.74
	5B	102.42	107.65	107.20	8.62	
	5C	109.74	115.84	115.34	8.15	
18	6A	105.86	111.19	110.67	9.77	9.67±0.16
	6B	101.33	105.69	105.27	9.75	
	6C	93.96	101.19	100.50	9.49	
21	7A	102.42	108.26	107.69	9.74	9.65±1.15
	7B	109.74	116.02	115.49	8.45	
	7C	96.32	102.09	101.47	10.75	
24	8A	105.86	109.64	108.91	19.30	20.65±1.50
	8B	93.96	98.64	97.59	22.26	
	8C	101.33	105.31	104.49	20.39	
27	9A	109.74	113.90	113.53	8.94	11.24±2.02
	9B	102.43	105.92	105.50	12.04	
	9C	96.33	101.46	100.81	12.75	
30	10A	101.33	105.24	104.78	11.72	11.95±0.35
	10B	93.96	97.13	96.73	12.36	
	10C	105.86	109.31	108.91	11.77	
33	11A	109.75	116.12	115.33	12.44	15.77±4.78
	11B	96.33	98.76	98.24	21.25	
	11C	102.43	107.42	106.74	13.63	
36	12A	101.33	105.73	105.08	14.81	16.48±1.82
	12B	105.87	109.56	108.96	16.22	
	12C	93.97	96.67	96.17	18.42	
				Avg (±SD)	**12.49±4.08**	

Table B.7 Organic matter results for Borehole-07

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	105.86	108.79	108.04	25.40	22.78±2.29
	1B	93.96	96.86	96.25	21.15	
	1C	101.33	104.28	103.64	21.79	
6	2A	96.33	99.29	98.64	21.92	22.19±3.42
	2B	102.42	105.91	105.25	18.90	
	2C	109.74	112.16	111.53	25.73	
9	3A	105.86	109.26	108.73	15.49	17.66±2.15
	3B	101.33	105.25	104.56	17.69	
	3C	93.96	96.88	96.30	19.79	
12	4A	102.42	104.60	104.00	27.44	22.22±4.55
	4B	109.74	112.17	111.68	20.15	
	4C	96.32	99.59	98.96	19.08	
15	5A	93.96	97.63	97.08	14.88	18.63±3.81
	5B	105.86	109.44	108.64	22.50	
	5C	101.33	104.83	104.18	18.50	
18	6A	109.74	114.11	113.44	15.40	14.51±0.92
	6B	96.33	98.48	98.19	13.56	
	6C	102.43	106.59	105.98	14.59	
21	7A	105.86	109.29	108.66	18.35	16.65±1.49
	7B	93.96	97.56	97.00	15.55	
	7C	101.33	104.56	104.04	16.07	
24	8A	102.42	107.57	106.81	14.84	17.24±2.81
	8B	96.32	99.94	99.21	20.33	
	8C	109.74	114.03	113.32	16.55	
27	9A	102.43	107.34	106.76	11.73	12.56±1.27
	9B	96.33	100.75	100.23	11.92	
	9C	109.74	113.52	112.99	14.02	
30	10A	105.87	108.86	108.20	21.92	21.91±2.92
	10B	93.96	97.09	96.49	18.99	
	10C	101.33	104.12	103.43	24.83	
33	11A	102.42	107.96	107.38	10.60	12.22±1.86
	11B	96.33	99.20	98.86	11.83	
	11C	109.74	113.26	112.76	14.25	
36	12A	93.96	97.52	96.96	15.74	15.33±1.36
	12B	105.86	110.18	109.58	13.81	
	12C	101.33	107.54	106.52	16.44	
				Avg (±SD)	**17.83±4.28**	

Table B.8 Organic matter results for Borehole-08

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
1.5	1A	93.96	98.60	98.43	3.68	3.89±0.18
	1B	105.87	111.12	110.91	3.96	
	1C	101.33	105.24	105.08	4.02	
3	2A	105.86	108.95	108.78	5.34	5.45±0.17
	2B	101.33	106.68	106.38	5.64	
	2C	93.97	99.32	99.03	5.36	
4.5	3A	102.42	107.27	107.06	4.34	4.03±0.57
	3B	96.32	100.06	99.89	4.39	
	3C	109.74	113.54	113.41	3.37	
				Avg (±SD)	**4.46±0.81**	

Table B.9 Organic matter results for Borehole-09

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
1.5	1A	109.74	114.27	114.16	2.58	3.13±0.77
	1B	102.42	107.12	106.99	2.81	
	1C	96.32	100.14	99.99	4.01	
4.5	2A	102.43	106.45	106.31	3.53	3.21±0.35
	2B	109.75	114.85	114.70	2.84	
	2C	96.32	101.50	101.33	3.25	
				Avg (±SD)	**3.17±0.53**	

Table B.10 Organic matter results for Borehole-10

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	105.87	109.46	108.28	32.85	36.46±4.51
	1B	101.33	106.06	104.41	35.02	
	1C	93.97	95.72	94.99	41.52	
6	2A	102.42	105.32	104.85	16.10	16.06±2.48
	2B	96.33	100.58	99.80	18.53	
	2C	109.74	114.61	113.95	13.57	
9	3A	102.43	106.82	106.19	14.33	15.67±1.48
	3B	96.33	100.70	100.03	15.42	
	3C	109.75	114.10	113.35	17.26	
12	4A	96.32	100.00	99.47	14.60	13.99±1.70
	4B	102.44	107.76	106.94	15.30	
	4C	109.75	113.39	112.95	12.07	
15	5A	105.87	110.19	109.79	9.34	9.74±0.48
	5B	93.96	99.40	98.88	9.61	
	5C	101.33	105.28	104.88	10.28	
18	6A	102.42	106.59	106.00	14.08	14.58±1.12
	6B	96.32	100.50	99.92	13.80	
	6C	109.74	113.62	113.01	15.86	
21	7A	93.97	98.00	97.45	13.66	14.88±1.19
	7B	101.33	106.07	105.36	14.94	
	7C	105.87	110.68	109.91	16.03	
24	8A	93.96	98.41	97.94	10.56	10.05±1.05
	8B	101.33	104.78	104.41	10.74	
	8C	105.87	110.92	110.47	8.84	
27	9A	101.33	106.03	105.36	14.43	14.08±0.68
	9B	93.97	98.21	97.59	14.52	
	9C	105.87	109.95	109.41	13.30	
30	10A	96.32	102.56	101.85	11.33	10.51±0.71
	10B	109.75	113.92	113.50	10.04	
	10C	102.42	106.95	106.49	10.16	
33	11A	96.33	99.96	99.12	23.15	23.04±1.21
	11B	102.43	105.86	105.03	24.19	
	11C	109.74	113.34	112.55	21.79	
36	12A	105.86	109.20	108.27	27.98	26.17±3.43
	12B	101.33	105.53	104.60	22.21	
	12C	93.96	97.93	96.81	28.31	
39	13A	102.43	106.85	106.21	14.34	16.09±1.52
	13B	109.74	113.27	112.68	16.78	
	13C	96.33	99.81	99.21	17.15	
41.7	14A	105.87	109.18	108.83	10.68	14.35±3.53
	14B	101.33	105.60	104.98	14.65	
	14C	93.97	98.19	97.44	17.71	
				Avg (±SD)	**16.83±7.28**	

Table B.11 Organic matter results for Borehole-11

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	93.96	97.93	97.29	16.13	17.33±2.32
	1B	101.33	104.19	103.62	20.01	
	1C	105.87	111.14	110.30	15.86	
6	2A	96.32	99.62	98.97	19.68	17.87±1.88
	2B	102.42	107.19	106.33	17.99	
	2C	109.74	113.93	113.27	15.92	
9	3A	93.96	99.14	98.34	15.43	17.07±3.23
	3B	105.86	110.40	109.46	20.79	
	3C	101.33	106.37	105.61	15.00	
12	4A	109.74	112.33	111.68	25.44	24.49±4.70
	4B	102.43	104.99	104.25	28.64	
	4C	96.33	100.83	99.96	19.40	
15	5A	109.74	112.91	112.29	19.39	16.75±2.89
	5B	102.43	107.47	106.60	17.21	
	5C	96.33	100.32	99.78	13.65	
18	6A	105.87	111.30	110.54	14.10	13.74±0.83
	6B	93.96	99.07	98.41	12.80	
	6C	101.33	105.91	105.25	14.33	
21	7A	96.32	100.17	99.68	12.80	16.23±3.67
	7B	109.74	114.98	113.93	20.10	
	7C	102.43	108.06	107.17	15.78	
24	8A	105.87	110.07	109.43	15.14	14.02±1.21
	8B	101.33	105.47	104.95	12.73	
	8C	93.97	97.77	97.23	14.20	
27	9A	93.97	99.56	98.45	19.81	21.39±1.39
	9B	101.33	105.83	104.85	21.93	
	9C	105.87	111.52	110.25	22.43	
30	10A	102.43	107.99	107.06	16.70	15.58±0.99
	10B	96.33	103.25	102.20	15.21	
	10C	109.74	113.59	113.02	14.84	
33	11A	105.86	109.86	109.31	13.76	14.19±1.59
	11B	93.96	97.86	97.24	15.95	
	11C	101.33	106.73	106.03	12.86	
36	12A	102.43	105.91	105.08	23.88	19.33±6.00
	12B	96.32	101.40	100.76	12.53	
	12C	109.74	113.39	112.61	21.58	
39	13A	102.43	106.86	106.32	12.03	12.26±0.51
	13B	96.33	100.42	99.93	11.90	
	13C	109.75	114.66	114.03	12.85	
				Avg (±SD)	**16.94±4.03**	

Table B.12 Organic matter results for Borehole-12

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	101.33	105.07	104.27	21.55	20.32±1.15
	1B	93.96	97.04	96.42	20.14	
	1C	105.87	110.11	109.29	19.27	
6	2A	105.87	110.44	109.65	17.25	19.05±3.05
	2B	101.33	105.00	104.36	17.33	
	2C	93.96	96.64	96.03	22.57	
9	3A	96.33	99.07	98.60	17.36	18.17±2.12
	3B	102.42	104.86	104.36	20.57	
	3C	109.74	112.93	112.41	16.57	
12	4A	109.75	113.32	112.83	13.74	15.20±2.33
	4B	102.43	106.03	105.52	13.96	
	4C	96.33	100.57	99.81	17.88	
15	5A	96.32	100.41	99.77	15.70	15.96±1.39
	5B	102.42	107.53	106.78	14.73	
	5C	109.75	113.47	112.82	17.47	
18	6A	105.87	107.99	107.51	22.91	20.19±3.43
	6B	101.32	104.91	104.14	21.34	
	6C	93.95	99.19	98.34	16.34	
21	7A	102.43	105.39	104.90	16.63	18.71±2.22
	7B	96.33	99.50	98.83	21.05	
	7C	109.74	114.05	113.26	18.45	
24	8A	93.97	97.65	96.88	20.84	17.52±2.90
	8B	105.87	110.51	109.76	16.18	
	8C	101.34	106.75	105.91	15.52	
27	9A	102.43	106.93	106.26	14.72	14.30±0.37
	9B	109.75	113.47	112.94	14.14	
	9C	96.33	101.68	100.92	14.05	
30	10A	101.34	105.44	104.86	14.17	16.46±2.54
	10B	93.97	97.25	96.73	16.02	
	10C	105.87	109.55	108.84	19.20	
33	11A	105.87	109.36	108.88	13.80	19.99±3.33
	11B	101.34	105.15	104.40	19.73	
	11C	93.96	98.61	97.38	26.45	
36	12A	96.33	100.38	99.62	18.71	16.90±1.84
	12B	109.75	113.45	112.89	15.04	
	12C	102.43	106.05	105.44	16.94	
39	13A	105.87	110.45	109.75	15.29	15.56±0.43
	13B	101.33	106.75	105.92	15.33	
	13C	93.97	97.70	97.10	16.06	
41.7	14A	96.32	100.71	100.09	14.13	14.04±2.56
	14B	102.42	108.21	107.55	11.44	
	14C	109.74	114.43	113.65	16.56	
				Avg (±SD)	**17.31±3.08**	

Table B.13 Organic matter results for Borehole-13

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	93.96	98.39	97.52	19.58	19.97±2.46
	1B	101.33	104.43	103.88	17.73	
	1C	105.87	108.91	108.22	22.59	
6	2A	109.74	113.95	113.18	18.39	19.81±2.19
	2B	102.43	105.31	104.67	22.33	
	2C	96.32	100.42	99.66	18.70	
9	3A	93.96	96.92	96.39	17.89	17.36±1.55
	3B	101.33	105.03	104.35	18.57	
	3C	105.87	109.92	109.29	15.62	
12	4A	101.33	106.06	105.17	18.95	19.91±1.02
	4B	105.87	110.34	109.40	20.98	
	4C	93.98	98.81	97.86	19.79	
15	5A	96.33	99.63	99.00	19.04	21.46±4.44
	5B	109.74	112.59	111.84	26.59	
	5C	102.42	106.44	105.69	18.76	
18	6A	105.86	111.07	110.21	16.54	18.05±1.35
	6B	93.96	99.26	98.28	18.47	
	6C	101.33	107.26	106.13	19.14	
21	7A	96.33	101.22	100.46	15.40	18.04±3.81
	7B	109.75	116.19	115.14	16.31	
	7C	102.43	107.08	106.04	22.40	
24	8A	101.33	104.11	103.21	32.21	30.10±1.99
	8B	105.87	109.07	108.16	28.25	
	8C	93.96	96.47	95.72	29.85	
27	9A	105.87	109.70	108.86	21.88	20.66±1.74
	9B	93.96	98.90	97.98	18.67	
	9C	101.33	104.63	103.92	21.42	
30	10A	109.75	116.75	115.48	18.09	21.76±3.38
	10B	102.43	108.27	106.96	22.44	
	10C	96.34	100.40	99.39	24.74	
31.5	11A	101.33	107.25	106.34	15.31	16.42±0.96
	11B	93.97	98.46	97.70	16.91	
	11C	105.87	110.20	109.46	17.04	
33	12A	109.74	113.19	112.33	24.83	24.08±1.02
	12B	102.42	107.57	106.39	22.92	
	12C	96.32	99.70	98.87	24.48	
33.6	13A	102.43	106.53	105.75	19.16	22.05±3.03
	13B	109.74	114.26	113.12	25.20	
	13C	96.33	100.77	99.80	21.79	
				Avg (±SD)	**20.74±3.99**	

Table B.14 Organic matter results for Borehole-14

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
1.5	1A	102.42	107.54	107.06	9.37	9.72±0.46
	1B	96.33	100.59	100.15	10.25	
	1C	109.75	113.96	113.56	9.55	
3	2A	93.96	98.11	97.69	9.99	9.86±0.28
	2B	101.33	106.00	105.55	9.54	
	2C	105.87	110.82	110.32	10.04	
4.5	3A	105.86	110.53	110.09	9.29	8.61±0.60
	3B	93.97	99.02	98.61	8.15	
	3C	101.33	107.63	107.10	8.40	
6	4A	96.32	101.26	100.76	10.09	11.26±1.98
	4B	102.42	108.39	107.78	10.14	
	4C	109.74	113.97	113.40	13.54	
9	5A	105.87	112.39	112.27	1.90	1.63±0.23
	5B	101.34	108.51	108.40	1.53	
	5C	93.96	101.06	100.96	1.47	
				Avg (±SD)	8.22±3.61	

Table B.15 Organic matter results for Borehole-15

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	109.75	113.86	113.41	10.78	10.07±0.80
	1B	102.43	107.88	107.33	10.21	
	1C	96.33	100.82	100.41	9.20	
6	2A	101.33	105.27	104.89	9.67	10.80±1.31
	2B	105.87	111.66	111.05	10.49	
	2C	93.97	98.36	97.82	12.24	
9	3A	109.74	113.49	112.89	16.13	12.60±3.28
	3B	96.32	101.05	100.48	11.99	
	3C	102.43	108.53	107.94	9.66	
12	4A	93.96	97.37	96.91	13.44	13.71±0.25
	4B	105.87	111.12	110.40	13.78	
	4C	101.33	106.95	106.16	13.92	
15	5A	102.43	106.38	105.67	18.08	17.31±1.38
	5B	109.75	113.90	113.15	18.13	
	5C	96.33	100.91	100.19	15.72	
				Avg (±SD)	**12.90±3.02**	

Table B.16 Organic matter results for Borehole-16

Depth (m)	Sample No.	W_1 (g)	W_2 (g)	W_3 (g)	Organic matter (%)	Avg. (±SD) Organic matter (%)
3	1A	96.32	100.31	99.66	16.25	14.92±2.16
	1B	102.43	107.09	106.34	16.08	
	1C	109.75	114.69	114.07	12.43	
4.5	2A	101.33	105.11	104.46	17.06	15.94±1.02
	2B	93.97	98.14	97.48	15.71	
	2C	105.87	110.94	110.17	15.05	
6	3A	93.96	98.36	97.70	15.01	12.88±2.23
	3B	105.87	110.93	110.39	10.55	
	3C	101.33	105.42	104.89	13.07	
				Avg (±SD)	**14.58±2.12**	

Appendix C

Table C.1 Specific gravity results for fine fraction retrieved from Borehole-01

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.18	2.26	2.28	2.24±0.05
6	2.11	2.19	2.15	2.15±0.04
9	2.25	2.27	2.29	2.27±0.02
12	2.29	2.32	2.33	2.32±0.02
15	2.16	2.19	2.20	2.18±0.02
18	2.22	2.31	2.32	2.29±0.05
21	2.34	2.39	2.36	2.36±0.02
24	2.25	2.26	2.26	2.26±0.01

Table C.2 Specific gravity results for fine fraction retrieved from Borehole-02

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.37	2.39	2.39	2.38±0.02
6	2.18	2.24	2.24	2.22±0.03
9	2.10	2.15	2.16	2.14±0.03
12	2.21	2.24	2.26	2.24±0.02
15	2.20	2.24	2.24	2.23±0.02
18	2.08	2.09	2.10	2.09±0.01
21	2.23	2.25	2.25	2.25±0.01
24	2.21	2.23	2.24	2.23±0.02
27	1.91	1.93	1.93	1.92±0.01
30	2.08	2.09	2.11	2.10±0.01

Table C.3 Specific gravity results for fine fraction retrieved from Borehole-03

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.22	2.24	2.25	2.24±0.02
6	2.13	2.16	2.18	2.16±0.03
9	2.26	2.29	2.30	2.29±0.02
12	2.13	2.16	2.16	2.15±0.02
15	2.06	2.07	2.08	2.07±0.01
18	2.33	2.34	2.35	2.34±0.01
21	2.28	2.29	2.29	2.29±0.01
24	2.28	2.28	2.28	2.28±0.00

Table C.4 Specific gravity results for fine fraction retrieved from Borehole-04

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.30	2.30	2.30	2.30±0.00
6	2.23	2.25	2.24	2.24±0.01
9	2.25	2.25	2.26	2.25±0.00
12	2.16	2.17	2.17	2.17±0.01
15	2.12	2.13	2.12	2.12±0.01
18	2.14	2.15	2.14	2.15±0.00
21	2.03	2.06	2.06	2.05±0.01
24	2.24	2.27	2.28	2.26±0.02
27	2.21	2.24	2.25	2.23±0.02
30	2.26	2.28	2.28	2.27±0.01
33	2.19	2.21	2.27	2.22±0.05
36	2.20	2.22	2.23	2.22±0.01

Table C.5 Specific gravity results for fine fraction retrieved from Borehole-05

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.09	2.14	2.16	2.13±0.04
6	2.17	2.20	2.22	2.20±0.02
9	2.20	2.23	2.23	2.22±0.02
12	2.23	2.26	2.27	2.26±0.02
15	2.17	2.21	2.22	2.20±0.03
18	2.42	2.44	2.45	2.44±0.02
21	2.45	2.48	2.48	2.47±0.02
27	2.42	2.44	2.45	2.44±0.01
30	2.42	2.44	2.45	2.43±0.01
33	2.33	2.36	2.36	2.35±0.02

