BEFORE HON'BLE
NATIONAL GREEN TRIBUNAL
WESTERN ZONE BENCH, PUNE

APPEAL NO. 40/2022

BETWEEN

Taloja Manufacturers Association ..... **Appellants**

VERSUS

Union of India & Ors. ..... **Respondents**

AFFIDAVIT IN REPLY BY RESPONDENT NO. 5 M/s. ARIHANT SUPERSTRUCTURES LTD.

INDEX ON NEXT PAGE

Date: **13/03/2023**
Place: **Pune**
FILED BY:

Adv. Raghunath Mahabal

Advocate R. B. Mahabal रघुनाथ भालचंद्र महाबळ
BE(Mech), ME(Prod)VJTI, CE, FIE, LLM, IIE Arbitrator, [MAH/349/2012]
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INDEX

No.	Particulars	Page No.
1.	Index	416
2.	Contact Details of Parties	417
3.	Abbreviations used	418
4.	Diary of Events	420
5.	Affidavit Reply by-R5	421
6.	**ANNEXURE – A** **2022/10/20** Stop-Work intimation submitted to PMC, MPCB and SEIAA	441
7.	**ANNEXURE – B** **2016/04/08** Solid Waste Management Rules 2016	457
8.	**ANNEXURE – C** Google Image with 200m and 500 distance from plot superimposed on it	498
9.	**ANNEXURE – D** **2023/02/01** Reports of analysis of the environmental samples collected in February 2023	499
10.	**ANNEXURE – E** **2018** EIA Report submitted to MoEFF by Mumbai Waste Management Ltd	556
11.	**ANNEXURE – F** **2001/02/01** CPCB Criteria for Hazardous Waste Landfills	826
12.	**ANNEXURE – G** Basel Convention Technical Guidelines on specially Engineered Landfill	880
13.	**ANNEXURE – H** **2022/01/30** UDCPR 2034 Pages 186-187 Point 10.2.4	922-923

CONTACT DETAILS OF PARTIES

BETWEEN

…… APPELLANTS

1. **TALOJA MANUFACTURERS ASSOCIATION,**
   Authorized Representative, Shekhar Shringare,
   R/o P-21, MIDC, Taloja, Taluka - Panvel,
   District - Raigad, Maharashtra.

VERSUS

…… RESPONDENTS

1. **Union of India,** The Secretary,
   Ministry of Environment, Forest & Climate Change (MoEFCC), Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi- 110003.
   E-mail: secy-moef@nic.in
2. **Central Pollution Control Board**
   through its Regional Director, Survey No. 110, Dhankude Multi-Purpose Hall, Baner Road, Baner, Pune.
   E-mail: bksharma.cpcb@nic.in
3. **Maharashtra Pollution Control Board,**
   Member Secretary, Kalpataru Point, 2nd – 4th Floor, Near Sion Circle, Sion (E), Mumbai.
   E-mail: lms@mpcb.gov.in
4. **State Environment Impact Assessment Authority (SEIAA), Maharashtra**
   Member Secretary, Environment and Climate Change Department, Room No.217,2nd Mantralaya, Mumbai 400032
   E-mail: psec.env@maharashtra.gov.in
5. **Arihant Superstructures Limited**,
   Arihant Aura, 25th Floor, B-Wing, Plot No. 13/l, TTC Industrial. Area, Thane Belapur Road, Turbhe, Navi Mumbai.400705
   Email- nimesh@asl.in

ABBREVIATIONS USED

Short	Full-form
APA	Air (Prevention and Control of Pollution) Act 1981
ASL	Arihant Superstructures Limited
BOOT	Build, Own Operate and Transfer
C2E	Consent To Established
CHWTSDF	Common Hazardous Waste Treatment, Storage and Disposal Facility
CIDCO	City and Industrial Development Corporation of Maharashtra Limited
CPCB	Central Pollution Control Board
CPCB/ PCB	Central Pollution Control Board/ Pollution Control Board
DCR	Development Control Regulations
EC	Environmental Clearance
EIA	Environmental Impact Assessment
EPR	Extended Producers Responsibility
FAE	Functional Area Expert
LPA	Local Planning Authority
MIDC	Maharashtra Industrial Development Corporation
MMRDA	Mumbai Metropolitan Region Development Authority
MOEFCC	Ministry of Environment, forests and Climate Change
MPCB	Maharashtra Pollution Control Board
MRTP	Maharashtra Regional and Town Planning Act, 1966

Short	Full-form
MSW	Municipal Solid Wastes
NGT	National Green Tribunal
PCC	Pollution Control Committee
PFR	Pre-Feasibility report
PMC	Panvel Municipal Corporation
PP	Project Proponent
PPP	Polluter Pays Principle
SEAC	State Expert Appraisal Committee
SEIAA	State Environmental Impact Assessment Authority
SPCB	State Pollution Control Board
TMA	Taloja Manufacturers Association
TSDF	Treatment, Storage, and Disposal Facility
UDD	Urban Development Department
WPA	Water (Prevention and Control of Pollution) Act 1974
NDZ	No Development Zone
BZ	Buffer Zone
MLRC	Maharashtra Land Revenue Code
MMRDA	Mumbai Metropolitan Region Development Authority
MWMPL	Mumbai Waste Management Pvt Ltd
UDCPR	Unified Development Control and Promotion Regulation

DIARY OF EVENTS

Date	Particulars
2014/10/02	Advertisement for Purchase of plot in Newspaper
2022/03/25	Sanction of Building Construction Plan
2022/02/20	Application for Environmental Clearance to SEIAA on Parivesh's website
2022/05/26	SEAC-2 Meeting
2022/07/04	SEAC-2 Meeting
2022/07/25	Grant of Environmental Clearance
2022/07/15	Application to MPCB for 'Consent to Establish'
2022/09/27	Grant of 'Consent to Establish'
2022/09/20	Start of construction at site
2022/10/20	Stop Work Notice by PMC
2022/10/20	**VOLUNTARY "STOP WORK AT SITE"**

MOST RESPECTFULLY SUBMITTED:

1. I, Nimesh Shah, aged about 48 years, am working as the Whole Time Director of **M/s Arihant Superstructures Ltd (ASL) – Respondent No.5 (R-5), the Project Proponent (hereafter referred to as PP)** in the above matter.

2. I state and submit that I have perused the contents of the Appeal. I categorically deny all the allegations and adverse averments against PP and I deny all of them categorically and specifically. Nothing shall be construed to be admitted merely because the same is not addressed by me hereafter in this affidavit.

3. The appeal is filed by the appellant with the prayers;

a) **to quash the EC and**

b) **restrain the PP from construction in pursuance of the Environmental Clearance granted.**

The appellant has challenged the EC but has not challenged the C2E issued by MPCB. The same is still valid and in force.

PP HAS STOPPED WORK AT SITE

4. I say and submit that without admitting anything, I have **stopped the work at the site**

from 20/10/2022. This is without prejudice to my rights.

5. This was done as a precautionary action as a responsible developer, who has concerns about the environment and human health.

6. We have also informed about this voluntary stop-work to Panvel Municipal Corporation through a letter dated **20/10/2022** and SEIAA/MPCB dated **10/11/2022**. **[Collectively Ax. A ■]**

REMAND BACK MATTER TO SEIAA

7. I say and submit that there are only two prayers in the appeal, on one ground of the presence of CHWTSDF in the vicinity, which was not disclosed to SEIAA in the application for EC.

8. I say and submit that this question was not specifically asked and hence was not answered. But this being the very reason, the matter may be remanded back to SEIAA for re-consideration of the EC granted in light of this fact and the provision of a Buffer Zone and any additional measures for the safety of human life, environment and effect of and on the surrounding.

9. **The appeal can be disposed of with this order at this stage itself. The EC granted after reconsideration shall be again in the public domain for debate and challenge, on merit**.

PURCHASE OF RESIDENTIAL PLOT

10. I say and submit that I gave a public notice in the newspaper on **02/10/2014** for verifying the title of land bearing survey nos 35/1A, 35/1B/35/1C, 36 and 60/1/2/B, that were intended to be purchased for constructing the residential property. I took a search of the land records to verify whether there are any reservations, encroachment, boja/charge, buffer zone, notified Ecologically Sensitive Zone restrictions, lien, any other acquisitions pending, attachment, acquisition notice, OR impediment of any type.

11. This land was previously falling under CIDCO as the Local Planning Authority (LPA). This is when earlier CHWTSDF was sanctioned and became operative. Then this was under MMRDA and then now under PMC. **None of these LPA has ever done any reservations or demarcation of Buffer Zone on this plot**.

12. I say and submit that right from the operation of CHWTSDF, over the last 20 years, no unpleasant incident has been pointed out or happened outside their battery limits. There is no contamination of groundwater within my plot or any effect of pollution, contamination, toxicity or corrosiveness on my plot, that was found by me OR is alleged by the appellant.

13. Only after ascertainment and verification as above that I have proceeded with the purchase of the land for the purpose of construction of the

residential project.

14. **I did not receive any objection from anyone and only thereafter I purchased this plot**. I paid the stamp duty and registered the agreement after making a payment toward the cost of the plot. The appellant did not challenge the sale or purchase of this plot at that point in time, even though there was a Public Notice to that effect.

15. I say and submit that the building plans were approved by the LPA PMC. The EC was obtained by submitting all the information that was asked in Form-1, 1A along with sanctioned building & construction plans by LPA.

LOCUS STANDI OF APPELLANT

16. I say and submit that the appellant per-se has no locus to challenge this EC. The CHWTSDF has neither challenged this nor objected to this. The CHWTSDF has not been impleaded as the essential and necessary party also, by the appellant. So, it is not an inconvenience for the CHWTSDF.

EC REQUIREMENTS

17. I say and submit that as per EIA Notification 14/09/2006, a new project or expansion/modernization or change of product mix needs EC, if it is above the threshold limits of any of the projects/activity in the Schedule of the above Notification. **This project falls under 8(b)B2 with a total covered built-up construction area of**

65157.55 m^2. EIA study is not required for such projects being of the B2 category.

18. Form-1 and Form-1A are to be filled in for such a project along with the Conceptual Plan. I have submitted all this information to SEAC/SEIAA-Maharashtra. Each and every question that was required to be answered was answered by me. None of the questions was dodged, avoided, OR any information that was asked for was suppressed.

19. The Questions and Answers where it is alleged that the information was suppressed are re-typed and reproduced hereinbelow. The plain and simple reading shows that none of the questions compels or mandates to disclose the presence of any such CHWTSDF facility to be referred to in it.

20. I say and submit that the entire exercise of the appraisal and the Forms are mainly drafted to ***bring out the project's impact on the surrounding environment***. The forms are not probably designed to bring out the impact of the surrounding environment on the project.

Sr	Areas	Name/ Identity	Aerial Distance (Within 15 km) Proposed Project location boundary

1	Areas protected under international conventions or local legislation for their ecological, landscape, cultural or other related value	No	
2	Areas which are important or sensitive for ecological reasons- Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forest	Yes	Taloja river is 1.0 km from the site
9	Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities)	Yes	Schools, hospitals are available 5.0 km from the site.

21. I say and submit that the presence of the CHWTSDF in the Taloja area is well known to everyone, including the Members of SEAC and SEIAA. PP had given the Google Image itself showing the location of the earlier operative CHWTSDF.

22. The Environmental Impact of the project on the surrounding environmental settings is to be estimated, and predicted; and mitigation measures are to be suggested to mitigate such an impact of the project on the external nearby surrounding area.

23. I say and submit, for the sake of clarity, that **impact of the project on the external surrounding area is to be envisaged** and hence it has to be brought down below the sustainable limits.

24. I say and submit that the plot at the 50m distance has no name board or indication of its land use or utilization. In the land records, the adjacent plot is now also in the name of CIDCO (Industrial Zone). The EC of the adjacent plot is not displayed and circulated to all the local offices as required by the EIA Notification. As such, we were not aware that it is for CHWTSDF. Now, on enquiry, I have learnt that no CHWTSDF is going to be operative on this new-adjacent plot.

BUFFER ZONE

25. **I say and submit that there is** already **a distance of 200 m from the existing CHWTSDF, which is there for over 20 years.**

26. **Moreover, the portion of the earlier existing CHWTSDF** land **towards the residential project and cells in it, are** already **under closure and now non-operative. The core operative zone within CHWTSDF is already almost 500 m distance from the plot of the PP.**

27. The new proposed area for which the EC has been granted to them for expansion is not operational and is facing resistance from the local residents. As such it is as it is, vacant. There is no signboard, marking, or identification mark which would enable one to identify that as part of CHWTSDF or as an expansion. The Buffer Zone around it is not under the control of MIDC and hence can't be notified by MIDC as Buffer Zone. As such the Buffer Zone has to be **WITHIN** the CHWTSDF

area, whatever is determined to be necessary while granting permission to such a facility.

28. I say and submit that **Solid Waste Management Rules 2016** have come into existence on **08/04/2016**. These are mainly for non-hazardous solid waste. But even then, these Rules also provide for the Buffer Zone to be kept **WITHIN** the facility; and not in the outside area. [**Ax. B** ■]

29. I say and submit that CHWTSDF is following all rules and regulations. All industries are paying charges towards and for this service. Since the **CHWTSDF is fully compliant they do not have any apprehension or fear of any malfunctioning in their services. The fact and history of over the past 20 years also support this assumption**.

30. I say and submit that the land was given to CHWTSDF by MIDC. As per CPCB Guidelines, the buffer zone of 200 m to 500 m, whatever is necessary, has to be provided **WITHIN** the CHWTSDF area that was owned by MIDC and which is LPA for the MIDC area. Then the same MIDC as LPA can Notify that as the Buffer Zone OR No Development Zone, as they have the ownership and planning rights over it. **No LPA or CPCB Guidelines can declare the NDZ or Buffer Zone on the land which is not owned by them OR without acquiring the rights over it**. Such declaration, on the land of someone else, purchased with consideration/owned by him would be in violation of

the Constitutional rights of the owner and against justice and equity.

31. I say and submit that the CHWTSDF has come into existence in the year 2001. The appellants are already in existence for over the last 30 years. I say and submit that MIDC and CHWTSDF, haven't demanded a Buffer Zone to be kept in the last 22 years, on the land owned by others or falling under various other LPAs CIDCO, MMRDA, PMC or UDD; and instead have provided it as part of their project.

32. **I say and submit that therefore all these issues may be allowed to be raised before the SEAC/SEIAA for their technical reconsideration of the EC, on the following limited points and only with respect to this specific CHWTSDF site and whether there is any effect on EC granted due to this**. They may seek guidance from other statutory authorities like MoEFCC, and CPCB, where there is a grey area.

a. **Buffer Zone**: How much Buffer Zone would be required in this specific case (i.e., 50m, 100m, 200m, or 500m) and from which point within the CHWTSDF (in this specific case)

b. Whether **Buffer Zone** should be provided within the CHWTSDF or on the adjacent land which is not owned by CHWTSDF, but by other bonafide buyers by payment of lawful consideration.

c. How much would be the Buffer Zone in this

specific case, in Ha AND when it is even more than the CHWTSDF area itself, then who would pay for it following the principles of **Extended Producer's Responsibility**, **Polluter Pays Principl**e and **strict and absolute liability** of CHWTSDF OR the Hazardous Waste Producing Industries.

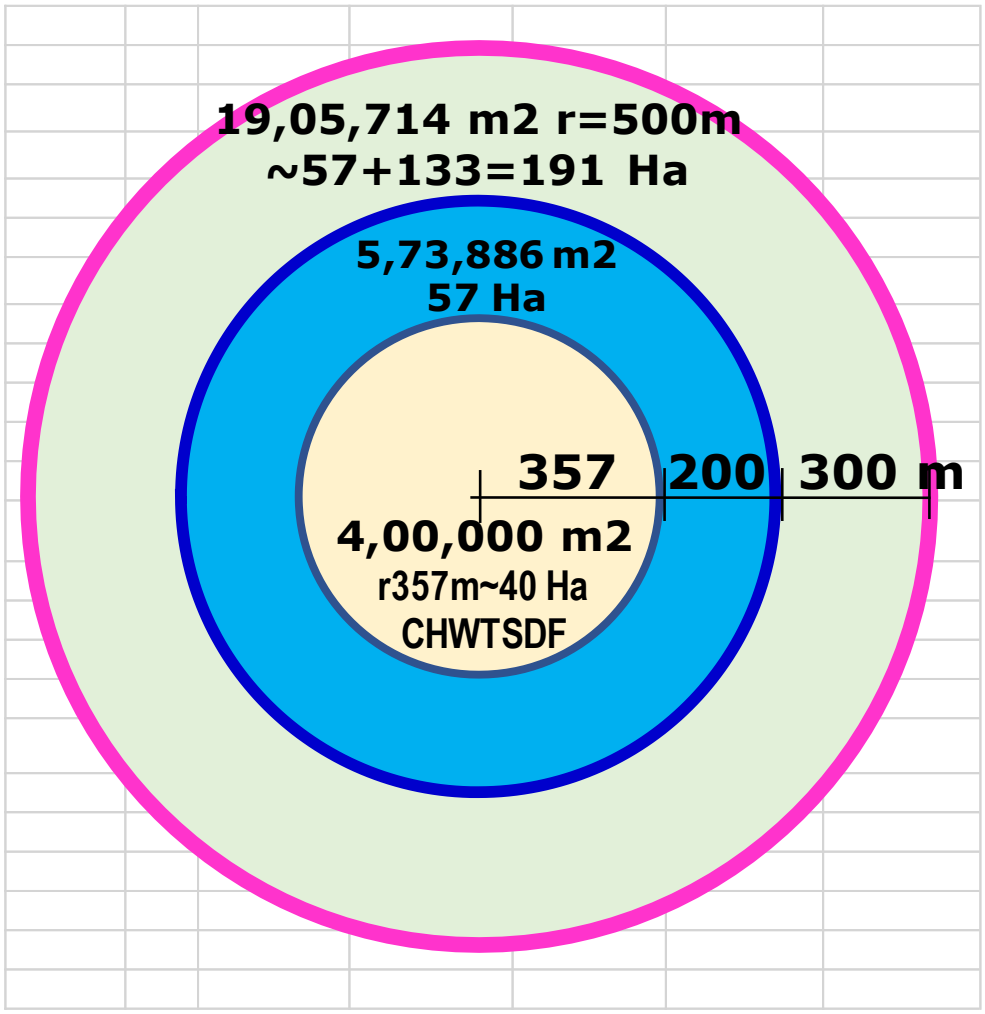
d. Considering the current Environmental Status at the project site, to be assessed as directed on the parameters by the SEAC/SEIAA, what should be the adequate Buffer Zone

e. Any additional measures, as may be necessary.

33. I say and submit that when the CHWTSDF is operating in full compliance with the environmental norms, there is no valid reason to be afraid of pollution, risk, and hazard from their operations. If there is any such probable risk due to them, their operations, and unscrupulous practices, and hence they don't want the Buffer Zone to be kept, outside their battery limits. They have already done it within the CHWTSDF.

34. I say and submit that the CPCB Guidelines of 2001 and so also other Guidelines are for the siting of the CHWTSDF sites, and in consideration of the surrounding environmental setting. e.g., Basel Convention Technical Guidelines on Specially Engineered Landfill 1995. Various Buffer Zones have been suggested in different Guidelines. But unless these are published as and by way of the formal

Gazette Notification, it would not have legal force. Such technical issues can be examined by SEAC/SEIAA, with the help of technical experts and then SEIAA can re-consider the additions/ deletions/ corrections to the EC granted, in terms of additional Buffer Zone, NDZ, etc.



35. I say and submit that please refer to the ***schematic diagram*** for a CHWTSDF of 40 Ha area (4,00,000 m^2). **The spread & area would be minimum if the land parcel if it is a *circle***. As per the CPCB Guidelines, a buffer zone of 200-500m has to be left out around this area. The same has to be notified by the respective LPA or Urban Development Department and/or the respective planning authorities. The cost of this buffer zone, following the principle of EPR and PPP, strict and absolute liability

must be footed by the generator of the pollution/ hazardous waste, including the cost for transport, treatment, and safe disposal of the safe.

I say and submit that the buffer zone of **200 m would need an annular buffer ring of the land area of at least 57 Ha (5,73,886m^2)** around 40 Ha CHWTSDF area.

36. I say and submit that the buffer zone of **500 m would need an annular buffer ring of the land area of more than 191 Ha (19,05,714 m^2)**, around the **40 Ha CHWTSDF** area. [**Ax. C** ■]

37. I say and submit that the PP has purchased the land as and by way of the bonafide buyer by following due process of law. **The lawful equity and ownership rights are generated in favour of the PP, by this bonafide purchase of the land**.

38. I say and submit that an application was made for a residential project on the subject land as per Unified DCR 2020 and available information as per the regional plan of MMRDA/Toposheet. I have also checked all-land records but there is no specific Buffer Zone demarcated by any planning authority. There was no specific direction/sign board displayed by any authority between the plot boundary of the CHWTSDF (expansion) site and the surrounding land area. The applicability of the Buffer Zone ought to have been displayed/specified for every side of the CHWTSDF boundary, so anyone could understand the risk of operational activities. ***The appellant has***

***not shown anywhere OR even claimed that this impugned plot is falling under the Notified Buffer Zone by any LPA or UDD. It is admitted position therefore that the said plot is not NOTIFIED by anyone as Buffer Zone or NDZ*.**

39. I say and submit that the construction activity at the site has been stopped by PP. In light of the above, the appeal prayer No. (b) has become infructuous.

40. However, now that the work has been stopped, I urge that the matter should be **referred back to SEAC/SEIAA for re-consideration of the issues freshly raised only with respect to**:

a. the presence of CHWTSDF and the effect of this project on it or vice-versa

b. Buffer Zone requirement of distance and from where it should be measured as per the clarifications in this present case

c. Whether it has to be within the CHWTSDF OR inside the adjacent properties that are not owned by CHWTSDF

d. Considering the Opinion of the Local Planning Authority.

41. Till the final re-consideration is done by SEAC/SEIAA and the EC shall remain in abeyance till

then. **Hon'ble Tribunal may kindly be pleased to direct** the SEAC/SEIAA to complete this entire process in the next SIXTY days while disposing of this Appeal, with this final order.

42. PP has got the samples collected from the impugned sites of the PP to understand the environmental status as of today.

43. I say and submit that it shows and helps understand the quality of environmental parameters at this proposed construction site. It is to be noted that the entire Taloja MIDC area is in existence and operation for the last three decades. The CHWTSDF facility is operative for the last two decades.

44. I say and submit that CPCB published the **Guidelines for Criterial for Hazardous Waste Landfills**, in February 2001. **[Ax. F ■]**

i. **Section 2(e)** states that a landfill site shall be at least 500 m from a notified habituated area and a zone of 500 m around a landfill boundary should be declared No Development Buffer Zone after the landfill location is finalized.

ii. **Section 2(b)** River: No landfill shall be constructed within 100 m of a navigable river or stream.

iii. **Section 3** Site selection- states that HW landfill will be selected following the guidelines published by MOEF and sub-clause (ii)(c) for identification of a list of potential sites on the

basis of restrictions listed in the location criteria (section 2.0)

45. Notification for land use change for Hazardous Waste Treatment Storage and Disposal Facility for said lands under MWMPL, Taloja was issued by MIDC vide Ref. No. 405/2001 on 10/09/2001.

46. MIDC notified the said lands after recommendations of the Expert committee comprising officials of CPCB MPCB and IIT professors.

a) The said lands are within 400 m of Karave *Gaothan*, a notified habituated village and Balamalang river is adjacent touching to the site – existing since a period long before 2001.

b) Since 1966 MLRC code and 1999 MMRDA DCR for the MMR region, all lands within 200 mt surrounding the *Gaothan* is also part of the habitat area known as the GES scheme and for residential use.

- if the HW Landfill Site location is selected within 200 m of the habitat area and touching the river with due consideration of the fact that the operations of HW landfill will not violate the environment of such surroundings and risk the human population residing within 500 m, then why to insist on No development buffer zone of 500 m around

such HW landfill sites.

47. As per **EIA Report submitted by MWMPL to MOEFCC dated 26/12/2018** for EC approval for expansion of HW Landfill Site: (The true copy of the extract is enclosed for ready reference) [**Ax. E ■**]

i. **Chapter 3** baseline environment
3.4 – Air environment Table 3.6
– all parameters of Ambient air quality levels at HW MWMPL site and within 10 km area are within permissible and acceptable NAAQ Standards.

ii. **Point 3.5** Noise levels, table 3.9 results show that noise levels at day and night for the HW site and surrounding 10 km area are within ambient noise standards of residential/ commercial respectively.

iii. **Point 3.7** Water environment – Table 3.12 - results of groundwater samples of HW site location and surrounding 10 km area shows all physio-chemical parameters and comparison with IS 10500-2012 Drinking Water Standards, all groundwater samples were found to be fit for drinking. However, some of the parameters in a few water samples were exceeding the acceptable limits but were within permissible limits.
Point 3.7 Table 3.13 for surface water quality – results were found to be complying

with CPCB standards for all parameters including of adjacent Bavamalang river.

iv. **Point 3.8** Soil quality – Table 3.17 results show no contamination for all physio-chemical characteristics

48. Environment Status (sampling and analysis) Reports of February 2023, conducted by M/s Ashwamedh Engineers, a MoEFCC Recognized Environmental Laboratory under Environment (Protection) Act 1986. [**Ax. D**]

All results and reports of the study done in February 2023 match with the baseline environment reports and parameters of 2018. Therefore, one can conclusively infer that no substantial contamination of any of the environmental parameters of water, air, soil and noise is done or found. The CHWTSDF is operative since 2002. But even after that, it is fit and safe as far as environmental status as of today on the site is concerned.

49. Based on the ***Basel Convention***, in which India is a participant country: [**Ax. G**]

i. Technical guidelines on specially engineered HW landfill – Annex 1 B – Landfill site selection criteria – suggests landfill be located away from property line by a minimum of 200 feet (i.e. 65m)

ii. Complete design, operations and handling

criteria and guidelines of Solid Waste Landfill Sites and HW Landfill Sites are based on zero/minimum environmental damages to the surrounding area with prevention of migration of leachate and harmful material/chemicals to ground soil of landfill site and maintaining ambient air as well as for stack emissions.

iii. As per these guidelines for solid waste landfill sites, the buffer zone is stipulated to be within the boundaries of the landfill site and a separation distance of min 200m as ***No Development Zone***. whereas on a case basis, the separation distance i.e. No Development Zone is reduced to 50 m and 100 m.

50. I say and submit that therefore all the above documents were published and in the public domain. Those were also available and presumably known to the SEIAA and SEAC Expert Members.

MWML never conducted the Public Hearing at the time of the grant of their EC. MWML never sought NDZ or Buffer Zone outside their premises, on land owned by others and as such, MWML never insisted on that. **MWML, therefore, has not even joined as the party to this Appeal**.

UDCPR 2020 Page 186-187 also gives some similar provisions about NDZ or Buffer Zone at Point No. 10.2.4. [Ax. H ■]

Hence, the ***No Development Zone*** has to be kept inside the boundary of the HW landfill site and within the area owned by them; and not by the other adjoining plot/land owners.

51. All the industries in Taloja are generators of pollution/pollutants or hazardous waste. The MWML CHWMF-TSDF is the agency treating the pollution of industries in Taloja.

52. If any ***Buffer Zone*** or ***No Development Zone*** has to be kept, it can be very well kept by buying such land and paying for it at the market rate. As per the 'polluter pays principle' and the principle of strict and absolute liability, such buffer zone cost shall be fully borne and paid by the polluter. Then such land owned by them for this purpose can be earmarked, demarcated and kept as NDZ in the UD or LPA map. The industries shall also ensure that there is no illegal encroachment on it and shall not develop slums or any kind of human habitation on it.

53. I say and submit that Hon'ble Tribunal shall consider all these submissions while passing the appropriate orders and disposing of the appeals.

AND for this act of kindness, I shall pray forever, as duty bound.

Place: **Navi Mumbai**
Date: **13/03/2023**

Nimesh Shah, Director
Respondent No.5

AFFIDAVIT & VERIFICATION

I, Nimesh Shah, aged about 48 years, am working as the Whole Time Director of M/s Arihant Superstructures Ltd (ASL) – Respondent No. 5 (R-5), the Project Proponent (PP) state that I have verified the contents of this affidavit and the True Copies of the Annexures enclosed.

I am submitting the information in this affidavit on my solemn affirmation and oath and that I have not suppressed any relevant facts.

ARIHANT SUPERSTRUCTURES LTD. NAVI MUMBAI

Place: **Navi Mumbai**
Date: **13/03/2023**

Nimesh Shah, Director
Respondent No.5

BEFORE ME
13 MAR 2023
Adv. ASHOK P. GAYKAR
B.Com., LL.B., G.D.C. & A.
NOTARY GOVT. OF INDIA
Reg. No. 5873.

Reg. No. 23
Sr. No. 7680
Date 13 MAR 2023
OF NOTARY REGISTER

NOTARY A. P. Gaykar Mumbai Maharashtra Reg. No. 5873 Exp. Dt. 12/5/23 GOVT. OF INDIA

ASHOK P. GAYKAR NOTARY MUMBAI MAHARASHTRA REGN. NO. 5873 GOVT. OF INDIA

20रु. बीस रुपये TWENTY RUPEES Rs.20 INDIA NOTARIAL

CONTINUING STABILITY

ARIHANT SUPERSTRUCTURES LTD.
CONTINUING STABILITY

Date: 20/10/2022

To,
The ADTPO,
Town Planning Dept.,
Panvel City Municipal Corporation,
Panvel -410206.

Sub: Reply for the Notice dated 20/10/2022.

Ref: Your office letter no. PMC/TP/Ghot/21-22/2598/2022 DATED 20/10/2022

Respected Madam/ Sir,

We accept your directions for No construction work to be done at site for proposed residential project on survey no. 35/1A, 35/1B, 35/1C & 36/0, village Ghot, Panvel.

We had started the initialization and mobilization to the site for construction activities since last 30 days. We have instructed complete stoppage of any construction activity until your further instructions.

Thanking You,

For Arihant Superstructures Ltd.

Authorised Signatory

Received 20/10/2022

To,:- The Hon. Municipal Commissioner, Panvel City Municipal Corporation.

CONTINUING STABILITY

ARIHANT
SUPERSTRUCTURES LTD.
CONTINUING STABILITY

Date: 20/10/2022

To,
The ADTPO,
Town Planning Dept.,
Panvel City Municipal Corporation,
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For Arihant Superstructures Ltd.

Authorised Signatory

Received
20/10/2022

Cc To,:- The Hon. Municipal Commissioner, Panvel City Municipal Corporation.

CONTINUING STABILITY

ARIHANT SUPERSTRUCTURES LTD.
CONTINUING STABILITY

Date: 20/10/2022

To,
The ADTPO,
Town Planning Dept.,
Panvel City Municipal Corporation,
Panvel -410206.

Sub: Reply for the Notice dated 20/10/2022.

Ref: Your office letter no. PMC/TP/Ghot/21-22/2598/2022 DATED 20/10/2022

Respected Madam/ Sir,

We accept your directions for No construction work to be done at site for proposed residential project on survey no. 35/1A, 35/1B, 35/1C & 36/0, village Ghot, Panvel.

We had started the initializa[tion] mobilization to the site for construction activities since last 30 days. We have inst[ructed] mplete stoppage of any construction activity until your further instructions.

Thanking You,

For Arihant Super[structures] ures Ltd.

Authorised Signatory

Resived
20/10/2022

To,:- The Hon. Municipal Commissioner, Panvel City Municipal Corporation.

CONTINUING STABILITY

ARIHANT
SUPERSTRUCTURES LTD.
CONTINUING STABILITY

Date: 20/10/2022

To,
The ADTPO,
Town Planning Dept.,
Panvel City Municipal Corporation,
Panvel -410206.

Sub: Reply for the Notice dated 20/10/2022.

Ref: Your office letter no. PMC/TP/Ghot/21-22/2598/2022 DATED 20/10/2022

Respected Madam/ Sir,

We accept your directions for No construction work to be done at site for proposed residential project on survey no. 35/1A, 35/1B, 35/1C & 36/0, village Ghot, Panvel.

We had started the initialization and mobilization to the site for construction activities since last 30 days. We have instructed complete stoppage of any construction activity until your further instructions.

Thanking You,

For Arihant Superstructures Ltd.

Authorised Signatory

Cc To,:- The Hon. Municipal Commissioner, Panvel City Municipal Corporation.

Received 20/10/2022

पनवेल महानगरपालिका

ता. पनवेल, जिल्हा- रायगड, पनवेल ४१० २०६

दुरध्वनी कार्यालय : ०२२-२७४५८०४०/४१/४२ ई-मेल : panvelcorporation@gmail.com

जा.क्र/पमपा/नरवि/घोट/२१-२२/2५९८/२०२२ दि. 2०/१०/ २०२२

प्रति.

मे. अरिहंत सुपरस्ट्रक्चर्स लि.
अरिहंत ऑरा, बी- विंग २६ वा मजला,
प्लॉट नं. ६३१६, T T C इंडस्ट्रियल एरिया,
नवी मुंबई- ४०० ७०५.

विषय :- मौजे-घोट, ता. पनवेल, जि. रायगड येथील सर्व्हे नं. ३५/१A,३५/१B, ३५/१C & ३६/० या जमीनीवरील बांधकाम परवानगीबाबत.

संदर्भ:- १. Development Permission for M/s. Arihant Superstructures Ltd. Vide Letter No.PMC/TP/Ghot/३५/१A,३५/१B, ३५/१C&३६/०/२१-२२/ १६१८८/८७७/२०२२, dt. २५/३/२०२२.

२. Taloja Manufactrue's Association यांचे पत्र क्र. TMA/515/22-23/61, दि. २४/०८/२०२२

३. Scientist-II, Environment & CC State Environment Impact Assesment Authority Mumbai Letter no. SEIAA-२०२२/CR-४६/ SEIAA, Dated ०९th September २०२२.

४. Divisional Head, Waste Management-II, Central Pollution Control Board, Official Letter No. CP-21/12/2022-WM-11-HO-CPCB-HO/ 6446, Date. 22/09/2022.

महोदय,

आपणांस वरील विषयांकित बाबतीत कळविण्यात येते की, मौजे- चाळ या महसुल गावाच्या हद्दी परिसरातील मौजे- घोट या गावाच्या हद्दीत सुरू असलेल्या निवासी इमारतीच्या बांधकामापैकी काही इमारतींच्या बांधकामाबाबत या कार्यालयास तसेच महाराष्ट्र शासनाच्या पर्यावरण विभागास तळोजा मॅन्युफॅक्चरींग असोसिएशन यांनी तक्रार दाखल केली आहे. सदर तक्रार अर्जामध्ये त्यांनी मौजे-चाळ येथील क्षेपनभुमी Dumping Ground मुळे भविष्यात रहिवाशांच्या आरोग्यास तसेच MIDC मधील उद्योगांवर विपरित परिणाम होऊ शकतो, त्याकरिता सदर परिसरातील बांधकामांना स्थगिती देण्यात यावी असेन नमूद केले आहे. त्याअनुषंगाने महाराष्ट्र शासनाचे संदर्भिय-३ व केंद्र शासनाने वरील बाबतीत अहवाल सादर करण्याबाबात कळविले आहे.

तथापि, उपरोक्त तक्रारीच्या अनुषंगाने आपणांस कळविण्यात येते की, या कार्यालयाचे पुढील आदेशापर्यंत आपले विषयांकित जमिनीवरील बांधकाम सुरू करू नये किंवा सुरू असल्यास तुर्तास थांबविण्यात यावे.

(मा. आयुक्त, पनवेल महानगरपालिका यांच्या मान्यतेने)

ज्योती कवाडे

(ज्योती कवाडे)
सहाय्यक संचालक, नगररचना
पनवेल महानगरपालिका

CONTINUING STABILITY

ARIHANT
SUPERSTRUCTURES LTD.
CONTINUING STABILITY

9 November 2022

To,
The Member Secretary
SEIAA-Maharashtra
The New Administration Building, 15th floor,
Madam Cama Road, Opp. Mantralay,
Mumbai-400032

Received 10-11-22
आवक लिपीक (सं.शा.)
पर्यावरण व वातावरणीय बदल विभाग
मंत्रालय, मुंबई ४०० ०३२

Subject : Grant of environmental clearance to proposed building and construction project located at Village Ghot, Tal: Panvel, Dist Raigad.

Reference : File No: SIA/MH/MIS/256824/2022 dated 25/07/2022

Respected Sir,

We hereby inform you that we have got the Environmental Clearance (EC) for the proposed construction of the residential building project located at Village Ghot, Taluka Panvel, District Raigad.

We came to know that a complaint is made by M/s Taloja Manufacturing Association. Further, an appeal has been filed in Hon'ble National Green Tribunal OA 40/2022 against the EC granted to this project. The ground is that the site is within 500m distance from the CHWTSDF site, Taloja.

With respect to this subject, we would like to share the following facts:

1. Panvel Municipal Corporation granted Development permission on dated 25/03/22 as per UDPCR 2020 as there was no buffer zone demarcated by any authority as of date.

2. We have applied for EC on impugned land as there was no buffer zone demarcated by any authority.

3. We have also checked the records through various government land-related documents, map etc., but there is no authentic Regional Plan Map or Development Plan available with such type of demarcated Buffer Zone for particular this area/region.

4. The Complainant has also admittedly stated the same in their complaint, that there is no Buffer Zone demarcated by any authority.

L51900MH1983PLC029643
Arihant Aura, B-Wing, 25th Floor, Plot No 13/1,
TTC Industrial Area, Thane Belapur Road,
Turbhe, Navi Mumbai, Maharashtra - 400705
Tel.: 022 6249 3333
022 6249 3344
Website : www.asl.net.in
Email : info@asl.net.in

CONTINUING STABILITY

ARIHANT SUPERSTRUCTURES LTD.
CONTINUING STABILITY

5. We had initiated mobilization and just started construction work of below ground level. **However, we on our own, stopped all construction activities immediately after getting information about this complaint.**

6. We have also informed about the stop-work to Panvel Municipal Corporation through a letter dated 20/10/2022.

7. We are responsible developers and have concerns about the environment and human health.

8. We would not initiate any construction activity till the further directions from the competent authority.

9. We have a valid Environmental Clearance and 'Consent to Establish' from MPCB. As such, we would re-start the work only after the issue is clarified and resolved; under advance intimation to you.

Thanking You,
Yours faithfully
M/s Arihant Superstructure Ltd

Nimesh Shah
(Director)

Copy for information to:

1. Regional Officer, Maharashtra Pollution Control Board.
2. The Commissioner, Panvel Municipal Corporation

CONTINUING STABILITY

ARIHANT
SUPERSTRUCTURES LTD.
CONTINUING STABILITY

o/c

9 November 2022

To,
The Member Secretary
SEIAA-Maharashtra
The New Administration Building, 15th floor,
Madam Cama Road, Opp. Mantralay,
Mumbai-400032

Subject : Grant of environmental clearance to proposed building and construction project located at Village Ghot, Tal: Panvel, Dist Raigad.

Reference : File No: SIA/MH/MIS/256824/2022 dated 25/07/2022

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We came to know that a complaint is made by M/s Taloja Manufacturing Association. Further, an appeal has been filed in Hon'ble National Green Tribunal OA 40/2022 against the EC granted to this project. The ground is that the site is within 500m distance from the CHWTSDF site, Taloja.

With respect to this subject, we would like to share the following facts:

1. Panvel Municipal Corporation granted Development permission on dated 25/03/22 as per UDPCR 2020 as there was no buffer zone demarcated by any authority as of date.

2. We have applied for EC on impugned land as there was no buffer zone demarcated by any authority.

3. We have also checked the records through various government land-related documents, map etc., but there is no authentic Regional Plan Map or Development Plan available with such type of demarcated Buffer Zone for particular this area/region.

4. The Complainant has also admittedly stated the same in their complaint, that there is no Buffer Zone demarcated by any authority.

प्रादेशिक कार्यालय, रायगड, नवी मुंबई
म.प्र.नि. मंडळ, रायगड भवन, ६ वा मजला,
भी.वी.डी. बेलापूर, नवी मुंबई

CONTINUING STABILITY

ARIHANT SUPERSTRUCTURES LTD
CONTINUING STABILITY

5. We had initiated mobilization and just started construction work of below ground level. **However, we on our own, stopped all construction activities immediately after getting information about this complaint.**

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7. We are responsible developers and have concerns about the environment and human health.

8. We would not initiate any construction activity till the further directions from the competent authority.

9. We have a valid Environmental Clearance and 'Consent to Establish' from MPCB. As such, we would re-start the work only after the issue is clarified and resolved; under advance intimation to you.

Thanking You,
Yours faithfully
M/s Arihant Superstructure Ltd

Nimesh Shah
(Director)

Copy for information to:

1. Regional Officer, Maharashtra Pollution Control Board.
2. The Commissioner, Panvel Municipal Corporation

पनवेल महानगरपालिका

ता. पनवेल, जिल्हा- रायगड, पनवेल ४१० २०६

दुरध्वनी कार्यालय : ०२२-२७४५८०४०/४१/४२ ई-मेल : panvelcorporation@gmail.com

जा.क्र/पमपा/नरवि/घोट/४३/३/२, ५९/१ व इतर/२१-२२/१६१८६/८०४८ /२०२२ दि. १५ / ११ / २०२२

प्रति,
मे. अरिहंत सुपरस्ट्रक्चर्स लि.,
तर्फे डायरेक्टर,
श्री. अशोक बी. छाजेड,
अरिहंत ऑरा, बी-विंग, २६ वा मजला,
प्लॉट नं. १३/१, टीटीसी इंडस्ट्रीयल एरिया,
ठाणे बेलापूर रोड, तुर्भे, नवी मुंबई – ४०० ७०५.

विषय :- मौजे-घोट, ता. पनवेल, जि. रायगड येथील सर्व्हे नं. ४३/३/२, ५९/१ व इतर या जमीनीवरील बांधकाम परवानगीबाबत.

संदर्भ:- १. Taloja Manufactrue's Association यांचे पत्र क्र. TMA/५१५/२२-२३/६१, दि. २४/०८/२०२२

२. Scientist-II, Environment & CC State Environment Impact Assesment Authority Mumbai Letter no. SEIAA-२०२२/CR-४६/SEIAA, Dated ०९th September २०२२.

३. Divisional Head, Waste Management-II, Central Pollution Control Board, Official Letter No. CP-२१/१२/२०२२-WM-११-HO-CPCB-HO/ ६४४६, Date. २२/०४/२०२२.

४. मे. अरिहंत सुपरस्ट्रक्चर्स लि. यांना या कार्यालयाकडील जा.क्र.PMC/TP/Ghot/ ४३/३/२, ५९/१ & Others/२१-२२/१६१८६/८७६/२०२२, दि. २५/३/२०२२ ने देण्यात आलेली बांधकाम परवानगी.

महोदय,

आपणांस वरील विषयांकित बाबतीत कळविण्यात येते की, मौजे- चाळ या महसुल गावाच्या हद्दी मधील डंपींग ग्राऊंड परिसराजवळच्या मौजे- घोट या गावाच्या हद्दीत सुरू असलेल्या निवासी इमारतीच्या बांधकामापैकी काही इमारतींच्या बांधकामाबाबत या कार्यालयास तसेच केंद्र व महाराष्ट्र शासनाच्या पर्यावरण विभागास तळोजा मॅन्युफॅक्चरींग असोसिएशन यांनी तक्रार दाखल केली आहे. सदर तक्रार अर्जामध्ये त्यांनी मौजे-चाळ येथील घातक कचरा (Hazardous Waste) क्षेपनभुमी Dumping Ground मुळे भविष्यात सदर परिसरातील निवासी इमारतीमधील रहिवाशांच्या आरोग्यास व पर्यायी MIDC मधील उद्योगांवर त्याचा विपरित परिणाम होऊ शकतो, त्याकरिता सदर परिसरातील बांधकामांना स्थगिती देण्यात यावी असे नमूद केले आहे. त्याअनुषंगाने महाराष्ट्र शासनाचे संदर्भिय-२ व केंद्र शासनाने संदर्भिय-३ अन्वये वरील बाबतीत अहवाल सादर करण्याबाबात कळविले आहे.

तथापि, उपरोक्त तक्रारीच्या तसेच संदर्भिय २ व ३ च्या अनुषंगाने आपणांस कळविण्यात येते की, वरिल बाबतीत पुढील निर्णय होईपर्यंत व या कार्यालयाचे पुढील आदेशापर्यंत आपण संदर्भिय-४ अन्वये देण्यात आलेल्या बांधकाम परवानगी नुसार विषयांकित जमिनीवर बांधकाम सुरू करू नये किंवा सुरू केलेले असल्यास थांबविण्यात यावे.

(मा. आयुक्त, पनवेल महानगरपालिका यांच्या मान्यतेने)

(ज्योती कवाडे)
सहाय्यक संचालक, नगररचना
पनवेल महानगरपालिका

PANVEL MUNICIPAL CORPORATION
पनवेल महानगरपालिका पनवेल-रायगड
PANVEL-RAIGAD

प्रत :-

१. वास्तूविशारद,
एन. आर्च आर्किटेक्ट अॅन्ड प्लानर,
ऑफिस नं. २० व २१, तळ मजला,
रहेजा आर्केड, प्लॉट नं. ६१, सेक्टर ११,
सी.बी.डी. बेलापूर, नवी मुंबई – ४०० ६१४.

२. अभियंता, नगररचना विभाग व सर्व्हेअर पनवेल महानगरपालिका यांनी जागेवर जावून स्थळ निरीक्षण करून फोटोसह पंचनामा करावा.

३. प्रभाग अधिकारी, प्रभाग समिती-अ, पनवेल महानगरपालिका, पनवेल.
यांनी संबंधित बांधकाम या कार्यालयाचा लेखी परवानगी शिवाय पुढे चालू राहणार नाही याची दक्षता घ्यावी.

CONTINUING STABILITY

ARIHANT
SUPERSTRUCTURES LTD.
CONTINUING STABILITY

22/11/2022.

To,
The ADTPO,
Town Planning Department,
Panvel Municipal Corporation,
Panvel

Sub: Reply for notice dated 15/11/2022.

Ref: 1) Your office letter no. PMC/TP/Ghot/43/3/2, 59/1 & Others/21-22/16186/2747/2022 dated 15/11/2022.

Respected Madam/Sir

With reference to the above referred letter we wish to bring to your notice that we had started construction of site office & other site establishment works such as labour camps, temporary water storage tanks for labours and from 20/10/2022 on our own have stopped all construction activities of site office immediately after getting information about the compliant.

We accept your directions for no construction work to be done at site for proposed residential project on survey no. 43/3/2, 59/1 & Others, village Ghot, Panvel taluka. We have instructed complete stoppage of any construction activity until your further instructions.

Thanking You

For M/s Arihant Superstructures Ltd.

Authorized Signatory

Cc To: 1) The Hon. Municipal Commissioner, Panvel Municipal Corporation

22/11/22
लेखनिक
आवक-जावक
पनवेल शहर महानगरपालिका
पनवेल - रायगड

ARIHANT
SUPERSTRUCTURES LTD.
CONTINUING STABILITY

22nd November 2022

To,
The Member Secretary
SEIAA-Maharashtra
The New Administration Building, 15th floor,
Madam Cama Road, Opp. Mantralaya,
Mumbai-400032

Subject : Grant of environmental clearance to proposed building and construction project located at Village Ghot, Tal: Panvel, Dist Raigad.

Reference : File No: SIA/MH/MIS/257591/2022 dated 25/07/2022

Respected Sir,

We hereby inform you that we have got the Environmental Clearance (EC) for the proposed construction of the residential building project located at Village Ghot, Taluka Panvel, District Raigad.

We came to know that a complaint is made by M/s Taloja Manufacturing Association. Further, an appeal has been filed in Hon'ble National Green Tribunal OA 39/2022 against the EC granted to this project. The ground is that the site is within 500m distance from the CHWTSDF site, Taloja.

23/11/22

प्रादेशिक कार्यालय, रायगड, नवी मुंबई
म.प्र.नि. मंडळ, रायगड भवन, ६ वा माळा,
सी.बी.डी. बेलापूर, नवी मुंबई ४०० ६१८

With respect to this subject, we would like to share the following facts:

1. Panvel Municipal Corporation granted Development permission on dated 25/03/22 as per UDPCR 2020 as there was no buffer zone demarcated by any authority as of date.

2. We have applied for EC on impugned land as there was no buffer zone demarcated by any authority.

3. We have also checked the records through various government land-related documents, map etc., but there is no authentic Regional Plan Map or Development Plan available with such type of demarcated Buffer Zone for particular this area/region.

4. The Complainant has also admittedly stated the same in their complaint, that there is no Buffer Zone demarcated by any authority.

CONTINUING STABILITY

ARIHANT
SUPERSTRUCTURES LTD.
CONTINUING STABILITY

5. We had started construction of site office and site establishment activities. **However, we on our own, from 20/10/2022 have stopped all site establishment activities immediately after getting information about this complaint.**

6. Stop work letter issued by Panvel Municipal Corporation dated 15/11/2022.

7. We have also informed about the stop-work to Panvel Municipal Corporation through a letter dated 22/11/2022.

8. We are responsible developers and have concerns about the environment and human health.

9. We would not initiate any construction activity till the further directions from the competent authority.

10. We have a valid Environmental Clearance and had applied 'Consent to Establish' from MPCB. As such, we would re-start the work only after the issue is clarified and resolved; under advance intimation to you.

Thanking You,
Yours faithfully
M/s Arihant Superstructure Ltd

Nimesh Shah
(Director)

Copy for information to:

1. The Municipal Commissioner, Panvel Municipal Corporation
2. Regional Officer, S.R.O 1, Raigad Bhavan, Maharashtra Pollution Control Board.

ARIHANT
SUPERSTRUCTURES LTD.
CONTINUING STABILITY

22nd November 2022

To,
The Member Secretary
SEIAA-Maharashtra
The New Administration Building, 15th floor,
Madam Cama Road, Opp. Mantralaya,
Mumbai-400032

Subject : Grant of environmental clearance to proposed building and construction project located at Village Ghot, Tal: Panvel, Dist Raigad.

Reference : File No: SIA/MH/MIS/257591/2022 dated 25/07/2022

Respected Sir,

We hereby inform you that we have got the Environmental Clearance (EC) for the proposed construction of the residential building project located at Village Ghot, Taluka Panvel, District Raigad.

We came to know that a complaint is made by M/s Taloja Manufacturing Association. Further, an appeal has been filed in Hon'ble National Green Tribunal OA 39/2022 against the EC granted to this project. The ground is that the site is within 500m distance from the CHWTSDF site, Taloja.

With respect to this subject, we would like to share the following facts:

1. Panvel Municipal Corporation granted Development permission on dated 25/03/22 as per UDPCR 2020 as there was no buffer zone demarcated by any authority as of date.

2. We have applied for EC on impugned land as there was no buffer zone demarcated by any authority.

3. We have also checked the records through various government land-related documents, map etc., but there is no authentic Regional Plan Map or Development Plan available with such type of demarcated Buffer Zone for particular this area/region.

4. The Complainant has also admittedly stated the same in their complaint, that there is no Buffer Zone demarcated by any authority.

22-11-22
आवक लिपिक (नां.प्रा.)
पर्यावरण व वातावरणीय बदल विभाग
मंत्रालय, मुंबई ४०० ०३२

ARIHANT
SUPERSTRUCTURES LTD.
CONTINUING STABILITY

5. We had started construction of site office and site establishment activities. **However, we on our own, from 20/10/2022 have stopped all site establishment activities immediately after getting information about this complaint.**

6. **Stop work letter issued by Panvel Municipal Corporation dated 15/11/2022.**

7. We have also informed about the stop-work to Panvel Municipal Corporation through a letter dated 22/11/2022.

8. We are responsible developers and have concerns about the environment and human health.

9. **We would not initiate any construction activity till the further directions from the competent authority.**

10. We have a valid Environmental Clearance and had applied 'Consent to Establish' from MPCB. As such, we would re-start the work only after the issue is clarified and resolved; under advance intimation to you.

Thanking You,
Yours faithfully
M/s Arihant Superstructure Ltd

Nimesh Shah
(Director)

Copy for information to:

1. The Municipal Commissioner, Panvel Municipal Corporation
2. Regional Officer, S.R.O 1, Raigad Bhavan, Maharashtra Pollution Control Board.

L51900MH1983PLC029643
Arihant Aura, B-Wing, 25th Floor, Plot No 13/1,
TTC Industrial Area, Thane Belapur Road,
Turbhe, Navi Mumbai, Maharashtra - 400705
Tel : 022 6249 3333
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Ax. B

नगरपालिकाओं की कुल संख्या:

प्रस्तुत की गई कार्य योजना की संख्या:

प्ररुप-V|

[नियम 25 देखें]

दुर्घटना का प्रतिवेदन

1.	दुर्घटना की तारीख और समय	:	
2.	दुर्घटना के लिए कारकों का अनुक्रम	:	
3.	दुर्घटना में शामिल अपशिष्ट	:	
4.	मानव स्वास्थ्य और पर्यावरण पर दुर्घटनाओं के प्रभावों का मूल्यांकन	:	
5.	किए गए आपातकालीन उपाय	:	
6.	दुर्घटनाओं के प्रभावों को कम करने के लिए उठाए गए कदम	:	
7.	ऐसी किसी दुर्घटना की पुनरावृत्ति को रोकने के लिए उठाए गए कदम	:	
तारीख		हस्ताक्षर	
स्थान		पदनाम	

[फा. सं.18-3/2004-एचएसएमडी]

विश्वनाथ सिन्हा, संयुक्त सचिव

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 8th April, 2016

S.O. 1357(E).—Whereas the draft of the Solid Waste Management Rules, 2015 were published under the notification of the Government of India in the Ministry of Environment, Forest and Climate Change number G.S.R. 451 (E), dated the 3rd June, 2015 in the Gazette of India, part II, Section3, sub- section (i) of the same date inviting objections or suggestions from the persons likely to be affected thereby, before the expiry of the period of sixty days from the publication of the said notification on the Solid Waste Management Rules, 2015 in supersession of the Municipal Solid Waste (Management and Handling) Rules, 2000;

And whereas, copies of the said Gazette were made available to the public on the 3rd June, 2015;

And whereas, the objections or comments received within the stipulated period were duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by sections 3, 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986) and in supersession of the Municipal Solid Waste (Management and Handling) Rules, 2000, except as respect things done or omitted to be done before such supersession, the Central Government hereby makes the following rules for management of Solid Waste, namely:-

1. **Short title and commencement.-**

(1) These rules may be called the Solid Waste Management Rules, 2016.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. **Application.-** These rules shall apply to every urban local body, outgrowths in urban agglomerations, census towns as declared by the Registrar General and Census Commissioner of India, notified areas, notified industrial townships, areas under the control of Indian Railways, airports, airbases, Ports and harbours, defence establishments, special economic zones, State and Central government organisations, places of pilgrims, religious and historical importance as may be notified by respective State government from time to time and to every domestic, institutional, commercial and any other non residential solid waste generator situated in the areas except industrial waste, hazardous waste, hazardous chemicals, bio medical wastes, e-waste, lead acid batteries and radio-active waste, that are covered under separate rules framed under the Environment (Protection) Act, 1986**.**

3. **Definitions –**(1) In these rules, unless the context otherwise requires,- (1) **"aerobic composting"** means a controlled process involving microbial decomposition of organic matter in the presence of oxygen;

2. **"anaerobic digestion"** means a controlled process involving microbial decomposition of organic matter in absence of oxygen;

3. **"authorisation"** means the permission given by the State Pollution Control Board or Pollution Control Committee, as the case may be, to the operator of a facility or urban local suthority, or any other agency responsible for processing and disposal of solid waste;

4. **"biodegradable waste "** means any organic material that can be degraded by micro-organisms into simpler stable compounds;

5. **"bio-methanation"** means a process which entails enzymatic decomposition of the organic matter by microbial action to produce methane rich biogas;

6. **"brand owner"** means a person or company who sells any commodity under a registered brand label.

7. "**buffer zone**" means zone of no development to be maintained around solid waste processing and disposal facility, exceeding 5 TPD of installed capacity. This will be maintained within total and area allotted for the solid waste processing and disposal facility.

8. **"bulk waste generator"** means and includes buildings occupied by the Central government departments or undertakings, State government departments or undertakings, local bodies, public sector undertakings or private companies, hospitals, nursing homes, schools, colleges, universities, other educational institutions, hostels, hotels, commercial establishments, markets, places of worship, stadia and sports complexes having an average waste generation rate exceeding 100kg per day**;**

9. **"bye-laws"** means regulatory framework notified by local body, census town and notified area townships for facilitating the implementation of these rules effectively in their jurisdiction**.**

10. **"census town"** means an urban area as defined by the Registrar General and Census Commissioner of India;

11. **"combustible waste"** means non-biodegradable, non-recyclable, non-reusable, non hazardous solid waste having minimum calorific value exceeding 1500 kcal/kg and excluding chlorinated materials like plastic, wood pulp, etc**;**

12. "**composting"** means a controlled process involving microbial decomposition of organic matter;

13. "**contractor**" means a person or firm that undertakes a contract to provide materials or labour to perform a service or do a job for service providing authority;

14. **"co-processing"** means use of non-biodegradable and non recyclable solid waste having calorific value exceeding 1500k/cal as raw material or as a source of energy or both to replace or supplement the natural mineral resources and fossil fuels in industrial processes;

15. **"decentralised processing"** means establishment of dispersed facilities for maximizing the processing of bio-degradable waste and recovery of recyclables closest to the source of generation so as to minimize transportation of waste for processing or disposal;

16. "**disposal"** means the final and safe disposal of post processed residual solid waste and inert street sweepings and silt from surface drains on land as specified in Schedule I to prevent contamination of ground water, surface water, ambient air and attraction of animals or birds;

17. **"domestic hazardous waste"** means discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicines, broken mercury thermometers, used batteries, used needles and syringes and contaminated gauge, etc., generated at the household level;

459

18. **"door to door collection"** means collection of solid waste from the door step of households, shops, commercial establishments , offices , institutional or any other non residential premises and includes collection of such waste from entry gate or a designated location on the ground floor in a housing society , multi storied building or apartments , large residential, commercial or institutional complex or premises;**.**

19. **"dry waste"** means waste other than bio-degradable waste and inert street sweepings and includes recyclable and non recyclable waste, combustible waste and sanitary napkin and diapers, etc;

20. **"dump sites"** means a land utilised by local body for disposal of solid waste without following the principles of sanitary land filling;

21. **"extended producer responsibility" (EPR)** means responsibility of any producer of packaging products such as plastic, tin, glass and corrugated boxes, etc., for environmentally sound management, till end-of-life of the packaging products;

22. **"facility"** means any establishment wherein the solid waste management processes namely segregation, recovery, storage, collection, recycling, processing, treatment or safe disposal are carried out;

23. **"fine" means** penalty imposed on waste generators or operators of waste processing and disposal facilities under the bye-laws for non-compliance of the directions contained in these rules and/or bye- laws

24. **"Form"** means a F8orm appended to these rules;

25. **"handling"** includes all activities relating to sorting, segregation, material recovery, collection, secondary storage, shredding, baling, crushing, loading, unloading, transportation, processing and disposal of solid wastes;

26. **"inerts"** means wastes which are not bio-degradable, recyclable or combustible street sweeping or dust and silt removed from the surface drains;

27. **"incineration"** means an engineered process involving burning or combustion of solid waste to thermally degrade waste materials at high temperatures;

28. **"informal waste collector"** includes individuals, associations or waste traders who are involved in sorting, sale and purchase of recyclable materials;

29. "**leachate"** means the liquid that seeps through solid waste or other medium and has extracts of dissolved or suspended material from it;

30. **" local body"** for the purpose of these rules means and includes the municipal corporation, nagar nigam, municipal council, nagarpalika, nagar Palikaparishad, municipal board, nagar panchayat and town panchayat, census towns, notified areas and notified industrial townships with whatever name they are called in different States and union territories in India;

31. "**materials recovery facility" (MRF)** means a facility where non-compostable solid waste can be temporarily stored by the local body or any other entity mentioned in rule 2 or any person or agency authorised by any of them to facilitate segregation, sorting and recovery of recyclables from various components of waste by authorised informal sector of waste pickers, informal recyclers or any other work force engaged by the local body or entity mentioned in rule 2for the purpose before the waste is delivered or taken up for its processing or disposal;

32. **"non-biodegradable waste"** means any waste that cannot be degraded by micro organisms into simpler stable compounds;

33. **"operator of a facility"** means a person or entity, who owns or operates a facility for handling solid waste which includes the local body and any other entity or agency appointed by the local body;

34. **primary collection"** means collecting, lifting and removal of segregated solid waste from source of its generation including households, shops, offices and any other non-residential premises or from any collection points or any other location specified by the local body;

35. "**processing"** means any scientific process by which segregated solid waste is handled for the purpose of reuse, recycling or transformation into new products**;**

36. **"recycling**" means the process of transforming segregated non-biodegradable solid waste into new material or product or as raw material for producing new products which may or may not be similar to the original products;

37. **"redevelopment"** means rebuilding of old residential or commercial buildings at the same site, where the existing buildings and other infrastructures have become dilapidated;

38. **"refused derived fuel**"(RDF) means fuel derived from combustible waste fraction of solid waste like plastic, wood, pulp or organic waste, other than chlorinated materials, in the form of pellets or fluff produced by drying, shredding, dehydrating and compacting of solid waste ;

39. "**residual solid waste"** means and includes the waste and rejects from the solid waste processing facilities which are not suitable for recycling or further processing;

40. **"sanitary land filling "** means the final and safe disposal of residual solid waste and inert wastes on land in a facility designed with protective measures against pollution of ground water, surface water and fugitive air dust, wind-blown litter, bad odour, fire hazard, animal menace, bird menace, pests or rodents, greenhouse gas emissions, persistent organic pollutants slope instability and erosion;

41. **"sanitary waste"** means wastes comprising of used diapers, sanitary towels or napkins, tampons, condoms, incontinence sheets and any other similar waste;

42. **"Schedule"** means the Schedule appended to these rules;

43. "**secondary storage**" means the temporary containment of solid waste after collection at secondary waste storage depots or MRFs or bins for onward transportation of the waste to the processing or disposal facility;

44. **"segregation"** means sorting and separate storage of various components of solid waste namely biodegradable wastes including agriculture and dairy waste, non biodegradable wastes including recyclable waste, non-recyclable combustible waste, sanitary waste and non recyclable inert waste, domestic hazardous wastes, and construction and demolition wastes;

45. **"service provider"** means an authority providing public utility services like water, sewerage, electricity, telephone, roads, drainage, etc;

46. **"solid waste"** means and includes solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other non residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture and dairy waste, treated bio-medical waste excluding industrial waste, bio-medical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities and other entities mentioned in rule 2;

47. **"sorting"** means separating various components and categories of recyclables such as paper, plastic, card-boards, metal, glass, etc., from mixed waste as may be appropriate to facilitate recycling;

48. **"stabilising"** means the biological decomposition of biodegradable wastes to a stable state where it generates no leachate or offensive odours and is fit for application to farm land ,soil erosion control and soil remediation;

49. **"street vendor"** means any person engaged in vending of articles, goods, wares, food items or merchandise of everyday use or offering services to the general public, in a street, lane, side walk, footpath, pavement, public park or any other public place or private area, from a temporary built up structure or by moving from place to place and includes hawker, peddler, squatter and all other synonymous terms which may be local or region specific; and the words "street vending" with their grammatical variations and cognate expressions, shall be construed accordingly;

50. **"tipping fee"** means a fee or support price determined by the local authorities or any state agency authorised by the State government to be paid to the concessionaire or operator of waste processing facility or for disposal of residual solid waste at the landfill;

51. **"transfer station"** means a facility created to receive solid waste from collection areas and transport in bulk in covered vehicles or containers to waste processing and, or, disposal facilities;

52. **"transportation"** means conveyance of solid waste, either treated, partly treated or untreated from a location to another location in an environmentally sound manner through specially designed and covered transport system so as to prevent the foul odour, littering and unsightly conditions;

53. **"treatment"** means the method, technique or process designed to modify physical, chemical or biological characteristics or composition of any waste so as to reduce its volume and potential to cause harm;

54. **"user fee"** means a fee imposed by the local body and any entity mentioned in rule 2 on the waste generator to cover full or part cost of providing solid waste collection, transportation, processing and disposal services.