Table C.6 Specific gravity results for fine fraction retrieved from Borehole-06

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.29	2.29	2.30	2.30±0.00
6	2.30	2.32	2.33	2.32±0.01
9	2.42	2.45	2.43	2.44±0.02
12	2.44	2.45	2.47	2.46±0.01
15	2.46	2.47	2.47	2.47±0.01
18	2.45	2.46	2.46	2.46±0.01
21	2.44	2.45	2.45	2.45±0.01
24	2.18	2.19	2.19	2.19±0.01
27	2.38	2.39	2.40	2.39±0.01
30	2.35	2.38	2.39	2.37±0.02
33	2.29	2.32	2.34	2.32±0.02
36	2.21	2.14	2.16	2.17±0.04

Table C.7 Specific gravity results for fine fraction retrieved from Borehole-07

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.15	2.17	2.18	2.17±0.02
6	2.17	2.20	2.20	2.19±0.01
9	2.23	2.24	2.25	2.24±0.01
12	2.18	2.21	2.22	2.21±0.02
15	2.18	2.21	2.21	2.20±0.01
18	2.33	2.34	2.34	2.34±0.01
21	2.30	2.32	2.33	2.32±0.02
24	2.27	2.28	2.25	2.26±0.02
27	2.40	2.41	2.42	2.41±0.01
30	2.25	2.28	2.28	2.27±0.02
33	2.39	2.41	2.42	2.41±0.02
36	2.28	2.30	2.31	2.30±0.01

Table C.8 Specific gravity results for fine fraction retrieved from Borehole-08

Depth (m)	Specific gravity			Avg. (±SD) S/pecific gravity
	Trail-1	Trail-2	Trail-3	
1.5	2.60	2.61	2.62	2.61±0.01
3	2.55	2.58	2.59	2.58±0.02
4.5	2.62	2.66	2.66	2.65±0.02

Table C.9 Specific gravity results for fine fraction retrieved from Borehole-09

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
1.5	2.65	2.66	2.66	2.66±0.01
4.5	2.68	2.69	2.69	2.69±0.01

Table C.10 Specific gravity results for fine fraction retrieved from Borehole-10

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	1.88	1.93	1.95	1.92±0.04
6	2.38	2.40	2.40	2.40±0.01
9	2.36	2.37	2.37	2.37±0.00
12	2.34	2.35	2.35	2.35±0.00
15	2.47	2.48	2.47	2.47±0.00
18	2.38	2.40	2.40	2.40±0.02
21	2.33	2.33	2.34	2.34±0.01
24	2.43	2.45	2.45	2.44±0.01
27	2.23	2.26	2.26	2.25±0.02
30	2.36	2.42	2.42	2.40±0.04
33	2.31	2.34	2.34	2.33±0.02
36	2.23	2.23	2.25	2.24±0.01
39	2.25	2.26	2.26	2.26±0.01
41.7	2.25	2.27	2.29	2.27±0.02

Table C.11 Specific gravity results for fine fraction retrieved from Borehole-11

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.34	2.35	2.36	2.35±0.01
6	2.28	2.30	2.31	2.30±0.01
9	2.15	2.19	2.20	2.19±0.03
12	2.16	2.18	2.19	2.18±0.01
15	2.32	2.35	2.35	2.34±0.02
18	2.31	2.30	2.34	2.32±0.02
21	2.28	2.30	2.32	2.30±0.02
24	2.37	2.37	2.37	2.37±0.00
27	2.31	2.31	2.31	2.31±0.00
30	2.27	2.27	2.27	2.27±0.00
33	2.31	2.34	2.35	2.34±0.02
36	2.30	2.32	2.32	2.32±0.01
39	2.34	2.34	2.34	2.34±0.00

Table C.12 Specific gravity results for fine fraction retrieved from Borehole-12

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.17	2.19	2.20	2.19±0.02
6	2.15	2.18	2.19	2.17±0.02
9	2.23	2.23	2.24	2.24±0.00
12	2.24	2.26	2.27	2.26±0.02
15	2.21	2.25	2.26	2.24±0.03
18	2.18	2.21	2.22	2.21±0.02
21	2.22	2.25	2.25	2.24±0.02
24	2.22	2.25	2.25	2.24±0.02
27	2.29	2.30	2.31	2.30±0.01
30	2.17	2.21	2.23	2.21±0.03
33	2.17	2.19	2.20	2.19±0.02
36	2.17	2.21	2.22	2.20±0.03
39	2.26	2.28	2.27	2.27±0.01
41.7	2.26	2.26	2.26	2.26±0.01

Table C.13 Specific gravity results for fine fraction retrieved from Borehole-13

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.22	2.24	2.24	2.23±0.01
6	2.20	2.22	2.22	2.22±0.01
9	2.31	2.31	2.32	2.31±0.01
12	2.27	2.29	2.29	2.28±0.01
15	2.24	2.25	2.25	2.25±0.01
18	2.26	2.27	2.27	2.27±0.01
21	2.18	2.21	2.22	2.21±0.02
24	2.26	2.28	2.29	2.28±0.01
27	2.28	2.28	2.28	2.28±0.01
30	2.27	2.28	2.29	2.28±0.01
31.5	2.29	2.32	2.33	2.31±0.02
33	2.23	2.25	2.26	2.24±0.02
33.6	2.18	2.19	2.21	2.19±0.01

Table C.14 Specific gravity results for fine fraction retrieved from Borehole-14

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
1.5	2.50	2.51	2.51	2.51±0.00
3	2.42	2.43	2.43	2.43±0.01
4.5	2.45	2.46	2.46	2.46±0.00
6	2.39	2.40	2.40	2.40±0.01
9	2.62	2.63	2.63	2.63±0.00

Table C.15 Specific gravity results for fine fraction retrieved from Borehole-15

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.46	2.45	2.45	2.46±0.00
6	2.47	2.46	2.46	2.46±0.00
9	2.38	2.38	2.37	2.38±0.00
12	2.70	2.70	2.70	2.71±0.00
15	2.38	2.38	2.38	2.38±0.00

Table C.16 Specific gravity results for fine fraction retrieved from Borehole-16

Depth (m)	Specific gravity			Avg. (±SD) Specific gravity
	Trail-1	Trail-2	Trail-3	
3	2.33	2.32	2.32	2.33±0.01
4.5	2.27	2.29	2.29	2.29±0.01
6	2.38	2.39	2.39	2.39±0.01

References

ASTM D 5550, 2006. Standard test: method for specific gravity of soil solids by helium gas pycnometer. American Society of Testing and Materials 19428–2959.

ASTM International, 2020. ASTM D2974-2020: Standard Test Methods for Determining the Water (Moisture) Content, Ash Content, and Organic Material of Peat and Other Organic Soils, ASTM International. United States of America.

Goli, V.S.N.S., Singh, P., Singh, D.N., Tak, L.K., 2022. Investigations on characteristics of landfill-mined-soil-like-fractions and their dependency on organic matter. Process Safety and Environmental Protection 162, 795–812. https://doi.org/10.1016/j.psep.2022.04.052

Mohammad, A., Goli, V.S.N.S., Chembukavu, A.A., Singh, D.N., 2021. DecoMSW: A Methodology to Assess Decomposition of Municipal Solid Waste for Initiation of Landfill Mining Activities. The Journal of Solid Waste Technology and Management 47, 465–481. https://doi.org/10.5276/JSWTM/2021.465

Patil, B.S., Agnes Anto, C., Singh, D.N., 2017. Simulation of municipal solid waste degradation in aerobic and anaerobic bioreactor landfills. Waste Management and Research. https://doi.org/10.1177/0734242X16679258

केंद्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF INDIA

F. No. CM-13013/19/2020-21-Tech-RD-Chennai/ October 22, 2025

ANNEXURE IX

To

1. The Commissioner
   Greater Hyderabad Municipal Corporation
   CC Complex, Tank Bund Road
   Lower Tank Bund, Hyderabad - 500063

2. The Member Secretary
   Telangana Pollution Control Board
   A-3, Paryavaran Bhavan, Sanath Nagar Road
   Sanath Nagar Industrial Estate, Sanath Nagar
   Hyderabad – 500018

3. Prof. D. N. Singh
   Department of Civil Engineering
   IIT Bombay
   Mumbai - 400076

Sub: Minutes of the meeting held on October 14, 2025 in case of Original Application No. 199 of 2021 (SZ) & IA No. 96 of 2022 (SZ) in the matter of Sh. Shankar Narayana Bala Krishna & Ors. Vs State of Telangana & Ors.

Sir,

This is in reference to the meeting of the authorities and Professor IIT Bombay held on 14.10.2025 at 4:30PM through Video Conference on above mentioned subject.

The minutes of the meeting is enclosed herewith for kind perusal and necessary action in the matter.

Yours faithfully

H.D Varalaxmi

(H. D. Varalaxmi)
Regional Director

Encl.: As Above

Copy to

1. PS to CCB: For kind information of CCB, please
2. PS to MS: For kind information of MS, please
3. DH UPC –II: For kind information, please

(H. D. Varalaxmi)

Central Pollution Control Board
Parivesh Bhawan, East Arjun Nagar, Delhi

Minutes of the meeting held on October 14, 2025 in case of Original Application No. 199 of 2021 (SZ) & IA No. 96 of 2022 (SZ) in the matter of Sh. Shankar Narayana Bala Krishna & Ors. Vs State of Telangana & Ors.

The Hon'ble NGT (SZ) vide order dated 06.08.2025 directed Chairman, CPCB to convene a meeting between the authorities and engage IIT Bombay to arrive with a solution for dealing with the legacy as well as the fresh waste generated at Jawahar Nagar dumpsite

In compliance with above NGT direction, CPCB convened a meeting on October 14, 2025 through video conferencing under the Chairmanship of Chairman, CPCB with the officials of Telangana State Pollution Control Board (TGPCB), Greater Hyderabad Municipal Corporation (GHMC) and Prof. D. N Singh, IIT Mumbai (who had prepared the Report on Jawahar Nagar dumpsite) . Member Secretary, CPCB, officials from Head office and Regional Directorate, Chennai also participated in the meeting. The list of participants is enclosed at ***Annexure I***.

Chairman, CPCB welcomed the officials of TGPCB, GHMC and Prof. D.N. Singh, IIT Mumbai and briefly highlighted the agenda for the meeting. Subsequently, CPCB made a detailed presentation highlighting the status of capped legacy waste dumpsite at Jawahar Nagar, Hyderabad, findings and recommendations of the Expert Group, constituted as per NGT Directions, related to remediation of capped legacy waste dumpsite. Issue related to dumping of around 120 Lac T of waste on unlined surface and contamination of Ground water & surface water bodies, in and around the dumpsite were highlighted during the presentation. The copy of the presentation made by CPCB is enclosed at Annexure ***II***.

Prof. D.N. Singh, IIT Mumbai informed that due to space constraints biomining is difficult in the area.

Chairman CPCB requested him to suggest a solution to the problems faced in the Jawahar Nagar dumpsite as he had the technical expertise in the area. Professor D. N. Singh, IIT Mumbai agreed to provide a solution for the same. He further agreed that he shall submit a brief report on the same before October 28, 2025, for which he may require to visit the Jawahar Nagar dumpsite.

Member Secretary, TGPCB stated that the ground water (14 location) and surface water bodies (3 locations) in and around the dumpsite was being monitored on monthly basis. The analysis results of 08 ground water samples indicated extreme contamination and 06 ground water samples indicated moderate contamination of the ground water. TGPCB further informed that several public complaints were being received by TGPCB regarding odour & water pollution from the Jawahar Nagar site.

Based on deliberations following action points were decided:

1. IIT Mumbai shall provide a solution to the problems faced in the Jawahar Nagar dumpsite. Brief report on the same shall be submitted before October 28, 2025 by IIT Mumbai
2. The solution, as provided by IIT Mumbai, may be implemented by GHMC. The entire cost shall be borne by GHMC.
3. CPCB RD Chennai and Telangana SPCB to share past data related to the Jawahar Nagar dumpsite with IIT Mumbai

The meeting ended with vote of thanks to the Chair.

Annexure I

List of participants attended the meeting on 14.10.2025

S. No.	Name of official	Designation	Organization
1	Sh. Vir Vikram Singh, IAS	Chairman	Central Pollution Control Board
2	Sh. Bharat Kumar Sharma	Member Secretary	Central Pollution Control Board
3	Sh. R.V. Karnan, IAS	Commissioner	Greater Hyderabad Municipal Corporation
4	Sh. G. Ravi, IAS	Member Secretary	Telangana Pollution Control Board
5	Sh. C. N. Raghu Prasad	Additional Commissioner	Greater Hyderabad Municipal Corporation
6	Dr. D N Singh	Professor	IIT Bombay
7	Smt. Divya Sinha	Director	Central Pollution Control Board
8	Smt. H D Varalaxmi	Regional Director, Chennai	Central Pollution Control Board
9	Smt Poornima B M	Scientist D	Central Pollution Control Board
10	Sh. B. Raghu	Chief Environment Engineer	Telangana Pollution Control Board
11	Sh. D. Krupanand	Joint Chief Environment Engineer	Telangana Pollution Control Board
12	Smt M Sujana Sree	Senior Environment Engineer	Telangana Pollution Control Board
13	Sh. R. Seenivasa Reddy	Executive Engineer	Greater Hyderabad Municipal Corporation
14	Dr. D. Prasad	Senior Environment Scientist	Telangana Pollution Control Board
15	Smt. Bhavaneswari	Assistant Environment Engineer	Telangana Pollution Control Board

Annexure II

Remediation of GHMC Legacy Waste Dumpsite [OA No. 199 of 2021 (SZ)]

Background

- The case was registered in Hon'ble NGT (SZ) Chennai on **05.09.2021** by Sh. Shankar Narayanan Bala Krishna against State of Telangana regarding **non-implementation of Solid waste Management (SWM) Rules, 2016** in the state of Telangana especially in Jawahar Nagar, Hyderabad and also **non-implementation of Directions** issued by NGT (PB) Delhi in the matter of OA No. 606 of 2018

- CPCB has submitted **05 reports** dated 24.2.2025, 26.9.2024, 14.7.2024, 16.4.2024 & 25.9.2023 (in compliance to the order dated 29.9.2022 in O A No 606/2018) before the Hon'ble NGT (SZ), Chennai

Status of Legacy waste dumpsite

- 12 Million Tonnes of waste been capped in 125 acres of land
- The 125 acres of land on which the waste stored is unlined, as a result of which the groundwater/surface water bodies in and around the area are exposed to hazard of contamination with the leachate generated from the dumpsite
- The Groundwater in and around the dumpsite is contaminated
- Waste is further being dumped on the capped site leading to further leachate generation

Expert Group: Constitution, Findings & Recommendations

Re-constitution of Expert Group as per NGT Directions

- Officials from National Institute of Hydrology(NIH), Central Ground Water Board (CGWB) & National Geophysical Research Institute (NGRI) nominated to the Expert Group
- Replacement of Superannuated officials

Findings of the Expert Group

- CGWB – 2012 Study has reported high value of TDS, TOC, Sodium & Fluoride in surface & GW
- Capping of dumpsite has been done in violation of SWM Rules 2016 as well as when the matter was subjudice before the Hon'ble NGT & Supreme Court
- Capped waste is contributing to leachate and contamination of GW even three years after capping has been completed
- Contamination of GW underneath the dumpsite (which could not be monitored) is expected to be much higher
- As the waste has high moisture content & is biodegradable in nature, there is a potential hazard related to subsidence of the capped site

Recommendations of the Expert Group

1.0 Preparation of Feasibility study regarding possibility of remediation of the capped site

a) Assessment of extent & trend of contamination of Soil, Groundwater & surface water bodies

b) Remedial measures for waste as well as contaminated soil & water bodies

c) Assessing potential hazard related to subsidence of the capped site due to settling of waste and remedial measures

d) Feasibility of bio-mining (considering volume of waste, space availability, utilization/disposal options for various rejects/by-products expected to be generated during bio-mining, etc.)

e) Leachate management

2.0 Preparation of DPR based on the Findings of Feasibility Study

3.0 Implementation of DPR by GHMC

The Expert Group had recommended that the above activities shall be carried out by a Group of Institutions including IITR, NIH, NGRI & CGWB

NGT order dated 06.08.2025

" 1. Even in our earlier order, we have asked the Central Pollution Control Board (CPCB), Telangana State Pollution Control Board and Greater Hyderabad Municipal Corporation (GHMC) to join hands and bring a workable solution as per the established guidelines.

2. We feel it appropriate that the Chairman, CPCB would step in at this point of time convene a meeting between the authorities and engage IIT – Bombay and arrive at a solution, which can be executed smoothly in dealing with the legacy as well as the fresh waste generated."

- Matter listed on **28.10.2025** for final hearing

Observations on IIT Bombay Report

1. Mainly covers characterization of Waste which is found to have high moisture and is biodegradable
2. Recommends that the waste should be capped owing to aforementioned characteristics , However, as per the SWM Rules , unstabilized waste is to be biomined and inert waste may be capped
3. No reference to the following concerns of the Expert Group :
   - Assessment of extent & trend of contamination of Soil, Groundwater & surface water bodies
   - Remedial measures for waste as well as contaminated soil & water bodies
   - Assessing potential hazard related to subsidence of the capped site due to settling waste and remedial measures

4.0 No reference to existing legal framework for legacy waste management (SWM Rules, CPCB Directions & Guidelines)

Way Forward

1. IIT Bombay to provide Action Plan to prepare the feasibility report & Detailed Project report (DPR) as per the recommendations of the Expert Group constituted as per NGT Directions
2. The Action Plan to cover the various activities as well as timeline for execution of the same.
3. The Action Plan to be prepared in seven days
4. The Action Plan, Feasibility Report and the DPR to be approved by the Expert Group
5. The cost of preparation of Feasibility report & DPR as well as its implementation shall be borne by GHMC
6. The activities to be coordinated by TGPCB under overall supervision of the Expert Group

Thank You

भारतीय प्रौद्योगिकी संस्थान मुंबई
पवई, मुंबई-400 076, भारत
Indian Institute of Technology Bombay
Powai, Mumbai-400 076, India
दूरभाष/Phone : (+91-22) 2572 2545
फैक्स/Fax : (+91-22) 2572 3480
वेबसाईट/Website : www.iitb.ac.in

ANNEXURE X

October 27, 2025

To

The Commissioner

GHMC, Hyderabad

&

Chairman CPCB

New Delhi

Subject: Way Forward to the issues prevailing at the MSW Processing & Disposal facility at Jawaharnagar, Hyderabad

1. Background

In compliance with the Hon'ble National Green Tribunal's (Southern Zone) directive dated 06.08.2025, the Central Pollution Control Board (CPCB) organized a Webex meeting on 14.10.2025 with the Telangana Pollution Control Board (TGPCB), Greater Hyderabad Municipal Corporation (GHMC), and the Indian Institute of Technology, Bombay. The meeting aimed to develop practical solutions for managing both legacy and fresh waste at Jawaharnagar. As per the Minutes of Meeting communicated on 22.10.2025, it was reiterated that "IIT Mumbai shall provide a solution to the problems faced in the Jawahar Nagar dumpsite. Brief report on the same shall be submitted before October 28, 2025 by IIT Mumbai".

2. Site Visit

I visited the Jawaharnagar dumpsite and MSW processing facility on 23.10.2025, where I interacted with representatives from (i) GHMC, led by Sri R. Sreenivasa Reddy, Executive Engineer, SWM, (ii) Telangana Pollution Control Board, led by Sri Rajendra, Regional Officer, and (iii) M/s Re-sustainability Ltd (the project's Concessionaire), led by Sri Manoj Agarwal, Project Head. During the visit, I inquired about developments since IIT Bombay submitted its Final Report on the capped dumpsite in July 2023.

These stakeholders were requested to submit any available data, reports, and their views on potential solutions to the challenges faced at the MSW Processing & Disposal facility at Jawaharnagar, as per the discussions, on the following points:

A. Greater Hyderabad Municipal Corporation

a. Various reports submitted before the Hon'ble NGT pertaining to different Original Applications (OAs) related to the capped legacy dumpsite, compliance with the SWM Rules, and the Action Plans submitted to NGT/ CPCB.

b. Details of the measures undertaken for leachate management, from both fresh waste and legacy leachate management projects.

c. Views and suggestions on the further course of action (way forward).

d. Any additional details, data, or observations deemed relevant may also be shared.