55. "**vermi composting"** means the process of conversion of bio-degradable waste into compost using earth worms;

56. "**waste generator**" means and includes every person or group of persons, every residential premises and non residential establishments including Indian Railways, defense establishments, which generate solid waste;

57. **"waste hierarchy"** means the priority order in which the solid waste is to should be managed by giving

461

emphasis to prevention, reduction, reuse, recycling, recovery and disposal, with prevention being the most preferred option and the disposal at the landfill being the least;

58. **"waste picker"** means a person or groups of persons informally engaged in collection and recovery of reusable and recyclable solid waste from the source of waste generation the streets, bins, material recovery facilities, processing and waste disposal facilities for sale to recyclers directly or through intermediaries to earn their livelihood.

(2) Words and expressions used herein but not defined, but defined in the Environment (Protection) Act, 1986, the Water (Prevention and Control of Pollution) Act, 1974, Water (Prevention and Control of Pollution) Cess Act, 1977 and the Air (prevention and Control of Pollution) Act, 1981 shall have the same meaning as assigned to them in the respective Acts.

4 Duties of waste generators.- (1) Every waste generator shall,-

(a) segregate and store the waste generated by them in three separate streams namely bio-degradable, non bio-degradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorised waste pickers or waste collectors as per the direction or notification by the local authorities from time to time;

(b) wrap securely the used sanitary waste like diapers, sanitary pads etc., in the pouches provided by the manufacturers or brand owners of these products or in a suitable wrapping material as instructed by the local authorities and shall place the same in the bin meant for dry waste or non- bio-degradable waste;

(c) store separately construction and demolition waste, as and when generated, in his own premises and shall dispose off as per the Construction and Demolition Waste Management Rules, 2016; and

(d) store horticulture waste and garden waste generated from his premises separately in his own premises and dispose of as per the directions of the local body from time to time.

(2) No waste generator shall throw**,** burn or burry the solid waste generated by him, on streets, open public spaces outside his premises or in the drain or water bodies.

(3) All waste generators shall pay such user fee for solid waste management, as specified in the bye-laws of the local bodies.

(4) No person shall organise an event or gathering of more than one hundred persons at any unlicensed place without intimating the local body, at least three working days in advance and such person or the organiser of such event shall ensure segregation of waste at source and handing over of segregated waste to waste collector or agency as specified by the local body.

(5) Every street vendor shall keep suitable containers for storage of waste generated during the course of his activity such as food waste, disposable plates, cups, cans, wrappers, coconut shells, leftover food, vegetables, fruits, etc., and shall deposit such waste at waste storage depot or container or vehicle as notified by the local body**.**

(6) All resident welfare and market associations shall, within one year from the date of notification of these rules and in partnership with the local body ensure segregation of waste at source by the generators as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorised recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.

(7) All gated communities and institutions with more than 5,000 sqm area shall, within one year from the date of notification of these rules and in partnership with the local body, ensure segregation of waste at source by the generators as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorizsd recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.

(8) All hotels and restaurants shall, within one year from the date of notification of these rules and in partnership with the local body ensure segregation of waste at source as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorised recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.

5. Duties of Ministry of Environment, Forest and Climate Change.- (1) The Ministry of Environment, Forest and Climate Change shall be responsible for over all monitoring the implementation of these rules in the country. It shall constitute a Central Monitoring Committee under the Chairmanship of Secretary, Ministry of Environment, Forest and Climate Change comprising officer not below the rank of Joint Secretary or Advisor from the following namely,-

462

1) Ministry of Urban Development

2) Ministry of Rural Development

3) Ministry of Chemicals and Fertilizers

4) Ministry of Agriculture

5) Central Pollution Control Board

6) Three State Pollution Control Boards or Pollution Control Committees by rotation

7) Urban Development Departments of three State Governments by rotation

8) Rural Development Departments from two State Governments by rotation

9) Three Urban Local bodies by rotation

10) Two census towns by rotation

11) FICCI, CII

12) Two subject experts

2. This Central Monitoring Committee shall meet at least once in a year to monitor and review the implementation of these rules. The Ministry of Environment, Forest and Climate Change may co-opt other experts, if needed. The Committee shall be renewed every three years.

6. Duties of Ministry of Urban Development.- (1) The Ministry of Urban Development shall coordinate with State Governments and Union territory Administrations to,-

(a) take periodic review of the measures taken by the states and local bodies for improving solid waste management practices and execution of solid waste management projects funded by the Ministry and external agencies at least once in a year and give advice on taking corrective measures;

(b) formulate national policy and strategy on solid waste management including policy on waste to energy in consultation with stakeholders within six months from the date of notification of these rules;

(c) facilitate States and Union Territories in formulation of state policy and strategy on solid management based on national solid waste management policy and national urban sanitation policy;

(d) promote research and development in solid waste management sector and disseminate information to States and local bodies;

(e) undertake training and capacity building of local bodies and other stakeholders;and

(f) provide technical guidelines and project finance to states, Union territories and local bodies on solid waste management to facilitate meeting timelines and standards.

7. Duties of Department of Fertilisers, Ministry of Chemicals and Fertilisers.- (1) The Department of Fertilisers through appropriate mechanisms shall,-

(a) provide market development assistance on city compost; and

(b) ensure promotion of co-marketing of compost with chemical fertilisers in the ratio of 3 to 4 bags: 6 to 7 bags by the fertiliser companies to the extent compost is made availablefor marketing to the companies.

8. Duties of Ministry of Agriculture, Government of India.- The Ministry of Agriculture through appropriate mechanisms shall,-

(a) provide flexibility in Fertiliser Control Order for manufacturing and sale of compost;

(b) propagate utlisation of compost on farm land;

(c) set up laboratories to test quality of compost produced by local authorities or their authorised agencies; and

(d) issue suitable guidelines for maintaining the quality of compost and ratio of use of compost visa-a-vis chemical fertilizers while applying compost to farmland.

9. Duties of the Ministry of Power.-The Ministry of Power through appropriate mechanisms shall,-

(a) decide tariff or charges for the power generated from the waste to energy plants based on solid waste.

(b) compulsory purchase power generated from such waste to energy plants by distribution company.

10. Duties of Ministry of New and Renewable Energy Sources- The Ministry of New and Renewable Energy Sources through appropriate mechanisms shall,-

(a) facilitate infrastructure creation for waste to energy plants; and

(b) provide appropriate subsidy or incentives for such waste to energy plants.

11. Duties of the Secretary–in-charge, Urban Development in the States and Union territories.- (1) The Secretary, Urban Development Department in the State or Union territory through the Commissioner or Director of Municipal Administration or Director of local bodies shall,-

(a) prepare a state policy and solid waste management strategy for the state or the union territory in consultation with stakeholders including representative of waste pickers**,** self help group and similar groups working in the field of waste management consistent with these rules, national policy on solid waste management and national urban sanitation policy of the ministry of urban development, in a period not later than one year from the date of notification of these rules;

(b) while preparing State policy and strategy on solid waste management, lay emphasis on waste reduction, reuse, recycling, recovery and optimum utilisation of various components of solid waste to ensure minimisation of waste going to the landfill and minimise impact of solid waste on human health and environment;

(c) state policies and strategies should acknowledge the primary role played by the informal sector of waste pickers, waste collectors and recycling industry in reducing waste and provide broad guidelines regarding integration of waste picker or informal waste collectors in the waste management system.

(d) ensure implementation of provisions of these rules by all local authorities;

(e) direct the town planning department of the State to ensure that master plan of every city in the State or Union territory provisions for setting up of solid waste processing and disposal facilities except for the cities who are members of common waste processing facility or regional sanitary landfill for a group of cities; and

(f) ensure identification and allocation of suitable land to the local bodies within one year for setting up of processing and disposal facilities for solid wastes and incorporate them in the master plans (land use plan) of the State or as the case may be, cities through metropolitan and district planning committees or town and country planning department;

(h) direct the town planning department of the State and local bodies to ensure that a separate space for segregation, storage, decentralised processing of solid waste is demarcated in the development plan for group housing or commercial, institutional or any other non-residential complex exceeding 200 dwelling or having a plot area exceeding 5,000 square meters;

(i) direct the developers of Special Economic Zone, Industrial Estate, Industrial Park to earmark at least five percent of the total area of the plot or minimum five plots or sheds for recovery and recycling facility.

(j) facilitate establishment of common regional sanitary land fill for a group of cities and towns falling within a distance of 50 km (or more) from the regional facility on a cost sharing basis and ensure professional management of such sanitary landfills;

(k) arrange for capacity building of local bodies in managing solid waste, segregation and transportation or processing of such waste at source;

(l) notify buffer zone for the solid waste processing and disposal facilities of more than five tons per day in consultation with the State Pollution Control Board; and

(m) start a scheme on registration of waste pickers and waste dealers.

12. Duties of District Magistrate or District Collector or Deputy Commissioner.- The District Magistrate or District Collector or as the case may be , the Deputy Commissioner shall, -

(a) facilitate identification and allocation of suitable land as per clause (f) of rules 11 for setting up solid waste processing and disposal facilities to local authorities in his district in close coordination with the Secretary-in-charge of State Urban Development Department within one year from the date of notification of these rules;

(b) review the performance of local bodies, at least once in a quarter on waste segregation, processing, treatment and disposal and take corrective measures in consultation with the Commissioner or Director of Municipal Administration or Director of local bodies and secretary-in-charge of the State Urban Development.

13. Duties of the Secretary–in-charge of Village Panchayats or Rural Development Department in the State and Union territory.- (1) The Secretary–in-charge of Village Panchayats or Rural Development Department in the State and Union territory shall have the same duties as the Secretary–in-charge, Urban Development in the States and Union territories, for the areas which are covered under these rules and are under their jurisdictions.

14. Duties of Central Pollution Control Board.-The Central Pollution Control Board shall, -

(a) co-ordinate with the State Pollution Control Boards and the Pollution Control Committees for implementation of these rules and adherence to the prescribed standards by local authorities;

(b) formulate the standards for ground water, ambient air, noise pollution, leachate in respect of all solid waste processing and disposal facilities;

(c) review environmental standards and norms prescribed for solid waste processing facilities or treatment technologies and update them as and when required;

(d) review through State Pollution Control Boards or Pollution Control Committees, at least once in a year, the implementation of prescribed environmental standards for solid waste processing facilities or treatment technologies and compile the data monitored by them;

(e) review the proposals of State Pollution Control Boards or Pollution Control Committees on use of any new technologies for processing, recycling and treatment of solid waste and prescribe performance standards, emission norms for the same within 6 months;

(f) monitor through State Pollution Control Boards or Pollution Control Committees the implementation of these rules by local bodies;

(g) prepare an annual report on implementation of these rules on the basis of reports received from State Pollution Control Boards and Committees and submit to the Ministry of Environment, Forest and Climate Change and the report shall also be put in public domain;

(h) publish guidelines for maintaining buffer zone restricting any residential, commercial or any other construction activity from the outer boundary of the waste processing and disposal facilities for different sizes of facilities handling more than five tons per day of solid waste;

(i) publish guidelines, from time to time, on environmental aspects of processing and disposal of solid waste to enable local bodies to comply with the provisions of these rules; and

(j) provide guidance to States or Union territories on inter-state movement of waste.

15. Duties and responsibilities of local authorities and village Panchayats of census towns and urban agglomerations.- The local authorities and Panchayats shall,-

(a) prepare a solid waste management plan as per state policy and strategy on solid waste management within six months from the date of notification of state policy and strategy and submit a copy to respective departments of State Government or Union territory Administration or agency authorised by the State Government or Union territory Administration;

(b) arrange for door to door collection of segregated solid waste from all households including slums and informal settlements, commercial, institutional and other non residential premises. From multi-storage buildings, large commercial complexes, malls, housing complexes, etc., this may be collected from the entry gate or any other designated location;

(c) establish a system to recognise organisations of waste pickers or informal waste collectors and promote and establish a system for integration of these authorised waste-pickers and waste collectors to facilitate their participation in solid waste management including door to door collection of waste;

(d) facilitate formation of Self Help Groups, provide identity cards and thereafter encourage integration in solid waste management including door to door collection of waste;

(e) frame bye-laws incorporating the provisions of these rules within one year from the date of notification of these rules and ensure timely implementation;

(f) prescribe from time to time user fee as deemed appropriate and collect the fee from the waste generators on its own or through authorised agency;

(g) direct waste generators not to litter i.e throw or dispose of any waste such as paper, water bottles, liquor bottles, soft drink canes, tetra packs, fruit peel, wrappers, etc., or burn or burry waste on streets, open public spaces, drains, waste bodies and to segregate the waste at source as prescribed under these rules and hand over the segregated waste to authorised the waste pickers or waste collectors authorised by the local body;

(h) setup material recovery facilities or secondary storage facilities with sufficient space for sorting of recyclable materials to enable informal or authorised waste pickers and waste collectors to separate recyclables from the waste and provide easy access to waste pickers and recyclers for collection of segregated recyclable waste such as paper, plastic, metal, glass, textile from the source of generation or from material recovery facilities; Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be printed white and those for storage of other wastes shall be printed black;

(i) establish waste deposition centres for domestic hazardous waste and give direction for waste generators to deposit domestic hazardous wastes at this centre for its safe disposal. Such facility shall be established in a city or town in a manner that one centre is set up for the area of twenty square kilometers or part thereof and notify the timings of receiving domestic hazardous waste at such centres;

(j) ensure safe storage and transportation of the domestic hazardous waste to the hazardous waste disposal facility or as may be directed by the State Pollution Control Board or the Pollution Control Committee;

(k) direct street sweepers not to burn tree leaves collected from street sweeping and store them separately and handover to the waste collectors or agency authorised by local body;

(l) provide training on solid waste management to waste-pickers and waste collectors;

(m) collect waste from vegetable, fruit, flower, meat, poultry and fish market on day to day basis and promote setting up of decentralised compost plant or bio-methanation plant at suitable locations in the markets or in the vicinity of markets ensuring hygienic conditions;

(n) collect separately waste from sweeping of streets, lanes and by-lanes daily, or on alternate days or twice a week depending on the density of population, commercial activity and local situation;

(o) set up covered secondary storage facility for temporary storage of street sweepings and silt removed from surface drains in cases where direct collection of such waste into transport vehicles is not convenient. Waste so collected shall be collected and disposed of at regular intervals as decided by the local body;

(p) collect horticulture, parks and garden waste separately and process in the parks and gardens, as far as possible;

(q) transport segregated bio-degradable waste to the processing facilities like compost plant, bio-methanation plant or any such facility. Preference shall be given for on site processing of such waste;

(r) transport non-bio-degradable waste to the respective processing facility or material recovery facilities or secondary storage facility;

(s) transport construction and demolition waste as per the provisions of the Construction and Demolition Waste management Rules, 2016;

(t) involve communities in waste management and promotion of home composting, bio-gas generation, decentralised processing of waste at community level subject to control of odour and maintenance of hygienic conditions around the facility;

(u) phase out the use of chemical fertilizer in two years and use compost in all parks, gardens maintained by the local body and wherever possible in other places under its jurisdiction. Incentives may be provided to recycling initiatives by informal waste recycling sector.

(v) facilitate construction, operation and maintenance of solid waste processing facilities and associated infrastructure on their own or with private sector participation or through any agency for optimum utilisation of various components of solid waste adopting suitable technology including the following technologies and adhering to the guidelines issued by the Ministry of Urban Development from time to time and standards prescribed by the Central Pollution Control Board. Preference shall be given to decentralised processing to minimize transportation cost and environmental impacts such as-

a) bio-methanation, microbial composting, vermi-composting, anaerobic digestion or any other appropriate processing for bio-stabilisation of biodegradable wastes;

b) waste to energy processes including refused derived fuel for combustible fraction of waste or supply as feedstock to solid waste based power plants or cement kilns;

(w) undertake on their own or through any other agency construction, operation and maintenance of sanitary landfill and associated infrastructure as per Schedule 1 for disposal of residual wastes in a manner prescribed under these rules;

(x) make adequate provision of funds for capital investments as well as operation and maintenance of solid waste management services in the annual budget ensuring that funds for discretionary functions of the local body have been allocated only after meeting the requirement of necessary funds for solid waste management and other obligatory functions of the local body as per these rules;

(y) make an application in Form-I for grant of authorisation for setting up waste processing, treatment or disposal facility, if the volume of waste is exceeding five metric tones per day including sanitary landfills from the State Pollution Control Board or the Pollution Control Committee, as the case may be;

(z) submit application for renewal of authorisation at least sixty days before the expiry of the validity of authorisation;

466

(za) prepare and submit annual report in Form IV on or before the 30th April of the succeeding year to the Commissioner or Director, Municipal Administration or designated Officer;

(zb) the annual report shall then be sent to the Secretary -in-Charge of the State Urban Development Department or village panchayat or rural development department and to the respective State Pollution Control Board or Pollution Control Committee by the 31st May of every year;

(zc) educate workers including contract workers and supervisors for door to door collection of segregated waste and transporting the unmixed waste during primary and secondary transportation to processing or disposal facility;

(zd) ensure that the operator of a facility provides personal protection equipment including uniform, fluorescent jacket, hand gloves, raincoats, appropriate foot wear and masks to all workers handling solid waste and the same are used by the workforce;

(ze) ensure that provisions for setting up of centers for collection, segregation and storage of segregated wastes, are incorporated in building plan while granting approval of building plan of a group housing society or market complex; and

(zf) frame bye-laws and prescribe criteria for levying of spot fine for persons who litters or fails to comply with the provisions of these rules and delegate powers to officers or local bodies to levy spot fines as per the bye laws framed; and

(zg) create public awareness through information, education and communication campaign and educate the waste generators on the following; namely:-

(i) not to litter;

(ii) minimise generation of waste;

(iii) reuse the waste to the extent possible;

(iv) practice segregation of waste into bio–degradable, non-biodegradable (recyclable and combustible), sanitary waste and domestic hazardous wastes at source;

(v) practice home composting, vermi-composting, bio-gas generation or community level composting;

(vi) wrap securely used sanitary waste as and when generated in the pouches provided by the brand owners or a suitable wrapping as prescribed by the local body and place the same in the bin meant for non-biodegradable waste;

(vii) storage of segregated waste at source in different bins;

(viii) handover segregated waste to waste pickers, waste collectors, recyclers or waste collection agencies; and

(ix) pay monthly user fee or charges to waste collectors or local bodies or any other person authorised by the local body for sustainability of solid waste management.

(zh) stop land filling or dumping of mixed waste soon after the timeline as specified in rule 23 for setting up and operationalisation of sanitary landfill is over;

(zi) allow only the non-usable, non-recyclable, non-biodegradable, non-combustible and non-reactive inert waste and pre-processing rejects and residues from waste processing facilities to go to sanitary landfill and the sanitary landfill sites shall meet the specifications as given in Schedule–I, however, every effort shall be made to recycle or reuse the rejects to achieve the desired objective of zero waste going to landfill;

(zj) investigate and analyse all old open dumpsites and existing operational dumpsites for their potential of bio-mining and bio-remediation and wheresoever feasible, take necessary actions to bio-mine or bio-remediate the sites;

(zk) in absence of the potential of bio-mining and bio-remediation of dumpsite, it shall be scientifically capped as per landfill capping norms to prevent further damage to the environment.

16. Duties of State Pollution Control Board or Pollution Control Committee.- (1) The State Pollution Control Board or Pollution Control Committee shall,-

(a) enforce these rules in their State through local bodies in their respective jurisdiction and review implementation of these rules at least twice a year in close coordination with concerned Directorate of Municipal Administration or Secretary-in-charge of State Urban Development Department;

(b) monitor environmental standards and adherence to conditions as specified under the Schedule I and Schedule II for waste processing and disposal sites;

(c) examine the proposal for authorisation and make such inquiries as deemed fit, after the receipt of the application for the same in Form I from the local body or any other agency authorised by the local body;

467

(d) while examining the proposal for authorisation, the requirement of consents under respective enactments and views of other agencies like the State Urban Development Department, the Town and Country Planning Department, District Planning Committee or Metropolitan Area Planning Committee, as may be applicable, Airport or Airbase Authority, the Ground Water Board, Railways, power distribution companies, highway department and other relevant agencies shall be taken into consideration and they shall be given four weeks time to give their views, if any;

(e) issue authorisation within a period of sixty days in Form II to the local body or an operator of a facility or any other agency authorised by local body stipulating compliance criteria and environmental standards as specified in Schedules I and II including other conditions, as may be necessary;

(f) synchronise the validity of said authorisation with the validity of the consents;

(g) suspend or cancel the authorization issued under clause (a) any time, if the local body or operator of the facility fails to operate the facility as per the conditions stipulated:

provided that no such authorization shall be suspended or cancelled without giving notice to the local body or operator, as the case may be; and

(h) on receipt of application for renewal, renew the authorisation for next five years, after examining every application on merit and subject to the condition that the operator of the facility has fulfilled all the provisions of the rules, standards or conditions specified in the authorisation, consents or environment clearance.

(2) The State Pollution Control Board or Pollution Control Committee shall, after giving reasonable opportunity of being heard to the applicant and for reasons thereof to be recorded in writing, refuse to grant or renew an authorisation.

(3) In case of new technologies, where no standards have been prescribed by the Central Pollution Control Board, State Pollution Control Board or Pollution Control Committee, as the case may be, shall approach Central Pollution Control Board for getting standards specified.

(4) The State Pollution Control Board or the Pollution Control Committee, as the case may be, shall monitor the compliance of the standards as prescribed or laid down and treatment technology as approved and the conditions stipulated in the authorisation and the standards specified in Schedules I and II under these rules as and when deemed appropriate but not less than once in a year.

(5) The State Pollution Control Board or the Pollution Control Committee may give directions to local bodies for safe handling and disposal of domestic hazardous waste deposited by the waste generators at hazardous waste deposition facilities.

(6) The State Pollution Control Board or the Pollution Control Committee shall regulate Inter-State movement of waste.

17. Duty of manufacturers or brand owners of disposable products and sanitary napkins and diapers.- (1) All manufacturers of disposable products such as tin, glass, plastics packaging, etc., or brand owners who introduce such products in the market shall provide necessary financial assistance to local authorities for establishment of waste management system.

(2) All such brand owners who sell or market their products in such packaging material which are non-biodegradable shall put in place a system to collect back the packaging waste generated due to their production.

(3) Manufacturers or brand owners or marketing companies of sanitary napkins and diapers shall explore the possibility of using all recyclable materials in their products or they shall provide a pouch or wrapper for disposal of each napkin or diapers along with the packet of their sanitary products.

(4) All such manufacturers, brand owners or marketing companies shall educate the masses for wrapping and disposal of their products.

18. Duties of the industrial units located within one hundred km from the refused derived fuel and waste to energy plants based on solid waste- All industrial units using fuel and located within one hundred km from a solid waste based refused derived fuel plant shall make arrangements within six months from the date of notification of these rules to replace at least five percent of their fuel requirement by refused derived fuel so produced.

19. Criteria for Duties regarding setting-up solid waste processing and treatment facility.- (1) The department in- charge of the allocation of land assignment shall be responsible for providing suitable land for setting up of the solid waste processing and treatment facilities and notify such sites by the State Government or Union territory Administration.

(2) The operator of the facility shall design and set up the facility as per the technical guidelines issued by the Central Pollution Control Board in this regard from time to time and the manual on solid waste management prepared by the Ministry of Urban Development.

468

(3) The operator of the facility shall obtain necessary approvals from the State Pollution Control Board or Pollution Control Committee.

(4) The State Pollution Control Board or Pollution Control Committee shall monitor the environment standards of the operation of the solid waste processing and treatment facilities.

(5) The operator of the facility shall be responsible for the safe and environmentally sound operations of the solid waste processing and or treatment facilities as per the guidelines issued by the Central Pollution Control Board from time to time and the Manual on Municipal Solid Waste Management published by the Ministry of Urban Development and updated from time to time.

(6) The operator of the solid waste processing and treatment facility shall submit annual report in Form III each year by 30th April to the State Pollution Control Board or Pollution Committee and concerned local body.

20. Criteria and actions to be taken for solid waste management in hilly areas.- In the hilly areas, the duties and responsibilities of the local authorities shall be the same as mentioned in rule 15 with additional clauses as under:

(a) Construction of landfill on the hill shall be avoided. A transfer station at a suitable enclosed location shall be setup to collect residual waste from the processing facility and inert waste. A suitable land shall be identified in the plain areas down the hill within 25 kilometers for setting up sanitary landfill. The residual waste from the transfer station shall be disposed of at this sanitary landfill.

(b) In case of non-availability of such land, efforts shall be made to set up regional sanitary landfill for the inert and residual waste.

(c) Local body shall frame Bye-laws and prohibit citizen from littering wastes on the streets and give strict direction to the tourists not to dispose any waste such as paper, water bottles, liquor bottles, soft drink canes, tetra packs, any other plastic or paper waste on the streets or down the hills and instead direct to deposit such waste in the litter bins that shall be placed by the local body at all tourist destinations.

(d) Local body shall arrange to convey the provisions of solid waste management under the bye-laws to all tourists visiting the hilly areas at the entry point in the town as well as through the hotels, guest houses or like where they stay and by putting suitable hoardings at tourist destinations.

(e) Local body may levy solid waste management charge from the tourist at the entry point to make the solid waste management services sustainable.

(f) The department in- charge of the allocation of land assignment shall identify and allot suitable space on the hills for setting up decentralised waste processing facilities. Local body shall set up such facilities. Step garden system may be adopted for optimum utilisation of hill space.

21. Criteria for waste to energy process.- (1) Non recyclable waste having calorific value of 1500 K/cal/kg or more shall not be disposed of on landfills and shall only be utilised for generating energy either or through refuse derived fuel or by giving away as feed stock for preparing refuse derived fuel.

(2) High calorific wastes shall be used for co-processing in cement or thermal power plants.

(3) The local body or an operator of facility or an agency designated by them proposing to set up waste to energy plant of more than five tones per day processing capacity shall submit an application in Form-I to the State Pollution Control Board or Pollution Control Committee, as the case may be, for authorisation.

(4) The State Pollution Control Board or Pollution Control Committee, on receiving such application for setting up waste to energy facility, shall examine the same and grant permission within sixty days.

22. Time frame for implementation.- Necessary infrastructure for implementation of these rules shall be created by the local bodies and other concerned authorities, as the case may be, on their own, by directly or engaging agencies within the time frame specified below:

Sl. No.	**Activity**	**Time limit from the date of notification of rules**
(1)	**(2)**	**(3)**
1.	identification of suitable sites for setting up solid waste processing facilities	1 year

469

2.	identification of suitable sites for setting up common regional sanitary landfill facilities for suitable clusters of local authorities under 0.5 million population and for setting up common regional sanitary landfill facilities or stand alone sanitary landfill facilities by all local authorities having a population of 0.5 million or more .	1 year
3.	procurement of suitable sites for setting up solid waste processing facility and sanitary landfill facilities	2 years
4.	enforcing waste generators to practice segregation of bio degradable, recyclable, combustible, sanitary waste domestic hazardous and inert solid wastes at source ,	2 years
5.	Ensure door to door collection of segregated waste and its transportation in covered vehicles to processing or disposal facilities.	2 years
6.	ensure separate storage, collection and transportation of construction and demolition wastes	2 years
7.	setting up solid waste processing facilities by all local bodies having 100000 or more population	2 years
8.	Setting up solid waste processing facilities by local bodies and census towns below 100000 population.	3 years
9	setting up common or stand alone sanitary landfills by or for all local bodies having 0.5 million or more population for the disposal of only such residual wastes from the processing facilities as well as untreatable inert wastes as permitted under the Rules	3 years
10.	setting up common or regional sanitary landfills by all local bodies and census towns under 0.5 million population for the disposal of permitted waste under the rules	3years
11.	bio-remediation or capping of old and abandoned dump sites	5years

23. State Level Advisory Body. – (1) Every Department in-charge of local bodies of the concerned State Government or Union territory administration shall constitute a State Level Advisory Body within six months from the date of notification of these rules comprising the following members, namely:-

Sl. No	**Designation**	**Member**
(1)	**(2)**	**(3)**
1.	Secretary, Department of Urban Development orLocal self government department of the State	Chairperson, ex-officio
2.	One representative of Panchayats or Rural development Department not below the rank of Joint Secretary to State Government	Member, ex-officio
3.	one representative of Revenue Department of State Government	Member,ex-officio
4.	One representative from Ministry of Environment, Forest and Climate Change Government of India	Member, ex-officio

470

5.	One representative from Ministry of Urban Development, Government of India	Member, ex-officio
6.	One representative from Ministry of Rural Development, Government of India	Member, ex-officio
7.	One representative from the Central Pollution Control Board	Member, ex-officio
8.	One representative from the State Pollution Control Board or Pollution Control Committee	Member, ex-officio
9.	One representative from Indian Institute of Technology or National Institute of Technology	Member,Ex-officio
10.	Chief town planner of the state	Member
11.	Three representatives from the local bodies by rotation	Member
12.	Two representatives from census towns or urban agglomerations by rotation.	Member
13.	One representative from reputed Non-Governmental Organisation or Civil Society working for the waste pickers or informal recycler or solid waste management	Member
14.	One representative from a body representing Industries at the State or Central level	Member
15.	one representative from waste recycling industry	member
16.	Two subject experts	Member
17.	Co-opt one representative each from agriculture department, and labour department of State Government.	Member

(2) The State Level Advisory Body shall meet at least one in every six months to review the matters related to implementation of these rules, state policy and strategy on solid waste management and give advice to state government for taking measures that are necessary for expeditious and appropriate implementation of these rules.