B. Telangana Pollution Control Board:

a. Water quality monitoring reports collected periodically from borewells both within and outside the facility, including details such as the distance of the borewells from the capped site and the frequency of sampling.

b. As recommended by Pollution Control Board officials, any literature or existing procedures/mechanisms for assessing or surveying the integrity of the capping.

c. Ambient air quality data, with a comparison of changes in various parameters before and after the capping of the legacy dump, along with the locations where the data was collected.

d. Observations from Telangana Pollution Control Board officials regarding seepage in the vicinity of the capped dumpsite.

e. Any additional details, data, or observations, as deemed appropriate, may also be shared.

C. Re-sustainability Limited

a. Details regarding questions raised during discussions, such as rainfall data, whether the area is in an earthquake-prone zone, the garland drain network map, and the history of fires at the dumpsite both before and after capping.

b. Data on leachate and landfill gas collected from the capped dump, including variations in parameters/composition over time.

c. Water quality monitoring reports from borewells within and outside the facility, excluding those monitored by the Telangana Pollution Control Board.

d. Data related to extraction borewells, including locations, runtime, and monitored parameters.

e. Information on any lapses observed by TGPCB or the local community, along with clarifications provided and rectification measures taken.

f. Details on site conditions, practical challenges faced, and the action plan for moving forward.

g. Any other relevant details, data, or observations may be shared as needed.

Subsequently, M/S Resustainability Ltd submitted a note, along with supporting data and an action plan addressing some of the challenges faced by their facility. GHMC submitted a detailed note along with supporting data, and TGPCB submitted the data and the way forward. CPCB RD, Chennai, shared four large PDF files (reports submitted to CPCB or filed before NGT, Chennai).

3. Recommendations

3.1 Air Quality Management

To mitigate high PM10 levels: implement regular water spraying, green curtains around the waste processing facilities, barricading of operational areas, enforcement of speed limits, mechanical road sweeping and pollution checks for vehicles & machinery at regular intervals.

3.2 Reduce the MSW burden at this site (Jawaharnagar) by decentralization

GHMC should **expedite** the establishment of decentralized MSW processing and disposal and Waste-to-Energy facilities for disposal of Segregated Combustible Fraction (SCF)/Refused Derived Fuel (RDF). GHMC shall also aim to reduce incoming waste to this facility by focusing on extensive Information, Education & Behaviour Change Communication campaigns to

motivate citizens and GHMC's waste collection workers to improve waste segregation at source, in line with Circular Economy principles. **CPCB and TGPCB should frame policies** to enhance SCF/RDF utilization in cement plants through enforcement mechanisms and policy amendments. An area designated as the RDF storage yard currently holds RDF accumulated over the years. The possibility of off-taking this RDF to cement factories and additional Waste to Energy Plants both at this site (Jawaharnagar) & other new sites should be explored. The RDF can be disposed either in shredded or unshredded form—based on the quality requirements specified by the cement plants. This will also help free up space for the construction of the SLF. In addition:

- Explore decentralized pre-processing of waste at transfer stations.
- Regulate waste intake at Jawaharnagar based on available windrow and expanding WtE RDF processing capacities at each corner of GHMC.
- Ensure complete treatment of leachate through the existing facilities (pre-treatment, RO, MEE, and MVR plants).

3.3 Leachate Management

GHMC should expand leachate treatment capacity, implement mechanised drain cleaning, use closed concrete tanks for odour control and regularly inspect drainage networks to prevent cross-contamination. Unlined leachate storage ponds shall be emptied into properly engineered storage.

The leachate treatment system should be designed to handle daily generation, including peak periods.

3.4 Storm Water and Surface Water Management

Implement 'first-cut' stormwater capture and treatment systems. The Authorities must address sewage inflow into stormwater network originating as urban runoff from the upstream catchment that currently discharge to the Malkaram tank (adjacent to the capped dumpsite) and also other nearby lakes, by developing localized sewage treatment infrastructure. The diversion channel that was closed by the farmers shall be reopened to ensure that the above-mentioned contaminated storm water from the upstream catchment is diverted away from the Malkaram tank, thereby avoiding delays to the legacy leachate treatment project.

The Authority shall also construct a lined, graded garland drain around the capped site to hydraulically isolate the area and route runoff to sumps. In addition, an STP/ETP equipped with oil–grit separation, sediment-control measures, safe access for O&M, and provisions for periodic desilting shall be established.

4. Way Forward

The Jawaharnagar facility presents several complex challenges related to legacy and fresh waste management. Considering the environmental and safety implications, **biomining does not seem to be an appropriate solution at this point** due to the reasons known very well and the following challenges:

Biomining is not recommended at this stage. If undertaken, it would need to be planned at 19,000–20,000 MT/day to handle both daily municipal solid waste (MSW) and the accumulated legacy waste—an operationally challenging scale.

By-product offtake is constrained - Limited demand for biomining outputs (SCF/RDF and bio-soil) makes disposal difficult and increases financial burden. In particular, SCF/**RDF disposal would require augmented waste-to-energy (WtE) capacity**, which is likely several years away.

It should also be noted that biomining of the capped landfill at this juncture when complete degradation has not taken place, may create a leachate (and gas) outbreak and slope failure. Maintaining the status quo of the capped legacy dumpsite, duly strengthening the air, leachate, and storm water management systems as recommended above, is the best possible option for the present. Periodic monitoring and inter-agency coordination remain essential for sustained environmental protection.

Hence, the following is recommended:

I) Immediate Term (0–6 months)

Retain the existing cap and implement a containment-first program:

(i) audit and repair cap details (seams, benches, gas, drainage geonet outlets, leachate collection sumps);

(ii) add LFG capture where practicable, with continuous flare uptime and prioritized routing of high-CH_4 streams to purification;

(iii) accelerate legacy leachate evacuation via existing MVRE capacity and new extraction points at the toe and down-gradient zones;

(iv) complete and line a full-perimeter garland drain hydraulically isolating all stormwater from process/legacy leachate and route to dedicated treatment; and

(v) publish a monitoring dashboard covering groundwater and AAQ readings outside boundary.

II) Near Term (6–18 months)

Close the system-level bottleneck by contracting additional SCF/RDF offtake: finalize WtE expansion and develop immediately with support from State and Central Government with clear milestones; re-secure long-term cement-kiln co-processing MOUs with transportation and disposal cost to be mutually agreed by Government and GHMC/HiMSW; and commission decentralized pre-processing nodes to de-risk transport peaks. For LFG, scale purification under the GAIL–BGL–HiMSW framework, add dewatering/sumps to minimize condensate carryover, and implement a gas–leachate interaction study to guide wellfield tuning.

BGL/GAIL to immediately start the off-take since the capacity is going to increase after Muller Biomethanation plant commissioning which is equally important for nation's resource utilization point of view.

III) Long Term (60- 120 months)

Adopt a criteria-based decision gate for any selective retrieval/biomining only after all the following conditions are fulfilled:

(i) leachate heads at the waste–foundation interface fall below agreed thresholds and remain stable through ten monsoon cycles,

(ii) LFG flows decline to low, steady-state values with no hot spots, and

(iii) end-to-end outlets are contractually locked for fines, recyclables and RDF residuals.

(iv) If and when conditions are satisfied, pilot small, peripheral cells with full enclosure, misting, negative-pressure dust control and

emergency response plans consistent with CPCB guidance; scale only upon demonstrated environmental performance.

(v) Continue post-closure care for ≥15 years as per Schedule-I, including slope stability inspections, groundwater protection, and LFG/leachate controls.

Considering the above, the following appears to be the possible solutions:

1. Capping to be retained: Do not reopen the capped Jawaharnagar dumpsite; doing so would dismantle engineered controls and vent trapped gases. Biomining can be reconsidered only after gas decline and further waste decay.
2. Stormwater & treatment by GHMC: Build a lined, graded garland drain around the site/cap to hydraulically isolate runoff; route flows to sumps and a Government of Telangana STP/ETP with oil–grit separation, sediment control, safe access, and periodic desilting
3. WtE expansion at Jawaharnagar: With 2×600 TPD lines operational (since Aug 2020) and 2×600 TPD on trial (since Jun 2025) and 800 TPD operational at Dundigal (since Mar 2024), planining for enhancing the WTE capacity to ~100 MW to handle ~4,000-5,000 TPD RDF will end on-site RDF stockpiles.
4. Three additional integrated MSW+WtE hubs: Government of Telangana to allocate land at three strategic GHMC locations; each plant to accept pre-treated waste and target ~100 MW. Together with Jawaharnagar (~100 MW), deliver ~400 MW distributed capacity, cut haul distances, eliminate buffer storage, and meet ~20,000 TPD needs through 2035 and beyond.
5. Groundwater safeguard: No contamination observed to date; implement periodic monitoring by TSPCB/empaneled agencies with transparent reporting. If contamination is detected, Government of Telangana will undertake remediation under a reputed institution's supervision.

4.1 Short-term

1. Evaluate the efficiency & performance of the leachate extraction wells.
2. Analysis of the leachate treatment scheme to assess its effectiveness, adequacy and compliance with standards and suggest improvements.
3. Provide technical assistance in achieving effective stabilization of Fresh waste and assessing the soundness of the lining under the areas allotted for drying/pre-processing of the fresh MSW for identifying possible locations for seepage of leachate, if any.

4.2 Medium-term

1. Assessing the subsurface conditions for necessary guidance in undertaking appropriate engineering interventions at the dumpsite to effectively manage and control subsurface leachate.
2. Analysis of the measures taken for surface runoff management, particularly during the extreme rainfall events and suggest improvements, including changes required in the design
3. Analysis of the piezometric data from the borewells.
4. Fresh sampling from these wells will also be conducted to establish the level of groundwater contamination.
5. For Ground water implement periodic monitoring by TSPCB/empanelled agencies. If contamination is detected, Government of Telangana will undertake remediation under a reputed institution's supervision like IIT or equivalent .
6. GHMC to expand and augment processing and disposal facilities in the City especially with focus on disposal of SCF/RDF for stored fraction and those derived from fresh waste.

4.3 Long-term

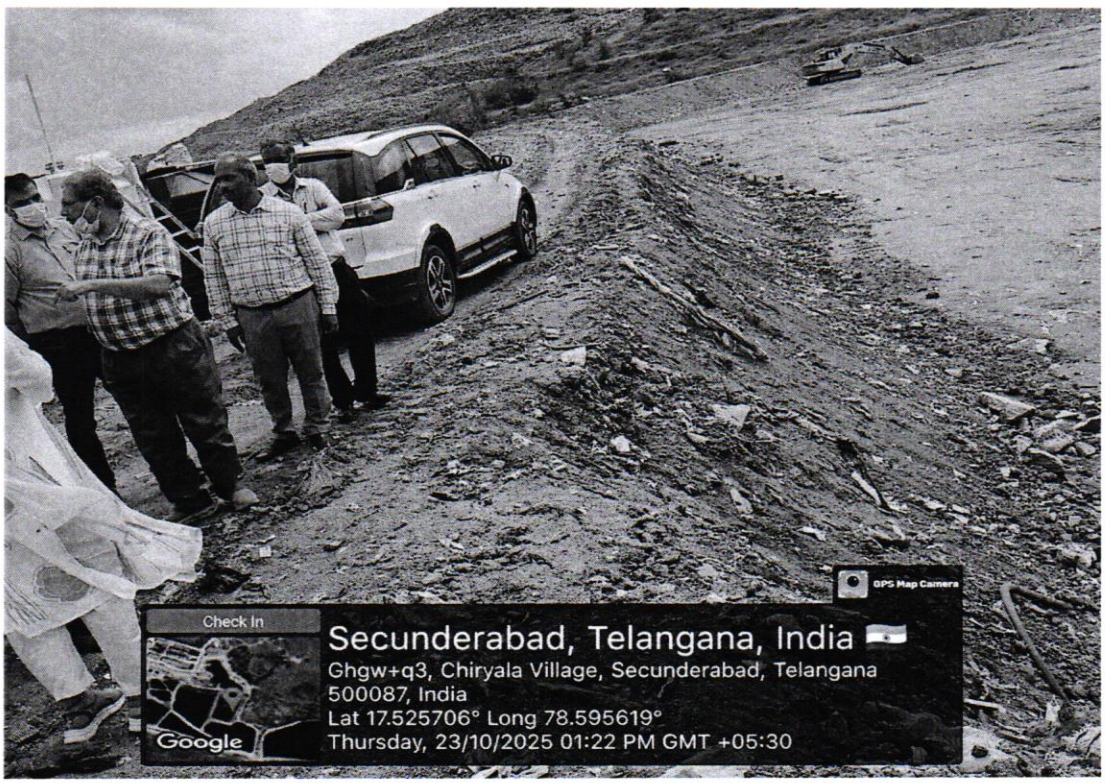
1. Exploring other adequate engineering solutions (possibilities) to reduce the outflow of leachate.
2. In fact, the possibility of "landfill rehabilitation" is to be attempted, which would be a very extensive, intricate, rare, but extremely useful scientific study, under the prevailing circumstances.

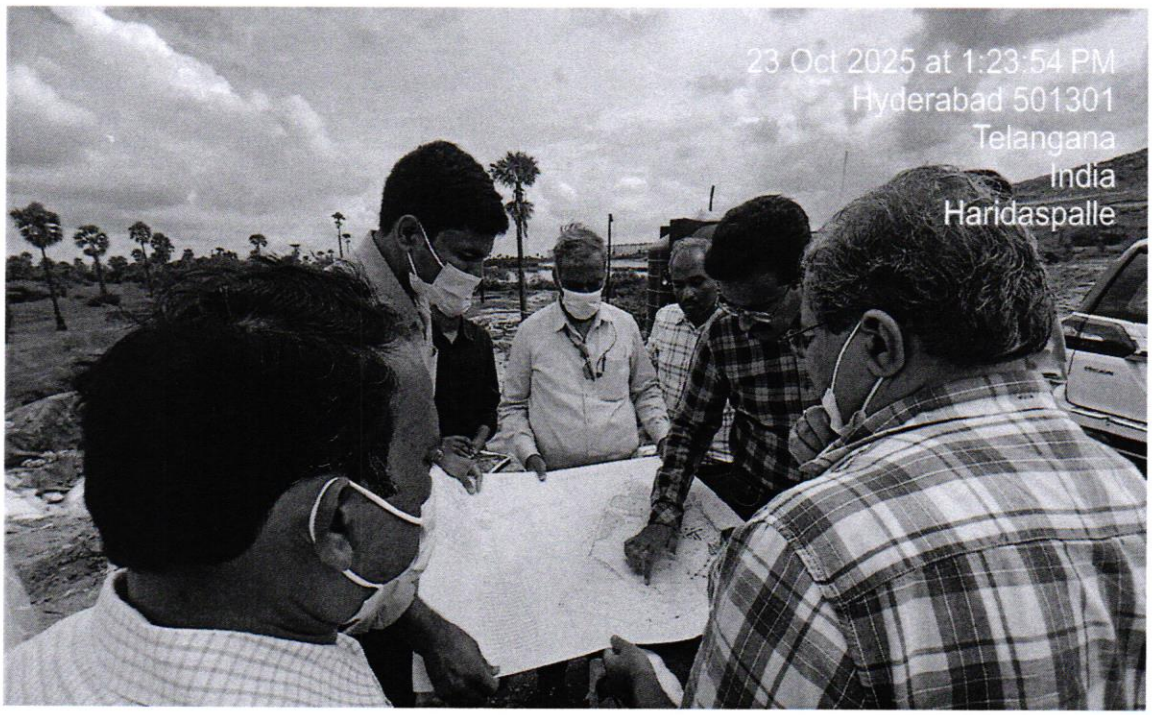
3. Develop adequate and practical guidelines to successfully carry out "bio-mining" operations in a challenging situation vis-à-vis SWM Rules, Manual and CPCB guidelines.
4. Comprehensive hydrogeological study of the entire area shall be undertaken with long-term monitoring.
5. Assessment of the status of the MSW in the capped landfill after two-three years (and may be after another 5 years thereafter) by employing advanced geophysical investigations for identifying the state of the MSW in the landfill to arrive at the technical feasibility aspect of bio-mining, if deemed necessary.

With my best regards!

Dr. D. N. Singh FNAE, FASCE, FICE(UK)
Editor-in-Chief, Environmental Geotechnics, ICE, UK
D.L. Shah Chair Professor for Innovation
Department of Civil Engineering
dns@civil.iitb.ac.in
Cell: +91-9820758508
www.civil.iitb.ac.in/~dns


Check In
Google
Secunderabad, Telangana, India
Gh8p+wcv Kcr Nagar, Ambedkar Nagar, Secunderabad, Telangana 500087, India
Lat 17.518157° Long 78.586678°
Thursday, 23/10/2025 10:53 AM GMT +05:30
GPS Map Camera


Check In
Google
Secunderabad, Telangana, India
Ghgw+q3, Chiryala Village, Secunderabad, Telangana 500087, India
Lat 17.525706° Long 78.595619°
Thursday, 23/10/2025 01:22 PM GMT +05:30
GPS Map Camera


23 Oct 2025 at 1:23:54 PM
Hyderabad 501301
Telangana
India
Haridaspalle

Annexure -XI							
Details of Existing STP's in the ULBs outside ORR Under PH&MED							
Before Judgement Order i.e., on 29-09-2022							
S.No.	**City/Town**	**Location of STP**	**Existing Capacity of STP in MLD**	**Technology**	**Capacity utilized in MLD**	**Operational Status**	**Remarks**
1	Karimnagar	Bommakal Road (Near Housing Board Colony)	38.00	MBBR	3	Operational	Inspection chambers, Sewerage connections are not taken up in UIDSSMT Scheme due to paucity of funds. 19500 Nos of Inspection chambers are proposed in Karimnagar Smart City Project (So that utilization can be improved).It is also proposed to complete the balance and all additional components under AMRUT 2.0.
2	Vikarabad	Chakali Gadda, Allampally	13.00	MBBR	7.5	Operational	STP is designed for prospective year demand.Present requirement is less than 2026 requirement. At present 9.0 MLD water is being supplied and the utilization is matching with 80% of the water supply.
3	Nizamabad	Dubba	31.50	MBBR	7.5	Operational	Network not fully laid due to paucity of funds.It is also proposed to complete the balance, Sewerage connections and all additional components under AMRUT 2.0.
		Yellammagutta	15.00	MBBR	3.5	Operational	
4	Miryalguda	Thallagadda	11.50	WSP	-	Non- Operational	Earlier,Motors and pumpsets were damaged and repaired now.Trail Run under progress.To utilise the 11.50 MLD capacity STP, sewerage connections are proposed under AMRUT 2.0 .
5	Siddipet	Chinthala Cheruvu	7.25	MBBR	7	Operational	
		Narsapur Cheruvu	11.00	SBR	10	Operational	
6 (a)	Gajwel	Rajareddy Pally	1.50	Phytorid	1.5	Operational	
		Pidichedu Road	3.50	Phytorid	3	Operational	
		Pandavula Chervu	0.50	Phytorid	0.5	Operational	
		Sub Total	**132.75**		**43.50**		

S.No.	City/Town	Location of STP	Existing Capacity of STP in MLD	Technology	Capacity utilized in MLD	Operational Status	Remarks
STPs completed after Judgement Order i.e., on 29-09-2022							
6(b)	Gajwel	Pragnapur (By-Pass Road)	1.25	Phytorid	0.75	Operational	
7	Suryapet	Pullareddy cheruvu	10.00	SBR	3.0	Operational	Network not fully laid due to paucity of funds.It is also proposed to complete the balance, Sewerage connections and all additional components under AMRUT 2.0.
8	GWMC	Ursugutta	5.00	SBR	3.5	Operational	
		Pragathinagar	15.00	SBR	12.5	Operational	
9	Devarakonda	Nainoni Kunta	1.50	SBT	1	Operational	
10	Nagar Kurnool	Bus Depot Backside	2.30	Phytorid	1	Operational	
11	Nalgonda	Sheshammagudem	17.16	WSP	9	Operational	STP has been commisioned recently.It is also proposed to complete the balance network, Sewerage connections and all additional components under AMRUT 2.0.
		Sub Total	**52.21**		**30.75**		
		Total	**184.96**		**74.25**		

Total No.of STPs completed: 17 Nos (in 11 ULBs)

Total installed capacity: 184.96 MLD

Annexure- XII

Details of under Construction STP's in the ULBs outside ORR Under PH&MED

S.No.	City & Funding	Location of STP	Capacity of STP in MLD	Technology	Physical Progress in %	Tentative date of Completion/ Commissioning	Remarks
1	Miryalguda (UIDSSMT & TUFIDC Rs.85.52 Cr (Rs.45.51 Cr+Rs.33.01Cr.)+ Rs.7.00 (TUFIDC)	Ramnagar Bandam	5.45	WSP	Physically Completed. Commissioning under progress. Interconnection and gap closing works pending.	31-12-2025	Commissioning will be completed after replacement of Pump Sets and motors which are under progress (taken up under AMRUT 2.0).
2	Nagar Kurnool SDF+TUFIDC Rs.90.00 Cr (Rs.35.00Cr+30.00Cr+ 25.00 Cr)	Bus Depot Backside	3.20	Phytorid	100%	31-12-2025	STP has been completed and commissioned. Intermittent Pump house to be taken up & completed for sewage pumping to STP. Revised AS sanctioned on 18-01-2025. Pump House work under progress.
3	Suryapet TUFIDC Rs.118.00Cr. (Rs.81.41 Cr. +Rs.36.59 Cr.)	Nalla cheruvu	10.00	SBR	100%	31-12-2025	STP completed and trial run under Progress.Sewer network not laid fully. Balance Sewer network proposed up under AMRUT 2.0
4	Sircilla Rs.61.25 Cr MB (Urban)- Subject to reimbursement from RWS&S Dept.	Shanthinagar behind 2BHK Colony	19.1	SBR	95%	31-12-2025	Progress of work slowed due to delay in payments and paucity of funds.
Total			**37.75**				
Total No.of STPs: 4 Nos (in 4 ULBs)							
Total capacity: 37.75 MLD							

Annexure- XIII							
Details of STP's taken up in the ULBs outside ORR under AMRUT 2.0 under PH&MED							
Sl. No	**ULB**	**Project Cost (including O&M in Cr)**	**No.of STPs proposed in AMRUT 2.0**	**Sewage treatment capacity (MLD)**	**Details of Package in which STP was included and total capacity in package**	**Tentative date of Completion/ Commissioning**	**Remarks**
Package-I							
1	Adilabad	225.46	**4**	**31.50**	**Package-I (Total Capacity:65.00 MLD) Project Cost : Rs.560.85 Cr**	**31-12-2027**	**Package-I: LOA issued on 07-03-2024,agreement concluded. Work grounded.**
2	Karimnagar	79.57	-	-		-	
3	Ramagundam	255.82	**5**	**33.50**		**31-12-2027**	
Package-II							
4	Miryalaguda	173.07	**1**	**6.00**	**Package-II (Total Capacity:63.30 MLD) Project Cost : Rs.955.55 Cr**	**31-12-2027**	**Package-II: LOA issued on 07-03-2024 & agreement concluded.Work grounded.**
5	Nalgonda	216.19	**1**	**3.80**		**31-12-2027**	
6	Suryapet	316.77	-	-		-	
7	Khammam	249.52	**2**	**53.50**		**31-12-2027**	
Package-III							
8	Nizamabad	162.81	-	-	**Package-III (Total Capacity:42.00 MLD) Project Cost : Rs.439.61 Cr**	-	**Package-III: LOA issued on 01-07-2024 & agreement concluded. Work grounded.**
9	Mahabubnagar	276.8	**3**	**42.00**		**31-12-2027**	
Total for 9 ULBs		**1956.01**	**16**	**170.30**			
Total No.of STPs proposed under AMRUT 2.0: 16 Nos (in 9 ULBs)							
Total capacity proposed under AMRUT 2.0: 170.30 MLD							

Annexure- XIV

Details of STPs proposed in 101 ULBs outside ORR under SBM 2.0 Under PH&MED

Sl No	Name of the ULB	Name of the District	No of STPs	STP 1	STP 2	STP 3	STP 4	STP 5	Total Capacity of STPs in MLD	Remarks
1	Kothagudem	Bhadradi Kothagudem	1	9.0					9.0	•Earlier total 72 No. of STP's of capacity 315.02 MLD in 30 ULB's was proposed to be taken up by the PH&ME Department for a tentative amount of Rs.2828.24 Crores and the same was submitted to the Govt. for according Administrative Sanction vide T/o Lr Dt:13-04-2020 & 03-10-2020. • Further, as per instructions of Govt. Vide Memo Dt:25.05.2021 of MA & UD (TP&E.2), it was proposed to take up the above under Hybrid Annuity Model. •Govt. vide G.O.Rt.No.478, Dt:15-07-2022 accorded administrative sanction for appointment of consultant M/s. Green Design and Engineering Services Pvt., Ltd for preparation of DPRs. (including updating existing DPRs) • Further, it was proposed to take up UGD Scheme in Ramagundam Municipal Corporation (one of the ULB under NGT 30 ULBs under polluted River Stretches) under AMRUT 2.0. • It is to submit that Govt. of India has sanctioned SBM 2.0 for Telangana State which includes construction of STPs and I&D Structures in ULBs. It is proposed to take up STPs in 103 ULBs (other than GHMC, 26 ORR ULBS, 11 AMRUT Towns, Siricilla but including 29 NGT ULBs) under SBM 2.0 in Hybrid Annuity Model. • The funding for STPs under SBM 2.0 is restricted to 2025 population only (that too @70%), whereas as per CPHEEO Manual, STPs are to be designed for 15 years (Prospective) and 30 years (ultimate). Accordingly, STPs capacities are calculated as per Prospective population Demand for 2038 and Ultimate population Demand for 2053. • Hence, the sanctioned amount under SBM 2.0 is not sufficient to meet the construction of STPs as per CPHEEO Manual Design. • Hence, it is proposed to float tenders on Hybrid Annuity Model by utilising the SBM provision as Viability Gap Funding. Addressed to Govt. for according approval to call tenders with open technology on RFP mode pending administrative sanction for taking up construction of 344 Nos of STPs in 103 ULBs for capacity of 789.20 MLD under SBM 2.0. Further, the Govt. vide Memo No. 6361/Engg.2/2023 of MA&UD (Engg.) Dept., Dt. 02-02-2024 has directed to submit revised proposals revising the capacities duly utilizing the GoI share under SBM 2.0 in Phase I as upfront payment, keeping in view the financial implication. Accordingly, this office vide letter Dt:07-02-2024 has submitted revised proposals and requested Govt. to accord Administrative sanction for an amount Rs. 3769.34 crores (including O&M and Annuity Payments and GST on Interest Component of Annuity) **Govt. vide G.O.Rt.No.388, Dt:21-08-2024 accorded administrative sanction for an amount of Rs.3769.34 Crores (including O&M and Annuity payments and GST on Interest component of Annuity payments) for "sewerage projects in 101 ULBS in the state of Telangana under SBM 2.0").Tender invited 3 times and no bidders participated in three calls . Further, permission also awaited from GoI for upfront payment duly utilizing central share.** **Further, this office vide letter dt:25-07-2025 requested the Govt. to accord Revised Administrative sanction for amount of Rs. 3705.75 crores (including Land Acquisition, O&M for 5 Years, Annuity Payments, GST etc) with permission to invite tenders in 3 packages instead of single package under LS contract system with Revised Hybrid Annuity Model and with latest SoR 2025-26 rates due to non - participation of the bidders in the tenders invited for 3 calls. Expected to be completed by December -2027 after approval from Govt.**
2	Manuguru		1	4.0					4.0	
3	palvancha		1	10.0					10.0	
4	Yellandu		1	4.00					4.0	
5	Madhira	Khammam	1	4.00					4.0	
6	Sattupalli		2	3.00		1.00			4.0	
7	Wyra		1	4.00					4.0	
8	Mahabubabad	Mahabubabad	1	8.00					8.0	
9	Dornakal		1	1.70					1.7	
10	Maripeda		1	2.50					2.5	
11	Thorrur		1	2.30					2.3	
12	Alampur	Jogulaba Gadwal	1	1.70					1.7	
13	Gadwal		1		8.00				8.0	
14	Ieeja		1		3.30				3.3	
15	Waddepalle		1			2.00			2.0	
16	Bhoothpur	Mahabubnagar	2	0.80	0.90				1.7	
17	Jadcherla		1	7.30					7.3	
18	Atchampet	Nagarkurnool	1	4.00					4.0	
19	Kalwakurthy		1		4.00				4.0	
20	Kollapur		1			3.00			3.0	
21	Kosgi	Narayanpet	1	3.30					3.3	
22	Makthal		1		3.60				3.6	
23	Narayanapet		1		5.00				5.0	
24	Amarchinta	Wanaparthy	1	2.00					2.0	
25	Atmakur		1	2.90					2.9	
26	Kothakota		1	3.20					3.2	
27	Pebbair		1				3.00		3.0	
28	Wanaparthy		1	8.00					8.0	
29	Banswada	Kamareddy	1	3.50					3.5	
30	Kamareddy		1		12.00				12.0	
31	Yellareddy		2	1.30		1.00			2.3	

Sl No	Name of the ULB	Name of the District	No of STPs	STP 1	STP 2	STP 3	STP 4	STP 5	Total Capacity of STPs in MLD	Remarks
32	Armoor	Nizamabad	2	5.30				2.20	7.5	•Earlier total 72 No. of STP's of capacity 315.02 MLD in 30 ULB's was proposed to be taken up by the PH&ME Department for a tentative amount of Rs.2828.24 Crores and the same was submitted to the Govt. for according Administrative Sanction vide T/o Lr Dt:13-04-2020 & 03-10-2020. • Further, as per instructions of Govt. Vide Memo Dt:25.05.2021 of MA & UD (TP&E.2), it was proposed to take up the above under Hybrid Annuity Model. •Govt. vide G.O.Rt.No.478, Dt:15-07-2022 accorded administrative sanction for appointment of consultant M/s. Green Design and Engineering Services Pvt., Ltd for preparation of DPRs. (including updating existing DPRs) • Further, it was proposed to take up UGD Scheme in Ramagundam Municipal Corporation (one of the ULB under NGT 30 ULBs under polluted River Stretches) under AMRUT 2.0. • It is to submit that Govt. of India has sanctioned SBM 2.0 for Telangana State which includes construction of STPs and I&D Structures in ULBs. It is proposed to take up STPs in 103 ULBs (other than GHMC, 26 ORR ULBS, 11 AMRUT Towns, Siricilla but including 29 NGT ULBs) under SBM 2.0 in Hybrid Annuity Model. • The funding for STPs under SBM 2.0 is restricted to 2025 population only (that too @70%), whereas as per CPHEEO Manual, STPs are to be designed for 15 years (Prospective) and 30 years (ultimate). Accordingly, STPs capacities are calculated as per Prospective population Demand for 2038 and Ultimate population Demand for 2053. • Hence, the sanctioned amount under SBM 2.0 is not sufficient to meet the construction of STPs as per CPHEEO Manual Design. • Hence, it is proposed to float tenders on Hybrid Annuity Model by utilising the SBM provision as Viability Gap Funding. Addressed to Govt. for according approval to call tenders with open technology on RFP mode pending administrative sanction for taking up construction of 344 Nos of STPs in 103 ULBs for capacity of 789.20 MLD under SBM 2.0. Further, the Govt. vide Memo No. 6361/Engg.2/2023 of MA&UD (Engg.) Dept., Dt. 02-02-2024 has directed to submit revised proposals revising the capacities duly utilizing the GoI share under SBM 2.0 in Phase I as upfront payment, keeping in view the financial implication. Accordingly, this office vide letter Dt:07-02-2024 has submitted revised proposals and requested Govt. to accord Administrative sanction for an amount Rs. 3769.34 crores (including O&M and Annuity Payments and GST on Interest Component of Annuity) **Govt. vide G.O.Rt.No.388, Dt:21-08-2024 accorded administrative sanction for an amount of Rs.3769.34 Crores (including O&M and Annuity payments and GST on Interest component of Annuity payments) for "sewerage projects in 101 ULBS in the state of Telangana under SBM 2.0").Tender invited 3 times and no bidders participated in three calls . Further, permission also awaited from GoI for upfront payment duly utilizing central share.** **Further, this office vide letter dt:25-07-2025 requested the Govt. to accord Revised Administrative sanction for amount of Rs. 3705.75 crores (including Land Acquisition, O&M for 5 Years, Annuity Payments, GST etc) with permission to invite tenders in 3 packages instead of single package under LS contract system with Revised Hybrid Annuity Model and with latest SoR 2025-26 rates due to non - participation of the bidders in the tenders invited for 3 calls. Expected to be completed by December -2027 after approval from Govt.**
33	Bheemgal		1	1.90					1.9	
34	Bodhan		1	10.00					10.0	
35	Jagtial	Jagtial	2		2.00			10.00	12.0	
36	Korutla		1		8.60				8.6	
37	Metpally		1			6.10			6.1	
38	Dharmapuri		1		2.00				2.0	
39	Raikal		2	1.20	1.00				2.2	
40	Huzurabad	karimnagar	2		2.50	3.50			6.0	
41	Jammikunta		1		5.00				5.0	
42	Kothapalli		1		1.40				1.4	
43	Choppadandi		1	2.40					2.4	
44	Peddapalli	Pedapalli	2		4.90			0.80	5.7	
45	Sultanabad		1	3.00					3.0	
46	Manthani		1	3.00					3.0	
47	Vemulawada	Rajanna Sircilla	1	5.50					5.5	
48	Sircilla		0	0.00					0.0	
49	Parkal	Hanamkonda	1		4.00				4.0	
50	Bhupalpally	Jayashankar Bhupalpally	1			7.00			7.0	
51	Jangoan	Jangoan	1		6.00				6.0	
52	Wardhannapet	Warangal	2		1.00		0.60		1.6	
53	Narsampet		1	4.20					4.2	
54	Bhainsa	Nirmal	1			6.00			6.0	
55	Nirmal		2	10.00		1.50			11.5	
56	Khanapur		1	2.30					2.3	
57	Bellampally	Mancherial	1		6.50				6.5	
58	Mandamari		1			6.00			6.0	
59	Manchiriyal		2	8.00			2.00		10.0	
60	Kethanapally		1		4.00				4.0	
61	Luxettipet		1		3.00				3.0	
62	Chennur		1			3.00			3.0	
63	Naspur		1	8.50					8.5	
64	Kagaznagar	Komaram Bheem Asifabad	1				6.70		6.7	

Sl No	Name of the ULB	Name of the District	No of STPs	STP 1	STP 2	STP 3	STP 4	STP 5	Total Capacity of STPs in MLD	Remarks
65	Medak	Medak	1		6.00				6.0	•Earlier total 72 No. of STP's of capacity 315.02 MLD in 30 ULB's was proposed to be taken up by the PH&ME Department for a tentative amount of Rs.2828.24 Crores and the same was submitted to the Govt. for according Administrative Sanction vide T/o Lr Dt:13-04-2020 & 03-10-2020. • Further, as per instructions of Govt. Vide Memo Dt:25.05.2021 of MA & UD (TP&E.2), it was proposed to take up the above under Hybrid Annuity Model. •Govt. vide G.O.Rt.No.478, Dt:15-07-2022 accorded administrative sanction for appointment of consultant M/s. Green Design and Engineering Services Pvt., Ltd for preparation of DPRs. (including updating existing DPRs) • Further, it was proposed to take up UGD Scheme in Ramagundam Municipal Corporation (one of the ULB under NGT 30 ULBs under polluted River Stretches) under AMRUT 2.0. • It is to submit that Govt. of India has sanctioned SBM 2.0 for Telangana State which includes construction of STPs and I&D Structures in ULBs. It is proposed to take up STPs in 103 ULBs (other than GHMC, 26 ORR ULBS, 11 AMRUT Towns, Siricilla but including 29 NGT ULBs) under SBM 2.0 in Hybrid Annuity Model. • The funding for STPs under SBM 2.0 is restricted to 2025 population only (that too @70%), whereas as per CPHEEO Manual, STPs are to be designed for 15 years (Prospective) and 30 years (ultimate). Accordingly, STPs capacities are calculated as per Prospective population Demand for 2038 and Ultimate population Demand for 2053. • Hence, the sanctioned amount under SBM 2.0 is not sufficient to meet the construction of STPs as per CPHEEO Manual Design. • Hence, it is proposed to float tenders on Hybrid Annuity Model by utilising the SBM provision as Viability Gap Funding. Addressed to Govt. for according approval to call tenders with open technology on RFP mode pending administrative sanction for taking up construction of 344 Nos of STPs in 103 ULBs for capacity of 789.20 MLD under SBM 2.0. Further, the Govt. vide Memo No. 6361/Engg.2/2023 of MA&UD (Engg.) Dept., Dt. 02-02-2024 has directed to submit revised proposals revising the capacities duly utilizing the GoI share under SBM 2.0 in Phase I as upfront payment, keeping in view the financial implication. Accordingly, this office vide letter Dt:07-02-2024 has submitted revised proposals and requested Govt. to accord Administrative sanction for an amount Rs. 3769.34 crores (including O&M and Annuity Payments and GST on Interest Component of Annuity) **Govt. vide G.O.Rt.No.388, Dt:21-08-2024 accorded administrative sanction for an amount of Rs.3769.34 Crores (including O&M and Annuity payments and GST on Interest component of Annuity payments) for "sewerage projects in 101 ULBS in the state of Telangana under SBM 2.0").Tender invited 3 times and no bidders participated in three calls . Further, permission also awaited from GoI for upfront payment duly utilizing central share.** **Further, this office vide letter dt:25-07-2025 requested the Govt. to accord Revised Administrative sanction for amount of Rs. 3705.75 crores (including Land Acquisition, O&M for 5 Years, Annuity Payments, GST etc) with permission to invite tenders in 3 packages instead of single package under LS contract system with Revised Hybrid Annuity Model and with latest SoR 2025-26 rates due to non - participation of the bidders in the tenders invited for 3 calls.Expected to be completed by December -2027 after approval from Govt.**
66	Narsapur		1			2.10			2.1	
67	Ramayampet		1	2.00					2.0	
68	Thoopran		1	3.00					3.0	
69	Andol-Jogipet	Sangareddy	1				3.00		3.0	
70	Narayankhed		1	2.50					2.5	
71	Sadasivapet		2		3.70	1.40			5.1	
72	Sangareddy		1		10.40				10.4	
73	Zaheerabad		1	10.10					10.1	
74	Cherial	Siddipet	1		2.30				2.3	
75	Dubbaka		1					3.50	3.5	
76	Husnabad		1		2.70				2.7	
77	Chandur	Nalgonda	1	1.70					1.7	
78	Chityal		1		1.90				1.9	
79	Devarakonda		1		2.00				2.0	
80	Haliya		1	2.00					2.0	
81	Nakrekal		1	3.50					3.5	
82	Nandikonda		1	2.00					2.0	
83	Huzurnagar	Suryapet	1				4.50		4.5	
84	Kodada		1		8.50				8.5	
85	Neredcherla		1		1.80				1.8	
86	Tirumalagiri		1		2.10				2.1	
87	Alair	Yadadri Bhuvanagiri	1	2.30					2.3	
88	Bhongir		2	2.20		4.60			6.8	
89	Choutuppal		1	4.20					4.2	
90	Mothkur		1	2.30					2.3	
91	Pochampally		2		1.20			1.00	2.2	
92	Yadagirigutta		1	2.50					2.5	
93	Amangal	Rangareddy	1	3.00					3.0	
94	Ibrahimpatnam		1	4.50					4.5	
95	Kothur		1		2.00				2.0	
96	Shadnagar		2	2.70	4.30				7.0	

Sl No	Name of the ULB	Name of the District	No of STPs	STP 1	STP 2	STP 3	STP 4	STP 5	Total Capacity of STPs in MLD	Remarks
97	Shankarpally		1	3.60					3.6	
98	Kodangal	Vikarabad	1	2.40					2.4	
99	Parigi		1		2.10				2.1	
100	Tandur		1		8.00				8.0	
101	Medchal	Medchal Mlakajgiri	1		9.50				9.5	
Total			**115**						**455.0**	
Total No.of STPs proposed under SBM 2.0: 115 Nos (in 101 ULBs with teritary treatment proposed for STP in Siricilla)										
Total capacity proposed under SBM 2.0: 455.00 MLD										

Details of STPs proposed in GWMC

Sl No	Name of the ULB	Name of the District	No of STPs	Total Capacity of STPs in MLD	Remarks
1	**GWMC**	Hanamkonda	**21**	**204.0**	Govt. vide G.O. Rt. No. 573, MA&UD (ENGG.2) Dept., Dt: 17-11-2024 accorded Administrative sanction "In-Principal approval" for Rs 4170.00 Crore for taking up UGD scheme in GWMC. Further, this office vide Lr.No. 4170/T1/GWMC/ UGD/2025-26, Dt:01-09-2025 requested Govt. to accord Administrative sanction for the work "Comprehensive Underground Drainage Scheme in GWMC, Warangal – Phase-I" for an amount of Rs. 5257.20 Crore from Head of Account "Assistance to Warangal Municipal Corporation 2217-80-191-25-SH(90)-310-312" duly allocating necessary funds to take up UGD scheme in GWMC on priority basis with concurrence of the finance department based on the proposal of the Commissioner, GWMC. In which, 21 No's of STPs of combined capacity 204.00 MLD was proposed. Govt. Permission awaited. Expected to be completed within 2 years after approval from Govt.