(3) The copies of the review report shall be forwarded to the State Pollution Control Board or Pollution Control Committee for necessary action.

24. Annual report.- (1) The operator of facility shall submit the annual report to the local body in Form-III on or before the 30th day of April every year.

(2) The local body shall submit its annual report in Form-IV to State P Control Board or P Committee and the Secretary-in-Charge of the Department of Urban Development of the concerned State or Union Territory in case of metropolitan city and to the Director of Municipal Administration or Commissioner of Municipal Administration or Officer in -Charge of Urban local bodies in the state in case of all other local bodies of state on or before the 30th day of June every year

(3) Each State Pollution Control Board or Pollution Control Committee as the case may be, shall prepare and submit the consolidated annual report to the Central Pollution Control Board and Ministry of Urban Development on the implementation of these rules and action taken against non complying local body by the 31stday of July of each year in Form-V.

(4) The Central Pollution Control Board shall prepare a consolidated annual review report on the status of implementation of these rules by local bodies in the country and forward the same to the Ministry of Urban Development

471

and Ministry of Environment, Forest and Climate Change, along with its recommendations before the 31st day of August each year.

(5) The annual report shall be reviewed by the Ministry of Environment, Forest and Climate Change during the meeting of Central Monitoring Committee.

25. Accident reporting- In case of an accident at any solid waste processing or treatment or disposal facility or landfill site, the Officer- in- charge of the facility shall report to the local body in Form-VI and the local body shall review and issue instructions if any, to the in- charge of the facility.

SCHEDULE I

[see rule 15 (w),(zi), 16 (1) (b) (e), 16 (4)]

Specifications for Sanitary Landfills

(A) Criteria for site selection.-

(i) The department in the business allocation of land assignment shall provide suitable site for setting up of the solid waste processing and treatment facilities and notify such sites.

(ii) The sanitary landfill site shall be planned, designed and developed with proper documentation of construction plan as well as a closure planin a phased manner. In case a new landfill facility is being established adjoining an existing landfill site, the closure plan of existing landfill should form a part of the proposal of such new landfill.

(iii) The landfill sites shall be selected to make use of nearby wastes processing facilities. Otherwise, wastes processing facility shall be planned as an integral part of the landfill site.

(iv) Landfill sites shall be set up as per the guidelines of the Ministry of Urban Development, Government of India and Central Pollution Control Board.

(v) The existing landfill sites which are in use for more than five years shall be improved in accordance with the specifications given in this Schedule.

(vi) The landfill site shall be large enough to last for at least 20-25 years and shall develop 'landfill cells' in a phased manner to avoid water logging and misuse.

(vii) The landfill site shall be 100 meter away from river, 200 meter from a pond, 200 meter from Highways, Habitations, Public Parks and water supply wells and 20 km away from Airports or Airbase. However in a special case, landfill site may be set up within a distance of 10 and 20 km away from the Airport/Airbase after obtaining no objection certificate from the civil aviation authority/ Air force as the case may be. The Landfill site shall not be permitted within the flood plains as recorded for the last 100 years, zone of coastal regulation, wetland, Critical habitat areas, sensitive eco-fragile areas..

(viii) The sites for landfill and processing and disposal of solid waste shall be incorporated in the Town Planning Department's land-use plans.

(ix) A buffer zone of no development shall be maintained around solid waste processing and disposal facility, exceeding five Tonnes per day of installed capacity. This will be maintained within the total area of the solid waste processing and disposal facility. The buffer zone shall be prescribed on case to case basis by the local body in consultation with concerned State Pollution Control Board.

(x) The biomedical waste shall be disposed of in accordance with the Bio-medical Waste Management Rules, 2016, as amended from time to time . The hazardous waste shall be managed in accordance with the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended from time to time. The E-waste shall be managed in accordance with the e-Waste (Management) Rules, 2016 as amended from time to time.

(xi) Temporary storage facility for solid waste shall be established in each landfill site to accommodate the waste in case of non- operation of waste processing and during emergency or natural calamities.

(B) Criteria for development of facilities at the sanitary landfills.-

(i) Landfill site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles, to prevent entry of unauthorised persons and stray animals

(ii) The approach and / internal roads shall be concreted or paved so as to avoid generation of dust particles due to vehicular movement and shall be so designed to ensure free movement of vehicles and other machinery.

(iii) The landfill site shall have waste inspection facility to monitor waste brought in for landfilling h, office facility for record keeping and shelter for keeping equipment and machinery including pollution monitoring equipment. The operator of the facility shall maintain record of waste received, processed and disposed.

472

(iv) Provisions like weigh bridge to measure quantity of waste brought at landfill site, fire protection equipment and other facilities as may be required shall be provided.

(v) Utilities such as drinking water and sanitary facilities (preferably washing/bathing facilities for workers) and lighting arrangements for easy landfill operations during night hours shall be provided.

(vi) Safety provisions including health inspections of workers at landfill sites shall be carried out made.

(vii) Provisions for parking, cleaning, washing of transport vehicles carrying solid waste shall be provided. The wastewater so generated shall be treated to meet the prescribed standards.

(C) Criteria for specifications for land filling operations and closure on completion of land filling.-

(i) Waste for land filling shall be compacted in thin layers using heavy compactors to achieve high density of the waste. In high rainfall areas where heavy compactors cannot be used, alternative measures shall be adopted.

(ii) Till the time waste processing facilities for composting or recycling or energy recovery are set up, the waste shall be sent to the sanitary landfill. The landfill cell shall be covered at the end of each working day with minimum 10 cm of soil, inert debris or construction material..

(iii) Prior to the commencement of monsoon season, an intermediate cover of 40-65 cm thickness of soil shall be placed on the landfill with proper compaction and grading to prevent infiltration during monsoon. Proper drainage shall be constructed to divert run-off away from the active cell of the landfill.

(iv) After completion of landfill, a final cover shall be designed to minimise infiltration and erosion. The final cover shall meet the following specifications, namely :--

a) The final cover shall have a barrier soil layer comprising of 60 cm of clay or amended soil with permeability coefficient less than 1 x 10^{-7} cm/sec.

b) On top of the barrier soil layer, there shall be a drainage layer of 15 cm.

c) On top of the drainage layer, there shall be a vegetative layer of 45 cm to support natural plant growth and to minimise erosion.

(D) Criteria for pollution prevention.-In order to prevent pollution from landfill operations, the following provisions shall be made, namely:-

(i) The storm water drain shall be designed and constructed in such a way that the surface runoff water is diverted from the landfilling site and leachates from solid waste locations do not get mixed with the surface runoff water. Provisions for diversion of storm water discharge drains shall be made to minimise leachate generation and prevent pollution of surface water and also for avoiding flooding and creation of marshy conditions.

(ii) Non-permeable lining system at the base and walls of waste disposal area. For landfill receiving residues of waste processing facilities or mixed waste or waste having contamination of hazardous materials (such as aerosols, bleaches, polishes, batteries, waste oils, paint products and pesticides) shall have liner of composite barrier of 1.5 mm thick high density polyethylene (HDPE) geo-membrane or geo-synthetic liners, or equivalent, overlying 90 cm of soil (clay or amended soil) having permeability coefficient not greater than 1 x 10-7 cm/sec. The highest level of water table shall be at least two meter below the base of clay or amended soil barrier layer provided at the bottom of landfills.

(iii) Provisions for management of leachates including its collection and treatment shall be made. The treated leachate shall be recycled or utilized as permitted, otherwise shall be released into the sewerage line, after meeting the standards specified in Schedule- II**.**. In no case, leachate shall be released into open environment.

(iv) Arrangement shall be made to prevent leachate runoff from landfill area entering any drain, stream, river, lake or pond. In case of mixing of runoff water with leachate or solid waste, the entire mixed water shall be treated by the concern authority.

(E) Criteria for water quality monitoring.-

(i) Before establishing any landfill site, baseline data of ground water quality in the area shall be collected and kept in record for future reference. The ground water quality within 50 meter of the periphery of landfill site shall be periodically monitored covering different seasons in a year that is, summer, monsoon and post-monsoon period to ensure that the ground water is not contaminated.

(ii) Usage of groundwater in and around landfill sites for any purpose (including drinking and irrigation) shall be considered only after ensuring its quality. The following specifications for drinking water quality shall apply for monitoring purpose, namely :-

473

S. No.	Parameters	IS 10500:2012, Edition 2.2(2003-09) Desirable limit (mg/l except for pH)
(1)	(2)`	(3)
	Arsenic	0.01
	Cadmium	0.01
	Chromium(as Cr^{6+})	0.05
	Copper	0.05
	Cyanide	0.05
	Lead	0.05
	Mercury	0.001
	Nickel	-
	Nitrate as NO_3	45.0
	pH	6.5-8.5
	Iron	0.3
	Total hardness (as $CaCO_3$)	300.0
	Chlorides	250
	Dissolved solids	500
	Phenolic compounds (as C_6H_5OH)	0.001
	Zinc	5.0
	Sulphate (as SO_4)	200

(F) Criteria for ambient air quality monitoring.-

(i) Landfill gas control system including gas collection system shall be installed at landfill site to minimize odour, prevent off-site migration of gases, to protect vegetation planted on the rehabilitated landfill surface. For enhancing landfill gas recovery, use of geomembranes in cover systems along with gas collection wells should be considered.

(ii) The concentration of methane gas generated at landfill site shall not exceed 25 per cent of the lower explosive limit (LEL).

(iii) The landfill gas from the collection facility at a landfill site shall be utilized for either direct thermal applications or power generation, as per viability. Otherwise, landfill gas shall be burnt (flared) and shall not be allowed to escape directly to the atmosphere or for illegal tapping. Passive venting shall be allowed in case if its utilisation or flaring is not possible.

(iv) Ambient air quality at the landfill site and at the vicinity shall be regularly monitored. Ambient air quality shall

meet the standards prescribed by the Central Pollution Control Board for Industrial area.

G. Criteria for plantation at landfill Site.- A vegetative cover shall be provided over the completed site in accordance with the following specifications, namely:-

(a) Locally adopted non-edible perennial plants that are resistant to drought and extreme temperatures shall be planted;

(b) The selection of plants should be of such variety that their roots do not penetrate more than 30 cms. This condition shall apply till the landfill is stabilized;

(c) Selected plants shall have ability to thrive on low-nutrient soil with minimum nutrient addition;

(d) Plantation to be made in sufficient density to minimise soil erosion.

(e) Green belts shall be developed all around the boundary of the landfill in consultation with State Pollution Control Boards or Pollution Control Committees .

H. Criteria for post-care of landfill site.- (1) The post-closure care of landfill site shall be conducted for at least fifteen years and long term monitoring or care plan shall consist of the following, namely :-'

(a) Maintaining the integrity and effectiveness of final cover, making repairs and preventing run-on and run-off from eroding or otherwise damaging the final cover;

(b) Monitoring leachate collection system in accordance with the requirement;

(c) Monitoring of ground water in and around landfill;

(d) Maintaining and operating the landfill gas collection system to meet the standards.

(2) Use of closed landfill sites after fifteen years of post-closure monitoring can be considered for human settlement or otherwise only after ensuring that gaseous emission and leachate quality analysis complies with the specified standards and the soil stability is ensured.

I. Criteria for special provisions for hilly areas.-Cities and towns located on hills shall have location-specific methods evolved for final disposal of solid waste by the local body with the approval of the concerned State Pollution Control Board or the Pollution Control Committee. The local body shall set up processing facilities for utilisation of biodegradable organic waste. The non-biodegradable recyclable materials shall be stored and sent for recycling periodically. The inert and non-biodegradable waste shall be used for building roads or filling-up of appropriate areas on hills. In case of constraints in finding adequate land in hilly areas, waste not suitable for road-laying or filling up shall be disposed of in regional landfills in plain areas.

J. Closure and Rehabilitation of Old Dumps- Solid waste dumps which have reached their full capacity or those which will not receive additional waste after setting up of new and properly designed landfills should be closed and rehabilitated by examining the following options:

(i) Reduction of waste by bio mining and waste processing followed by placement of residues in new landfills or capping as in (ii) below.

(i). Capping with solid waste cover or solid waste cover enhanced with geomembrane to enable collection and flaring / utilisation of greenhouse gases.

(iii) Capping as in (ii) above with additional measures (in alluvial and other coarse grained soils) such as cut-off walls and extraction wells for pumping and treating contaminated ground water.

(iv) Any other method suitable for reducing environmental impact to acceptable level.

SCHEDULE II

[see rule 16 (1), (b), (e), 16 (4))

Standards of processing and treatment of solid waste

A. Standards for composting.- The waste processing facilities shall include composting as one of the technologies for processing of bio degradable waste. In order to prevent pollution from compost plant, the following shall be complied with namely :-

(a) The incoming organic waste at site shall be stored properly prior to further processing. To the extent possible, the waste storage area should be covered. If, such storage is done in an open area, it shall be provided with impermeable base with facility for collection of leachate and surface water run-off into lined drains leading to a leachate treatment and disposal facility;

(b) Necessary precaution shall be taken to minimise nuisance of odour, flies, rodents, bird menace and fire hazard;

475

(c) In case of breakdown or maintenance of plant, waste intake shall be stopped and arrangements be worked out for diversion of waste to the temporary processing site or temporary landfill sites which will be again reprocessed when plant is in order;

(d) Pre-process and post-process rejects shall be removed from the processing facility on regular basis and shall not be allowed to pile at the site. Recyclables shall be routed through appropriate vendors. The non-recyclable high calorific fractions to be segregated and sent to waste to energy or for RDF production, co-processing in cement plants or to thermal power plants. Only rejects from all processes shall be sent for sanitary landfill site(s).

(e) The windrow area shall be provided with impermeable base. Such a base shall be made of concrete or compacted clay of 50 cm thick having permeability coefficient less than 10^{-7} cm/sec. The base shall be provided with 1 to 2 per cent slope and circled by lined drains for collection of leachate or surface run-off;

(f) Ambient air quality monitoring shall be regularly carried out. Odurnuisance at down-wind direction on the boundary of processing plant shall also be checked regularly.

(g) Leachate shall be re-circulated in compost plant for moisture maintenance.

(h) The end product compost shall meet the standards prescribed under Fertilizer Control Order notified from time to time.

(i) In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely:-

Parameters	**Organic Compost (FCO 2009)**	**Phosphate Rich Organic Manure (FCO 2013)**
(1)	**(2)**	**(3)**
Arsenic (mg/Kg)	10.00	10.00
Cadmium (mg/Kg)	5.00	5.00
Chromium (mg/Kg)	50.00	50.00
Copper (mg/Kg)	300.00	300.00
Lead (mg/Kg)	100.00	100.00
Mercury (mg/Kg)	0.15	0.15
Nickel (mg/Kg)	50.00	50.00
Zinc (mg/Kg)	1000.00	1000.00
C/N ratio	<20	Less than 20:1
pH	6.5-7.5	(1:5 solution) maximum 6.7
Moisture, percent by weight, maximum	15.0-25.0	25.0
Bulk density (g/cm^3)	<1.0	Less than 1.6
Total Organic Carbon, per cent by weight, minimum	12.0	7.9

476

Total Nitrogen (as N), per cent by weight, minimum	0.8	0.4
Total Phosphate (as $P_2 0_5$) percent by weight, minimum	0.4	10.4
Total Potassium (as $K_2 0$), percent by weight, minimum	0.4	-
Colour	Dark brown to black	-
Odour	Absence of foul Odor	-
Particle size	Minimum 90% material should pass through 4.0 mm IS sieve	Minimum 90% material should pass through 4.0 mm IS sieve
Conductivity (as dsm-1), not more than	4.0	8.2

* Compost (final product) exceeding the above stated concentration limits shall not be used for food crops. However, it may be utilized for purposes other than growing food crops.

B. Standards for treated leachates.-The disposal of treated leachates shall meet the following standards, namely:-

S. No	Parameter	Standards (Mode of Disposal)		
		Inland surface water	Public sewers	Land disposal
(1)	(2)	(3)	(4)	(5)
1.	Suspended solids, mg/l, max	100	600	200
2.	Dissolved solids (inorganic) mg/l, max.	2100	2100	2100
3	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
4	Ammonical nitrogen (as N), mg/l, max.	50	50	-
5	Total Kjeldahl nitrogen (as N), mg/l, max.	100	-	-
6	Biochemical oxygen demand (3 days at 27^0 C) max.(mg/l)	30	350	100
7	Chemical oxygen demand, mg/l, max.	250	-	-
8	Arsenic (as As), mg/l, max	0.2	0.2	0.2
9	Mercury (as Hg), mg/l, max	0.01	0.01	-
10	Lead (as Pb), mg/l, max	0.1	1.0	-
11	Cadmium (as Cd), mg/l, max	2.0	1.0	-

477

12	Total Chromium (as Cr), mg/l, max.	2.0	2.0	-
13	Copper (as Cu), mg/l, max.	3.0	3.0	-
14	Zinc (as Zn), mg/l, max.	5.0	15	-
15	Nickel (as Ni), mg/l, max	3.0	3.0	-
16	Cyanide (as CN), mg/l, max.	0.2	2.0	0.2
17	Chloride (as Cl), mg/l, max.	1000	1000	600
18	Fluoride (as F), mg/l, max	2.0	1.5	-
19	Phenolic compounds (as C_6H_5OH) mg/l, max.	1.0	5.0	-

Note : While discharging treated leachates into inland surface waters, quantity of leachates being discharged and the quantity of dilution water available in the receiving water body shall be given due consideration.

C. Standards for incineration: The Emission from incinerators /thermal technologies in Solid Waste treatment/disposal facility shall meet the following standards, namely:-

Parameter	**Emission standard**	
(1)	**(2)**	**(3)**
Particulates	50 mg/Nm^3	Standard refers to half hourly average value
HCl	50 mg/Nm^3	Standard refers to half hourly average value
SO2	200 mg/Nm^3	Standard refers to half hourly average value
CO	100 mg/Nm^3	Standard refers to half hourly average value
	50 mg/Nm^3	Standard refers to daily average value
Total Organic Carbon	20 mg/Nm^3	Standard refers to half hourly average value
HF	4 mg/Nm^3	Standard refers to half hourly average value
NOx (NO and NO2 expressed as NO2)	400 mg/Nm^3	Standard refers to half hourly average value
Total dioxins and furans	0.1 ng TEQ/Nm^3	Standard refers to 6-8 hours sampling. Please refer guidelines for 17 concerned congeners for toxic equivalence values to arrive at total toxic equivalence.
Cd + Th + their compounds	0.05 mg/Nm^3	Standard refers to sampling time anywhere between 30 minutes and 8 hours.
Hg and its compounds	0.05 mg/Nm^3	Standard refers to sampling time anywhere between 30 minutes and 8 hours.

Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V + their compounds	0.5 mg/Nm^3	Standard refers to sampling time anywhere between 30 minutes and 8 hours.
Note.- *All values corrected to 11% oxygen on a dry basis.*		

Note:

(a) Suitably designed pollution control devices shall be installed or retrofitted with the incinerator to achieve the above emission limits..

(b) Waste to be incinerated shall not be chemically treated with any chlorinated disinfectants.

(c) Incineration of chlorinated plastics shall be phased out within two years.

(d) if the concentation of toxic metals in incineration ash exceeds the limits specified in the Hazardous Waste (Management, Handling and Trans boundary Movement) Rules, 2008, as amended from time to time, the ash shall be sent to the hazardous waste treatment, storage and disposal fcaility.

(e) Only low sulphur fuel like LDO, LSHS, Diesel**,** bio-mass, coal, LNG, CNG, RDF and bio-gas shall be used as fuel in the incinerator.

(f) The CO2 concentration in tail gas shall not be more than 7%.

(g) All the facilities in twin chamber incinerators shall be designed to achieve a minimum temperature of 950^0C in secondary combustion chamber and with a gas residence time in secondary combustion chamber not less than 2 (two) seconds.

(h) Incineration plants shall be operated (combustion chambers) with such temperature, retention time and turbulence, as to achieve total Organic Carbon (TOC) content in the slag and bottom ash less than 3%, or the loss on ignition is less than 5% of the dry weight.

(i) Odour from sites shall be managed as per guidelines of CPCB issued from time to time

FORM – I

[see rule 15 (y) 16 (1) (c), 21(3)]

Application for obtaining authorisation under solid waste management rules

for processing/recycling/treatment and disposal of solid waste

To,

The Member Secretary,

State Pollution Control Board or Pollution Control Committee,

of…....

Sir,

I/We hereby apply for authorisation under the Solid Waste Management Rules, 2016 for processing, recycling, treatment and disposal of solid waste.

1.	Name of the local body/agency appointed by them/ operator of facility	
2.	Correspondence address Telephone No. Fax No. ,e-mail:	

479

3.	Nodal Officer & designation(Officer authorised by the local body or agency responsible for operation of processing/ treatment or disposal facility)	
4.	Authorisation required for setting up and operation of the facility (Please tick mark)	waste processing recycling treatment disposal at landfill
5.	Attach copies of the Documents Site clearance (local body) Proof of Environmental Clearance Consent for establishment Agreement between municipal authority and operating agency Investment on the project and expected return	
6.	**Processing/recycling/treatment of solid waste** (i) Total Quantity of waste to be processed per day Quantity of waste to be recycled Quantity of waste to be treated Quantity of waste to be disposed into landfill (ii)Utilisation programme for waste processed (Product utilisation) (iii)Methodology for disposal (attach details) Quantity of leachate Treatment technology for leachate (iv)Measures to be taken for prevention and control of environmental pollution (v)Measures to be taken for safety of workers working in the plant (vi)Details on solid waste processing/recycling/ treatment/disposal facility (to be attached)	
7.	**Disposal of solid waste** Number of sites identified Quantity of waste to be disposed per day Details of methodology or criteria followed for site selection (attach) Details of existing site under operation Methodology and operational details of landfilling Measures taken to check environmental pollution	
8	Any other information.	

Date: Signature:

Place: Designation

Form- II

[see rule 16 (1) (e)]

Format for issue of authorisation

File No.: _____

Dated:_____

Authorisation No_____

To

Ref: Your application number _____dt. _____

The _____State Pollution Control Board/Pollution Control Committee after examining the proposal hereby authorises_____ having administrative office at _____to set up and operate waste processing/recycling/ treatment/disposal facility at_____

The authorisation is hereby granted to operate the facility for processing, recycling, treatment and disposal of solid waste.

The authorisation is subject to the terms and conditions stated below and such conditions as may be otherwise specified in these rules and the standards laid down in Schedules I and II under these rules.

The _____State Pollution Control Board/Pollution Control Committees of the UT may, at any time, revoke any of the conditions applicable under the authorisation and shall communicate the same in writing.

Any violation of the provision of the Solid Waste Management Rules, 2016will attract the penal provision of the Environment (Protection) Act, 1986 (29 of 1986).

(Member Secretary)

State Pollution Control Board/Pollution Control Committee of the UT

(Signature and designation)

Date:

Place:

Form – III

[see rule 19 (6), 24 (1)]

Format of annual report to be submitted by the operator of facility to the local body

1	Name of the City/Town and State	
2	Population	
3	Area in sq. kilometers	
4	Name & Address of the local body Telephone No. Fax No. E-mail:	
5	Name and address of operator of the facility	
6	Name of officer in-charge of the facility Phone No: Fax No: E-mail:	

481

7	Number of households in the city/town , Number of non-residential premises in the city Number of election/ administrative wards in the city/town	
8	Quantity of Solid waste	
	Estimated Quantity of solid waste generated in the local body area per day in metric tones	/tpd
	Quantity of solid waste collected per day	/tpd
	Per capita waste collected per day	/gm/day
	Quantity of solid waste processed	/tpd
	Quantity of solid waste disposed at landfill	/tpd
9	Status of Solid Waste Management (SWM) service	
	Segregation and storage of waste at source Whether solid waste is stored at source in domestic/commercial/ institutional bins If yes, Percentage of households practice storage of waste at source in domestic bins Percentage of non-residential premises practice storage of waste at source in commercial /institutional bins Percentage of households dispose of throw solid waste on the streets Percentage of non-residential premises dispose of throw solid waste on the streets Whether solid waste is stored at source in a segregated form If yes, Percentage of premises segregating the waste at source	 Yes/No % % % % Yes/No %
	Door to Door Collection of solid waste	
	Whether door to door collection (D2D) of solid waste is being done in the city/town	Yes/No
	if yes	
	Number of wards covered in D2D collection of waste	
	No. of households covered	
	No. of non-residential premises including commercial establishments ,hotels, restaurants educational institutions/ offices etc covered	

	Percentage of residential and non-residential premises covered in door to door collection through : Motorized vehicle Containerized tricycle/handcart Other device	% % %
	If not, method of primary collection adopted	
	Sweeping of streets	
	Length of roads, streets, lanes, bye-lanes in the city that need to be cleaned	km
	Frequency of street sweepings and percentage of population covered	frequency: Daily / Alternate days / Twice a week / Occasionally % of population covered
	Tools used Manual sweeping Mechanical sweeping Whether long handle broom used by sanitation workers Whether each sanitation worker is given handcart/tricycle for collection of waste Whether handcart / tricycle is containerized Whether the collection tool synchronizes with collection/ waste storage containers utilized	% % Yes/No Yes/No Yes/No Yes/No
.	Secondary Waste Storage facilities	
	No. and type of waste storage depots in the city/town Open waste storage sites Masonry bins Cement concrete cylinder bins Dhalao/covered rooms/space Covered metal/plastic containers Upto 1.1 m^3 bins 2 to 5 m^3 bins Above 5m^3 containers Bin-less city	No. Capacity in m^3
	Bin/ population ratio	

	Ward wise details of waste storage depots (attach) : Ward No: Area: Population: No. of bins placed Total volume of bins placed		
	Total storage capacity of waste storage facilities in cubic meters		
	Total waste actually stored at the waste storage depots daily		
	Give frequency of collection of waste from the depots Number of bins cleared	Frequency	No. of bins
		Daily	
		Alternate day	
		Twice a week	
		Once a week	
		Occasionally	
	Whether storage depots have facility for storage of segregated waste in green, blue and black bins	Yes/ No (if yes, add details) No. of green bins: No. of blue bins: No. of black bins:	
	Whether lifting of solid waste from storage depots is manual or mechanical. Give percentage	(%) of Manual Lifting of SOLID WASTE	%
		(%) of Mechanical lifting	%
	If mechanical – specify the method used	front-end loaders/ Top loaders	
	Whether solid waste is lifted from door to door and transported to treatment plant directly in a segregated form	Yes/ No (if yes, specify)	

	Waste Transportation per day Type and Number of vehicles used (pl tick or add)	No. Trips made waste transported
	Animal cart Tractors Non tipping Truck Tipping Truck Dumper Placers Refuse collectors Compactors Others JCB/loader	
	Frequency of transportation of waste	Frequency (%) of waste transported Daily Alternate day Twice a week Once a week Occasionally
	Quantity of waste transported each day	/tpd
	Percentage of total waste transported daily	%
	Waste Treatment Technologies used	
	Whether solid waste is processed	Yes/No
	If yes, Quantity of waste processed daily	/tpd
	Land(s) available with the local body for waste processing (in Hectares)	
	Land currently utilized for waste processing	
	Solid waste processing facilities in operation	
	Solid waste processing facilities under construction	
	Distance of processing facilities from city/town boundary	
	Details of technologies adopted	

	Composting ,	Qty. raw material processed Qty. final product produced Qty. sold Qty. of residual waste landfilled
	vermi composting	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Bio-methanation	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Refuse Derived Fuel	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Waste to Energy technology such as incineration, gasification, pyrolysis or any other technology (give detail)	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Co-processing	Qty. raw material processed
	Combustible waste supplied to cement plant	
	Combustible waste supplied to solid waste based power plants	
	Others	Qty.
	Solid waste disposal facilities	
	No. of dumpsites sites available with the local body	
	No. of sanitary landfill sites available with the local body	
	Area of each such sites available for waste disposal	
	Area of land currently used for waste disposal	
	Distance of dumpsite/landfill facility from city/town	kms
	Distance from the nearest habitation	kms
	Distance from water body	kms

	Distance from state/national highway	kms
	Distance from Airport	kms
	Distance from important religious places or historical monument	kms
	Whether it falls in flood prone area	Yes/No
	Whether it falls in earthquake fault line area	Yes/No
	Quantity of waste landfilled each day	tpd
	Whether landfill site is fenced	Yes / No
	Whether Lighting facility is available on site	Yes / No
	Whether Weigh bridge facility available	Yes / No
	Vehicles and equipments used at landfill (specify)	Bulldozer, Compacters etc. available
	Manpower deployed at landfill site	Yes/No (if yes, attach details)
	Whether covering is done on daily basis	Yes/No
	If not, Frequency of covering the waste deposited at the landfill	
	Cover material used	
	Whether adequate covering material is available	Yes/No
	Provisions for gas venting provided	Yes/No, (if yes, attach technical data sheet)
	Provision for leachate collection	Yes/No, (if yes, attach technical data sheet)
10	Whether an Action Plan has been prepared for improving solid waste management practices in the city	Yes/No (if Yes attach Action Plan details)
11	What separate provisions are made for : Dairy related activities : Slaughter houses waste : C&D waste (construction debris) :	Attach details on Proposals, Steps taken, Yes/No Yes/No Yes/No
12	Details of Post Closure Plan	Attach Plan
13	How many slums are identified and whether these are provided with Solid Waste Management facilities :	Yes/ No (if Yes, attach details)
14	Give details of manpower deployed for collection including street sweeping, secondary storage, transportation, processing and disposal of waste	

487

15	Mention briefly, the difficulties being experienced by the local body in complying with provisions of these rules	
16	Mention briefly, if any innovative idea is implemented to tackle a problem related to solid waste, which could be replicated by other local bodies.	