ANNEXURE XV

Hyderabad Metropolitan Water Supply and Sewerage Board

Details of under construction STPs in GHMC area

Sl.No	Location	Capacity (MLD)	Technology	Physical Progress	Tentative date of Completion/ Commissioning
1	Rainbow Vista	43.5	SBR	90% work completed	Nov-25
2	Attapur-2	40	SBR	80% work completed	Dec-25

ANNEXURE XVI

Hyderabad Metropolitan Water Supply and Sewerage Board

Details of each existing STP with utilization capacity under HMWSSB, GHMC,HMDA

Sl.No.	Location	Existing STP Capacity	Technology	Maintained by	Capacity Utilized	Operational Status of STP	Compliance Status of STP by PCB, EPTRI, QCEMS
1	2	3	4	5	6	7	8
1	Amberpet	339	UASB	HMWSSB	303.6	Working	Complied
2	Nagole	172	UASB	HMWSSB	162.9	Working	Complied
3	Nallacheruvu	30	UASB	HMWSSB	27.52	Working	Complied
4	Attapur 1	51	SBR	HMWSSB	9.08	Working	Complied
5	Attapur 2	23	SBR	HMWSSB	7.2	Working	Complied
6	Pedda Cheruvu, Nacharam	10	Extended Aeration	HMWSSB	8.96	Working	Complied
7	Miralam Tank 1	10	Extended Aeration	HMWSSB	5.61	Working	Complied
8	Miralam Tank 2	5	Extended Aeration	HMWSSB	4.77	Working	Complied
9	Durgam Cheruvu, SLP	5	Extended Aeration	HMWSSB	3.74	Working	Complied
10	Patel Cheruvu, Nacharam	2.5	Extended Aeration	HMWSSB	2.44	Working	Complied
11	Saroor Nagar	2.5	Extended Aeration	HMWSSB	2.44	Working	Complied
12	Langer House	1.2	Extended Aeration	HMWSSB	1.21	Working	Complied
13	Noor Mohammad Kunta	4	Extended Aeration	HMWSSB	2.6	Working	Complied
14	Safilguda, Malkajgiri	0.6	Extended Aeration	HMWSSB	0.26	Working	Complied
15	Khajakunta, Metro, KKP	12	MBBR	HMWSSB	10	Working	Complied
16	Khajaguda, Gachibowli	7	MBBR	HMWSSB	2.9	Working	Complied
17	Nanakramguda,Gachibowli	4.5	MBBR	HMWSSB	3.05	Working	Complied
18	JVR Park, NagarjunaCircle	0.5	Extended Aeration	HMWSSB	0.5	Working	Complied
19	Lingam Kunta, BHEL	30	MBBR	HMWSSB	16.24	Working	Complied
20	Gopanapally, SLP	4.5	MBBR	HMWSSB	3.31	Working	Complied
21	Durgam Cheruvu	7	SBR	HMWSSB	7	Working	Complied
22	Kokapet	15	SBR	HMWSSB	15	Working	Complied
23	Peddacheruvu	17.5	SBR	HMWSSB	17.5	Working	Complied
24	Nallacheruvu-I	86.5	SBR	HMWSSB	60	Working	Complied
25	Safilguda	5.5	SBR	HMWSSB	5.5	Working	Complied
26	Miralam Site-1	41.5	SBR	HMWSSB	20	Working	Complied
27	Miyapur Patelcheruvu	7	SBR	HMWSSB	3	Working	Complied
28	Nagole	320	SBR	HMWSSB	164.1	Working	Complied
29	Khajakunta	20	SBR	HMWSSB	6	Working	Complied
30	Fathenagar-I	133	SBR	HMWSSB	100	Working	Complied
31	Vennelagadda	10	SBR	HMWSSB	8.8	Working	Complied
32	Palapitta Park	7	SBR	HMWSSB	1.37	Working	Complied
33	Shivalaynagar	14	SBR	HMWSSB	8	Working	Complied
34	Mullakathuwa Cheruvu	25	SBR	HMWSSB	18	Working	Complied
35	Nallagandla	7	SBR	HMWSSB	1	Working	Complied
36	Attapur-1	64	SBR	HMWSSB	10	Trial run	Under compliance to PCB
37	Amberpet	212.5	SBR	HMWSSB	100	Trial run	Under compliance to PCB
38	Ramacheruvu	30	SBR	HMWSSB	-	Trial run	Under compliance to PCB
39	Necklace Road	20	EA SBR ultra filtration Membrane	HMDA	20	Working	-
40	Pattigadda	30	EA BNR	HMDA	30	Working	
41	Rangadhamini Lake, KKP	5	Extended Aeration	HMDA	5	Working	-
42	Krishnakanth Park,	0.5	Extended Aeration	GHMC	-		-
43	Amber Cheruvu, Pragatinagar	2.5	Extended Aeration	GHMC	-		-
		1794.8			1178.6		

Abstract

Sl. No.	Sewage Generation & Treatment	MLD
1	Sewage Generation in GHMC & upto ORR (as on the date of NGT order 29.09.2022)	1950.00 MLD
2	Existing STPs Capacity (25 Nos)	772.30 MLD
3	Newly Constructed & commissioned STPs (18 Nos)	1022.50 MLD
	Total Installed STPs capacity (2) & (3)	**1794.8**
4	Present Utilization Capacity	1178.6
5	New STPs under construction (nearing completion)	83.50 MLD
6	Utilization Capacity after completion of under progress STPs	90%
7	Gap in Treatment Capacity	72 MLD Being taken up under AMRUT-2

ANNEXURE XVII

TELANGANA POLLUTION CONTROL BOARD
ZONAL OFFICE: HYDERABAD
H.No.6-3-1219, TS No.1 Part, Block - C, Ward No.91, Near Country Club,
Uma Nagar, Begumpet, Hyderabad. Phone: 040-23402495
Email: jcee-zhyd-tspcb@telangana.gov.in

Order No:1435-RR-I/TGPCB/ZOH/CFO/2025 - 1242 **Date: 11.10.2025**

Sub: TGPCB – ZOH – **M/s. HMWS & SB 86.5 MLD STP at Nallacheruvu, Uppal, Medchal-Malkajgiri District -** Industry's request for extension of CFO Renewal Period - CFO Amendment - Issued – Reg.

Ref:
1. CFO Order No. 1435-RR-I/TGPCB/ZOH/CFO/2024 -969 dt. 26.09.2024 valid upto 31.08.2029.
2. Hon'ble NGT order dated: April 30, 2019 in O.A. No.1069/2018.
3. CFO Committee Meeting held on 10.10.2025 at TGPCB, Zonal Office, Hyderabad.

* * *

In the reference 1st cited, the Board has issued CFO & HWA Order to M/s. HMWS & SB 86.5 MLD STP at Nallacheruvu, Uppal, Medchal-Malkajgiri District vide order dated 26.09.2024 with a validity period up to 31.08.2029 to operate STP plant of capacity – 86.5 MLD

S.No.	Name of the Products and By-products / Activity	Total Capacity
1	Sewage Treatment Plant (STP)	86.5 MLD

Vide reference 3rd cited, the issue was placed in the CFO Committee meeting held on 10.10.2025 and the committee noted that the standards stipulated in the CFO conditions of the Sewerage Treatment Plants issued vide reference 1st cited needs to be amended inline with directions of the Hon'ble NGT order dt.30.04.2019 in O.A. No.1069/2018 and recommended to issue amendment to the existing CFO & HWA order of M/s. HMWS & SB 86.5 MLD STP at Nallacheruvu, Uppal, Medchal-Malkajgiri District by amending the limiting standards as per the NGT Order dated: 30.04.2019 in O.A. No.1069/2018 . Hence, as per the recommendations of the Committee, the amendment is issued to the consent as below:

1. The HMWS& SB shall treat the sewage to the following standards:

S.No.	Parameters	Standards
1	pH	5.5 to 9.0
2	Temperature	Should not exceed 50C above the receiving water temperature
3	Suspended solids	100 mg/l
4	Oil & grease	10 Mg/l
5	Chemical Oxygen Demand (COD)	250 mg/l
6	Biological Oxygen Demand (BOD)	≤10 mg/l
7	Ammonical Nitrogen	50 mg/l
8	Arsenic (as As)	0.2 mg/l
9	Mercury (as Hg)	0.01 mg/l
10	Lead (as Pb)	0.1 mg/l
11	Cadmium (as Cd	2.0 mg/l
12	Hexavalent chromium (as Cr+6)	0.1 mg/l
13	Total chromium	2.0 mg/l
14	Zinc (as Zn)	5.0 mg/l
15	Copper (as Cu)	3.0 mg/l
16	Sulphide (as S)	2.0 mg/l
17	Dissolved Phosphates	5.0 mg/l
18	Total residual chlorine	1.0 mg/l

19	Total Nitrogen (as N)	100 mg/l
20	Free ammonia (as NH3)	5.0 mg/l
21	Bio Assey test	90% survival of fish after 96 hours in 100% effluent

Shall be read as

1. The HMWS& SB shall treat the sewage to the following standards as per the Hon'ble NGT Order dated: 30.04.2019 in O.A. No.1069/2018:

S. No.	Parameters	Standards
1	pH	5.5 to 9.0
2	Temperature	Should not exceed 50C above the receiving water temperature
3	Total Suspended solids	20 mg/l
4	Oil & grease	10 Mg/l
5	Chemical Oxygen Demand (COD)	50 mg/l
6	Biological Oxygen Demand (BOD)	10 mg/l
7	Ammonical Nitrogen	50 mg/l
8	Arsenic (as As)	0.2 mg/l
9	Mercury (as Hg)	0.01 mg/l
10	Lead (as Pb)	0.1 mg/l
11	Cadmium (as Cd	2.0 mg/l
12	Hexavalent chromium (as Cr+6)	0.1 mg/l
13	Total chromium	2.0 mg/l
14	Zinc (as Zn)	5.0 mg/l
15	Copper (as Cu)	3.0 mg/l
16	Sulphide (as S)	2.0 mg/l
17	Dissolved Phosphates	5.0 mg/l
18	Total residual chlorine	1.0 mg/l
19	Total Nitrogen (as N)	10 mg/l
20	Free ammonia (as NH3)	5.0 mg/l
21	Bio Assey test	90% survival of fish after 96 hours in 100% effluent
22	Phosphorus-Total (For Discharge in to ponds, Lakes)	1.0 mg/l
23	Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN / 100 ml	Desirable - 100 permissible - 230

All other conditions mentioned in Schedule A, B & C of the CFO & HWA order issued and the validity issued vide reference 1st cited shall remain the same.

11/10/21

JOINT CHIEF ENVIRONMENTAL ENGINEER (FAC)

To
M/s. HMWS & SB 41.50 MLD,
Miralam–I Sewage Treatment Plant,
Near 10 MLD Miralam Tank STP,
Dannamajopidi, Hyderabad.

Copy to the Environmental Engineer, Regional Office, Rangareddy - I for information and necessary action.

TELANGANA POLLUTION CONTROL BOARD
ZONAL OFFICE: HYDERABAD
H.No.6-3-1219, TS No.1 Part, Block - C, Ward No.91, Near Country Club,
Uma Nagar, Begumpet, Hyderabad. Phone: 040-23402495
Email: jcee-zhyd-tspcb@telangana.gov.in

Order No: 1825–RR-II/TGPCB/ZOH/CFO/2025- 1235 **Date: 11.10.2025**

Sub: TGPCB – ZOH – **M/s. HMWSSB, Project Division – II, 133 MLD capacity of STP at Fatehnagar, Balanagar (M), Medchal - Malkajgiri District -** Industry's request for extension of CFO Renewal Period - CFO Amendment - Issued – Reg.

Ref:
1. CFO Order No. 1825–RR-II/TGPCB/ZOH/CFO/2025 dt.05.03.2025 valid upto 31.01.2030.
2. Hon'ble NGT order dated: April 30, 2019 in O.A. No.1069/2018.
3. CFO Committee Meeting held on 10.10.2025 at TGPCB, Zonal Office, Hyderabad.

* * *

In the reference 1st cited, the Board has issued CFO & HWA Order to M/s. HMWSSB, Project Division – II, 133 MLD capacity of STP at Fatehnagar, Balanagar (M), Medchal - Malkajgiri District vide order dated dt.05.03.2025 with a validity period up to 31.01.2030 to operate STP plant of capacity – 133 MLD:

S.No.	Name of the Products and By-products / Activity	Total Capacity
1	Sewage Treatment Plant (STP)	133 MLD

Vide reference 3rd cited, the issue was placed in the CFO Committee meeting held on 10.10.2025 and the committee noted that the standards stipulated in the CFO conditions of the Sewerage Treatment Plants issued vide reference 1st cited needs to be amended inline with directions of the Hon'ble NGT order dt.30.04.2019 in O.A. No.1069/2018 and recommended to issue amendment to the existing CFO & HWA order of M/s. HMWSSB, Project Division – II, 133 MLD capacity of STP at Fatehnagar, Balanagar (M), Medchal - Malkajgiri District by amending the limiting standards as per the NGT Order dated: 30.04.2019 in O.A. No.1069/2018 . Hence, as per the recommendations of the Committee, the amendment is issued to the consent as below:

1. The HMWS& SB shall treat the sewage to the following standards:

S.No.	Parameters	Standards
1	pH	5.5 to 9.0
2	Temperature	Should not exceed 50C above the receiving water temperature
3	Suspended solids	100 mg/l
4	Oil & grease	10 Mg/l
5	Chemical Oxygen Demand (COD)	250 mg/l
6	Biological Oxygen Demand (BOD)	≤10 mg/l
7	Ammonical Nitrogen	50 mg/l
8	Arsenic (as As)	0.2 mg/l
9	Mercury (as Hg)	0.01 mg/l
10	Lead (as Pb)	0.1 mg/l
11	Cadmium (as Cd	2.0 mg/l
12	Hexavalent chromium (as Cr+6)	0.1 mg/l
13	Total chromium	2.0 mg/l
14	Zinc (as Zn)	5.0 mg/l
15	Copper (as Cu)	3.0 mg/l

16	Sulphide (as S)	2.0 mg/l
17	Dissolved Phosphates	5.0 mg/l
18	Total residual chlorine	1.0 mg/l
19	Total Nitrogen (as N)	100 mg/l
20	Free ammonia (as NH3)	5.0 mg/l
21	Bio Assey test	90% survival of fish after 96 hours in 100% effluent

Shall be read as

1. The HMWS& SB shall treat the sewage to the following standards as per the Hon'ble NGT Order dated: 30.04.2019 in O.A. No.1069/2018:

S. No.	Parameters	Standards
1	pH	5.5 to 9.0
2	Temperature	Should not exceed 50C above the receiving water temperature
3	Total Suspended solids	20 mg/l
4	Oil & grease	10 Mg/l
5	Chemical Oxygen Demand (COD)	50 mg/l
6	Biological Oxygen Demand (BOD)	10 mg/l
7	Ammonical Nitrogen	50 mg/l
8	Arsenic (as As)	0.2 mg/l
9	Mercury (as Hg)	0.01 mg/l
10	Lead (as Pb)	0.1 mg/l
11	Cadmium (as Cd	2.0 mg/l
12	Hexavalent chromium (as Cr+6)	0.1 mg/l
13	Total chromium	2.0 mg/l
14	Zinc (as Zn)	5.0 mg/l
15	Copper (as Cu)	3.0 mg/l
16	Sulphide (as S)	2.0 mg/l
17	Dissolved Phosphates	5.0 mg/l
18	Total residual chlorine	1.0 mg/l
19	Total Nitrogen (as N)	10 mg/l
20	Free ammonia (as NH3)	5.0 mg/l
21	Bio Assey test	90% survival of fish after 96 hours in 100% effluent
22	Phosphorus-Total (For Discharge in to ponds, Lakes)	1.0 mg/l
23	Fecal Coliform (FC) (Most Probable Number per 100 mililiter, MPN / 100 ml	Desirable - 100 permissible - 230

All other conditions mentioned in Schedule A, B & C of the CFO & HWA order issued and the validity issued vide reference 1st cited shall remain the same.

JOINT CHIEF ENVIRONMENTAL ENGINEER (FAC)

To
M/s. HMWSSB, Project Division – II,
133 MLD capacity of STP at Fatehnagar,
Balanagar (M), Medchal - Malkajgiri District.

Copy to the Environmental Engineer, Regional Office, Medchal for information and necessary action.

TELANGANA POLLUTION CONTROL BOARD
ZONAL OFFICE: HYDERABAD
H.No.6-3-1219, TS No.1 Part, Block - C, Ward No.91, Near Country Club,
Uma Nagar, Begumpet, Hyderabad. Phone: 040-23402495
Email: jcee-zhyd-tspcb@telangana.gov.in

Order No: 1438-RR-I/TGPCB/ZOH/CFO/2025 - 1240 **Date: 11.10.2025**

Sub: TGPCB – ZOH – **M/s. HMWS & SB 320 MLD STP at Nagole, Uppal, Medchal-Malkajgiri District** - Industry's request for extension of CFO Renewal Period - CFO Amendment - Issued – Reg.

Ref:
1. CFO Order No. 1438-RR-I/TGPCB/ZOH/CFO/2025- 1734 dt. 03.02.2025 valid upto 30.11.2029.
2. Hon'ble NGT order dated: April 30, 2019 in O.A. No.1069/2018.
3. CFO Committee Meeting held on 10.10.2025 at TGPCB, Zonal Office, Hyderabad.