Signature of Operator

Dated :

Place:

Form – IV

[see rules 15(za), 24(2)]

Format for annual report on solid waste management to be submitted by the local body

CALENDAR YEAR:	**DATE OF SUBMISSION OF REPORT:**

1	Name of the City/Town and State	
2	Population	
3	Area in sq. kilometers	
4	Name & Address of local body Telephone No. Fax No. E-mail:	
5	Name of officer in-charge dealing with solid waste management (SOLID WASTEM)Phone No: Fax No: E-mail:	
6	Number of households in the city/town Number of non-residential premises in the city Number of election/ administrative wards in the city/town	
7	Quantity of Solid waste (solid waste)	
	Estimated Quantity of solid waste generated in the local body area per day in metric tones	/tpd
	Quantity of solid waste collected per day	/tpd

	Per capita waste collected per day	/gm/day
	Quantity of solid waste processed	/tpd
	Quantity of solid waste disposed at dumpsite/ landfill	/tpd
8	Status of Solid Waste Management service	
	Segregation and storage of waste at source Whether SOLID WASTE is stored at source in domestic/commercial/ institutional bins, If yes, Percentage of households practice storage of waste at source in domestic bins Percentage of non-residential premises practice storage of waste at source in commercial /institutional bins Percentage of households dispose or throw solid waste on the streets Percentage of non-residential premises dispose of throw solid waste on the streets Whether solid waste is stored at source in a segregated form, If yes, Percentage of premises segregating the waste at source	 Yes/No % % % % Yes/No %
	Door to Door Collection of solid waste	
	Whether door to door collection (D2D) of solid waste is being done in the city/town	Yes/No
	if yes	
	Number of wards covered in D2D collection of waste	
	No. of households covered	
	No. of non-residential premises including commercial establishments ,hotels, restaurants educational institutions/ offices etc covered	
	Percentage of residential and non-residential premises covered in door to door collection through : Motorized vehicle Containerized tricycle/handcart Other device	 % % %
	If not, method of primary collection adopted	
	Sweeping of streets	
	Length of roads, streets, lanes, bye-lanes in the city that need to be cleaned	km

489

	Frequency of street sweepings and percentage of population covered	frequency	Daily	Alternate days	Twice a week	Occasionally
		% of population covered				
	Tools used					
	Manual sweeping			%		
	Mechanical sweeping			%		
	Whether long handle broom used by sanitation workers			Yes/No		
	Whether each sanitation worker is given handcart/tricycle for collection of waste			Yes/No		
	Whether handcart / tricycle is containerized			Yes/No		
	Whether the collection tool synchronizes with collection/ waste storage containers utilized			Yes/No		
.	Secondary Waste Storage facilities					
	No. and type of waste storage depots in the city/town Open waste storage sites Masonry bins Cement concrete cylinder bins Dhalao/covered rooms/space Covered metal/plastic containers Upto 1.1 m3 bins 2 to 5 m3 bins Above 5m3 containers Bin-less city	No. Capacity in m^3				
	Bin/ population ratio					
	Ward wise details of waste storage depots (attach) : Ward No: Area: Population: No. of bins placed Total volume of bins placed					
	Total storage capacity of waste storage facilities in cubic meters					
	Total waste actually stored at the waste storage depots daily					

	Give frequency of collection of waste from the depots Number of bins cleared	Frequency	No. of bins
		Daily	
		Alternate day	
		Twice a week	
		Once a week	
		Occasionally	
	Whether storage depots have facility for storage of segregated waste in green, blue and black bins	Yes/ No (if yes, add details) No. of green bins: No. of blue bins: No. of black bins:	
	Whether lifting of solid waste from storage depots is manual or mechanical. Give percentage (%) of Manual Lifting of solid waste (%) of Mechanical lifting	% %	
	If mechanical – specify the method used	front-end loaders/ Top loaders	
	Whether solid waste is lifted from door to door and transported to treatment plant directly in a segregated form	Yes/ No (if yes, specify)	
	Waste transportation per day Type and Number of vehicles used	No. Trips made waste transported	
	Animal cart Tractors Non tipping Truck Tipping Truck Dumper Placers Refuse collectors Compactors Others JCB/loader		

491

	Frequency of transportation of waste	Frequency (%) of waste transported Daily Alternate day Twice a week Once a week Occasionally
	Quantity of waste transported each day	/tpd
	Percentage of total waste transported daily	%
	Waste Treatment Technologies used	
	Whether solid waste is processed	Yes/No
	If yes, Quantity of waste processed daily	/tpd
	Whether treatment is done by local body or through an agency	
	Land(s) available with the local body for waste processing (in Hectares)	
	Land currently utilized for waste processing	
	Solid waste processing facilities in operation	
	Solid waste processing facilities under construction	
	Distance of processing facilities from city/town boundary	
	Details of technologies adopted	
	Composting ,	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Vermi composting	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Bio-methanation	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled

	Refuse Derived Fuel	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Waste to Energy technology such as incineration, gasification, pyrolysis or any other technology (give detail)	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Co-processing	Qty. raw material processed
	Combustible waste supplied to cement plant	
	Combustible waste supplied to solid waste based power plants	
	Others	Qty.
	Solid waste disposal facilities	
	No. of dumpsites sites available with the local body	
	No. of sanitary landfill sites available with the local body	
	Area of each such sites available for waste disposal	
	Area of land currently used for waste disposal	
	Distance of dumpsite/landfill facility from city/town	kms
	Distance from the nearest habitation	kms
	Distance from water body	kms
	Distance from state/national highway	kms
	Distance from Airport	kms
	Distance from important religious places or historical monument	kms
	Whether it falls in flood prone area	Yes/No
	Whether it falls in earthquake fault line area	Yes/No
	Quantity of waste landfilled each day	tpd
	Whether landfill site is fenced	Yes / No
	Whether Lighting facility is available on site	Yes / No

493

	Whether Weigh bridge facility available	Yes / No
	Vehicles and equipments used at landfill (specify)	Bulldozer, Compacters etc. available
	Manpower deployed at landfill site	Yes/No (if yes, attach details)
	Whether covering is done on daily basis	Yes/No
	If not, Frequency of covering the waste deposited at the landfill	
	Cover material used	
	Whether adequate covering material is available	Yes/No
	Provisions for gas venting provided	Yes/No (if yes, attach technical data sheet)
	Provision for leachate collection	Yes/No (if yes, attach technical data sheet)
9	Whether an Action Plan has been prepared for improving solid waste management practices in the city	Yes/No (if Yes attach Action Plan details)
10	What separate provisions are made for : Dairy related activities : Slaughter houses waste : C&D waste (construction debris) :	Attach details on Proposals,Steps taken, Yes/No Yes/No Yes/No
11	Details of Post Closure Plan	Attach Plan
12	How many slums are identified and whether these are provided with Solid Waste Management facilities :	Yes/ No (if Yes, attach details)
13	Give details of: Local body's own manpower deployed for collection including street sweeping, secondary storage, transportation, processing and disposal of waste	
14	Give details of: Contractor/ concessionaire's manpower deployed for collection including street sweeping, secondary storage, transportation, processing and disposal of waste	
15	Mention briefly, the difficulties being experienced by the local body in complying with provisions of these rules	

16	Mention briefly, if any innovative idea is implemented to tackle a problem related to solid waste, which could be replicated by other local bodies	

Signature of CEO/Municipal Commissioner/

Executive Officer/Chief Officer

Date:

Place:

Form – V

[see rule 24(3)]

Format of annual report to be submitted by the state pollution control board or pollution control committee committees to the central pollution control board

PART A

To,

The Chairman

Central Pollution Control Board

Parivesh Bhawan, East Arjun Nagar

DELHI- 110 0032

1.	Name of the State/Union territory	:	
2.	Name & address of the State Pollution Control	:	
3.	Number of local bodies responsible for management of solid waste in the State/Union territory under these rules	:	
4.	No. of authorisation application Received	:	
5.	A Summary Statement on progress made by local body in respect of solid waste management	:	Please attach as Annexure-I
6.	A Summary Statement on progress made by local bodies in respect of waste collection, segregation, transportation and disposal	:	Please attach as Annexure-II
7.	A summary statement on progress made by local bodies in respect of implementation of Schedule II	:	Please attach as Annexure-III

Date: …… Place: ……..	Chairman or the Member Secretary State Pollution Control Board/ Pollution Control Committee

PART B

Towns/cities

Total number of towns/cities

Total number of ULBs

Number of class I & class II cities/towns

Authorisation status (names/number)

Number of applications received

Number of authorisations granted

Authorisations under scrutiny

SOLID WASTE Generation status

Solid waste generation in the state (TPD)

collected

treated

landfilled

Compliance to Schedule I of SW Rules (Number/names of towns/capacity)

Good practices in cities/towns

House-to-house collection

Segregation

Storage

Covered transportation

Processing of SW (Number/names of towns/capacity)

Solid Waste processing facilities setup:

Sl. No.	Composting	Vermi-composting	Biogas	RDF/Pelletization

Processing facility operational:

Sl. No.	Composting	Vermi-composting	Biogas	RDF/Pelletization

Processing facility under installation/planned:

Sl. No.	Composting	Vermi-composting	Biogas	RDF/Pelletisation

Waste-to-Energy Plants: (Number/names of towns/capacity)

Sl. No.	Plant Location	Status of operation	Power generation (MW)	Remarks

Disposal of solid waste (number/names of towns/capacity):

Landfill sites identified

Landfill constructed

Landfill under construction

Landfill in operation

Landfill exhausted

Landfilled capped

Solid Waste Dumpsites (number/names of towns/capacity):

Total number of existing dumpsites

Dumpsites reclaimed/capped

Dumpsites converted to sanitary landfill

Monitoring at Waste processing/Landfills sites

Sl. No.	Name of facilities	Ambient air	Groundwater	Leachate quality	Compost quality	VOCs
1.						
2.						
3.						

Status of Action Plan prepared by Municipalities

Total number of municipalities:

Number of Action Plan submitted:

Form – VI

[see rule 25]

Accident Reporting

1.	Date and time of accident	:	
2.	Sequence of events leading to accident	:	
3.	The waste involved in accident	:	

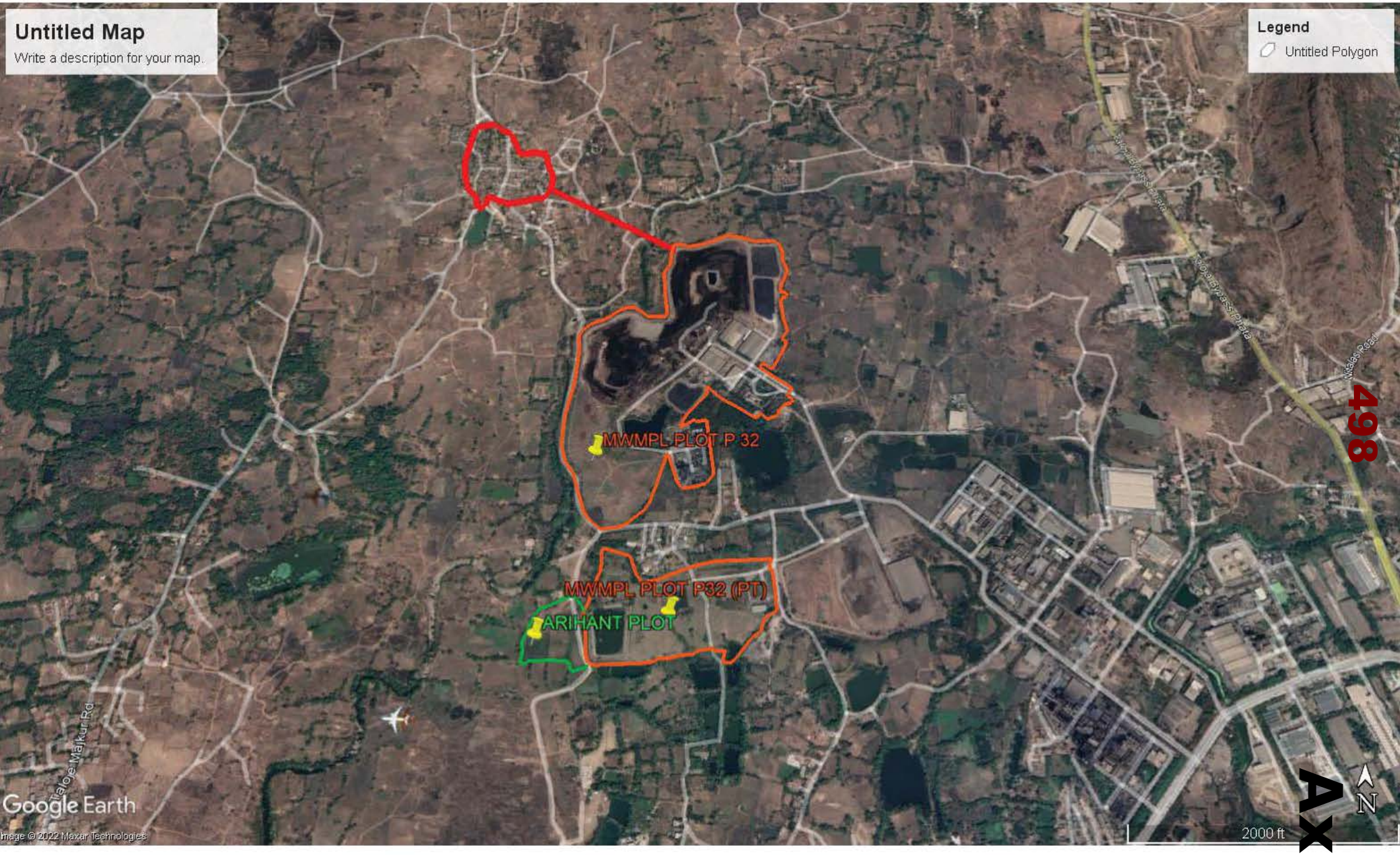
497

4.	Assessment of the effects of the accidents on human health and the environment	:	
5.	Emergency measures taken	:	
6.	Steps taken to alleviate the effects of accidents	:	
7.	Steps taken to prevent the recurrence of such an accident	:	
Date: ……		Signature:…….……	
Place: ……		Designation: ……	

[F. No. 18-3/2004-HSMD]

BISHWANATH SINHA, Jt. Secy.

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MWMPL PLOT P 32
MWMPL PLOT P32 (PT)
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Nidasi Road
Talaje Melkur Rd
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499

AMBIENT AIR QUALITY MONITORING REPORT

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Sample ID : AA/01/23/0540	Report No. AA/01/23/0540	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Ambient Air
Sampling Location	Plot - 1 Road Side	Date - Sampling	20/01/2023to 21/01/2023
Sample Quantity / Packing	PM_{10}, Bap, Metals: 1 x 3 no. filter paper $PM_{2.5}$: 1 x 1 no. filter paper SO_2, NO_2: 30 ml x 6 no. plastic bottle each NH_3: 10 ml x 24 no. plastic bottle Ozone: 10 ml x 1 no. plastic bottle C_6H_6: 1 x 6 no. charcoal tubes VOC: 6 no. charcoal tubes CO: 1 x 1 no. tedlar bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	As per method reference	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Meteorological Data / Environmental Conditions

Average Wind Velocity	Wind Direction	Relative Humidity	Temperature	Duration of Survey
11.7 km/h	S.S.E	(Max./Min.): 78/53%	(Max./Min.): 31/27°C	24 h

Parameter	Result	NAAQS# 2009	Unit	Method
Chemical Testing; Group: Atmospheric Pollution				
Sulphur Dioxide (SO_2)	**5.02**	80	µg/m³	IS 5182 (Part 2): 2001
Nitrogen Dioxide (NO_2)	**7.68**	80	µg/m³	IS 5182 (Part 6): 2006
Particulate Matter (size less than 10 µm) or PM_{10}	**54**	100	µg/m³	IS 5182 (Part 23):2006
Particulate Matter (size less than 2.5µm) or $PM_{2.5}$	**17**	60	µg/m³	CPCB Guideline, Volume I,36/2012-13, Page No.15:2013
Ozone (O_3)	**BLQ (LOQ:19.6)**	180	µg/m³	Methods of Air Sampling and Analysis (AWMA), 3rd Ed., Method 411,Page no. 403 :1988
Lead (as Pb)	**BLQ (LOQ:0.02)**	1	µg/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.2
Carbon Monoxide (CO)	**1.34**	4	mg/m³	CPCB Guidelines, Volume II, 37/2012-13, Page no.16: 2013
Ammonia (NH_3)	**BLQ (LOQ:20)**	400	µg/m³	CPCB Guidelines, Volume I,36/2012-13, Page No.35: 2013
Benzene (C_6H_6)	**2.57**	5	µg/m³	IS 5182 (Part 11) : 2006
Benzo (a) pyrene (BaP) Particulate Phase only	**BLQ (LOQ:0.2)**	1	ng/m³	IS 5182 (Part 12): 2004
Arsenic (as As)	**BLQ (LOQ:0.3)**	6	ng/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.4
Nickel (as Ni)	**BLQ (LOQ:3)**	20	ng/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.2

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
TWA : Time Weighted Average
: NAAQS (National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area) specified as: 24 hours TWA in case of Sulphur Dioxide, Nitrogen Dioxide, PM10, PM2.5, Lead and Ammonia, 1 hour TWA in case of Carbon Monoxide and Ozone, Annual TWA in case of Benzene, Benzo (a) Pyrene, Arsenic and Nickel.
Note: Sample ID AA/01/23/0540 bears two Test Reports-AA/01/23/0540 and AA/01/23/0540N

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Reviewed & Authorised by

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Sample ID : AA/01/23/0540	Report No. AA/01/23/0540	Report Date	01/02/2023

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End of Report

Note:
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AMBIENT AIR QUALITY MONITORING REPORT

Sample ID : AA/01/23/0540	Report No. AA/01/23/0540N	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Ambient Air
Sampling Location	Plot - 1 Road Side	Date - Sampling	20/01/2023 to 21/01/2023
Sample Quantity / Packing	PM_{10}, Bap, Metals: 1 x 3 no. filter paper $PM_{2.5}$: 1 x 1 no. filter paper SO_2, NO_2: 30 ml x 6 no. plastic bottle each NH_3: 10 ml x 24 no. plastic bottle Ozone: 10 ml x 1 no. plastic bottle C_6H_6: 1 x 6 no. charcoal tubes VOC: 6 no. charcoal tubes CO: 1 x 1 no. tedlar bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	As per method reference	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Meteorological Data / Environmental Conditions

Average Wind Velocity	Wind Direction	Relative Humidity	Temperature	Duration of Survey
11.7 km/h	S.S.E	(Max./Min.): 78/53%	(Max./Min.): 31/27°C	24 h

Parameter	Result	NAAQS# 2009	Unit	Method
Chemical Testing; Group: Atmospheric Pollution				
Toluene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Xylene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Methyl Isobutyl Ketone	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Ethyl Acetate	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Ethyl Benzene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
TWA : Time Weighted Average
: NAAQS (National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area) specified as: 24 hours TWA in case of Sulphur Dioxide, Nitrogen Dioxide, PM10, PM2.5, Lead and Ammonia, 1 hour TWA in case of Carbon Monoxide and Ozone, Annual TWA in case of Benzene, Benzo (a) Pyrene, Arsenic and Nickel.
Note: Sample ID AA/01/23/0540 bears two Test Reports-AA/01/23/0540 and AA/01/23/0540N

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Sample ID : AA/01/23/0540	Report No. AA/01/23/0540N	Report Date	01/02/2023

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AMBIENT AIR QUALITY MONITORING REPORT

Sample ID : AA/01/23/0541	Report No. AA/01/23/0541	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Ambient Air
Sampling Location	Plot - 1 Back Side	Date - Sampling	20/01/2023to 21/01/2023
Sample Quantity / Packing	PM_{10}, Bap, Metals: 1 x 3 no. filter paper $PM_{2.5}$: 1 x 1 no. filter paper SO_2, NO_2: 30 ml x 6 no. plastic bottle each NH_3: 10 ml x 24 no. plastic bottle Ozone: 10 ml x 1 no. plastic bottle C_6H_6: 1 x 6 no. charcoal tubes VOC: 6 no. charcoal tubes CO: 1 x 1 no. tedlar bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	As per method reference	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Meteorological Data / Environmental Conditions

Average Wind Velocity	Wind Direction	Relative Humidity	Temperature	Duration of Survey
11.7 km/h	S.S.E	(Max./Min.): 78/53%	(Max./Min.): 31/27°C	24 h

Parameter	Result	NAAQS# 2009	Unit	Method
Chemical Testing; Group: Atmospheric Pollution				
Sulphur Dioxide (SO_2)	**5.25**	80	µg/m³	IS 5182 (Part 2): 2001
Nitrogen Dioxide (NO_2)	**8.30**	80	µg/m³	IS 5182 (Part 6): 2006
Particulate Matter (size less than 10 µm) or PM_{10}	**53**	100	µg/m³	IS 5182 (Part 23):2006
Particulate Matter (size less than 2.5µm) or $PM_{2.5}$	**15**	60	µg/m³	CPCB Guideline, Volume I.36/2012-13, Page No.15:2013
Ozone (O_3)	**BLQ (LOQ:19.6)**	180	µg/m³	Methods of Air Sampling and Analysis (AWMA), 3rd Ed., Method 411,Page no. 403 :1988
Lead (as Pb)	**BLQ (LOQ:0.02)**	1	µg/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.2
Carbon Monoxide (CO)	**1.54**	4	mg/m³	CPCB Guidelines, Volume II, 37/2012-13, Page no.16: 2013
Ammonia (NH_3)	**BLQ (LOQ:20)**	400	µg/m³	CPCB Guidelines, Volume I.36/2012-13, Page No.35: 2013
Benzene (C_6H_6)	**2.22**	5	µg/m³	IS 5182 (Part 11) : 2006
Benzo (a) pyrene (BaP) Particulate Phase only	**BLQ (LOQ:0.2)**	1	ng/m³	IS 5182 (Part 12): 2004
Arsenic (as As)	**BLQ (LOQ:0.3)**	6	ng/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.4
Nickel (as Ni)	**BLQ (LOQ:3)**	20	ng/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.2

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
TWA : Time Weighted Average
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Note: Sample ID AA/01/23/0541 bears two Test Reports-AA/01/23/0541 and AA/01/23/0541N

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Sample ID : AA/01/23/0541	Report No. AA/01/23/0541	Report Date	01/02/2023

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AMBIENT AIR QUALITY MONITORING REPORT

Sample ID : AA/01/23/0541	Report No. AA/01/23/0541N	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Ambient Air
Sampling Location	Plot - 1 Back Side	Date - Sampling	20/01/2023 to 21/01/2023
Sample Quantity / Packing	PM_{10}, Bap, Metals: 1 x 3 no. filter paper $PM_{2.5}$: 1 x 1 no. filter paper SO_2, NO_2: 30 ml x 6 no. plastic bottle each NH_3: 10 ml x 24 no. plastic bottle Ozone: 10 ml x 1 no. plastic bottle C_6H_6: 1 x 6 no. charcoal tubes VOC: 6 no. charcoal tubes CO: 1 x 1 no. tedlar bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	As per method reference	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Meteorological Data / Environmental Conditions

Average Wind Velocity	Wind Direction	Relative Humidity	Temperature	Duration of Survey
11.7 km/h	S.S.E	(Max./Min.): 78/53%	(Max./Min.): 31/27°C	24 h

Parameter	Result	NAAQS# 2009	Unit	Method
Chemical Testing; Group: Atmospheric Pollution				
Toluene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Xylene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Methyl Isobutyl Ketone	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Ethyl Acetate	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Ethyl Benzene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
TWA : Time Weighted Average
: NAAQS (National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area) specified as: 24 hours TWA in case of Sulphur Dioxide, Nitrogen Dioxide, PM10, PM2.5, Lead and Ammonia, 1 hour TWA in case of Carbon Monoxide and Ozone, Annual TWA in case of Benzene, Benzo (a) Pyrene, Arsenic and Nickel.
Note: Sample ID AA/01/23/0541 bears two Test Reports-AA/01/23/0541 and AA/01/23/0541N

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Sample ID : AA/01/23/0541	Report No. AA/01/23/0541N	Report Date	01/02/2023

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AMBIENT AIR QUALITY MONITORING REPORT

Sample ID : AA/01/23/0542	Report No. AA/01/23/0542	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Ambient Air
Sampling Location	Plot - 2 Road Side	Date - Sampling	20/01/2023 to 21/01/2023
Sample Quantity / Packing	PM_{10}, Bap, Metals: 1 x 3 no. filter paper $PM_{2.5}$: 1 x 1 no. filter paper SO_2, NO_2: 30 ml x 6 no. plastic bottle each NH_3: 10 ml x 24 no. plastic bottle Ozone: 10 ml x 1 no. plastic bottle C_6H_6: 1 x 6 no. charcoal tubes VOC: 6 no. charcoal tubes CO: 1 x 1 no. tedlar bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	As per method reference	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Meteorological Data / Environmental Conditions

Average Wind Velocity	Wind Direction	Relative Humidity	Temperature	Duration of Survey
11.7 km/h	S.S.E	(Max./Min.): 78/53%	(Max./Min.): 31/27°C	24 h

Parameter	Result	NAAQS# 2009	Unit	Method
Chemical Testing; Group: Atmospheric Pollution				
Sulphur Dioxide (SO_2)	**BLQ (LOQ:4)**	80	µg/m³	IS 5182 (Part 2): 2001
Nitrogen Dioxide (NO_2)	**7.91**	80	µg/m³	IS 5182 (Part 6): 2006
Particulate Matter (size less than 10 µm) or PM_{10}	**47**	100	µg/m³	IS 5182 (Part 23):2006
Particulate Matter (size less than 2.5µm) or $PM_{2.5}$	**14**	60	µg/m³	CPCB Guideline, Volume I,36/2012-13, Page No.15:2013
Ozone (O_3)	**BLQ (LOQ:19.6)**	180	µg/m³	Methods of Air Sampling and Analysis (AWMA), 3rd Ed., Method 411,Page no. 403 :1988
Lead (as Pb)	**BLQ (LOQ:0.02)**	1	µg/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.2
Carbon Monoxide (CO)	**1.43**	4	mg/m³	CPCB Guidelines, Volume II, 37/2012-13, Page no.16: 2013
Ammonia (NH_3)	**BLQ (LOQ:20)**	400	µg/m³	CPCB Guidelines, Volume I,36/2012-13, Page No.35: 2013
Benzene (C_6H_6)	**2.44**	5	µg/m³	IS 5182 (Part 11) : 2006
Benzo (a) pyrene (BaP) Particulate Phase only	**BLQ (LOQ:0.2)**	1	ng/m³	IS 5182 (Part 12): 2004
Arsenic (as As)	**BLQ (LOQ:0.3)**	6	ng/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.4
Nickel (as Ni)	**BLQ (LOQ:3)**	20	ng/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.2

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Sample ID : AA/01/23/0542	Report No. AA/01/23/0542	Report Date	01/02/2023

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
TWA : Time Weighted Average
: NAAQS (National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area) specified as: 24 hours TWA in case of Sulphur Dioxide, Nitrogen Dioxide, PM10, PM2.5, Lead and Ammonia, 1 hour TWA in case of Carbon Monoxide and Ozone, Annual TWA in case of Benzene, Benzo (a) Pyrene, Arsenic and Nickel.
Note: Sample ID AA/01/23/0542 bears two Test Reports-AA/01/23/0542 and AA/01/23/0542N

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509

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AMBIENT AIR QUALITY MONITORING REPORT

Sample ID : AA/01/23/0542	Report No. AA/01/23/0542N	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Ambient Air
Sampling Location	Plot - 2 Road Side	Date - Sampling	20/01/2023 to 21/01/2023
Sample Quantity / Packing	PM_{10}, Bap, Metals: 1 x 3 no. filter paper $PM_{2.5}$: 1 x 1 no. filter paper SO_2, NO_2: 30 ml x 6 no. plastic bottle each NH_3: 10 ml x 24 no. plastic bottle Ozone: 10 ml x 1 no. plastic bottle C_6H_6: 1 x 6 no. charcoal tubes VOC: 6 no. charcoal tubes CO: 1 x 1 no. tedlar bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	As per method reference	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Meteorological Data / Environmental Conditions

Average Wind Velocity	Wind Direction	Relative Humidity	Temperature	Duration of Survey
11.7 km/h	S.S.E	(Max./Min.): 78/53%	(Max./Min.): 31/27°C	24 h

Parameter	Result	NAAQS# 2009	Unit	Method
Chemical Testing; Group: Atmospheric Pollution				
Toluene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Xylene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Methyl Isobutyl Ketone	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Ethyl Acetate	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Ethyl Benzene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
TWA : Time Weighted Average
: NAAQS (National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area) specified as: 24 hours TWA in case of Sulphur Dioxide, Nitrogen Dioxide, PM10, PM2.5, Lead and Ammonia, 1 hour TWA in case of Carbon Monoxide and Ozone, Annual TWA in case of Benzene, Benzo (a) Pyrene, Arsenic and Nickel.
Note: Sample ID AA/01/23/0542 bears two Test Reports-AA/01/23/0542 and AA/01/23/0542N

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Sample ID : AA/01/23/0542	Report No. AA/01/23/0542N	Report Date	01/02/2023

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AMBIENT AIR QUALITY MONITORING REPORT

Sample ID : AA/01/23/0543	Report No. AA/01/23/0543	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Ambient Air
Sampling Location	Plot - 2 Back Side	Date - Sampling	20/01/2023 to 21/01/2023
Sample Quantity / Packing	PM_{10}, Bap, Metals: 1 x 3 no. filter paper $PM_{2.5}$: 1 x 1 no. filter paper SO_2, NO_2: 30 ml x 6 no. plastic bottle each NH_3: 10 ml x 24 no. plastic bottle Ozone: 10 ml x 1 no. plastic bottle C_6H_6: 1 x 6 no. charcoal tubes VOC: 6 no. charcoal tubes CO: 1 x 1 no. tedlar bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	As per method reference	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Meteorological Data / Environmental Conditions

Average Wind Velocity	Wind Direction	Relative Humidity	Temperature	Duration of Survey
11.7 km/h	S.S.E	(Max./Min.): 78/53%	(Max./Min.): 31/27°C	24 h

Parameter	Result	NAAQS# 2009	Unit	Method
Chemical Testing; Group: Atmospheric Pollution				
Sulphur Dioxide (SO_2)	**6.10**	80	µg/m³	IS 5182 (Part 2): 2001
Nitrogen Dioxide (NO_2)	**8.06**	80	µg/m³	IS 5182 (Part 6): 2006
Particulate Matter (size less than 10 µm) or PM_{10}	**50**	100	µg/m³	IS 5182 (Part 23):2006
Particulate Matter (size less than 2.5µm) or $PM_{2.5}$	**16**	60	µg/m³	CPCB Guideline, Volume I.36/2012-13, Page No.15:2013
Ozone (O_3)	**BLQ (LOQ:19.6)**	180	µg/m³	Methods of Air Sampling and Analysis (AWMA), 3rd Ed., Method 411,Page no. 403 :1988
Lead (as Pb)	**BLQ (LOQ:0.02)**	1	µg/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.2
Carbon Monoxide (CO)	**1.48**	4	mg/m³	CPCB Guidelines, Volume II, 37/2012-13, Page no.16: 2013
Ammonia (NH_3)	**BLQ (LOQ:20)**	400	µg/m³	CPCB Guidelines, Volume I.36/2012-13, Page No.35: 2013
Benzene (C_6H_6)	**2.78**	5	µg/m³	IS 5182 (Part 11) : 2006
Benzo (a) pyrene (BaP) Particulate Phase only	**BLQ (LOQ:0.2)**	1	ng/m³	IS 5182 (Part 12): 2004
Arsenic (as As)	**BLQ (LOQ:0.3)**	6	ng/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.4
Nickel (as Ni)	**BLQ (LOQ:3)**	20	ng/m³	EPA/625/R-96/010 a Compendium Method IO-3.1 & 3.2