* * *

In the reference 1st cited, the Board has issued CFO & HWA Order to 320 MLD STP of M/s. HMWWS&SB at Nagole, Uppal, Medchal-Malkajgiri District vide order dated 03.02.2025 with a validity period up to 30.11.2029 to operate STP plant of capacity – 320 MLD

S.No.	Name of the Products and By-products / Activity	Total Capacity
1	Sewage Treatment Plant (STP)	320 MLD

Vide reference 3rd cited, the issue was placed in the CFO Committee meeting held on 10.10.2025 and the committee noted that the standards stipulated in the CFO conditions of the Sewerage Treatment Plants issued vide reference 1st cited needs to be amended inline with directions of the Hon'ble NGT order dt.30.04.2019 in O.A. No.1069/2018 and recommended to issue amendment to the existing CFO & HWA order of M/s. HMWS & SB 320 MLD STP at Nagole, Uppal, Medchal-Malkajgiri District by amending the limiting standards as per the NGT Order dated: 30.04.2019 in O.A. No.1069/2018 . Hence, as per the recommendations of the Committee, the amendment is issued to the consent as below:

1. The HMWS& SB shall treat the sewage to the following standards:

S.No.	Parameters	Standards
1	pH	5.5 to 9.0
2	Temperature	Should not exceed 50C above the receiving water temperature
3	Suspended solids	100 mg/l
4	Oil & grease	10 Mg/l
5	Chemical Oxygen Demand (COD)	250 mg/l
6	Biological Oxygen Demand (BOD)	≤10 mg/l
7	Ammonical Nitrogen	50 mg/l
8	Arsenic (as As)	0.2 mg/l
9	Mercury (as Hg)	0.01 mg/l
10	Lead (as Pb)	0.1 mg/l
11	Cadmium (as Cd	2.0 mg/l
12	Hexavalent chromium (as Cr+6)	0.1 mg/l
13	Total chromium	2.0 mg/l
14	Zinc (as Zn)	5.0 mg/l
15	Copper (as Cu)	3.0 mg/l
16	Sulphide (as S)	2.0 mg/l
17	Dissolved Phosphates	5.0 mg/l
18	Total residual chlorine	1.0 mg/l

19	Total Nitrogen (as N)	100 mg/l
20	Free ammonia (as NH3)	5.0 mg/l
21	Bio Assey test	90% survival of fish after 96 hours in 100% effluent

Shall be read as

1. The HMWS& SB shall treat the sewage to the following standards as per the Hon'ble NGT Order dated: 30.04.2019 in O.A. No.1069/2018:

S. No.	Parameters	Standards
1	pH	5.5 to 9.0
2	Temperature	Should not exceed 50C above the receiving water temperature
3	Total Suspended solids	20 mg/l
4	Oil & grease	10 Mg/l
5	Chemical Oxygen Demand (COD)	50 mg/l
6	Biological Oxygen Demand (BOD)	10 mg/l
7	Ammonical Nitrogen	50 mg/l
8	Arsenic (as As)	0.2 mg/l
9	Mercury (as Hg)	0.01 mg/l
10	Lead (as Pb)	0.1 mg/l
11	Cadmium (as Cd	2.0 mg/l
12	Hexavalent chromium (as Cr+6)	0.1 mg/l
13	Total chromium	2.0 mg/l
14	Zinc (as Zn)	5.0 mg/l
15	Copper (as Cu)	3.0 mg/l
16	Sulphide (as S)	2.0 mg/l
17	Dissolved Phosphates	5.0 mg/l
18	Total residual chlorine	1.0 mg/l
19	Total Nitrogen (as N)	10 mg/l
20	Free ammonia (as NH3)	5.0 mg/l
21	Bio Assey test	90% survival of fish after 96 hours in 100% effluent
22	Phosphorus-Total (For Discharge in to ponds, Lakes)	1.0 mg/l
23	Fecal Coliform (FC) (Most Probable Number per 100 mililiter, MPN / 100 ml	Desirable - 100 permissible - 230

All other conditions mentioned in Schedule A, B & C of the CFO & HWA order issued and the validity issued vide reference 1st cited shall remain the same.

11/10/25

JOINT CHIEF ENVIRONMENTAL ENGINEER (FAC)

To

M/s. HMWS & SB 320 MLD STP at Nagole,
Uppal, Medchal-Malkajgiri District

Copy to the Environmental Engineer, Regional Office, Rangareddy - I for information and necessary action.

ANNEXURE XVIII

Hyderabad Metropolitan Water Supply and Sewerage Board

Details of STPs with utilization capacities & final disposal points

Sl.No	Location of STP With coordinates (Latitude and Longitude)	Status (Operational/ Non-Operational/ Under Construction)	Technology	Instailed Capacity of STP (in MLD)	Location of disposal of treated sewage
1	Amberpet	Operational	UASB	339	Disposal to Musi River
2	Nagole	Operational	UASB	172	Disposal to Musi River
3	Nallacheruvu	Operational	UASB	30	Disposal to Musi River
4	Attapur 1	Operational	Extended Aeration	51	Disposal to Musi River
5	Attapur 2	Operational	Extended Aeration	23	Disposal to Musi River
6	Pedda Cheruvu,, Nacharam	Operational	EA SBR ultra filtration Membrane	10	Disposal to Pedda cheruvu tank
7	Miralam Tank 1	Operational	EA BNR	10	Disposal to Miralam tank
8	Miralam Tank 2	Operational	Extended Aeration	5	Disposal to Miralam tank
9	Durgam Cheruvu, SLP	Operational	Extended Aeration	5	Disposal to Durgam cheruvu and water added to shilpaparam and KBRN park for gardening
10	Patel Cheruvu, Nacharam	Operational	SBR	2.5	Disposal to Patel cheruvu, nacharam
11	Saroor Nagar	Operational	Extended Aeration	2.5	Disposal to Saroornagar Cheruvu
12	Langer House	Operational	Extended Aeration	1.2	Disposal to Langer House Lake
13	Noor Mohammad Kunta	Operational	Extended Aeration	4	Disposal To Noor Mohd Kunta lake
14	Safilguda, Malkajgiri	Operational	SBR	0.6	Disposal to Safilguda lake
15	Khajakunta, Metro, KKP	Operational	SBR	12	Disposal to Khazakunta lake
16	Khajaguda, Gachibowli	Operational	MBBR	7	Disposal to Khajaguda lake
17	Nanakramguda,Gachibowli	Operational	MBBR	4.5	Disposal to Bhagiradha Cheruvu (Manikonda cheruvu)
18	JVR Park, NagarjunaCircle	Operational	MBR	0.5	Gardening and discharging Into small lake inside the Park.
19	Lingam Kunta, BHEL	Operational	Extended Aeration	30	Disposal to Lingamkunta lake
20	Gopanapally, SLP	Operational	MBBR	4.5	Disposal to Gopanpally Cheruvu.
21	Durgam Cheruvu	Operational	Extended Aeration	7	Disposal to Durgam cheruvu
22	Kokapet	Operational	Extended Aeration	15	Disposal to kokapet
23	Peddacheruvu	Operational	Extended Aeration	17.5	Disposal to peddacheruvu
24	Nallacheruvu-I	Operational	Extended Aeration	86.5	Disposal to River Musi
25	Safilguda	Operational	Extended Aeration	5.5	Disposal to Lake
26	Miralam Site-I	Operational	MBBR	41.5	Disposal to Miralam tank
27	Miyapur Patelcheruvu	Operational	SBR	7	Disposal to Lake
28	Nagole	Operational	SBR	320	Disposal to River Musi
29	Khajakunta	Operational	SBR	20	Disposal to Lake
30	Fathenagar-I	Operational	SBR	133	Disposal to Hussainsagar Lake
31	Vennelagadda	Operational	SBR	10	Disposal to Lake
32	Palapitta Park	Operational	SBR	7	Disposal to Lake
33	Shivalaynagar	Operational	SBR	14	Disposal to Lake
34	Mullakathuwa Cheruvu	Operational	SBR	25	Disposal to Lake
35	Nallagandla	Operational	SBR	7	Disposal to Lake
36	Attapur-1	Operational	SBR	64	Disposal to River Musi
37	Amberpet	Operational	SBR	212.5	Disposal to River Musi
38	Ramacheruvu	Operational	SBR	30	Disposal to Lake
39	Necklace Road	Operational	SBR	20	Disposal to Hussainsagar Lake
40	Pattigadda	Operational	SBR	30	Disposal to Hussainsagar Lake
41	Rangadhamini Lake, KKP	Operational	SBR	5	Disposal to Rangadhamuni Cheruvu
42	Krishnakanth Park,	Operational	SBR	0.5	
43	Amber Cheruvu, Pragatinagar	Operational & OCEMS is under process	SBR	2.5	Disposal to Pragathi Nagar Lake
		Total in (MLD)		**1794.8**	

ANNEXURE XIX A

3596

Municipal Administration & Urban Development Department - Hyderabad Metropolitan Water Supply and Sewerage Board - Construction of (17) STPs along River Musi and at Kukatpally Nala Catchment (Hussain Sagar Lake catchment) under Sewerage Improvement Project of Sewerage Master Plan of Hyderabad Urban Agglomeration - Administrative Sanction for an amount of Rs.512.87 Crores for two years i.e. Rs.256.175 Crores each year - Orders - Issued.

MUNICIPAL ADMINISTRATION & URBAN DEVELOPMENT (ENGG.) DEPARTMENT

G.O.Rt. No.374.

Dated: 11.09.2020

Read:

From the M.D., HMWS&SB, Hyderabad, Lr.No.HMWSSB/MD/STPs-Project/AS/2020-21/dated: 22.08.2020

* * *

ORDER:

In the reference read above the Managing Director, HMWSSB, Hyderabad has submitted a proposal for construction of 17 STPs with a total capacity of 376.5 MLD which will address the issue of pollution from catchment area of Hussain Sagar effectively on a permanent basis. The Total cost of this project including O&M is Rs.1280.87 Crores. The Detailed Project Report along with site locations are ready. It is proposed on HAM model, wherein 40% of the cost is to be borne by the State Government and the balance will be met by the concessionaire agency. The 40% of Government share i.e., Rs.512.35 crores is to be provided in two years i.e. Rs.256.175 Crores each in 1st and 2nd year respectively.

2. After careful examination of the matter Government hereby accords administrative approval for construction of 17 STPs in the catchment nalas of Hussain Sagar, under HAM mode of Contract, along with concurrence to meet the 40% of Government share coming to Rs. 512.35 Crores which is to be provided in two years i.e. Rs. 256.175 Crores each from Hyderabad Urban Agglomeration budget.

3. The Managing Director, Hyderabad Metropolitan Water Supply and Sewerage Board, Hyderabad shall take further action accordingly.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF TELANGANA)

ARVIND KUMAR
PRINCIPAL SECRETARY TO GOVERNMENT

To
The Managing Director, Hyderabad Metropolitan Water Supply and Sewerage Board, Hyderabad.

Copy to:
The Prl. Secretary to Hon'ble C.M.
OSD to Hon'ble M(MA&UD).
P.S. to Principal Finance Secretary, Finance Department.
P.S. to Prl. Secretary to Govt., MA&UD Dept.,
P.A. to Secretary to Government, MA&UD.
The Finance (DCM) Dept.
SF/SC.

//FORWARDED :: BY ORDER//

GOVERNMENT OF TELANGANA

ABSTRACT

MA&UD Dept., HMWSSB - Comprehensive Sewerage Master Plan for Hyderabad – Construction of (31) STPs in three Packages under Sewerage Improvement - Administration sanction for Package-I and Package -II (Musi River Catchment) and budget allocation – Orders –Issued.

MUNICIPAL ADMINISTRATION & URBAN DEVELOPMENT (ENGG.2) DEPARTMENT

G.O. Rt. No.669 **Dated:22.09.2021**

Managing Director Office
25 SEP 2021
CC No: 3300.

25 SEP 2021
19362

Read the following:-

1. G.O.Rt. No. 518, MA&UD(Engg) Dept., Dated 02.07.2018.
2. From the M.D., HMWSSB, Hyderabad Letter No. HMWSSB/MD/STPs-Projects/as/2020-21, Dated: 19.08.2020.
3. G.O.Rt.No. 374, MA&UD(Engg.2) Dept., Dated 11.09.2020.
4. From the MD., HMWSSB, Letter No. HMWSSB/MD/STPs-Projects/as/2020-21/34 and note Dated:04.02.2021.

DP:I.

ORDER:-

It was reported by the Managing Director, Hyderabad Metropolitan Water Supply & Sewerage Board, that the existing sewerage system is having the sewer network and sewage treatment plants. The present sewage generation in GHMC area is 1650 MLD.

2. It was reported that the present sewage treatment capacity is 772MLD through 25 STPs existing in GHMC area which accounts for 46.78% of treatment capacity.

3. It was reported that, in GHMC area, the gap of sewage treatment is 878 MLD which is mostly flowing through river Musi. Further it was reported that, the service area of HMWSSB was extended upto ORR by the Government. After detailed review of sewerage status, the Government has appointed M/s.Shah Technical Consultants, Mumbai for preparation of Comprehensive Sewerage Master Plan for Hyderabad Urban Agglomeration (HUA) vide reference 1st cited.

4. The Managing Director, Hyderabad Metropolitan Water Supply & Sewerage Board reported that, the consultant has conducted the detailed study of planning, survey, investigation, design, estimations and furnished the "Comprehensive Sewerage Master Plan (CSMP)" for HUA. As per the study of M/s.Shah Technical Consultants, Mumbai, it was reported that the total generation of sewage for the year 2021 is 1950 Mld i.e. 1650 MLD in GHMC and 300 MLD in ORR area. The estimated sewage flows for the year 2036 is 2814Mld and for the year 2051 is 3715 Mld. The consultants have recommended for construction of 62 STPs for the estimated sewage flows of year 2036.

5. Further the consultants have prioritized 31 STPs for GHMC in 3 packages for immediate phase as under:-

Package-1: 8 STPs of 402.5MLD capacity at a cost of Rs.1230.21 Crores including O&M for 15 years for North of Musi.

Package-2: 6 STPs of 480.5MLD at a cost of Rs.1355.13 Crores including O&M for 15 years for South of Musi.

Package-3: 17 STPs of 376.5 MLD capacity at a cost of Rs.1280.87 Crores including O&M for 15 years for Kukatpally-H.S.Lake Catchment.

6. The consultants have reported that, by implementation of 3 Packages as above, the 100% sewage treatment will takes place in GHMC area. In the reference 2nd read above, the M.D., HMWSSB, has submitted the proposals for 31 STPs in 3 packages to the Government for administrative sanction to take up under HAM mode of contracts i.e. 60% investment by agency and 40% cost by the Government, with project implementation period of 2 years and O & M

Contd. P.2

Period of 15 years as above. In the reference 3rd read above, Government have accorded administrative approval for construction of 17 STPs in the catchment Nalas of Hussain Sagar, under HAM Mode of contract, to meet the 40% of Government share coming to Rs.512.35 Crores which is to be provided in two years i.e. Rs. 256.175 Crores per year from Hyderabad Urban Agglomeration Budget. In the reference 4th read above, the MD., HMWSSB has requested the Government for Administrative sanction for the Package-I and Package-II STPs of Musi River Catchment with budget allocation of all three packages to the HMWSSB for implementation under HAM mode of contract. It was also reported that, the Hon'ble NGT is constantly issuing directions for establishment of STPs for all urban cities including Hyderabad City. Further MD, HMWSSB reported that, as there is trend of positive responses to the investments by the private agencies to the STPs projects under HAM mode of contracts, it is proposed to consider the implementation of these 2 STP projects under HAM (60:40) mode.

7. The budgetary requirement towards 40% share of the Government to be provided in 2 years during 1st year & 2nd year for all three STP packages is submitted as below:-

STP Project Name & Package	Total Project Cost (Rs. inCr.)	Total Government shares towards 40% cost (Rs.in Cr.)	Government share during 1st year (2021-22) (Rs. In Cr.)	Government share during 1st year (2022-23) (rs. In Cr.)
Package-3 - Hussainsagar Lake Catchment area STPs Project (already accorded administrative sanction vide GO Rt.No.374, dt: 11.9.2020)	1280.87	512.35	256.175	256.175
Package-1 - North of Musi STPs Project	1230.21	492.084	246.042	246.042
Package-2 - South of Musi STPs Project	1355.13	542.052	271.026	271.026
Total	**3866.21**	**1546.486**	**773.243**	**773.243**

The Managing Director, Hyderabad Metropolitan Water Supply & Sewerage Board has requested the Government for Administrative Sanction to the two packages of Package-I and Package-II (Musi River Catchment) for implementation.

8. After careful examination of the entire matter, the Government hereby accord administrative sanction for the STPs of Package-I & Package-II under HAM mode of contract (60% investment by agency & 40% share through Government budget) for implementation of the projects in 2 years period:-

Package-1: Construction of 8 STPs of 402.5MLD capacity at a cost of Rs.1230.21 Crores including O&M for 15 years with budgetary support of Rs.246.042 Cr in 1st year & Rs.246.042 Cr for 2nd year.

Package-2: Construction of 6 STPs of 480.5 MLD capacity at a cost of Rs.1355.13 Crores including O&M for 15 years with budgetary support of Rs.271.026 Cr in 1st year & Rs.271.026 Cr for 2nd year.

9. The Hyderabad Metropolitan Water Supply & Sewerage Board shall ensure that on implementation of the STP projects of Package-I, II & III by construction of 31 STPs, the 100% sewage generated in GHMC area shall be processed, treated and disposed.

10. The Managing Director, Hyderabad Metropolitan Water Supply & Sewerage Board shall take further action accordingly.

11. This order issued with the concurrence of Finance (DCM) Department vide their U.O. No. 2248/227/A2/DCM/2020, Dated :07.01.2021.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF TELANGANA)

ARVIND KUMAR
SPECIAL CHIEF SECRETARY TO GOVERNMENT

To
The M.D., HMWS&SB, Hyderabad.

Contd.. P.3

Copy to:
The P.S. to Prl. Secretary to C.M.
OSD to Minister (MAUD)
The Finance (DCM) Department,
The G.A.(Cabinet) Department.
P.S. Spl. C.S. to Government, MA&UD Dept.
P.A. to Secretary to Government, MA&UD Dept.
Sf/Sc

//FORWARDED:: BY ORDER//

SECTION OFFICER

GOVERNMENT OF TELANGANA
ABSTRACT

Municipal Administration and Urban Development Department – HMWSSB- Sewerage Projects-Construction of 1STP in PPP mode and 38 STPs in HAM mode-Administrative sanction for an amount of Rs.3849.10 crores under AMRUT 2.0 (TRANCHE-III)-Accorded-Orders-Issued.

MUNICIPAL ADMINISTRATION & URBAN DEVELOPMENT (UBS) DEPARTMENT

G.O.Rt.No. 344 — Dated: 03 .08.2024

Read the following:

1. Government Memo No 681/UBS/2024, dated:20.1.2024.
2. State Level High Powered Steering Committee CR No:05, dated:5.2.2024.
3. Approval of Appex Committee of AMRUT 2.0, GOI, New Delhi, dated:14.3.2024.
4. From Managing Director, HMWSSB Lr No HMWSSB/MD/Musi Riverfront/AMRUT-2.0/STPs-ORR/AS/2023-24/150, dated:26.4.2024.
5. From Vice Chairman & Managing Director, Hyderabad Lr No 21/TUFIDC/AMRUT 2.0/TRANCHE-III/2024, dated:15.5.2024.

ORDER:

In the circumstances reported in the references 4th and 5th read above and after careful examination , Government hereby accord administrative sanction for an amount of Rs.3849.10 crores (Rupees Three Thousand Eight Hundred Forty Nine crores and Ten lakh only) for construction of STPs for ULBs between GHMC & ORR area under Hyderabad Agglomeration as part of Musi Riverfront-Musi Cleanup in 3 sewerage projects with the following funding pattern

(Rs. In crores)

Sector	No. of projects	Total project cost excluding O&M	Funding Breakup of Project cost			ULB Contribution O&M for 15 years	Total project cost including O&M
			Central share (30%)	State share (30%)	PPP (40%)		
Sewerage Project - 1 STP in PPP	1	51.37	15.41	15.41	20.55	12.74	64.11
Sub Total	1	51.37	15.41	15.41	20.55	12.74	64.11

Sector	No.of projects	Total project cost excluding O&M	Funding Breakup of Project cost			ULB Contribution O&M for 15 years	Total project cost including O&M
			Central share (25%)	State share (35%)	HAM (40%)		
Sewerage Project -16 STPs in HAM (Package.-I)	1	1251.90	312.98	438.18	500.75	626.65	1878.55
Sewerage Project -22 STPs in HAM (Package.-II)	1	1266.54	316.64	443.31	506.60	639.90	1906.44
Sub Total :	2	2518.44	629.61	881.48	1007.35	1266.55	3784.99
Total :	3	2569.81	645.02	896.89	1027.90	1279.29	3849.10

2. Government also accord permission to Managing Director, HMWSSB, Hyderabad to adopt the approved terms and conditions of ongoing STP projects taken up under the HAM mode in HMWSSB.