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
TWA : Time Weighted Average
: NAAQS (National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area) specified as: 24 hours TWA in case of Sulphur Dioxide, Nitrogen Dioxide, PM10, PM2.5, Lead and Ammonia, 1 hour TWA in case of Carbon Monoxide and Ozone, Annual TWA in case of Benzene, Benzo (a) Pyrene, Arsenic and Nickel.
Note: Sample ID AA/01/23/0543 bears two Test Reports-AA/01/23/0543 and AA/01/23/0543N

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Sample ID : AA/01/23/0543	Report No. AA/01/23/0543	Report Date	01/02/2023

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AMBIENT AIR QUALITY MONITORING REPORT

Sample ID : AA/01/23/0543	Report No. AA/01/23/0543N	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Ambient Air
Sampling Location	Plot - 2 Back Side	Date - Sampling	20/01/2023 to 21/01/2023
Sample Quantity / Packing	PM_{10}, Bap, Metals: 1 x 3 no. filter paper $PM_{2.5}$: 1 x 1 no. filter paper SO_2, NO_2: 30 ml x 6 no. plastic bottle each NH_3: 10 ml x 24 no. plastic bottle Ozone: 10 ml x 1 no. plastic bottle C_6H_6: 1 x 6 no. charcoal tubes VOC: 6 no. charcoal tubes CO: 1 x 1 no. tedlar bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	As per method reference	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Meteorological Data / Environmental Conditions

Average Wind Velocity	Wind Direction	Relative Humidity	Temperature	Duration of Survey
11.7 km/h	S.S.E	(Max./Min.): 78/53%	(Max./Min.): 31/27°C	24 h

Parameter	Result	NAAQS# 2009	Unit	Method
Chemical Testing; Group: Atmospheric Pollution				
Toluene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Xylene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Methyl Isobutyl Ketone	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Ethyl Acetate	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID
Ethyl Benzene	**BLQ (LOQ:0.1)**	Not specified	µg/m³	By GC-FID

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
TWA : Time Weighted Average
: NAAQS (National Ambient Air Quality Standards (Industrial, Residential, Rural and other Area) specified as: 24 hours TWA in case of Sulphur Dioxide, Nitrogen Dioxide, PM10, PM2.5, Lead and Ammonia, 1 hour TWA in case of Carbon Monoxide and Ozone, Annual TWA in case of Benzene, Benzo (a) Pyrene, Arsenic and Nickel.
Note: Sample ID AA/01/23/0543 bears two Test Reports-AA/01/23/0543 and AA/01/23/0543N

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Section In-charge (Chemical)
Reviewed & Authorised by

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End of Report

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Sample ID : AA/01/23/0543	Report No. AA/01/23/0543N	Report Date	01/02/2023

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NOISE LEVEL MEASURMENT REPORT

Sample ID: N/01/23/6319	Report No.: N/01/23/6319	Report Date	25/01/2023
Name and Address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad.		
Monitoring Done By	Laboratory	Sample Description/Type	Ambient Noise
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date of Monitoring	20/01/2023 to 21/01/2023
Calibration Certificate	AEC/0722/SM-5	Instrument Model	Sound level Meter
Consent Number & Date.	-	Instrument ID	AEC-SLM-180

Chemical Testing; Group: Atmospheric Pollution

Sr No	Location	Day Time (6AM-10PM) dB (A)	Night Time (10PM -6AM) dB (A)	Method
		Leq	Leq	
1	Akarshan Site (Back Side)	52.1	44.4	CPCB Protocol for Ambient Level Noise Monitoring. July AEC/C/SAP/SAM/356 36. Issue no.:4. Issue date 01.04.2018

Limit

As Per the Environment (Protection)Rules, 1986, Schedule -I

Type of Area	Limits in dB (A) weighted scale	
	Day (6 a.m. to 10 p.m.)	Night (10 p.m. to 6 a.m.)
Industrial Area	75	70
Commercial	65	55
Residential Area	55	45
Silence Zone	50	40

Ninad Soundankar
Technical Manager (Chemical)
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NOISE LEVEL MEASURMENT REPORT

Sample ID: N/01/23/6320	Report No.: N/01/23/6320	Report Date	25/01/2023
Name and Address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Monitoring Done By	Laboratory	Sample Description/Type	Ambient Noise
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date of Monitoring	20/01/2023 to 21/01/2023
Calibration Certificate	AEC/0722/SM-6	Instrument Model	Sound level Meter
Consent Number & Date.	-	Instrument ID	AEC-SLM-176

Chemical Testing; Group: Atmospheric Pollution

Sr No	Location	Day Time (6AM-10PM) dB (A)	Night Time (10PM -6AM) dB (A)	Method
		Leq	Leq	CPCB Protocol for Ambient Level Noise Monitoring. July AEC/C/SAP/SAM/356 36. Issue no.:4. Issue date 01.04.2018
1	Akarshan Site (Road Side)	54.1	45.7	

Limit

As Per the Environment (Protection)Rules, 1986, Schedule -I

Type of Area	Limits in dB (A) weighted scale	
	Day (6 a.m. to 10 p.m.)	Night (10 p.m. to 6 a.m.)
Industrial Area	75	70
Commercial	65	55
Residential Area	55	45
Silence Zone	50	40

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ULR-TC550923000001540F

TEST REPORT

Sample ID : W/01/23/0809	Report No. W/01/23/0809	Report Date	03/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Customer	Sample Description / Type	Water (Ground Water)
Sampling Location	Plot No.1-Borewell	Date - Receipt of Sample	24/01/2023
Sample Quantity / Packing	10 L x 1 no. plastic can 250 ml x 1 no. sterile bottle	Date - Start of Analysis	24/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	02/02/2023

Sr.No.	Parameter	Result	Acceptable Limit as per IS 10500:2012	Unit	Method
Chemical Testing; Group: Water, Residues in Water					
Organoleptic and Physical Parameters					
1	Colour	**1**	Max. 5	Hazen Units	IS 3025 (Part 4):1983
2	Odour	**Agreeable**	Agreeable	-	IS 3025 (Part 5):2018
3	pH value	**7.18**	6.5-8.5	-	IS 3025 (Part 11): 1983
4	Turbidity	**0.38**	Max. 1	NTU	IS 3025 (Part 10):1984
5	Total Dissolved Solids	**334**	Max.500	mg/L	IS 3025 (Part 16): 1984
General Parameters concerning substances undesirable in excessive amounts					
6	Aluminium (as Al)	**BLQ (LOQ:0.025)**	Max.0.03	mg/L	IS 3025 (Part 55):2003
7	Ammonia (as NH_3-N)	**BLQ (LOQ:0.1)**	Max. 0.5	mg/L	APHA, 23rd Ed., 4500 NH3, F, 4 -119: 2017
8	Anionic Detergents (as MBAS, Calculated as LAS, mol.wt. 288.38)	**BLQ (LOQ:0.1)**	Max. 0.2	mg/L	APHA, 23rd Ed.:2017,5540-B&C,5-53 & 5-55
9	Barium (as Ba)	**BLQ (LOQ:0.1)**	Max. 0.7	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
10	Boron (as B)	**BLQ (LOQ:0.1)**	Max.0.5	mg/L	IS 3025 (Part 57):2003
11	Calcium (as Ca)	**48**	Max. 75	mg/L	IS 3025 (Part 40): 1991
12	Chloramines (as Cl_2)	**BLQ (LOQ:0.05)**	Max. 4.0	mg/L	APHA, 23rd Ed., 2017, 4500-Cl-G, 4-72
13	Chloride (as Cl)	**43.5**	Max. 250	mg/L	IS 3025 (Part 32):1988
14	Copper (as Cu)	**BLQ (LOQ:0.02)**	Max. 0.05	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
15	Fluoride (as F)	**0.3**	Max. 1	mg/L	IS 3025 (Part 60):2008
16	Free Residual Chlorine	**BLQ (LOQ:0.05)**	Min.0.2	mg/L	APHA, 23rd Ed., 2017, 4500-Cl-G, 4-72
17	Iron (as Fe)	**0.105**	Max. 1	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
18	Magnesium (as Mg)	**28**	Max. 30	mg/L	IS 3025 (Part 46): 1994
19	Manganese (as Mn)	**0.047**	Max. 0.1	mg/L	IS 3025 (Part 2): 2019 / ISO 11885:2007
20	Mineral Oil	**BLQ (LOQ:0.005)**	Max. 1.0	mg/L	Clause 6 of IS: 3025 (Part 39):2021
21	Nitrate (as NO_3)	**0.51**	Max. 45	mg/L	APHA, 23rd Ed., 4500- NO3 ,B-4-127: 2017

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ULR-TC550923000001540F

Sample ID : W/01/23/0809	Report No. W/01/23/0809	Report Date	03/02/2023

Sr.No.	Parameter	Result	Acceptable Limit as per IS 10500:2012	Unit	Method
22	Phenolic compounds(as C_6H_5OH)	**BLQ (LOQ:0.001)**	Max. 0.001	mg/L	Clause 6 of IS 3025(Part 43):1992
23	Selenium (as Se)	**BLQ (LOQ:0.005)**	Max. 0.01	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
24	Silver (as Ag)	**BLQ (LOQ:0.005)**	Max. 0.1	mg/L	IS 3025 (Part 2):2019/ISO 11885:2007
25	Sulphate (as SO_4)	**58**	Max. 200	mg/L	IS 3025 (Part 24): 1986
26	Sulphide (as H_2S)	**BLQ (LOQ:0.025)**	Max. 0.05	mg/L	IS 3025 (Part 29):1986
27	Total Alkalinity (as $CaCO_3$)	**185**	Max. 200	mg/L	IS 3025(Part 23): 1986
28	Total Hardness (as $CaCO_3$)	**236**	Max. 200	mg/L	IS 3025 (Part 21): 1983
29	Zinc (as Zn)	**BLQ (LOQ:0.05)**	Max. 5	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
Parameters Concerning Toxic Substances					
30	Cadmium (as Cd)	**BLQ (LOQ:0.002)**	Max. 0.003	mg/L	IS 3025 (Part 2): 2019 / ISO 11885:2007
31	Cyanide (as CN)	**BLQ (LOQ:0.001)**	Max. 0.05	mg/L	Clause 2 of IS 3025 (Part 27):1986, Ed. 2.1
32	Lead (as Pb)	**BLQ (LOQ:0.008)**	Max. 0.01	mg/L	IS 3025 (Part 2): 2019/ ISO 11885:2007
33	Mercury (as Hg)	**BLQ (LOQ:0.0008)**	Max. 0.001	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
34	Molybdenum (as Mo)	**BLQ (LOQ:0.002)**	Max. 0.07	mg/L	IS 3025 (Part 2): 2019/ISO 11885:2007
35	Nickel (as Ni)	**BLQ (LOQ:0.01)**	Max. 0.02	mg/L	IS 3025 (Part 2): 2019/ISO 11885:2007
36	Polychlorinated biphenyls (PCB)	**BLQ (LOQ:0.00007)**	Max 0.0005	mg/L	AEC/C/SAP/INS/6-12, Issue No.05, Issue Date: 01.04.2021
37	Polynuclear aromatic hydrocarbons (PAH)	**BLQ (LOQ:0.00007)**	Max. 0.0001	mg/L	AEC/C/SAP/INS/6-12, Issue No.05, Issue Date: 01.04.2021
Pesticide Residues					
38	Alachlor	**BLQ (LOQ:0.01)**	20	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
39	Aldrin/Dieldrin	**BLQ (LOQ:0.01)**	0.03	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
40	Alpha HCH	**BLQ (LOQ:0.01)**	0.01	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
41	Beta HCH	**BLQ (LOQ:0.01)**	0.04	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
42	Butachlor	**BLQ (LOQ:0.01)**	125	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
43	Chlorpyrifos	**BLQ (LOQ:0.05)**	30	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
44	Delta HCH	**BLQ (LOQ:0.01)**	0.04	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021

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ULR-TC550923000001540F

Sample ID : W/01/23/0809	Report No. W/01/23/0809	Report Date	03/02/2023

Sr.No.	Parameter	Result	Acceptable Limit as per IS 10500:2012	Unit	Method
45	2,4-Dichlorophenoxyacetic acid	**BLQ (LOQ:0.07)**	30	µg/L	AEC/C/SAP/INS/5-3, Issue no.: 05, Issue date: 01.04. 2021
46	DDT (o,p & p,p- Isomers of DDT, DDE, DDD)	**BLQ (LOQ:0.01)**	1	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
47	Endosulfan (α,β,Sulphate)	**BLQ (LOQ:0.01)**	0.4	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
48	Ethion	**BLQ (LOQ:0.05)**	3	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
49	Gamma-HCH (Lindane)	**BLQ (LOQ:0.01)**	2	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
50	Isoproturon	**BLQ (LOQ:0.07)**	9	µg/L	US EPA 532:2000
51	Malathion	**BLQ (LOQ:0.05)**	190	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
52	Methyl Parathion	**BLQ (LOQ:0.05)**	0.3	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
53	Monocrotophos	**BLQ (LOQ:0.05)**	1	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
54	Phorate	**BLQ (LOQ:0.05)**	2	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04. 2021
Biological Testing; Group: Water					
Bacteriological Parameters					
55	*Escherichia coli*	**Present**	Not Detectable	/100 ml	APHA, 23rd Ed., 9221-G, 9-80: 2017
56	Total Coliforms	**Present**	Not specified	/100 ml	APHA, 23rd Ed., 9221-D, 9-75 P-A Coliform test: 2017
BLQ: Below Limit of Quantification, LOQ: Limit of Quantification					

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End of Report

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4. There are no additions to, deviations or exclusions from the method.

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ULR-TC550923000001541F

TEST REPORT

Sample ID : W/01/23/0806	Report No. W/01/23/0806	Report Date	03/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel,Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Water (Surface Water)
Sampling Location	Road Site-Plot No.1 (Run off Water)	Date - Sampling	21/01/2023
Sample Quantity / Packing	10 L x 1 no. plastic can 250 ml x 1 no. sterile bottle	Date - Receipt of Sample	23/01/2023
Sampling Procedure	IS 1622:1981 & IS 3025(Part I):1987 & APHA 23rd Ed.2017, 1060 B,1-40, 9060 A,9-36 & 9060 B,9-39 & ISO 19458:2006	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	02/02/2023

Sr.No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Water, Residues in Water				
Organoleptic and Physical Parameters				
1	Colour	**1**	Hazen Units	IS 3025 (Part 4):1983
2	Odour	**Agreeable**	-	IS 3025 (Part 5):2018
3	pH value	**8.15**	-	IS 3025 (Part 11): 1983
4	Turbidity	**0.57**	NTU	IS 3025 (Part 10):1984
5	Total Dissolved Solids	**210**	mg/L	IS 3025 (Part 16): 1984
General Parameters concerning substances undesirable in excessive amounts				
6	Aluminium (as Al)	**BLQ (LOQ:0.025)**	mg/L	IS 3025 (Part 55):2003
7	Ammonia (as NH_3-N)	**BLQ (LOQ:0.1)**	mg/L	APHA, 23rd Ed., 4500 NH3, F, 4 -119: 2017
8	Anionic Detergents (as MBAS, Calculated as LAS, mol.wt. 288.38)	**BLQ (LOQ:0.1)**	mg/L	APHA, 23rd Ed.:2017,5540-B&C,5-53 & 5-55
9	Barium (as Ba)	**BLQ (LOQ:0.1)**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
10	Boron (as B)	**BLQ (LOQ:0.1)**	mg/L	IS 3025 (Part 57):2003
11	Calcium (as Ca)	**34**	mg/L	IS 3025 (Part 40): 1991
12	Chloramines (as Cl_2)	**BLQ (LOQ:0.05)**	mg/L	APHA, 23rd Ed., 2017, 4500-Cl-G, 4-72
13	Chloride (as Cl)	**21**	mg/L	IS 3025 (Part 32):1988
14	Copper (as Cu)	**BLQ (LOQ:0.02)**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
15	Fluoride (as F)	**0.2**	mg/L	IS 3025 (Part 60):2008
16	Free Residual Chlorine	**BLQ (LOQ:0.05)**	mg/L	APHA, 23rd Ed., 2017, 4500-Cl-G, 4-72
17	Iron (as Fe)	**0.263**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
18	Magnesium (as Mg)	**20**	mg/L	IS 3025 (Part 46): 1994
19	Manganese (as Mn)	**0.087**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885:2007
20	Mineral Oil	**BLQ (LOQ:0.005)**	mg/L	Clause 6 of IS: 3025 (Part 39):2021
21	Nitrate (as NO_3)	**2.67**	mg/L	APHA, 23rd Ed., 4500- NO3 ,B-4-127: 2017
22	Phenolic compounds(as C_6H_5OH)	**BLQ (LOQ:0.001)**	mg/L	Clause 6 of IS 3025(Part 43):1992
23	Selenium (as Se)	**BLQ (LOQ:0.005)**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
24	Silver (as Ag)	**BLQ (LOQ:0.005)**	mg/L	IS 3025 (Part 2):2019/ISO 11885:2007
25	Sulphate (as SO_4)	**18**	mg/L	IS 3025 (Part 24): 1986
26	Sulphide (as H_2S)	**BLQ (LOQ:0.025)**	mg/L	IS 3025 (Part 29):1986
27	Total Alkalinity (as $CaCO_3$)	**160**	mg/L	IS 3025(Part 23): 1986

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Sample ID : W/01/23/0806	Report No. W/01/23/0806	Report Date	03/02/2023

Sr.No.	Parameter	Result	Unit	Method
28	Total Hardness (as $CaCO_3$)	**168**	mg/L	IS 3025 (Part 21): 1983
29	Zinc (as Zn)	**BLQ (LOQ:0.05)**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
Parameters Concerning Toxic Substances				
30	Cadmium (as Cd)	**BLQ (LOQ:0.002)**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885:2007
31	Cyanide (as CN)	**BLQ (LOQ:0.001)**	mg/L	Clause 2 of IS 3025 (Part 27):1986, Ed. 2.1
32	Lead (as Pb)	**BLQ (LOQ:0.008)**	mg/L	IS 3025 (Part 2): 2019/ ISO 11885:2007
33	Mercury (as Hg)	**BLQ (LOQ:0.0008)**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
34	Molybdenum (as Mo)	**BLQ (LOQ:0.002)**	mg/L	IS 3025 (Part 2): 2019/ISO 11885:2007
35	Nickel (as Ni)	**BLQ (LOQ:0.01)**	mg/L	IS 3025 (Part 2): 2019/ISO 11885:2007
36	Polychlorinated biphenyls (PCB)	**BLQ (LOQ:0.00007)**	mg/L	AEC/C/SAP/INS/6-12, Issue No.05, Issue Date: 01.04.2021
37	Polynuclear aromatic hydrocarbons (PAH)	**BLQ (LOQ:0.00007)**	mg/L	AEC/C/SAP/INS/6-12, Issue No.05, Issue Date: 01.04.2021
Pesticide Residues				
38	Alachlor	**BLQ (LOQ:0.01)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
39	Aldrin/Dieldrin	**BLQ (LOQ:0.01)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
40	Alpha HCH	**BLQ (LOQ:0.01)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
41	Beta HCH	**BLQ (LOQ:0.01)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
42	Butachlor	**BLQ (LOQ:0.01)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
43	Chlorpyrifos	**BLQ (LOQ:0.05)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
44	Delta HCH	**BLQ (LOQ:0.01)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
45	2,4-Dichlorophenoxyacetic acid	**BLQ (LOQ:0.07)**	µg/L	AEC/C/SAP/INS/5-3, Issue no.: 05, Issue date: 01.04.2021
46	DDT (o,p & p,p- Isomers of DDT, DDE, DDD)	**BLQ (LOQ:0.01)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
47	Endosulfan (α,β,Sulphate)	**BLQ (LOQ:0.01)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
48	Ethion	**BLQ (LOQ:0.05)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
49	Gamma-HCH (Lindane)	**BLQ (LOQ:0.01)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
50	Isoproturon	**BLQ (LOQ:0.07)**	µg/L	US EPA 532:2000
51	Malathion	**BLQ (LOQ:0.05)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
52	Methyl Parathion	**BLQ (LOQ:0.05)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
53	Monocrotophos	**BLQ (LOQ:0.05)**	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021

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Sample ID : W/01/23/0806	Report No. W/01/23/0806	Report Date	03/02/2023

Sr.No.	Parameter	Result	Unit	Method
54	Phorate	**BLQ (LOQ:0.05)**	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
Biological Testing; Group: Water				
Bacteriological Parameters				
55	*Escherichia coli*	**Present**	/100 ml	APHA 23rd Ed., 9221-G, 9-80: 2017
56	Total Coliforms	**Present**	/100 ml	APHA 23rd Ed., 9221-D, 9-75 P-A Coliform test: 2017

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification

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End of Report

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Note:
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TEST REPORT

Sample ID : W/01/23/0807	Report No. W/01/23/0807	Report Date	03/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel,Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Water (Surface Water)
Sampling Location	Back Site -Plot No.1 (Run off Water)	Date - Sampling	21/01/2023
Sample Quantity / Packing	10 L x 1 no. plastic can 250 ml x 1 no. sterile bottle	Date - Receipt of Sample	23/01/2023
Sampling Procedure	IS 1622:1981 & IS 3025(Part I):1987 & APHA 23rd Ed.2017, 1060 B,1-40, 9060 A,9-36 & 9060 B,9-39 & ISO 19458:2006	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	02/02/2023

Sr.No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Water, Residues in Water				
Organoleptic and Physical Parameters				
1	Colour	**1**	Hazen Units	IS 3025 (Part 4):1983
2	Odour	**Agreeable**	-	IS 3025 (Part 5):2018
3	pH value	**7.96**	-	IS 3025 (Part 11): 1983
4	Turbidity	**1.42**	NTU	IS 3025 (Part 10):1984
5	Total Dissolved Solids	**302**	mg/L	IS 3025 (Part 16): 1984
General Parameters concerning substances undesirable in excessive amounts				
6	Aluminium (as Al)	**BLQ (LOQ:0.025)**	mg/L	IS 3025 (Part 55):2003
7	Ammonia (as NH_3-N)	**BLQ (LOQ:0.1)**	mg/L	APHA, 23rd Ed., 4500 NH3, F, 4 -119: 2017
8	Anionic Detergents (as MBAS, Calculated as LAS, mol.wt. 288.38)	**BLQ (LOQ:0.1)**	mg/L	APHA, 23rd Ed.:2017,5540-B&C,5-53 & 5-55
9	Barium (as Ba)	**BLQ (LOQ:0.1)**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
10	Boron (as B)	**BLQ (LOQ:0.1)**	mg/L	IS 3025 (Part 57):2003
11	Calcium (as Ca)	**40**	mg/L	IS 3025 (Part 40): 1991
12	Chloramines (as Cl_2)	**BLQ (LOQ:0.05)**	mg/L	APHA, 23rd Ed., 2017, 4500-Cl-G, 4-72
13	Chloride (as Cl)	**21**	mg/L	IS 3025 (Part 32):1988
14	Copper (as Cu)	**BLQ (LOQ:0.02)**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
15	Fluoride (as F)	**0.3**	mg/L	IS 3025 (Part 60):2008
16	Free Residual Chlorine	**BLQ (LOQ:0.05)**	mg/L	APHA, 23rd Ed., 2017, 4500-Cl-G, 4-72
17	Iron (as Fe)	**0.265**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
18	Magnesium (as Mg)	**28**	mg/L	IS 3025 (Part 46): 1994
19	Manganese (as Mn)	**0.088**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885:2007
20	Mineral Oil	**BLQ (LOQ:0.005)**	mg/L	Clause 6 of IS: 3025 (Part 39):2021
21	Nitrate (as NO_3)	**2.56**	mg/L	APHA, 23rd Ed., 4500- NO3 ,B-4-127: 2017
22	Phenolic compounds(as C_6H_5OH)	**BLQ (LOQ:0.001)**	mg/L	Clause 6 of IS 3025(Part 43):1992
23	Selenium (as Se)	**BLQ (LOQ:0.005)**	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
24	Silver (as Ag)	**BLQ (LOQ:0.005)**	mg/L	IS 3025 (Part 2):2019/ISO 11885:2007
25	Sulphate (as SO_4)	**59**	mg/L	IS 3025 (Part 24): 1986
26	Sulphide (as H_2S)	**BLQ (LOQ:0.025)**	mg/L	IS 3025 (Part 29):1986
27	Total Alkalinity (as $CaCO_3$)	**200**	mg/L	IS 3025(Part 23): 1986

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Sample ID : W/01/23/0807	Report No. W/01/23/0807	Report Date	03/02/2023

Sr.No.	Parameter	Result	Unit	Method
28	Total Hardness (as $CaCO_3$)	214	mg/L	IS 3025 (Part 21): 1983
29	Zinc (as Zn)	BLQ (LOQ:0.05)	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
Parameters Concerning Toxic Substances				
30	Cadmium (as Cd)	BLQ (LOQ:0.002)	mg/L	IS 3025 (Part 2): 2019 / ISO 11885:2007
31	Cyanide (as CN)	BLQ (LOQ:0.001)	mg/L	Clause 2 of IS 3025 (Part 27):1986, Ed. 2.1
32	Lead (as Pb)	BLQ (LOQ:0.008)	mg/L	IS 3025 (Part 2): 2019/ ISO 11885:2007
33	Mercury (as Hg)	BLQ (LOQ:0.0008)	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
34	Molybdenum (as Mo)	BLQ (LOQ:0.002)	mg/L	IS 3025 (Part 2): 2019/ISO 11885:2007
35	Nickel (as Ni)	BLQ (LOQ:0.01)	mg/L	IS 3025 (Part 2): 2019/ISO 11885:2007
36	Polychlorinated biphenyls (PCB)	BLQ (LOQ:0.00007)	mg/L	AEC/C/SAP/INS/6- 12, Issue No.05, Issue Date: 01.04: 2021
37	Polynuclear aromatic hydrocarbons (PAH)	BLQ (LOQ:0.00007)	mg/L	AEC/C/SAP/INS/6- 12, Issue No.05, Issue Date: 01.04: 2021
Pesticide Residues				
38	Alachlor	BLQ (LOQ:0.01)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
39	Aldrin/Dieldrin	BLQ (LOQ:0.01)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
40	Alpha HCH	BLQ (LOQ:0.01)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
41	Beta HCH	BLQ (LOQ:0.01)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
42	Butachlor	BLQ (LOQ:0.01)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
43	Chlorpyrifos	BLQ (LOQ:0.05)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
44	Delta HCH	BLQ (LOQ:0.01)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
45	2,4-Dichlorophenoxyacetic acid	BLQ (LOQ:0.07)	µg/L	AEC/C/SAP/INS/5-3, Issue no.: 05, Issue date: 01.04: 2021
46	DDT (o,p & p,p- Isomers of DDT, DDE, DDD)	BLQ (LOQ:0.01)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
47	Endosulfan (α,β,Sulphate)	BLQ (LOQ:0.01)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
48	Ethion	BLQ (LOQ:0.05)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
49	Gamma-HCH (Lindane)	BLQ (LOQ:0.01)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
50	Isoproturon	BLQ (LOQ:0.07)	µg/L	US EPA 532:2000
51	Malathion	BLQ (LOQ:0.05)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
52	Methyl Parathion	BLQ (LOQ:0.05)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021
53	Monocrotophos	BLQ (LOQ:0.05)	µg/L	AEC/C/SAP/INS/6- 12, Issue no. 05, Issue date: 01.04.2021

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Laboratory Services Division
TC-5509

Ashwamedh Engineers & Consultants
Survey No. 102, Plot No.26, Wadala Pathardi Road, Indira Nagar, Nashik - 422009, Maharashtra, India
(Near Guru Gobind Singh School, Near Pandav Nagari, Turn at Sai Mandir Chowk / Samrat Sweet Turning)
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ULR-TC550923000001542F

Sample ID : W/01/23/0807	Report No. W/01/23/0807	Report Date	03/02/2023

Sr.No.	Parameter	Result	Unit	Method
54	Phorate	**BLQ (LOQ:0.05)**	µg/L	AEC/C/SAP/INS/G-12, Issue no. 05, Issue date: 01.04.2021
Biological Testing; Group: Water				
Bacteriological Parameters				
55	*Escherichia coli*	**Present**	/100 ml	APHA 23rd Ed., 9221-G, 9-80: 2017
56	Total Coliforms	**Present**	/100 ml	APHA 23rd Ed., 9221-D, 9-75 P-A Coliform test: 2017

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification

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Kavita Shewale
Section In-charge (Chemical)
Reviewed & Authorised by

End of Report

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4. There are no additions to, deviations or exclusions from the method.

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526

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ULR-TC550923000001543F

TEST REPORT

Sample ID : W/01/23/0808	Report No. W/01/23/0808	Report Date	03/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Water (Ground Water)
Sampling Location	MWML Borewell	Date - Sampling	21/01/2023
Sample Quantity / Packing	10 L x 1 no. plastic can 250 ml x 1 no. sterile bottle	Date - Receipt of Sample	23/01/2023
Sampling Procedure	IS 1622:1981 & IS 3025(Part I):1987 & APHA 23rd Ed.2017, 1060 B,1-40, 9060 A,9-36 & 9060 B,9-39 & ISO 19458:2006	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date - Completion of Analysis	02/02/2023

Sr.No.	Parameter	Result	Acceptable Limit as per IS 10500:2012	Unit	Method
Chemical Testing; Group: Water, Residues in Water					
Organoleptic and Physical Parameters					
1	Colour	**1**	Max. 5	Hazen Units	IS 3025 (Part 4):1983
2	Odour	**Agreeable**	Agreeable	-	IS 3025 (Part 5):2018
3	pH value	**7.36**	6.5-8.5	-	IS 3025 (Part 11): 1983
4	Turbidity	**1.44**	Max. 1	NTU	IS 3025 (Part 10):1984
5	Total Dissolved Solids	**1394**	Max.500	mg/L	IS 3025 (Part 16): 1984
General Parameters concerning substances undesirable in excessive amounts					
6	Aluminium (as Al)	**BLQ (LOQ:0.025)**	Max.0.03	mg/L	IS 3025 (Part 55):2003
7	Ammonia (as NH_3-N)	**BLQ (LOQ:0.1)**	Max. 0.5	mg/L	APHA, 23rd Ed., 4500 NH3, F, 4 -119: 2017
8	Anionic Detergents (as MBAS, Calculated as LAS, mol.wt. 288.38)	**BLQ (LOQ:0.1)**	Max. 0.2	mg/L	APHA, 23rd Ed.:2017,5540-B&C,5-53 & 5-55
9	Barium (as Ba)	**BLQ (LOQ:0.1)**	Max. 0.7	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
10	Boron (as B)	**BLQ (LOQ:0.1)**	Max.0.5	mg/L	IS 3025 (Part 57):2003
11	Calcium (as Ca)	**192**	Max.75	mg/L	IS 3025 (Part 40): 1991
12	Chloramines (as Cl_2)	**BLQ (LOQ:0.05)**	Max. 4.0	mg/L	APHA, 23rd Ed., 2017, 4500-Cl-G, 4-72
13	Chloride (as Cl)	**604**	Max. 250	mg/L	IS 3025 (Part 32):1988
14	Copper (as Cu)	**BLQ (LOQ:0.02)**	Max. 0.05	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
15	Fluoride (as F)	**1.2**	Max. 1	mg/L	IS 3025 (Part 60):2008
16	Free Residual Chlorine	**BLQ (LOQ:0.05)**	Min.0.2	mg/L	APHA, 23rd Ed., 2017, 4500-Cl-G, 4-72
17	Iron (as Fe)	**0.248**	Max. 1	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
18	Magnesium (as Mg)	**112**	Max. 30	mg/L	IS 3025 (Part 46): 1994
19	Manganese (as Mn)	**0.083**	Max. 0.1	mg/L	IS 3025 (Part 2): 2019 / ISO 11885:2007

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ULR-TC550923000001543F

Sample ID : W/01/23/0808	Report No. W/01/23/0808	Report Date	03/02/2023

Sr.No.	Parameter	Result	Acceptable Limit as per IS 10500:2012	Unit	Method
20	Mineral Oil	**BLQ (LOQ:0.005)**	Max. 1.0	mg/L	Clause 6 of IS: 3025 (Part 39):2021
21	Nitrate (as NO_3)	**8.78**	Max. 45	mg/L	APHA, 23rd Ed., 4500- NO3 ,B-4-127: 2017
22	Phenolic compounds(as C_6H_5OH)	**BLQ (LOQ:0.001)**	Max. 0.001	mg/L	Clause 6 of IS 3025(Part 43):1992
23	Selenium (as Se)	**BLQ (LOQ:0.005)**	Max. 0.01	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
24	Silver (as Ag)	**BLQ (LOQ:0.005)**	Max. 0.1	mg/L	IS 3025 (Part 2):2019/ISO 11885:2007
25	Sulphate (as SO_4)	**280**	Max. 200	mg/L	IS 3025 (Part 24): 1986
26	Sulphide (as H_2S)	**BLQ (LOQ:0.025)**	Max. 0.05	mg/L	IS 3025 (Part 29):1986
27	Total Alkalinity (as $CaCO_3$)	**325**	Max. 200	mg/L	IS 3025(Part 23): 1986
28	Total Hardness (as $CaCO_3$)	**940**	Max. 200	mg/L	IS 3025 (Part 21): 1983
29	Zinc (as Zn)	**BLQ (LOQ:0.05)**	Max. 5	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
Parameters Concerning Toxic Substances					
30	Cadmium (as Cd)	**BLQ (LOQ:0.002)**	Max. 0.003	mg/L	IS 3025 (Part 2): 2019 / ISO 11885:2007
31	Cyanide (as CN)	**BLQ (LOQ:0.001)**	Max. 0.05	mg/L	Clause 2 of IS 3025 (Part 27):1986, Ed. 2.1
32	Lead (as Pb)	**BLQ (LOQ:0.008)**	Max. 0.01	mg/L	IS 3025 (Part 2): 2019/ ISO 11885:2007
33	Mercury (as Hg)	**BLQ (LOQ:0.0008)**	Max. 0.001	mg/L	IS 3025 (Part 2): 2019 / ISO 11885: 2007
34	Molybdenum (as Mo)	**BLQ (LOQ:0.002)**	Max. 0.07	mg/L	IS 3025 (Part 2): 2019/ISO 11885:2007
35	Nickel (as Ni)	**BLQ (LOQ:0.01)**	Max. 0.02	mg/L	IS 3025 (Part 2): 2019/ISO 11885:2007
36	Polychlorinated biphenyls (PCB)	**BLQ (LOQ:0.00007)**	Max 0.0005	mg/L	AEC/C/SAP/INS/6-12, Issue No.05, Issue Date: 01.04.2021
37	Polynuclear aromatic hydrocarbons (PAH)	**BLQ (LOQ:0.00007)**	Max. 0.0001	mg/L	AEC/C/SAP/INS/6-12, Issue No.05, Issue Date: 01.04.2021
Pesticide Residues					
38	Alachlor	**BLQ (LOQ:0.01)**	20	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
39	Aldrin/Dieldrin	**BLQ (LOQ:0.01)**	0.03	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
40	Alpha HCH	**BLQ (LOQ:0.01)**	0.01	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
41	Beta HCH	**BLQ (LOQ:0.01)**	0.04	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
42	Butachlor	**BLQ (LOQ:0.01)**	125	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021

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Sample ID : W/01/23/0808	Report No. W/01/23/0808	Report Date	03/02/2023

Sr.No.	Parameter	Result	Acceptable Limit as per IS 10500:2012	Unit	Method
43	Chlorpyrifos	**BLQ (LOQ:0.05)**	30	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
44	Delta HCH	**BLQ (LOQ:0.01)**	0.04	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
45	2,4-Dichlorophenoxyacetic acid	**BLQ (LOQ:0.07)**	30	µg/L	AEC/C/SAP/INS/5-3, Issue no.: 05, Issue date: 01.04: 2021
46	DDT (o,p & p,p- Isomers of DDT, DDE, DDD)	**BLQ (LOQ:0.01)**	1	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
47	Endosulfan (α,β,Sulphate)	**BLQ (LOQ:0.01)**	0.4	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
48	Ethion	**BLQ (LOQ:0.05)**	3	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
49	Gamma-HCH (Lindane)	**BLQ (LOQ:0.01)**	2	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
50	Isoproturon	**BLQ (LOQ:0.07)**	9	µg/L	US EPA 532:2000
51	Malathion	**BLQ (LOQ:0.05)**	190	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
52	Methyl Parathion	**BLQ (LOQ:0.05)**	0.3	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
53	Monocrotophos	**BLQ (LOQ:0.05)**	1	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
54	Phorate	**BLQ (LOQ:0.05)**	2	µg/L	AEC/C/SAP/INS/6-12, Issue no. 05, Issue date: 01.04.2021
Biological Testing; Group: Water					
Bacteriological Parameters					
55	*Escherichia coli*	**Present**	Not Detectable	/100 ml	APHA 23rd Ed., 9221-G, 9-80: 2017
56	Total Coliforms	**Present**	Not specified	/100 ml	APHA 23rd Ed., 9221-D, 9-75 P-A Coliform test: 2017
BLQ: Below Limit of Quantification, LOQ: Limit of Quantification					

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End of Report

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TEST REPORT

Sample ID : S/01/23/0260	Report No. S/01/23/0260	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 1 Road Site	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	pH (1:5 suspension)	**7.14**	-	FAO, Sec. III, 1, Page no.65
2	Moisture Content	**14.2**	% by Weight	Dept. of Agriculture & Coopration , Ministry of Agriculture, Govt. of India, Jan 2011
3	Water Holding Capacity	**31.8**	%	AEC/C/SAP/S-18
4	Hexavalent Chromium (as Cr^{+6})	**BLQ (LOQ:5)**	mg/kg	USEPA Method -7196A
5	Total Potassium (as K)	**172**	mg/kg	USEPA/SW846/7000B
6	Copper (as Cu)	**80.6**	mg/kg	USEPA/SW 846/7000B
7	Chromium (as Cr)	**138**	mg/kg	USEPA/SW 846/7000B
8	Cadmium (as Cd)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/7000B
9	Lead (as Pb)	**13.2**	mg/kg	USEPA/SW 846/7000B
10	Zinc (as Zn)	**65.8**	mg/kg	USEPA/SW 846/7000B
11	Sodium (as Na)	**342**	mg/kg	USEPA/SW 846/7000B
12	Manganese (as Mn)	**4289**	mg/kg	USEPA/SW 846/7000B
13	Nickel (as Ni)	**112**	mg/kg	USEPA/SW 846/7000B
14	Selenium (as Se)	**1.08**	mg/kg	USEPA/SW 846/ 6010 C
15	Vanadium (as V)	**147**	mg/kg	USEPA/SW 846/6010C
16	Silver (as Ag)	**BLQ (LOQ:0.5)**	mg/kg	USEPA/SW 846/6010C
17	Chloride (as Cl)	**141**	mg/kg	AEC/C/SAP/S-7

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0260 bears two Test Reports - S/01/23/0260 and S/01/23/0260N

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Laboratory Services Division

End of Report

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530
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Sample ID : S/01/23/0260	Report No. S/01/23/0260	Report Date	01/02/2023

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531

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TEST REPORT

Sample ID : S/01/23/0260	Report No. S/01/23/0260N	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 1 Road Site	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	Corrosivity	**Non-Corrosive**	-	CPCB Manual LATS/16/2003-2004, Ch.7.7.2,Page no. 165
2	Reactivity	**Non-Reactive**	-	AEC/C/SAP/SW/HW-24
3	Flammability	**Non-Flammable**	-	USEPA/SW 846/1010A
4	Nitrate (as nitrate-nitrogen)	**4.73**	mg/kg	APHA.23nd Ed..2017.4500-NO3.B-4-127
5	Cyanide (as CN)	**BLQ (LOQ:0.01)**	mg/kg	CPCB Manual ,Chapter No.5.15,Page no.102
6	Fluoride (as F)	**0.50**	mg/kg	APHA, 23rd Ed., 4500-F-, D, 4-90
7	Sulphide (as H_2S)	**2.24**	mg/kg	APHA, 23rd Ed., 4500 –S2, C-4-183, F-4-187
8	Ammonia (as NH_3)	**1.74**	mg/kg	APHA, 23rd Ed., 4500-NH3, B &C, 4-110, 4-112
9	Total Alkalinity (as $CaCO_3$)	**137**	mg/kg	IS 3025(Part 23):1986
10	Total Petroleum Hydrocarbons (TPH)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/9071B
11	Mercury (as Hg)	**0.297**	mg/kg	USEPA/SW 846/7000B
12	Arsenic (as As)	**0.426**	mg/kg	USEPA/SW 846/7000B
13	Antimony (as Sb)	**5.55**	mg/kg	USEPA /SW 846/6010C
14	Cobalt (as Co)	**21.4**	mg/kg	USEPA/SW 846/6010C
15	Barium (as Ba)	**346**	mg/kg	USEPA/SW 846/6010C
16	Beryllium (as Be)	**0.558**	mg/kg	USEPA /SW 846/6010C
17	Molybdenum (as Mo)	**BLQ (LOQ:1)**	mg/kg	USEPA/SW 846/6010C
18	Thallium	**1.55**	mg/kg	USEPA/SW 846/6010 C

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0260 bears two Test Reports - S/01/23/0260 and S/01/23/0260N

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End of Report

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Sample ID : S/01/23/0260	Report No. S/01/23/0260N	Report Date	01/02/2023

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TEST REPORT

Sample ID : S/01/23/0261	Report No. S/01/23/0261	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 1 Backside Left	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	pH (1:5 suspension)	**7.50**	-	FAO, Sec. III, 1, Page no.65
2	Moisture Content	**13.3**	% by Weight	Dept. of Agriculture & Coopration , Ministry of Agriculture, Govt. of India, Jan 2011
3	Water Holding Capacity	**25.4**	%	AEC/C/SAP/S-18
4	Hexavalent Chromium (as Cr^{+6})	**7.95**	mg/kg	USEPA Method -7196A
5	Total Potassium (as K)	**316**	mg/kg	USEPA/SW846/7000B
6	Copper (as Cu)	**85.7**	mg/kg	USEPA/SW 846/7000B
7	Chromium (as Cr)	**144**	mg/kg	USEPA/SW 846/7000B
8	Cadmium (as Cd)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/7000B
9	Lead (as Pb)	**7.86**	mg/kg	USEPA/SW 846/7000B
10	Zinc (as Zn)	**68.2**	mg/kg	USEPA/SW 846/7000B
11	Sodium (as Na)	**318**	mg/kg	USEPA/SW 846/7000B
12	Manganese (as Mn)	**2443**	mg/kg	USEPA/SW 846/7000B
13	Nickel (as Ni)	**122**	mg/kg	USEPA/SW 846/7000B
14	Selenium (as Se)	**0.627**	mg/kg	USEPA/SW 846/ 6010 C
15	Vanadium (as V)	**23.1**	mg/kg	USEPA/SW 846/6010C
16	Silver (as Ag)	**BLQ (LOQ:0.5)**	mg/kg	USEPA/SW 846/6010C
17	Chloride (as Cl)	**194**	mg/kg	AEC/C/SAP/S-7

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0261 bears two Test Reports - S/01/23/0261 and S/01/23/0261N

Ninad Soundankar
Technical Manager (Chemical)
Reviewed & Authorised by

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534
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Sample ID : S/01/23/0261	Report No. S/01/23/0261	Report Date	01/02/2023

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4. There are no additions to, deviations or exclusions from the method.

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535

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TEST REPORT

Sample ID : S/01/23/0261	Report No. S/01/23/0261N	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 1 Backside Left	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	Corrosivity	**Non-Corrosive**	-	CPCB Manual LATS/16/2003-2004. Ch.7.7.2.Page no. 165
2	Reactivity	**Non-Reactive**	-	AEC/C/SAP/SW/HW-24
3	Flammability	**Non-Flammable**	-	USEPA/SW 846/1010A
4	Nitrate (as nitrate-nitrogen)	**49.7**	mg/kg	APHA.23nd Ed..2017.4500-NO3.B-4-127
5	Cyanide (as CN)	**BLQ (LOQ:0.01)**	mg/kg	CPCB Manual ,Chapter No.5.15,Page no.102
6	Fluoride (as F)	**BLQ (LOQ:0.25)**	mg/kg	APHA. 23rd Ed., 4500-F-. D. 4-90
7	Sulphide (as H_2S)	**2.43**	mg/kg	APHA. 23rd Ed., 4500 -S2. C-4-183. F-4-187
8	Ammonia (as NH_3)	**1.50**	mg/kg	APHA. 23rd Ed., 4500-NH3. B &C. 4-110. 4-112
9	Total Alkalinity (as $CaCO_3$)	**24.8**	mg/kg	IS 3025(Part 23):1986
10	Total Petroleum Hydrocarbons (TPH)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/3571B
11	Mercury (as Hg)	**0.280**	mg/kg	USEPA/SW 846/7000B
12	Arsenic (as As)	**0.368**	mg/kg	USEPA/SW 846/7000B
13	Antimony (as Sb)	**3.43**	mg/kg	USEPA /SW 846/6010C
14	Cobalt (as Co)	**13.8**	mg/kg	USEPA/SW 846/6010C
15	Barium (as Ba)	**148**	mg/kg	USEPA/SW 846/6010C
16	Beryllium (as Be)	**0.559**	mg/kg	USEPA /SW 846/6010C
17	Molybdenum (as Mo)	**BLQ (LOQ:0.1)**	mg/kg	USEPA/SW 846/6010C
18	Thallium	**1.27**	mg/kg	USEPA/SW 846/6010 C

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0261 bears two Test Reports - S/01/23/0261 and S/01/23/0261N

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Sample ID : S/01/23/0261	Report No. S/01/23/0261N	Report Date	01/02/2023

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TEST REPORT

Sample ID : S/01/23/0262	Report No. S/01/23/0262	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 1 Backside Right	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	pH (1:5 suspension)	**7.55**	-	FAO, Sec. III, 1, Page no.65
2	Moisture Content	**24.5**	% by Weight	Dept. of Agriculture & Coopration , Ministry of Agriculture, Govt. of India, Jan 2011
3	Water Holding Capacity	**33.5**	%	AEC/C/SAP/S-18
4	Hexavalent Chromium (as $Cr+^{6}$)	**BLQ (LOQ:5)**	mg/kg	USEPA Method -7196A
5	Total Potassium (as K)	**325**	mg/kg	USEPA/SW846/7000B
6	Copper (as Cu)	**99.5**	mg/kg	USEPA/SW 846/7000B
7	Chromium (as Cr)	**156**	mg/kg	USEPA/SW 846/7000B
8	Cadmium (as Cd)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/7000B
9	Lead (as Pb)	**14.4**	mg/kg	USEPA/SW 846/7000B
10	Zinc (as Zn)	**60.7**	mg/kg	USEPA/SW 846/7000B
11	Sodium (as Na)	**288**	mg/kg	USEPA/SW 846/7000B
12	Manganese (as Mn)	**2128**	mg/kg	USEPA/SW 846/7000B
13	Nickel (as Ni)	**121**	mg/kg	USEPA/SW 846/7000B
14	Selenium (as Se)	**0.789**	mg/kg	USEPA/SW 846/ 6010 C
15	Vanadium (as V)	**191**	mg/kg	USEPA/SW 846/6010C
16	Silver (as Ag)	**BLQ (LOQ:0.5)**	mg/kg	USEPA/SW 846/6010C
17	Chloride (as Cl)	**195**	mg/kg	AEC/C/SAP/S-7

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0262 bears two Test Reports - S/01/23/0262 and S/01/23/0262N

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Sample ID : S/01/23/0262	Report No. S/01/23/0262	Report Date	01/02/2023

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539

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TEST REPORT

Sample ID : S/01/23/0262	Report No. S/01/23/0262N	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 35/1A, 35/1B, 35/1C, 36 i.e Plot 1, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 1 Backside Right	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/15 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	Corrosivity	**Non-Corrosive**	-	CPCB Manual LATS/16/2003-2004, Ch.7,7.2,Page no. 165
2	Reactivity	**Non-Reactive**	-	AEC/C/SAP/SW/HW-24
3	Flammability	**Non-Flammable**	-	USEPA/SW 846/1010A
4	Nitrate (as nitrate-nitrogen)	**9.69**	mg/kg	APHA,23nd Ed..2017,4500-NO3.B-4-127
5	Cyanide (as CN)	**BLQ (LOQ:0.01)**	mg/kg	CPCB Manual ,Chapter No.5.15,Page no.102
6	Fluoride (as F)	**BLQ (LOQ:0.25)**	mg/kg	APHA, 23rd Ed., 4500-F-, D, 4-90
7	Sulphide (as H_2S)	**0.35**	mg/kg	APHA, 23rd Ed., 4500 –S2, C-4-183, F-4-187
8	Ammonia (as NH_3)	**0.70**	mg/kg	APHA, 23rd Ed., 4500-NH3, B &C, 4-110, 4-112
9	Total Alkalinity (as $CaCO_3$)	**74.9**	mg/kg	IS 3025(Part 23):1986
10	Total Petroleum Hydrocarbons (TPH)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/9071B
11	Mercury (as Hg)	**0.373**	mg/kg	USEPA/SW 846/7000B
12	Arsenic (as As)	**0.299**	mg/kg	USEPA/SW 846/7000B
13	Antimony (as Sb)	**6.59**	mg/kg	USEPA /SW 846/6010C
14	Cobalt (as Co)	**21.9**	mg/kg	USEPA/SW 846/6010C
15	Barium (as Ba)	**207**	mg/kg	USEPA/SW 846/6010C
16	Beryllium (as Be)	**0.423**	mg/kg	USEPA /SW 846/6010C
17	Molybdenum (as Mo)	**BLQ (LOQ:0.1)**	mg/kg	USEPA/SW 846/6010C
18	Thallium	**0.185**	mg/kg	USEPA/SW 846/6010 C

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0262 bears two Test Reports - S/01/23/0262 and S/01/23/0262N

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Sample ID : S/01/23/0262	Report No. S/01/23/0262N	Report Date	01/02/2023

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TEST REPORT

Sample ID : S/01/23/0263	Report No. S/01/23/0263	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 2 Road Site	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	pH (1:5 suspension)	**8.14**	-	FAO, Sec. III, I, Page no.65
2	Moisture Content	**23.4**	% by Weight	Dept. of Agriculture & Coopration , Ministry of Agriculture, Govt. of India, Jan 2011
3	Water Holding Capacity	**32.7**	%	AEC/C/SAP/S-18
4	Hexavalent Chromium (as $Cr+^{6}$)	**BLQ (LOQ:5)**	mg/kg	USEPA Method -7196A
5	Total Potassium (as K)	**428**	mg/kg	USEPA/SW846/7000B
6	Copper (as Cu)	**99.8**	mg/kg	USEPA/SW 846/7000B
7	Chromium (as Cr)	**140**	mg/kg	USEPA/SW 846/7000B
8	Cadmium (as Cd)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/7000B
9	Lead (as Pb)	**11.5**	mg/kg	USEPA/SW 846/7000B
10	Zinc (as Zn)	**53.5**	mg/kg	USEPA/SW 846/7000B
11	Sodium (as Na)	**513**	mg/kg	USEPA/SW 846/7000B
12	Manganese (as Mn)	**4513**	mg/kg	USEPA/SW 846/7000B
13	Nickel (as Ni)	**131**	mg/kg	USEPA/SW 846/7000B
14	Selenium (as Se)	**1.12**	mg/kg	USEPA/SW 846/ 6010 C
15	Vanadium (as V)	**181**	mg/kg	USEPA/SW 846/6010C
16	Silver (as Ag)	**BLQ (LOQ:0.5)**	mg/kg	USEPA/SW 846/6010C
17	Chloride (as Cl)	**141**	mg/kg	AEC/C/SAP/S-7

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0263 bears two Test Reports - S/01/23/0263 and S/01/23/0263N

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Sample ID : S/01/23/0263	Report No. S/01/23/0263	Report Date	01/02/2023

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TEST REPORT

Sample ID : S/01/23/0263	Report No. S/01/23/0263N	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 2 Road Site	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	Corrosivity	**Non-Corrosive**	-	CPCB Manual LATS/16/2003-2004, Ch.7.7.2,Page no. 165
2	Reactivity	**Non-Reactive**	-	AEC/C/SAP/SW/HW-24
3	Flammability	**Non-Flammable**	-	USEPA/SW 846/1010A
4	Nitrate (as nitrate-nitrogen)	**6.90**	mg/kg	APHA,23nd Ed.,2017,4500-NO3.B-4-127
5	Cyanide (as CN)	**BLQ (LOQ:0.01)**	mg/kg	CPCB Manual ,Chapter No.5.15,Page no.102
6	Fluoride (as F)	**BLQ (LOQ:0.25)**	mg/kg	APHA, 23rd Ed., 4500-F-, D, 4-90
7	Sulphide (as H_2S)	**0.27**	mg/kg	APHA, 23rd Ed., 4500 -S2, C-4-183, F-4-187
8	Ammonia (as NH_3)	**0.52**	mg/kg	APHA, 23rd Ed., 4500-NH3, B &C, 4-110, 4-112
9	Total Alkalinity (as $CaCO_3$)	**86.9**	mg/kg	IS 3025(Part 23):1986
10	Total Petroleum Hydrocarbons (TPH)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/3171B
11	Mercury (as Hg)	**0.436**	mg/kg	USEPA/SW 846/7000B
12	Arsenic (as As)	**0.409**	mg/kg	USEPA/SW 846/7000B
13	Antimony (as Sb)	**4.44**	mg/kg	USEPA /SW 846/6010C
14	Cobalt (as Co)	**34.3**	mg/kg	USEPA/SW 846/6010C
15	Barium (as Ba)	**393**	mg/kg	USEPA/SW 846/6010C
16	Beryllium (as Be)	**0.483**	mg/kg	USEPA /SW 846/6010C
17	Molybdenum (as Mo)	**BLQ (LOQ:0.1)**	mg/kg	USEPA/SW 846/6010C
18	Thallium	**0.809**	mg/kg	USEPA/SW 846/6010 C

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0263 bears two Test Reports - S/01/23/0263 and S/01/23/0263N

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TEST REPORT

Sample ID : S/01/23/0264	Report No. S/01/23/0264	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 2 Backside Left	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	pH (1:5 suspension)	**7.58**	-	FAO, Sec. III, 1, Page no.65
2	Moisture Content	**18.5**	% by Weight	Dept. of Agriculture & Coopration , Ministry of Agriculture, Govt. of India, Jan 2011
3	Water Holding Capacity	**22.4**	%	AEC/C/SAP/S-18
4	Hexavalent Chromium (as Cr^{+6})	**BLQ (LOQ:5)**	mg/kg	USEPA Method -7196A
5	Total Potassium (as K)	**169**	mg/kg	USEPA/SW846/7000B
6	Copper (as Cu)	**87.9**	mg/kg	USEPA/SW 846/7000B
7	Chromium (as Cr)	**75.3**	mg/kg	USEPA/SW 846/7000B
8	Cadmium (as Cd)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/7000B
9	Lead (as Pb)	**13.6**	mg/kg	USEPA/SW 846/7000B
10	Zinc (as Zn)	**40.6**	mg/kg	USEPA/SW 846/7000B
11	Sodium (as Na)	**532**	mg/kg	USEPA/SW 846/7000B
12	Manganese (as Mn)	**4180**	mg/kg	USEPA/SW 846/7000B
13	Nickel (as Ni)	**43.7**	mg/kg	USEPA/SW 846/7000B
14	Selenium (as Se)	**0.332**	mg/kg	USEPA/SW 846/ 6010 C
15	Vanadium (as V)	**165**	mg/kg	USEPA/SW 846/6010C
16	Silver (as Ag)	**BLQ (LOQ:0.5)**	mg/kg	USEPA/SW 846/6010C
17	Chloride (as Cl)	**141**	mg/kg	AEC/C/SAP/S-7

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0264 bears two Test Reports - S/01/23/0264 and S/01/23/0264N

Ninad Soundankar
Technical Manager (Chemical)
Reviewed & Authorised by

Ashwamedh Engineers & Consultants
Laboratory Services Division

End of Report

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TC-5509

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Survey No. 102, Plot No.26, Wadala Pathardi Road,
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Sample ID : S/01/23/0264	Report No. S/01/23/0264	Report Date	01/02/2023

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547

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TEST REPORT

Sample ID : S/01/23/0264	Report No. S/01/23/0264N	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 2 Backside Left	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	Corrosivity	**Non-Corrosive**	-	CPCB Manual LATS/16/2003-2004, Ch.7.7.2,Page no. 165
2	Reactivity	**Non-Reactive**	-	AEC/C/SAP/SW/HW-24
3	Flammability	**Non-Flammable**	-	USEPA/SW 846/1010A
4	Nitrate (as nitrate-nitrogen)	**45**	mg/kg	APHA.23nd Ed..2017.4500-NO3.B-4-127
5	Cyanide (as CN)	**BLQ (LOQ:0.01)**	mg/kg	CPCB Manual ,Chapter No.5.15,Page no.102
6	Fluoride (as F)	**BLQ (LOQ:0.25)**	mg/kg	APHA. 23rd Ed., 4500-F-. D. 4-90
7	Sulphide (as H_2S)	**2.79**	mg/kg	APHA. 23rd Ed., 4500 –S2. C-4-183. F-4-187
8	Ammonia (as NH_3)	**1.14**	mg/kg	APHA. 23rd Ed., 4500-NH3. B &C. 4-110. 4-112
9	Total Alkalinity (as $CaCO_3$)	**74.8**	mg/kg	IS 3025(Part 23):1986
10	Total Petroleum Hydrocarbons (TPH)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/3171B
11	Mercury (as Hg)	**0.316**	mg/kg	USEPA/SW 846/7000B
12	Arsenic (as As)	**0.307**	mg/kg	USEPA/SW 846/7000B
13	Antimony (as Sb)	**4.16**	mg/kg	USEPA /SW 846/6010C
14	Cobalt (as Co)	**2.58**	mg/kg	USEPA/SW 846/6010C
15	Barium (as Ba)	**81.4**	mg/kg	USEPA/SW 846/6010C
16	Beryllium (as Be)	**0.396**	mg/kg	USEPA /SW 846/6010C
17	Molybdenum (as Mo)	**BLQ (LOQ:0.1)**	mg/kg	USEPA/SW 846/6010C
18	Thallium	**BLQ (LOQ:0.1)**	mg/kg	USEPA/SW 846/6010 C

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0264 bears two Test Reports - S/01/23/0264 and S/01/23/0264N

Ninad Soundankar
Technical Manager (Chemical)
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Sample ID : S/01/23/0264	Report No. S/01/23/0264N	Report Date	01/02/2023

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TEST REPORT

Sample ID : S/01/23/0265	Report No. S/01/23/0265	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 2 Backside Right	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	pH (1:5 suspension)	**7.11**	-	FAO, Sec. III, 1, Page no.65
2	Moisture Content	**6.93**	% by Weight	Dept. of Agriculture & Coopration , Ministry of Agriculture, Govt. of India, Jan 2011
3	Water Holding Capacity	**29.4**	%	AEC/C/SAP/S-18
4	Hexavalent Chromium (as $Cr+^{6}$)	**BLQ (LOQ:5)**	mg/kg	USEPA Method -7196A
5	Total Potassium (as K)	**290**	mg/kg	USEPA/SW846/7000B
6	Copper (as Cu)	**128**	mg/kg	USEPA/SW 846/7000B
7	Chromium (as Cr)	**82.6**	mg/kg	USEPA/SW 846/7000B
8	Cadmium (as Cd)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/7000B
9	Lead (as Pb)	**23.1**	mg/kg	USEPA/SW 846/7000B
10	Zinc (as Zn)	**60**	mg/kg	USEPA/SW 846/7000B
11	Sodium (as Na)	**373**	mg/kg	USEPA/SW 846/7000B
12	Manganese (as Mn)	**4225**	mg/kg	USEPA/SW 846/7000B
13	Nickel (as Ni)	**55.3**	mg/kg	USEPA/SW 846/7000B
14	Selenium (as Se)	**0.166**	mg/kg	USEPA/SW 846/ 6010 C
15	Vanadium (as V)	**193**	mg/kg	USEPA/SW 846/6010C
16	Silver (as Ag)	**BLQ (LOQ:0.5)**	mg/kg	USEPA/SW 846/6010C
17	Chloride (as Cl)	**159**	mg/kg	AEC/C/SAP/S-7

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0265 bears two Test Reports - S/01/23/0265 and S/01/23/0265N

Ninad Soundankar
Technical Manager (Chemical)
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End of Report

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550
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Sample ID : S/01/23/0265	Report No. S/01/23/0265	Report Date	01/02/2023

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551

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TEST REPORT

Sample ID : S/01/23/0265	Report No. S/01/23/0265N	Report Date	01/02/2023
Name and address of Customer	**Arihant Superstructures Ltd. (Akarshan Site)** Survey Nos. 43/3/2, 59/1, 60/1/2B and others i.e Plot 2, At Village- Ghot, Tal. Panvel, Dist. Raigad,Maharashtra		
Sampling done by	Laboratory	Sample Description / Type	Soil
Sample Location	Plot 2 Backside Right	Date - Sampling	21/01/2023
Sample Quantity / Packing	1 kg x 1 no. plastic bag	Date - Receipt of Sample	23/01/2023
Sampling Procedure	AEC/SAM/37	Date - Start of Analysis	23/01/2023
Order Reference	W.O. No. A/Aakarshan/WO/16 dated 17.01.2023	Date - Completion of Analysis	31/01/2023