[P.T.O.]

3. The Managing Director, HMWSSB, Hyderabad / the Vice Chairman & Managing Director, TUFIDC, Hyderabad shall take necessary further action in the matter accordingly.

4. This order issues with the concurrence of Finance Department vide their U.O.No 2558353-A/153/PF/2024, dated: 22.6.2024.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF TELANGANA)

M.DANA KISHORE
PRINCIPAL SECRETARY TO GOVERNMENT

To
The Managing Director, HMWSSB, Hyderabad
The Vice Chairman & Managing Director, TUFIDC, Hyderabad
Copy to:
The Metropolitan Commissioner, HMDA, Hyderabad
The Commissioner, GHMC, Hyderabad
The Managing Director, MRDCL, Hyderabad
The Director of Municipal Administration, Hyderabad
The Engineer-in-Chief (PH), Hyderabad
The Director, Town & Country Planning, Hyderabad
The Member Secretary, Telangana Pollution Control Board, Hyderabad
The MA&UD (TP&E) Department
The Finance (DCM) Department
The OSD to Spl. Secretary to Hon'ble C.M.
The OSD to Prl.Secretary to Government
Sf/sc

//FORWARDED::BY ORDER//

ASSISTANT DIRECTOR

Sl. No.	G.O.No. and date	Capacity (MLD)	Amount sanctioned (Rs in Crs)	Package No.	Catchment area/ULB	No. of STPs
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	MD & CEO, GWSCCL Proc. No. GWSCCL/WGL/ CEO/24/2019, dt: 16-02-2019 • (5.00 MLD, 15.00 MLD & 100.00 MLD)	120	200.00	1	GWMC	3
2.	Govt. Memo No. 2899/Plg.VI/2018, Dt:02.11.2019 G.O.Rt.No.15, Planning (VI) Dept., Dt:19.01.2023 • (1.50 MLD, 3.50 MLD, 1.25 MLD & 0.50 MLD) • 99.00 + 56.00 Addl. Sanction	6.75	155.00	1	Gajwel	04
3.	G.O. Rt. No. 834 of MA&UD (UBS) Dept, Dt: 15-11-2021	11.00	155.13	1	Siddipet	01
4.	G.O.Rt.No.549, Dt: 06-08-2019 of MA&UD (UBS) Department Revised AS - Govt .Memo.No.9138/UBS/2023, Dt.01-07-2023 • (23.20 + 1.80 Addl. Sanction)	1.50	25.00	1	Devarakonda	1
5.	G. O. Rt. No. 558, MA&UD (Engg.-2) Dept., dt: 06-08-2021	19.10	61.25	1	Sircilla	1
6.	G. O. Rt. No. 4, MA&UD (Engg.) Dept., dt: 04-01-2022	20.00	100.00	1	Khammam	1
7.	G.O. Rt. No. 139 of MA&UD (UBS) Dept, Dt: 06-03-2018 Revised AS - G.O. Rt. No. 409 of MA&UD (UBS) Dept, Dt: 22-06-2022 • (10 MLD & 10 MLD) • (81.41 + 36.59 Addl. Sanction)	20	118.00	1	Suryapet	2

8.	GO Rt.No.637, MA & UD (UBS) Dept, dated:23-08-2023	1.50	30.00	1	Devarakonda	1
9.	G. O. Rt. No. 132, MA&UD (UBS) Dept., dt: 12-03-2024 • (5.00 MLD, 0.90 MLD, 0.40 MLD & 0.50 MLD)	6.80	128.00	1	Madhira	4
10.	G. O. Rt. No. 522, MA&UD (UBS) Dept., dt: 02-07-2018 Revised AS - G. O. Rt. No. 22, MA&UD (UBS) Dept., dt: 18-01-2025 • (2.30 MLD & 3.20 MLD) • (65.00 + 25.00 Addl. Sanction)	5.50	90.00	1	Nagarkurnool	2
	Total	**212.15**	**1062.38**	**10**		**20**

GOVERNMENT OF TELANGANA

ABSTRACT

Municipal Administration and Urban Development Department - AMRUT 2.0 – 98 Water Supply Projects and 9 Sewerage Projects in three (3) packages under AMRUT 2.0 – Administrative Sanction – Accorded – Orders – Issued.

MUNICIPAL ADMINISTRATION & URBAN DEVELOPMENT (UBS) DEPARTMENT

G.O. Rt. No.762 Dated: 29-09-2023

Read the following: -

1. G.O. Rt. No. 831, MA&UD (UBS) Department, Dated:12.11.2021.
2. G.O. Rt. No. 832, MA&UD (UBS) Department, Dated:12.11.2021.
3. State High Power Steering Committee CR No. 1, Dated:11.3.2022.
4. 1st APEX Committee, MoHUA, GOI, New Delhi, Dated:16.3.2022.
5. 4th APEX Committee, MoHUA, GOI, New Delhi, Dated:12.8.2022.
6. State Level Technical Committee CR No.1, Dated: 27.8.2022.
7. GoRt No 312, MA&UD (UBS) Department, Dated:20.5.2023
8. From ENC (PH), Hyderabad letter No 21/T1/AMRUT2.0./ General/2023-24, dated: 24.6.2023
9. From ENC (PH), Hyderabad letter No 21/T1/AMRUT2.0./ General/2023-24, dated: 20.7.2023

<<>><<>>

ORDER:-

In the circumstances reported by the Engineer-in-Chief (Public Health), Telangana Hyderabad in the reference 9th read above and in partial modification of the orders issued in G.O 7th read above and after careful examination, Government hereby accord administrative sanction for an amount of Rs. 5385.05 crores for the following 98 Water Supply Projects and 9 Sewerage Projects in three packages (3) under AMRUT 2.0. The ULB-wise funding pattern for 98 Water Supply Projects and 9 sewerage projects appended to this order.

Rs. in Crores

Sl. No.	Package No.	Details of the Package	Project Cost as per approved SWAP excluding O&M cost	Central Share	State share	XV FC Grant	ULB Share O&M Cost	Total Project Cost including O&M	Land Acquisition (LA) for STPs	Total Project Cost including O&M and LA
1	I	Water Supply Projects in 30 ULBs and Sewerage projects in 03 ULBs under AMRUT 2.0 under the jurisdiction of Adilabad, Karimnagar and Warangal PH Divisions	1541.630	652.084	726.456	163.090	190.450	1732.080	13.000	1745.080
2	II	Water Supply Projects in 25 ULBs and Sewerage projects in 04 ULBs under AMRUT 2.0 under the jurisdiction of Nalgonda and Khammam PH Divisions	1540.740	607.442	817.558	115.740	210.620	1751.360	7.000	1758.360
3	III	Water Supply Projects in 42 ULBs and Sewerage projects in 02 ULBs under AMRUT 2.0 under the jurisdiction of Sangareddy, Rangareddy, Nizamabad, and Mahabubnagar PH Divisions	1682.550	721.060	782.490	179.000	189.060	1871.610	10.000	1881.610
		Total	4764.920	1980.586	2326.504	457.830	590.130	5355.050	30.000	5385.050

2. The Government also issues the following:

(1) To accord permission to cancel the tenders invited for 98 Water supply projects in 09 packages.
(2) To accord permission for inviting the tenders of 98 water supply and 09 sewerage projects into 3 packages as per Para above.
(3) Approval for stipulating certain parameters and tender conditions in the bid document, slightly deviating from the standard procedure as per codal rules keeping in view the specific requirements of the water supply projects.
(4) To accord permission to incorporate requisite parameters and tender conditions for Sewerage projects on the similar lines of water supply projects as sought for by the Engineer-in-Chief (PH) vide reference 8th cited.
(5) To entrust the O&M of water supply system and sewerage system for 5 years (for existing infrastructure as well as new infrastructure to be added under AMRUT 2.0) on completion of capital work under AMRUT 2.0 at the same tender percentage of capital work.
(6) Approval for bringing PH division, Khammam under control of SE (PH), TUFIDC, Nalgonda to the extent of AMRUT 2.0 project works.

3. The Telangana Urban Finance and Infrastructure Development Corporation (TUFIDC), Hyderabad shall be the Nodal Agency for release of funds under AMRUT 2.0.

4. The Government direct the Director of Municipal Administration, Telangana, Hyderabad to release the share of 15th FC grants in proportion to GoI & GoTs share to TUFIDC.

5. The Government also direct the Director of Municipal Administration, Telangana, Hyderabad to issue instructions to the Commissioners of AMRUT 2.0 ULBs to conclude separate agreements with the same agencies (entrusted with the capital works) for O&M of water supply system and sewerage system for 5 years (as provided in the bid document of AMRUT 2.0 capital work).

6. This order issues with the concurrence of Finance Department vide their U.O. No. 1696307/239/A2/DCM/2022/Finance (DCM) Department, dated 28.11.2022.

7. The Engineer-in-Chief (PH), Telangana, Hyderabad / Vice Chairman & Managing Director, TUFIDC, Hyderabad / Director of Municipal Administration, Telangana, Hyderabad shall take action accordingly in the matter.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF TELANGANA)

ARVIND KUMAR
SPECIAL CHIEF SECRETARY TO GOVERNMENT

To
The Engineer-in-Chief (Public Health), Telangana, Hyderabad.
The Vice Chairman & Managing Director, TUFIDC, Hyderabad.
The Director of Municipal Administration, Telangana, Hyderabad.
Copy to:
The Commissioner, Greater Hyderabad Municipal Corporation, Hyderabad.
The Managing Director, HMWSSB, Hyderabad.
The Director of Town & Country Planning, Telangana, Hyderabad.
OSD to Hon'ble Minister (MA&UD).
OSD to Special Chief Secretary to Government, MA&UD Department.
SF/SC.

//FORWARDED :: BY ORDER//

ASSISTANT DIRECTOR

Annexure to G.O. Rt. No. 762, MA& UD (UBS) Department, dated 29-09-2023

Package Wise details of 98 Water Supply and 09 Sewerage Projects under AMRUT 2.0

PACKAGE-I

Sl. No.	PH Division / Old District	New District	ULB	Sector	Project Cost as per approved SWAP excluding O&M	Central Share	State Share	XV FC grant	ULB Share O&M Cost	Total Project Cost including O&M	Land Acquisition (LA) for STPs	Total Project Cost including O&M and LA
1	Adilabad	Nirmal	Khanapur	Water Supply	20.880	10.440	8.710	1.730	1.620	22.500		22.500
2			Nirmal	Water Supply	57.940	28.970	20.970	8.000	4.560	62.500		62.500
		Sub Total for Nirmal District			**78.820**	**39.410**	**29.680**	**9.730**	**6.180**	**85.000**	**0.000**	**85.000**
3		Mancherial	Luxettipet	Water Supply	18.540	9.270	7.450	1.820	1.460	20.000		20.000
4			Naspur	Water Supply	67.650	33.830	27.620	6.200	5.350	73.000		73.000
5			Chennur	Water Supply	28.760	14.380	12.390	1.990	2.240	31.000		31.000
6			Kyathanpally	Water Supply	38.490	19.250	16.310	2.930	3.010	41.500		41.500
7			Mancherial	Water Supply	44.950	22.480	15.150	7.320	3.550	48.500		48.500
8			Bellampalle	Water Supply	56.990	28.500	23.780	4.710	4.510	61.500		61.500
9			Mandamarri	Water Supply	28.270	14.135	9.725	4.410	2.230	30.500		30.500
		Sub Total for Mancherial District			**283.650**	**141.845**	**112.425**	**29.380**	**22.350**	**306.000**	**0.000**	**306.000**
10		Adilabad	Adilabad	Water Supply	88.490	29.497	52.423	6.570	7.010	95.500		95.500
11			Adilabad	Sewerage	177.620	59.200	111.860	6.560	37.840	215.460	10.000	225.460
		Sub Total for Adilabad District			**266.110**	**88.697**	**164.283**	**13.130**	**44.850**	**310.960**	**10.000**	**320.960**
		Total for Adilabad Division			**628.580**	**269.952**	**306.388**	**52.240**	**73.380**	**701.960**	**10.000**	**711.960**

Sl. No.	PH Division / Old District	New District	ULB	Sector	Project Cost as per approved SWAP excluding O&M	Central Share	State Share	XV FC grant	ULB Share O&M Cost	Total Project Cost including O&M	Land Acquisition (LA) for STPs	Total Project Cost including O&M and LA
12			Raikal	Water Supply	13.800	6.900	5.610	1.290	1.400	15.200		15.200
13			Dharmpuri	Water Supply	20.800	10.400	9.060	1.340	2.200	23.000		23.000
14		Jagtial	Jagtial	Water Supply	35.000	11.670	14.420	8.910	3.600	38.600		38.600
15			Kortulla	Water Supply	37.750	18.880	13.010	5.860	3.750	41.500		41.500
16			Metpalli	Water Supply	17.600	8.800	4.220	4.580	1.800	19.400		19.400
		Sub Total for Jagtial District			**124.950**	**56.650**	**46.320**	**21.980**	**12.750**	**137.700**	**0.000**	**137.700**
17			Choppandandi	Water Supply	33.000	16.500	15.110	1.390	3.300	36.300		36.300
18			Kothapally	Water Supply	23.750	11.875	10.945	0.930	2.400	26.150		26.150
19		Karimnagar	Jammikunta	Water Supply	30.000	15.000	11.280	3.720	3.000	33.000		33.000
20			Huzurabad	Water Supply	14.750	7.380	4.460	2.910	1.500	16.250		16.250
21	Karimnagar		Karimnagar	Water Supply	132.200	44.067	75.743	12.390	13.300	145.500		145.500
22			Karimnagar	Sewerage	72.570	24.190	35.990	12.390	7.000	79.570	0.000	79.570
		Sub Total for Karimnagar District			**306.270**	**119.012**	**153.528**	**33.730**	**30.500**	**336.770**	**0.000**	**336.770**
23			Sultanabad	Water Supply	16.700	8.350	6.680	1.670	1.700	18.400		18.400
24		Peddapalli	Manthani	Water Supply	11.000	5.500	3.970	1.530	1.100	12.100		12.100
25			Peddapalli	Water Supply	23.250	11.625	7.345	4.280	2.350	25.600		25.600
26			Ramagundam	Sewerage	206.660	68.880	118.430	19.350	46.160	252.820	3.000	255.820
		Sub Total for Peddapalli District			**257.610**	**94.355**	**136.425**	**26.830**	**51.310**	**308.920**	**3.000**	**311.920**
27		Rajanna sircilla	Sircilla	Water Supply	94.750	47.375	39.625	7.750	9.500	104.250		104.250
28			Vemulawada	Water Supply	12.100	6.050	2.140	3.910	1.250	13.350		13.350
		Sub Total for Rajanna sircilla District			**106.850**	**53.425**	**41.765**	**11.660**	**10.750**	**117.600**	**0.000**	**117.600**

		Total for Karimnagar Division			**795.680**	**323.442**	**378.038**	**94.200**	**105.310**	**900.990**	**3.000**	**903.990**
29	Warangal	Warangal	Wardhannapet	Water Supply	30.980	15.490	14.330	1.160	3.100	34.080		34.080
30			Narsampet	Water Supply	27.710	13.855	10.735	3.120	2.780	30.490		30.490
		Sub Total for Warangal District			**58.690**	**29.345**	**25.065**	**4.280**	**5.880**	**64.570**	**0.000**	**64.570**
31		Hanmakonda	Parkala	Water Supply	10.670	5.340	2.410	2.920	1.070	11.740		11.740
		Sub Total for Hanmakonda District			**10.670**	**5.340**	**2.410**	**2.920**	**1.070**	**11.740**	**0.000**	**11.740**
32		Jangaon	Jangaon	Water Supply	30.750	15.375	10.935	4.440	3.080	33.830		33.830
		Sub Total for Jangaon District			**30.750**	**15.375**	**10.935**	**4.440**	**3.080**	**33.830**	**0.000**	**33.830**
33		Jayshankar bhupalpally	Bhupalpalli	Water Supply	17.260	8.630	3.620	5.010	1.730	18.990		18.990
		Sub Total for Jayshankar bhupalpally District			**17.260**	**8.630**	**3.620**	**5.010**	**1.730**	**18.990**	**0.000**	**18.990**
		Total for Warangal Division			**117.370**	**58.690**	**42.030**	**16.650**	**11.760**	**129.130**	**0.000**	**129.130**
Grand Total for Package - I					**1541.630**	**652.084**	**726.456**	**163.090**	**190.450**	**1732.080**	**13.000**	**1745.080**

[PACKAGE-II Contd...]

PACKAGE-II

Sl. No.	PH Division / Old District	New District	ULB	Sector	Project Cost as per approved SWAP excluding O&M	Central Share	State Share	XV FC grant	ULB Share O&M Cost	Total Project Cost including O&M	Land Acquisition (LA) for STPs	Total Project Cost including O&M and LA
1	Nalgonda	Nalgonda	Chityal	Water Supply	11.600	5.800	4.540	1.260	0.900	12.500		12.500
2			Chandur	Water Supply	9.090	4.550	3.450	1.090	0.710	9.800		9.800
3			Haliya	Water Supply	14.100	7.050	5.590	1.460	1.100	15.200		15.200
4			Nakrekal	Water Supply	23.240	11.620	9.170	2.450	1.760	25.000		25.000
5			Nandikonda	Water Supply	40.780	20.390	19.050	1.340	3.220	44.000		44.000
6			Nalgonda	Water Supply	52.530	17.510	28.050	6.970	4.220	56.750		56.750
7			Miryalaguda	Water Supply	86.500	28.830	53.080	4.590	6.900	93.400		93.400
8			Nalgonda	Sewerage	195.270	65.080	123.230	6.960	20.920	216.190	0.000	216.190
9			Miryalaguda	Sewerage	152.070	50.680	96.810	4.580	21.000	173.070	0.000	173.070
		Sub Total for Nalgonda District			**585.180**	**211.510**	**342.970**	**30.700**	**60.730**	**645.910**	**0.000**	**645.910**
10		Suryapet	Nereddcherla	Water Supply	10.210	5.110	3.850	1.250	0.790	11.000		11.000
11			Tirumalagiri	Water Supply	27.810	13.905	12.345	1.560	2.190	30.000		30.000
12			Kodada	Water Supply	23.940	11.970	5.640	6.330	1.860	25.800		25.800
13			Suryapet	Water Supply	41.870	13.960	22.450	5.460	3.130	45.000		45.000
14			Suryapet	Sewerage	266.670	88.880	172.340	5.450	50.100	316.770	0.000	316.770
		Sub Total for Suryapet District			**370.500**	**133.825**	**216.625**	**20.050**	**58.070**	**428.570**	**0.000**	**428.570**
15		Yadadri bhuvanagiri	Alair	Water Supply	11.130	5.570	4.120	1.440	0.870	12.000		12.000
16			Choutuppal	Water Supply	19.470	9.735	7.105	2.630	1.530	21.000		21.000
17			Mothkur	Water Supply	11.120	5.560	4.220	1.340	0.880	12.000		12.000
18			Pochampally	Water Supply	16.240	8.120	6.690	1.430	1.260	17.500		17.500

19	Nalgonda	Yadadri bhuvanagiri	Yadagirigutta	Water Supply	35.800	17.900	16.580	1.320	2.840	38.640		38.640
20			Bhongir	Water Supply	20.250	10.125	5.085	5.040	1.550	21.800		21.800
		Sub Total for Yadadri bhuvanagiri District			**114.010**	**57.010**	**43.800**	**13.200**	**8.930**	**122.940**	**0.000**	**122.940**
		Total for Nalgonda Division			**1069.690**	**402.345**	**603.395**	**63.950**	**127.730**	**1197.420**	**0.000**	**1197.420**
21	Khammam	Khammam	Wyra	Water Supply	24.870	12.440	9.810	2.620	2.000	26.870		26.870
22			Madhira	Water Supply	15.830	7.920	5.220	2.690	1.260	17.090		17.090
23			Sathupalle	Water Supply	17.820	8.910	6.140	2.770	1.420	19.240		19.240
24			Khammam	Sewerage	182.660	60.887	97.653	24.120	59.860	242.520	7.000	249.520
		Sub Total for Khammam District			**241.180**	**90.157**	**118.823**	**32.200**	**64.540**	**305.720**	**7.000**	**312.720**
25		Mahabubabad	Dornakal	Water Supply	23.400	11.700	10.480	1.220	1.870	25.270		25.270
26			Maripeda	Water Supply	23.690	11.845	10.355	1.490	1.890	25.580		25.580
27			Thorrur	Water Supply	25.390	12.700	11.080	1.610	2.030	27.420		27.420
28			Mahabubebad	Water Supply	26.330	13.165	7.325	5.840	2.100	28.430		28.430
		Sub Total for Mahabubabad District			**98.810**	**49.410**	**39.240**	**10.160**	**7.890**	**106.700**	**0.000**	**106.700**
29		Bhadradri kothagudem	Kothagudem	Water Supply	115.280	57.640	50.910	6.730	9.200	124.480		124.480
30			Manuguru	Water Supply	15.780	7.890	5.190	2.700	1.260	17.040		17.040
		Sub Total for Bhadradri Kothagudem District			**131.060**	**65.530**	**56.100**	**9.430**	**10.460**	**141.520**	**0.000**	**141.520**
		Total for Khammam Division			**471.050**	**205.097**	**214.163**	**51.790**	**82.890**	**553.940**	**7.000**	**560.940**
Grand Total for Package - II					**1540.740**	**607.442**	**817.558**	**115.740**	**210.620**	**1751.360**	**7.000**	**1758.360**

[PACKAGE-III Contd...]

PACKAGE-III

Sl. No.	PH Division / Old District	New District	ULB	Sector	Project Cost as per approved SWAP excluding O&M	Central Share	State Share	XV FC grant	ULB Share O&M Cost	Total Project Cost including O&M	Land Acquisition (LA) for STPs	Total Project Cost including O&M and LA
1	Sangareddy	Medak	Narsapur	Water Supply	11.160	5.580	3.990	1.590	0.840	12.000		12.000
2			Thoopran	Water Supply	8.360	4.180	2.400	1.780	0.640	9.000		9.000
3			Ramayampet	Water Supply	6.530	3.270	1.750	1.510	0.470	7.000		7.000
4			Medak	Water Supply	27.820	13.910	9.610	4.300	2.180	30.000		30.000
		Sub Total for Medak District			**53.870**	**26.940**	**17.750**	**9.180**	**4.130**	**58.000**	**0.000**	**58.000**
5		Sangareddy	Narayankhed	Water Supply	12.520	6.260	4.720	1.540	0.980	13.500		13.500
6			Sangareddy	Water Supply	40.830	20.415	12.935	7.480	3.170	44.000		44.000
7			Zaheerabad	Water Supply	61.220	30.610	23.020	7.590	4.780	66.000		66.000
8			Sadasivpet	Water Supply	7.900	3.950	0.260	3.690	0.600	8.500		8.500
		Sub Total for Sangareddy District			**122.470**	**61.235**	**40.935**	**20.300**	**9.530**	**132.000**	**0.000**	**132.000**
9		Siddipet	Cherial	Water Supply	12.520	6.260	4.720	1.540	0.980	13.500		13.500
10			Gajwel	Water Supply	25.980	12.990	9.870	3.120	2.020	28.000		28.000
11			Siddipet	Water Supply	81.130	27.040	49.170	4.920	6.370	87.500		87.500
		Sub Total for Siddipet District			**119.630**	**46.290**	**63.760**	**9.580**	**9.370**	**129.000**	**0.000**	**129.000**
		Total for Sangareddy Division			**295.970**	**134.465**	**122.445**	**39.060**	**23.030**	**319.000**	**0.000**	**319.000**
12	Rangareddy	Vikarabad	Kodangal	Water Supply	4.190	2.100	0.890	1.200	0.310	4.500		4.500
13			Parigi	Water Supply	14.380	7.190	5.650	1.540	1.120	15.500		15.500
14			Vikarabad	Water Supply	11.180	5.590	0.230	5.360	0.820	12.000		12.000
15			Tandur	Water Supply	25.540	12.770	6.790	5.980	1.960	27.500		27.500
		Sub Total for Vikarabad District			**55.290**	**27.650**	**13.560**	**14.080**	**4.210**	**59.500**	**0.000**	**59.500**

16	Ranga Reddy	Ranga Reddy	Shankarpally	Water Supply	32.470	16.240	14.480	1.750	2.530	35.000		35.000
17			Amangal	Water Supply	29.740	14.870	12.730	2.140	2.260	32.000		32.000
18			Kothur	Water Supply	17.180	8.590	7.410	1.180	1.320	18.500		18.500
19			Shadnagar	Water Supply	25.530	12.770	8.170	4.590	1.970	27.500		27.500
		Sub Total for Ranga Reddy District			**104.920**	**52.470**	**42.790**	**9.660**	**8.080**	**113.000**	**0.000**	**113.000**
20		Medchal-malkajgiri	Medchal	Water Supply	35.230	17.615	14.135	3.480	2.770	38.000		38.000
		Sub Total for Medchal-Malkajgiri District			**35.230**	**17.615**	**14.135**	**3.480**	**2.770**	**38.000**	**0.000**	**38.000**
		Total for Ranga Reddy Division			**195.440**	**97.735**	**70.485**	**27.220**	**15.060**	**210.500**	**0.000**	**210.500**
21	Nizamabad	Kamareddy	Banswada	Water Supply	48.250	24.130	21.600	2.520	3.750	52.000		52.000
22			Yallareddy	Water Supply	32.520	16.260	14.600	1.660	2.480	35.000		35.000
23			Kamareddy	Water Supply	86.250	28.750	48.700	8.800	6.750	93.000		93.000
		Sub Total for Kamareddy District			**167.020**	**69.140**	**84.900**	**12.980**	**12.980**	**180.000**		**180.000**
24		Nizamabad	Bheemgal	Water Supply	23.300	11.650	10.350	1.300	1.700	25.000		25.000
25			Bodhan	Water Supply	46.400	23.200	16.230	6.970	3.600	50.000		50.000
26			Armoor	Water Supply	39.960	19.980	14.310	5.670	3.040	43.000		43.000
27			Nizamabad	Water Supply	201.180	67.060	119.150	14.970	15.820	217.000		217.000
28			Nizamabad	Sewerage	148.770	49.590	84.220	14.960	14.040	162.810	0.000	162.810
		Sub Total for Nizamabad District			**459.610**	**171.480**	**244.260**	**43.870**	**38.200**	**497.810**	**0.000**	**497.810**
		Total for Nizamabad Division			**626.630**	**240.620**	**329.160**	**56.850**	**51.180**	**677.810**	**0.000**	**677.810**
29	Mahabubnagar	Jogulamba gadwal	Alampur	Water Supply	13.450	6.730	5.600	1.120	1.350	14.800		14.800
30			Waddepalle	Water Supply	10.370	5.190	4.060	1.120	1.040	11.410		11.410
31			Gadwal	Water Supply	57.500	28.750	22.790	5.960	5.750	63.250		63.250
		Sub Total for Jogulamba Gadwal District			**81.320**	**40.670**	**32.450**	**8.200**	**8.140**	**89.460**	**0.000**	**89.460**

32		Narayanpet	Kosgi	Water Supply	11.390	5.695	3.895	1.800	1.140	12.530		12.530
33			Makthal	Water Supply	13.980	6.990	5.120	1.870	1.400	15.380		15.380
34			Narayanpet	Water Supply	25.150	12.575	9.055	3.520	2.510	27.660		27.660
		Sub Total for Narayanpet District			**50.520**	**25.260**	**18.070**	**7.190**	**5.050**	**55.570**	**0.000**	**55.570**
35		Mahabubnagar	Bhoolpur	Water Supply	15.860	7.930	6.840	1.090	1.590	17.450		17.450
36			Jadcherla	Water Supply	41.840	20.920	16.530	4.390	5.160	47.000		47.000
37			Mahabubnagar	Sewerage	204.160	68.050	117.810	18.300	62.640	266.800	10.000	276.800
		Sub Total for Mahabubnagar District			**261.860**	**96.900**	**141.180**	**23.780**	**69.390**	**331.250**	**10.000**	**341.250**
38	Mahabubnagar	Wanaparthy	Almakur	Water Supply	15.660	7.830	6.560	1.270	1.560	17.220		17.220
39			Amarchinta	Water Supply	11.820	5.910	4.960	0.950	1.180	13.000		13.000
40			Kothakota	Water Supply	13.600	6.800	5.200	1.600	1.350	14.950		14.950
41			Pebbair	Water Supply	9.780	4.890	3.580	1.310	0.980	10.760		10.760
42			Wanaparthy	Water Supply	65.780	32.890	26.960	5.930	6.580	72.360		72.360
		Sub Total for Wanaparthy District			**116.640**	**58.320**	**47.260**	**11.060**	**11.650**	**128.290**	**0.000**	**128.290**
43		Nagarkurnool	Nagarkurnool	Water Supply	32.940	16.470	13.360	3.110	3.290	36.230		36.230
44			Kalwakurthy	Water Supply	21.230	10.620	8.080	2.530	2.270	23.500		23.500
		Sub Total for Nagarkurnool District			**54.170**	**27.090**	**21.440**	**5.640**	**5.560**	**59.730**	**0.000**	**59.730**
		Total for Mahabubnagar Division			**564.510**	**248.240**	**260.400**	**55.870**	**99.790**	**664.300**	**10.000**	**674.300**
Grand Total for Package - III					**1682.550**	**721.060**	**782.490**	**179.000**	**189.060**	**1871.610**	**10.000**	**1881.610**
Grand Total for 98 WS and 09 Sewerage Projects					**4764.920**	**1980.586**	**2326.504**	**457.830**	**590.130**	**5355.050**	**30.000**	**5385.050**

ARVIND KUMAR
SPECIAL CHIEF SECRETARY TO GOVERNMENT

.....

GOVERNMENT OF TELANGANA 3614

ABSTRACT

MA&UD Department - Engineering- PH&ME- Hon'ble NGT Directions (not to discharge untreated waste water into water bodies & rivers) - Construction of Sewage Treatment Plants in all Urban Local Bodies of Telangana - Administrative sanction for an amount Rs.3769.34 crores (including O&M and Annuity Payments and GST on Interest Component of Annuity Payments) for "Sewerage Projects in 101 ULBs in the State of Telangana under SBM 2.0" - Accorded - Orders Issued.

MUNICIPAL ADMINISTRATION & URBAN DEVELOPMENT (ENGG.) DEPARTMENT

G.O. Rt. No.388 Dated:21.08.2024

Read the following:-

1. From the ENC(PH), Hyderabad, Lr.No.: T1/SBM 2.0/STPs & I&Ds /2022-23,Dt.: 15.04.2023.
2. Govt., Memo No. 6361/Engg.2/2023, Dt.02-02-2024]
3. From the ENC (PH), Hyderabad, Lr.No.T1/SBM 2.0/STPs & I&Ds/2023-24, Dt: 07.02.2024.

-000-

ORDER:

In the reference 1st read above, the Engineer-in-Chief (Public Health) Hyderabad has informed that, the Director (SBM), MoHUA, GoI has communicated the Minutes of Meeting of 7th NARC of SBM Urban duly mentioning that Action Plans submitted by the Govt. of Telangana for Urban Water Management have been aprroved containing proposals costing Rs. 934.60 Crores towards establishment of STPs and I&D for Urban Water Management have been approved in 101 ULBs and requested to issue the RFP for engagement of agencies for establishment, O&M of STPs and construction of I&D structures and to take further action for effective UWM under SBM Urban 2.0.

2. The Engineer-in-Chief (Public Health), Hyderabad has further informed that, the Hon'ble National Green Tribunal have given directions to take measures not to discharge untreated waste water into water bodies & rivers. Government of Telangana has either established or is in the process of establishing STPs in the ULBs of Warangal, Karimnagar, Nizamabad, Siddipet, Nalgonda, Miryalaguda, Suryapet, Sircilla, Gajwel, Vikarabad, Nagar Kurnool, Devarakonda, Alampur, Khammam besides GHMC to meet the requirements of respective prospective years. The ENC (PH) has requested the Government to give suitable directions on taking up STPs in 103 ULBs which are to be funded through SBM 2.0 Scheme.

3. In the reference 2nd read above, Government have requested the ENC (PH) to furnish the proposal, duly revising the installed capacity as per the discussions held in this regard by the Principal Secretary to Government MA&UD Department with the Engineer-in-Chief (Public Health), Hyderabad for taking further action in the matter.

4. In the reference 3rd read above, the Engineer-in-Chief (Public Health) has stated that previously they have submitted the proposals of SBM 2.0 to the Government for construction of 344 No. of STPs (total capacity of 789.20 MLD, considering 2038 as prospective year) along with I&D Structures with 10 years O&M with a tentative financial implication of about Rs. 5503.107 crores, along with a request to accord permission to

(PTO)

invite tenders with open technology on RFP mode in Hybrid Annuity Model without mentioning Internal Bench Mark, pending Administrative Sanction. It was also indicated therein that Administrative Sanction would be sought along with tender approval after finallzation of the tenders.

5. The Engineer-in-Chief (Public Health) has further stated that, during the review meeting with the Principal Secretary to Government, MA&UD Dept. on 11-01-2024, the proposals of SBM 2.0 were placed before the Government and it was instructed to take up the proposals in two phases, duly utilizing the GoI share under SBM 2.0 in Phase-I as upfront payment, keeping in view the financial implication, and in single package in order to create healthy competition among available agencies who have experience in executing similar projects in HAM mode.

6. The Engineer-in-Chief (Public Health) has further stated that, after detailed deliberations, it has been decided in the above meeting on the following proposals under SBM 2.0:-

- Proposals under Phase-I: To consider STPs of only certain catchments of the ULB for the prospective year 2038 satisfying the criteria of SBM 2.0 Guidelines that all towns will need to prepare a DPR containing the provision of minimum one STP (for 70% of current (2025) population).

  Where there is marginal difference in capacity of STP of the catchment corresponding to the prospective year 2038 when compared to the intended capacity in Phase I (corresponding to 70% of current (2025) population of the town), those STP capacities are further reduced to meet the criteria of SBM 2.0 guidelines with a contemplation to take up capacity augmentation of these STPs as and when required on case to case basis.

- Proposals under Phase-II: Capacity augmentation (on modular basis) of the catchments under consideration in Phase I along with the new catchments deferred in Phase I can be considered in Phase II proposals.

7. The Engineer-in-Chief (Public Health) has also informed that, it has been decided to prepare estimates with the same rates as adopted for AMRUT 2.0 projects i.e., SSR 2022-23 with the cement & steel rates for the month of April 2023 and STP rates from GWSSB SOR for the year 2022-23, since the original proposal was submitted to Govt. on Dt. 15-04-2023. The estimated Operation and Maintenance cost of 115 STPs for 10 years is Rs.1608.50 Crores (*considering 5% non compounding increase on each year's O&M cost*) based on CPHEEO Guidelines, Consortium of IITs report of Ganga River Basin Environment Management Plan and common SSR-2022-23 of Government of Telangana.

8. Stating the above position, the Engineer-in-Chief (Public Health) T.G, Hyderabad has finally requested the Govt., to accord permission on the following:-

i. Administrative sanction for an amount Rs.3769.34 crores (including O&M and Annuity Payments and GST on Interest Component of Annuity Payments) for "Sewerage Projects in 101 ULBs in the State of Telangana under SBM 2.0".

Cont.P. 3

ii. Permission to invite tenders in single package under LS contract system with Hybrid Annuity Model (35% upfront and 65% deferred), duly cancelling the G.O.Rt.No.343, MA&UD (UBS) Department, Dt. 29-05-2023.

iii. Request to address the Govt. of India for permission to utilize the GOI share as upfront payment (35%) during the construction period of initial 2 years and balance (65%) to be paid in 10 annuities by the State Government along with O&M payments, considering the present financial situation of the State Government.

iv. Permission to invite tenders pending acquisition of land, in relaxation of G.O.Ms.No. 94, I&CAD (PW-COD) Department, Dated: 01-07-2023 and G.O.Ms.No. 1, Finance (Works & Projects-F7) Department, Dt. 25-02-2012 and to initiate the Land Acquisition process parallelly. In case the tender process is postponed till completion of land acquisition process, it may have a cascading effect resulting in cost escalation. Also, GoI is pursuing with the State Government constantly regarding award of the projects under SBM 2.0.

v. Land Acquisition costs will be submitted to the Government and administrative sanction for those amounts will be sought in due course.

vi. Permission from State Government to entrust the O&M of sewerage projects under SBM 2.0 for 10 years on completion of capital work at the same tender percentage of capital work, by concluding a separate agreement with the same agency by the ULB.

vii. To give directions to the DMA, Hyderabad to instruct the Commissioners of the respective ULBs (falling in SBM 2.0) to conclude separate agreements with the same agencies (entrusted with the capital works) for O&M of sewerage schemes proposed under Phase I of SBM 2.0.

viii. To give directions to the DMA, Hyderabad to instruct the Commissioners of all the respective ULBs for identification of potential users/ industries of treated waste water (minimum of 20%), which enables ULBs to avail 15th Finance Commission tied grants.

ix. The draft bid document for the LS Contract System with Hybrid Annuity Model is under preparation and the same will be submitted to the Government in due course for approval.

9. Government after careful examination of the matter, hereby accord permission on the following:-

i. Administrative sanction is accorded for an amount Rs.3769.34 Crores (including O&M and Annuity Payments and GST on Interest Component of Annuity Payments) for "Sewerage Projects in 101 ULBs in the State of Telangana under SBM 2.0"

Cont. P.4

ii. Permission is accorded to invite tenders in single package under LS contract system with Hybrid Annuity Model (35% upfront and 65% deferred), duly cancelling the G.O.Rt.No.343, MA&UD (UBS) Department, Dt. 29-05-2023.

iii. The Director of Municipal Administration, being the State Mission Director, SBM 2.0 is directed to address the Govt. of India for permission to utilize the GOI share as upfront payment (35%) during the construction period of initial 2 years and balance (65%) to be paid in 10 annuities by the State Government along with O&M payments.

iv. Permission is accorded to invite tenders pending acquisition of land, in relaxation of G.O.Ms.No.94, I&CAD (PW-COD) Dept.,Dt.01-7-2023 and G.O.Ms.No.1, Finance (Works & Projects-F7) Dept., Dt. 25-02-2012 and to initiate the Land Acquisition process parallelly, and to submit the proposals of Administrative Sanction for land acquisition if required.

v. Permission is accorded to entrust the O&M of sewerage projects under SBM 2.0 for 10 years on completion of capital work at the same tender percentage of capital work, by concluding a separate agreement with the same agency by the ULB.

vi. DMA, Hyderabad is directed to instruct the Commissioners of the respective ULBs (falling in SBM 2.0) to conclude separate agreements with the same agencies (entrusted with the capital works) for O&M of sewerage schemes proposed under Phase I of SBM 2.0.

vii. DMA, Hyderabad is directed to instruct the Commissioners of all the respective ULBs for identification of potential users/ industries of treated waste water (minimum of 20%), which enables ULBs to avail 15th Finance Commission tied grants.

10. The Engineer-in-Chief, Public Health/ the Director of Municipal Administration, Telangana, Hyderabad shall take further necessary action accordingly.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF TELANGANA)

M. DANA KISHORE
PRINCIPAL SECRETARY TO GOVERNMENT

To
The Engineer-in-Chief (PH), Telangana, Hyderabad.
The Director of Municipal Administration, Telangana, Hyderabad.
Copy to:
The OSD to Spl. Secretary to Chief Minister.
OSD to Prl. Secretary to Govt., MA&UD Department.
Sf/Sc

// FORWARDED :: BY ORDER //

SECTION OFFICER