Sr. No.	Parameter	Result	Unit	Method
Chemical Testing; Group: Pollution & Environment				
1	Corrosivity	**Non-Corrosive**	-	CPCB Manual LATS/16/2003-2004, Ch.7.7.2,Page no. 165
2	Reactivity	**Non-Reactive**	-	AEC/C/SAP/SW/HW-24
3	Flammability	**Non-Flammable**	-	USEPA/SW 846/1010A
4	Nitrate (as nitrate-nitrogen)	**29.6**	mg/kg	APHA,23nd Ed..2017,4500-NO3.B-4-127
5	Cyanide (as CN)	**BLQ (LOQ:0.01)**	mg/kg	CPCB Manual ,Chapter No.5.15,Page no.102
6	Fluoride (as F)	**BLQ (LOQ:0.25)**	mg/kg	APHA, 23rd Ed., 4500-F-, D, 4-90
7	Sulphide (as H_2S)	**1.70**	mg/kg	APHA, 23rd Ed., 4500 -S2, C-4-183, F-4-187
8	Ammonia (as NH_3)	**1.40**	mg/kg	APHA, 23rd Ed., 4500-NH3, B &C, 4-110, 4-112
9	Total Alkalinity (as $CaCO_3$)	**74.9**	mg/kg	IS 3025(Part 23):1986
10	Total Petroleum Hydrocarbons (TPH)	**BLQ (LOQ:5)**	mg/kg	USEPA/SW 846/9071B
11	Mercury (as Hg)	**0.354**	mg/kg	USEPA/SW 846/7000B
12	Arsenic (as As)	**0.416**	mg/kg	USEPA/SW 846/7000B
13	Antimony (as Sb)	**5.15**	mg/kg	USEPA /SW 846/6010C
14	Cobalt (as Co)	**7.42**	mg/kg	USEPA/SW 846/6010C
15	Barium (as Ba)	**163**	mg/kg	USEPA/SW 846/6010C
16	Beryllium (as Be)	**0.510**	mg/kg	USEPA /SW 846/6010C
17	Molybdenum (as Mo)	**BLQ (LOQ:0.1)**	mg/kg	USEPA/SW 846/6010C
18	Thallium	**1.69**	mg/kg	USEPA/SW 846/6010 C

BLQ: Below Limit of Quantification, LOQ: Limit of Quantification
Note: All results are on air dry basis.
FAO: Food & Agriculture Organization, United Nations.
Sample ID S/01/23/0265 bears two Test Reports - S/01/23/0265 and S/01/23/0265N

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Sr. No	Parameters	Results	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 Schedule II	Units	Method
Class A					
A1.	Arsenic		5.0	mg/L	USEPA/SW 846/ 6DIO C
A2.	Barium		100.0	mg/L	USEPA/SW 846/ BOID C
A3.	Cadmium		1.0	mg/L	USEPA/SW 846/ BOID C
A4.	Chromium and/or Chromium(lll) compounds		5.0	mg/L	USEPA/SW 848/ BOID C
A5.	Lead		5.0	mg/L	USEPA/SW 84B/ BOID'C
A6.	Manganese		10.0	mg/L	USEPA/SW 846/ BOID C
A7.	Mercury		0.2	mg/L	USEPA/SW 846/ BOID C
A8.	Selenium		LO	mg/L	USEPA/SW 846/ BOID C
A9.	Silver		5.0	mg/L	USEPA/SW 846/ BOID C
A10.	Ammonia		50•	mg/L	APHA 22nd Ed.1012.4500-NH3.8 6 C.4 -110.4-112
A11.	Cyanide		20•	mg/L	AEC/C/SAP/SW/HW-22. Issue no.4
A12.	Nitrate (as nitrate-nitrogen)		1000.0	mg/L	APHA 22" Ed.2012.4500- NlhB-4-122
A13.	Sulphide (as H2S)		5.0	mg/L	Is 3025 (flart 29): 198B.Reaffirmed 2009
A14.	1,1-Dichloroethylene		0.7	mg/L	WI/SAfl GCMSMS/5/07
A15	1,2-Dichloroethane		0.5	mg/L	WI/SAfl GCMSMS/5/07
A16.	1,4-Dichlorobenzene		7.5	mg/L	WI/SAP-GC MSMS/5/07
A17.	2,45-Trichlorophenol		400.0	mg/L	WI/SAfl-GC MSMS/5/07
A18.	2,4,6-Trichlorophenol		2.0	mg/L	WI/SAP·GCMSMS/5/07
A19.	2,4-Dinitrotoluene		0.13	mg/L	WI/SAP-GCMSMS/5/07
A20.	Benzene		0.5	mg/L	WI/SAP·GCMSMS/5/07
A21.	Benzo(a)Pyrene		0.001	mg/L	WI/SAP-GCMSMS/5/07
A22.	Bromodichloromethane		6.0	mg/L	WI/SAfl-GC MSMS/5/07
A23.	Bromoform		10.0	mg/L	WI/SAfl GCMSMS/5/07
A24.	Carbon tetrachloride		0.5	mg/L	WISAP-GC MSMS/5/07
A25.	Chlorobenzene		100.0	mg/L	WI/SAP-GC MSMS/5/07
A26.	Chloroform		6.0	mg/L	WI/SAP-GC MSMS/5/07
A27.	Cresol (ortho+ meta+ para)		200.0	mg/L	WI/SAP-GC MSMS/5/07
A28	Dibromochloromethane		10.0	mg/L	WI/SAP-GCMSMS/5/07
A29.	Hexachlorobenzene		0.13	mg/L	WI/SAfl-GCMSMS/5/07
A30.	Hexachlorobutadiene		0.5	mg/L	WI/SAfl-GC MSMS/5/07
A31.	Hexachloroethane		3.0	mg/L	WI/SAP-GCMSMS/5/07
A32.	Methyl ethyl ketone		200.0	mg/L	WI/SAP-GCMSMS/5/07
A33.	Naphthalene		5.0	mg/L	WI/SAP-GCMSMS/5/D7
A34.	Nitrobenzene		2.0	mg/L	WI/SAP-GCMSMS/5/07
A35.	Pentachlorophenol		100.0	mg/L	WI/SAPGCMSMS/5/07
A36.	Pyridine		5.0	mg/L	WI/SAP-CCMSMS/5/07
A37.	Tetrachloroethylene		0.7	mg/L	WI/SAP-GCMSMS/5/07
A38.	Trichloroethylene		0.5	mg/L	WI/SAP-GCMSMS/5/07
A39.	Vinyl chloride		0.2	mg/L	WI/SAP-GCMSMS/5/07
A40.	2,4, S-TP {Silver)		1.0	mg/L	WI/SAP-GCMSMS/5/07
A41.	2,4-Dichlorophenoxyacetic acid		10.0	mg/L	WI/SAP-GCMSMS/5/07
A42.	Alachlor		2.0	mg/L	WI/SAP·GCMSMS/5/07
A43.	Alpha HCH		0.001	mg/L	WI/SAP·CCMSMS/5/07
A44.	Atrazine		0.2	mg/L	WI/SAP-CC MSMS/5/07
A45.	Beta HCH		0.004	mg/L	WI/SAP·GCMSMS/5/07
A46.	Butachlor		12.5	mg/L	WI/SAP-GCMSMS/5/07
A47.	Chlordane		0.03	mg/L	WI/SAP-GCMSMS/5 /07
A48.	Chlorpyriphos		9.0	mg/L	WI/SAP-GCMSMS/5/07
A49.	Delta HCH		0.004	mg/L	WI/SAP-GCMSMS/5/07
A50.	Endosulfan (alpha+ beta+ sulphate)		0.04	mg/L	WI/SAP-GCMSMS/5/07
A51.	Endrin		0.02	mg/L	WI/SAP·GCMSMS/5/07

A52.	Ethion		0.3	mg/L	WI/SAP-GCMSMS/5/07
A53.	Heptachlor (& its Epoxide)		0.008	mg/L	WI/SAP·GCMSMS/5/07
A54.	Iproturon		0.9	mg/L	WI/SAPGCMSMS/5/07
A55.	Lindane		0.4	mg/L	WI/SAP GCMSMS/5/07
A56.	Malathion		19	mg/L	WI/SAP-GCMSMS/5/07
A57.	Methoxychlor		10	mg/L	WI/SAP-GCMSMS/5/07
A58.	Methyl Parathion		0.7	mg/L	WI/SAP-GCMSMS/5/07
A59.	Monochrotophos		0.1	mg/L	WI/SAPGCMSMS/5/07
A60.	Phorate		0.2	mg/L	WI/SAP·GCMSMS/5/07
A61.	Toxaphene		0.5	mg/L	WI/SAP-GC MSMS/5/07
A62.	Antimony		15	mg/L	USEPA/SW 846/ 601D C
A63.	Beryllium		0.75	mg/L	USEPA/SW 846/ SOIO C
A64.	Chromium (VI)		5.0	mg/L	USEP 8461719 6 A
A65.	Cobalt		80.0	mg/L	USEP 846/ 6010 C
A66.	Copper		25.0	mg/L	USEPA/SW 846/ sumc
A67.	Molybdenum		350	mg/L	USEPA/SW 846/ 6DIO C
A68.	Nickel		20.0	mg/L	USEPA/SW 846/ 6DIO C
A69.	Thallium		7.0	mg/L	By IductiY! lly Couple Plasma Spectrophotometer
A70.	Vanadium		24.0	mg/L	WI/SAP-GCMSMS/5/07
A71.	Zinc		250	mg/L	WI/SAP-GCMSMS/5/07
A72.	Fluoride		180.0	mg/L	APHA.22" Ed.lOrl.4500-f· 0.4-87
A73.	Aldrin		0.14	mg/L	WI/SAP-GC MSMS/5/07
A74.	Dichlorodiphenyltrichloroethane (DDT) Dichlorodiphenyldichloroethylene (DDE), Dichlorodiphenyltrichloroethane (DDD)		0.1	mg/L	WI/SAP-GCMSMS/5/07
A75.	Dieldrin		0.8	mg/L	WI/SAP-GCMSMS/5/07
A76.	Kepone		2.1	mg/L	WI/SAP-GCMSMS/5/07
A77.	Mirex		2.1	mg/L	WI/SAP-GCMSMS/5/07
A78.	Polychlorinated biphenyls		5.0	mg/L	WI/SAP-GCMSMS/5/07
Class B					
B2.	Total Petroleum Hydrocarbons (TPH) (C5- C36)		5000	mg/kg	WI/SAP-GCMSMS/5/07
1.	Acid Amides		-	mg/L	WI/SAP-GCMSMS/5/07
2.	Amines		-	mg/L	WI/SAP-GCMSMS/5/07
3.	Anthracene		-	mg/L	WI/SAP-GCMSMS/5/07
4.	Aromatic compounds other than those listed in Class A	Dodecane Detected	-	mg/L	WI/SAP-GCMSMS/5/07
5.	Bromates (hypo-bromites)		-	mg/L	WI/SAP-GCMSMS/5/07
6.	chlorates (hypo-chlorites)		-	mg/L	WI/SAP-GCMSMS/5/07
7.	Carbonyls		-	mg/L	WI/SAP-GCMSMS/5/07
8.	Hydrazine (s)		-	mg/L	WI/SAP-GCMSMS/5/07
9.	Inorganic Acids		-	mg/L	WI/SAP-GCMSMS/5/07
10.	Inorganic Tin Compounds		-	mg/L	WI/SAP-GCMSMS/5/07
11.	Manganese-silicate		-	mg/L	WI/SAP-GCMSMS/5/07
12.	Nitriles		-	mg/L	WI/SAP-GCMSMS/5/07
13.	Organic azo and azoxy Compounds		-	mg/L	WI/SAP-GCMSMS/5/07
14.	Oregano nitro and nitroso compounds		-	mg/L	WI/SAP-GCMSMS/5/07
15.	Phenanthrene		-	mg/L	WI/SAP-GCMSMS/5/07
16.	Phenolic Compounds		-	mg/L	WI/SAP-GCMSMS/5/07
17.	Total Sulphur		-	%	1S1350(Part ll) 1369Rloflmed 2009
18.	Tungsten Compounds		-	mg/L	WI/SAP-GCMSMS/5/07
19.	Tellurium and tellurium compounds		-	mg/L	WI/SAP-GCMSMS/5/07
20.	Phosphorus		-	mg/L	WI/SAP-GCMSMS/5/07
21.	2-Acetylaminofluorene		-	mg/L	WI/SAP-GCMSMS/5/07
22.	4-Aminodipheny		-	mg/L	WI/SAP-GCMSMS/5/07
23.	Benzidine and its salts		-	mg/L	WI/SAP-GCMSMS/5/07
24.	Bis (Chloromethyl) ether		-	mg/L	WI/SAP-GCMSMS/5/07
25.	Methyl chloromethyl ether		-	mg/L	WI/SAP-GCMSMS/5/07
26.	1,2-Dibromo- 3-chloropropane		-	mg/L	WI/SAP-GCMSMS/5/07
27.	3,3'-Dichlorobenzidlne and its salts		-	mg/L	WI/SAP-GCMSMS/5/07

28.	**4-Dimethylaminoazobenzene**	-	mg/L	WI/SAP-GCMSMS/5/07
29.	**4-Nitrobiphenyl**	-	mg/L	WI/SAP-GCMSMS/5/07
30.	**Beta-Propiolactone**	-	mg/L	WI/SAP-GCMSMS/5/07
Class C				
C1.	**Flammability**	-	-	USEPA/SW 846/I0I0A
C2.	**Corrosivity**	-	-	USEPA/SW 846/I0I0A
C3.	**Reactivity**	-	-	CPCB Guidelines
C4.	**Toxicity**			
1.	**Acute Aquatic Toxicity for Zebra fish**	*50* % mortality within 96 hours		IS 6582.1971. Reaffirmed 1987
C5.	**Substances or Wastes liable to Spontaneous combustion**			Qualitative Method
C6.	**Substances or Wastes which, in Contact with water emit flammable gases**			Qualitative Method
C10.	**Infectious substances**			
1.	***Salmonella Spp***		/25g	IS5887 (Part-3)
2.	**Shingella spp**		/25g	IS5887 (Part-7)
3.	**Vibrio cholerae**		/25g	IS5887 (Part-V)
4.	**Vibrio parahaemolyticus**		/25g	IS5887 (Part-V)

556

ENVIRONMENTAL IMPACT ASSESSMENT

Ax. E

Report for expansion of existing

INTEGRATED COMMON HAZARDOUS WASTE TREATMENT STORAGE AND DISPOSAL FACILITY (ICHWTSDF)



Submitted by

RAMKY GROUP
Towards Sustainable Growth

MUMBAI WASTE MANAGEMENT LTD.

Common Hazardous Treatment Storage And Disposal Facility

Prepared by

RAMKY GROUP

RAMKY ENVIRO SERVICES PVT. LTD.

Ramky grandiose, Ramky Towers Complex. Gachibowli, Hyderabad.

(QCI/NABET Approved - Certificate No. NABET/EIA/1518/SA 061)

January, 2019

557

Environmental Impact Assessment

Report for expansion of existing

INTEGRATED COMMON HAZARDOUS WASTE TREATMENT STORAGE & DISPOSAL FACILITY (ICHWTSDF)

at

Plot No.32 ,MIDC Taloja, Panvel, Raigad, Maharashtra By MWML.

Submitted to

MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE

Jorbagh Road, Aliganj, New Delhi – 110003.

Submitted by

Mumbai Waste Management Limited

Plot No. P-32, MIDC Taloja, Panvel, Raigad Dist. - 410 208.

Prepared by

Ramky Enviro Services Pvt. Ltd.

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(QCI/NABET Approved - Certificate No. NABET/EIA/1518/SA 061)

January, 2019

Table of Contents			
QCI/NABET Certificate			
Declaration of Experts			
Project Proponent Undertaking			
Consultant Undertaking			
Terms of Reference (TOR)			
TOR Compliance			
Executive Summary			1-5
Chapter 1	Introduction		1.1-1.11
1.1	Introductionand background		1.1
1.2	Purpose of the study		1.1
1.3	Identification of project and project proponent		1.2
	1.3.1	Project	1.2
	1.3.2	Project proponent	1.2
1.4	Brief description of the project		1.3
	1.4.1	Size of the project	1.3
	1.4.2	Location of the project	1.5
	1.4.3	Importance of the project country & region	1.8
1.5	Scope of the study		1.9
1.6	Regulatory Framework		1.11
	1.6.1	Environmental Clearance for proposed expansion	1.11
Chapter 2	Project Description		2.1-2.38
2.1	Type of project		2.1
2.2	Need for the project		2.2
2.3	Location of the project		2.2
2.4	Magnitude of Operation & Its associated activities		2.6
2.5	Land area requirement		2.7
2.6	Manpower requirement		2.7
2.7	Water requirement and wastewater generation		2.7
	2.7.1	Source of Water	2.8
	2.7.2	Wastewater generation	2.9
2.8	Power requirement		2.9
2.9	Solid waste generation		2.10
2.10	Hazardous waste management and process description		2.10
	2.10.1	Waste acceptance criteria and disposal pathways	2.11
	2.10.2	Waste collection and transportation	2.13
	2.10.3	Laboratory facilities	2.15
	2.10.4	Temporary Storage	2.15
	2.10.5	Waste disposal operations	2.16
	2.10.6	Incineration	2.24
2.11	Bio-medical waste treatment		2.25
	2.11.1	Categories of BMW as per BMW Rules, 2016	2.25

	2.11.2	Collection & Transportation	2.27
	2.11.3	Disinfection and destruction	2.27
	2.11.4	Biomedical waste Incineration	2.27
	2.11.5	Autoclave	2.28
2.12	E-waste management		2.29
	2.12.1	Methodology	2.29
	2.12.2	Process description	2.29
2.13	Recycling facilities		2.32
	2.13.1	Spent solvent recovery	2.33
	2.13.2	Alternative Fuel and Raw Material facility	2.34
	2.13.3	Waste plastic recycling	2.36
	2.13.4	Waste paper recycling	2.37
	2.13.5	MS (Mild Steel) drums recycling	2.38
Chapter 3	**Description of the Environment**		**3.1-3.56**
3.1	Introduction		3.1
3.2	Study period and methodology		3.1
3.3	Micrometeorlogy		3.4
	3.3.1	Climate condition - 30 Years IMD data (1981-2010)	3.4
	3.3.2	Site specific meteorology	3.5
3.4	Air environment		3.6
	3.3.1	Analysis of baseline concentrations	3.7
3.5	Noise environment		3.12
	3.5.1	Sampling and analytical techniques	3.13
	3.5.2	Vibration	3.15
3.6	Traffic & transportation study		3.15
	3.6.1	Methodology & results	3.15
3.7	Water Environment		3.17
	3.7.1	Methodology of sampling and analysis	3.17
	3.7.2	Groundwater quality	3.17
	3.7.3	Surface water quality	3.20
3.8	Soil Quality		3.21
	3.8.1	Methodology	3.22
	3.8.2	Soil Quality Analysis	3.23
	3.8.3	Soil Characteristics	3.26
3.9	Land use/ land cover details		3.26
	3.9.1	Land use of study area	3.26
	3.9.2	Land use of project site	3.27
3.10	Physical Environment		3.29
	3.10.1	Topography	3.29
	3.10.2	Drainage Pattern	3.29
	3.10.3	Geology	3.32
	3.10.4	Hydrogeology	3.32

3.11	Biological & Ecological Environment		3.33
	3.11.1	Methodology adopted for the survey	3.34
	3.11.2	Ecology and Biodiversity: Baseline Information	3.34
	3.11.3	Terrestrial Vegetation and Flora of the core zone	3.34
	3.11.4	Vegetation and Flora of the Buffer zone:	3.35
	3.11.5	Terrestrial fauna of the Core area and the Buffer zone:	3.40
	3.11.6	Aquatic flora and fauna of the study area	3.44
	3.11.7	Wildlife sanctuaries/National parks/Biosphere reserve	3.46
3.12	Demography and Socio-economic environment		3.48
	3.12.1	Methodology adopted for the study	3.48
	3.12.2	Demographic aspects	3.48
	3.12.3	Social structure	3.50
	3.12.4	Literacy levels	3.50
	3.12.5	Occupational structure	3.50
	3.12.6	Dependency ratio	3.51
	3.12.7	Primary observations in the core zone	3.51
Chapter 4	**Anticipated Environmental Impacts and its Mitigation Measures**		**4.1-4.27**
4.1	Introduction		4.1
4.2	Identification of impacts		4.1
4.3	Methodology		4.2
4.4	Potential impacts		4.2
4.5	Prediction of impacts		4.2
	4.5.1	Impacts during construction phase	4.2
	4.5.2	Impact on air quality	4.4
	4.5.3	Impact on water quality	4.5
	4.5.4	Impact of noise	4.6
	4.5.5	Impact due to solid waste generation	4.6
	4.5.6	Impact on soil and land use	4.7
	4.5.7	Demography and socio-economic	4.8
	4.5.8	Potential impact on biological environment	4.9
	4.5.9	Impacts on wildlife habitat in the non-forested area	4.9
4.6	Impact during operation phase		4.9
	4.6.1	Prediction of impacts on the air environment	4.11
	4.6.2	Atmospheric dispersion of stack emissions	4.11
	4.6.3	Pollution sources	4.11
	4.6.4	Air pollution mitigation measures	4.15
4.7	Impact on water quality		4.16
	4.7.1	Leachate collection/ treatment and disposal	4.18
	4.7.2	Leachate treatment plant	4.19
	4.7.3	Effluent treatment plant	4.20
	4.7.4	Water impacts mitigation measures	4.21
	4.7.5	Storm water management	4.21
4.8	Noise level impact and Management		4.21

	4.8.1	Noise mitigation measures	4.21
4.9	Prediction of impacts on land environment		4.22
4.10	Predicted impacts of the landfill		4.22
4.11	Impact on community		4.23
4.12	Impact on ecology		4.23
	4.12.1	Aesthetic environment	4.23
4.13	Impact on socio economics		4.24
4.14	Odour management		4.24
	4.14.1	Odour control measures	4.24
4.15	Public Health		4.25
4.16	Occupational health and risk to surrounding community		4.25
	4.16.1	Mitigation Measures	4.25
4.17	Impact on Soil & Geology		4.25
Chapter 5	**Analysis of Alternatives (Technology & Site)**		**5.1-5.8**
5.1	Introduction		5.1
	5.1.1	Site selection	5.1
	5.1.2	Compliance of the site with site selection criteria	5.1
5.2	Technological aspects		5.3
	5.2.1	Waste minimization	5.4
	5.2.2	Waste recycling	5.4
	5.2.3	Treatment of waste	5.4
	5.2.4	Collection, transportation and disposal	5.5
5.3	Disposal of hazardous waste		5.6
	5.3.1	Landfill disposal	5.6
	5.3.2	Underground disposal	5.6
	5.3.3	Incineration	5.7
5.4	Plasma gasification		5.8
5.5	Pros and cons of plasma gasification		5.8
5.6	No project option		5.9
Chapter 6	**Environmental Monitoring Program**		**6.1-6.8**
6.1	Environmental monitoring program		6.1
6.2	Construction Phase		6.1
6.3	Operation Phase		6.3
6.4	Post operational Phase		6.5
6.5	Environmental laboratory equipment		6.6
	6.5.1	Environmental management Cell	6.6
6.6	Pollution Monitoring Facilities		6.7
	6.6.1	Reporting schedules of the monitoring data	6.7
	6.6.2	Public health monitoring	6.7
	6.6.3	Budgetary provision for EMP	6.7
Chapter 7	**Additional Studies**		**7.1-7.26**
7.1	Risk assessment and disaster management plan		7.1
	7.1.1	Risk analysis	7.1

	7.1.2	Evaluating hazards	7.1
7.2	Risk assessment and hazard identification		7.1
	7.2.1	Identification of toxic, flammable, explosive chemicals	7.2
	7.2.2	Storage of hazardous chemicalsand nature of possible hazards	7.2
	7.2.3	Maximum credible accident analysis for diesel storage area	7.3
	7.2.4	Nature of hazard from oil storage	7.5
	7.2.5	Heat radiation and thermal damage criteria	7.5
7.3	Hazards occurring at site		7.12
	7.3.1	Safety during construction	7.12
	7.3.2	Fire	7.12
	7.3.3	Eelctrical Accidents	7.13
	7.3.4	Major explosion of chemicals/fire & toxic gas release in landfill or stores	7.13
	7.3.5	Contamination of soil and water sources due to leakage of contaminant	7.15
	7.3.6	Release of toxic gases from the incinerator	7.15
	7.3.7	Hazards due to combustibles	7.16
	7.3.8	First aid and emergency procedures	7.17
7.4	On-site emergency plan		7.17
	7.4.1	Organizational set up and infrastructure for emergency operations	7.17
	7.4.2	Roles and responsibilities of emergency personnel	7.18
	7.4.3	Existing safety facilities	7.19
	7.4.4	Local actions taken up during an emergency	7.22
7.5	Operational systems during emergency		7.22
	7.5.1	Communication system	7.22
	7.5.2	Warning system and control	7.22
	7.5.3	Mutual aid	7.23
7.6	Off-site emergency plan		7.23
7.7	Disaster management plan		7.25
	7.7.1	Earthquake	7.25
	7.7.2	Flood	7.26
	7.7.3	Mock drill monitoring	7.26
Chapter 8	**Project Benefits**		**8.1-8.15**
8.1	Introduction		8.1
8.2	Benefits of the proposed project		8.1
8.3	Benefits of processing and resource recovery from E-waste		8.1
8.4	Benefits of bio-medical waste treatment		8.1
8.5	Benefits of secured landfill		8.2
8.6	Benefits from recycling facilities		8.2
	8.6.1	Lead recycling	8.2
	8.6.2	Used oil recycling	8.2
	8.6.3	Spent solvent recycling	8.3
	8.6.4	Waste paper recycling	8.3

	8.6.5	Waste plastic recycling	8.3
8.7	Improvements in the physical infrastructure		8.3
8.8	Improvements in the social infrastructure		8.3
8.9	CER and CSR activities and budget		8.4
	8.9.1	Corporate Environmental Responsibility (CER)	8.4
	8.9.2	Monitoring of CSR Activities	8.4
	8.9.3	CER and CSR Funding	8.5
8.10	Employment potential		8.14
8.11	Other tangible benefits		8.14
8.12	SWOT Analysis		8.15
	8.12.1	Strategies derived from the SWOT profile of the landfill	8.15
8.13	Conclusion		8.15
Chapter 9	**Environmental Management Plan**		**9.1-9.22**
9.1	Introduction		9.1
9.2	Environmental management during construction		9.1
	9.2.1	Air quality mitigation measures	9.1
	9.2.2	Water quality mitigation measures	9.2
	9.2.3	Noise mitigation measures	9.2
	9.2.4	Solid waste mitigation measures	9.2
	9.2.5	Ecological aspects	9.3
	9.2.6	Site security	9.3
9.3	Environmental Management Plan during operation stage		9.4
	9.3.1	Air quality management	9.4
	9.3.2	Odor control	9.4
	9.3.3	Gas management	9.5
	9.3.4	Water quality mitigation measures	9.5
	9.3.5	Noise mitigation measures	9.5
	9.3.6	Solid waste mitigation measures	9.5
9.4	Post operation of landfill		9.6
9.5	Socio economic development activities under CEP		9.7
	9.5.1	Planning	9.7
	9.5.2	Implementation	9.8
	9.5.3	Possible area of activities under CEP	9.9
	9.5.4	Occupational health management	9.10
9.6	Fire protection system		9.10
9.7	Greenbelt Development		9.10
	9.7.1	Action plan for greenbelt development in 33% of area	9.10
9.8	Environmental management cell		9.13
	9.8.1	Record keeping and reporting	9.14
9.9	Budgetary provision for EMP		9.14
9.10	E-waste Management and Handling Rules 2016		9.15
9.11	Action plan for complying performance evaluation and monitoring of TSDF		9.17
9.12	Compliance with Hazardous Waste Managenent Rules, 2016		9.17

Chapter 10	Summary and Conclusion		10.1-10.9
10.1	Project name and location		10.1
10.2	Products and capacities.		10.1
10.3	Requirement of land, raw material, water, power, fuel, with source of supply		10.1
10.4	Process description in brief		10.2
10.5	Capital cost of the project, estimated time of completion		10.2
10.6	Site selected for the project		10.3
10.7	Baseline environmental data		10.3
10.8	Identification of hazards		10.5
10.9	Likely impact and Mitigation measures for project		10.5
10.10	Emergency preparedness plan		10.7
10.11	Issues raised during public hearing		10.7
10.12	CSR plan with proposed expenditure		10.7
10.13	Occupational Health Measures		10.7
10.14	Post project monitoring plan		10.8
10.15	Solid & Hazardous waste generation system		10.8
10.16	Recommendations		10.8
10.17	Conclusion		10.9
Chapter 11	Disclosure of Consultants		11.1-11.3
11.1	About the group		11.1
11.2	About the accredited consultant organization		11.1
	11.2.1	Consultancy services	11.1
	11.2.2	Laboratory services	11.2
	11.2.3	Training services	11.2
	11.2.4	Field services	11.2
	11.2.5	Treatment plant services	11.3
	11.2.6	Solid waste management services	11.3
11.3	Declaration by Accredited Consultant Organization		11.3

List of Tables

Table No.	Title	Page No.
1.1	Details of Proposed and Existing Project Capacities	1.4
1.2	Status of waste disposal in secured landfill facility at Taloja.	1.4
1.3	Environmental settings of the project site	1.5
1.4	Details of the statutory clearance of existing unit	1.8
1.5	Chronology of events for obtaining EC	1.8
2.1	Salient features of the proposed project	2.1
2.2	Existing and Proposed Project capacities	2.6
2.3	Existing project List of individual units	2.6
2.4	Proposed project List of individual units	2.7
2.5	Land area breakup	2.7
2.6	Details of manpower requirement	2.7

2.7	Water requirement	2.8
2.8	Details of wastewater generation	2.9
2.9	Power and fuel requirement	2.9
2.10	Details of Solid waste generation details	2.10
2.11	Total quantity of hazardous waste received and disposed	2.13
2.12	List of vehicles available at MWML site	2.13
2.13	Manifest system for HW as per HWM rules 2016	2.14
2.14	Reagents, infrastructure and operations for waste stabilization unit	2.16
2.15	Stabilization mechanism based on waste characteristics	2.17
2.16	Cross section details of secured landfill at BWMP	2.18
2.17	Categories, types, colour coding and treatment options for BMW	2.26
2.18	Features of the proposed autoclave	2.28
3.1	Methodology for sample collection and analysis	3.3
3.2	Climatology and Meteorology of the region	3.4
3.3	Summary of the site specific Meteorological data	3.5
3.4	Frequency distribution table for post monsoon season (Sep 2018 to Nov 2018)	3.5
3.5	Air Quality Monitoring Stations	3.7
3.6	Ambient Air Quality levels in the study area	3.8
3.6.a	Air Quality Index Base Level Air Quality	3.9
3.7	Noise level monitoring Locations	3.13
3.8	Standard for Monitoring Ambient Noise Level as per CPCB	3.13
3.9	Ambient Noise level results	3.15
3.10	Traffic volume in PCU per day	3.16
3.11	Water sampling locations	3.17
3.12	Groundwater Quality	3.19
3.13	Surface water Quality	3.21
3.14	Soil sampling Locations	3.22
3.15	Methodology of sampling collection	3.22
3.16	Standard classification of soil	3.22
3.17	Soil quality of the study area	3.25
3.18	Land use pattern of Study area (10 Km buffer zone)	3.26
3.19	Land use pattern of project site (Core zone)	3.27
3.20	Rain water	3.33
3.21	List of Existing green belt of the project area	3.35
3.22	List of trees, shrubs and perennial climbers found in the Buffer Zone	3.36
3.23	List Fauna either spotted or reported from the study area	3.41
3.24	List of Mangrove species and the halophytes found in the study area.	3.45
3.25	List of semi aquatic Macrophytes found in the surface water bodies	3.45
3.26	Distribution of population in the study area	3.49
3.27	Population Projections	3.49
3.28	Distribution of population by social structure	3.50
3.29	Distribution of literate and literacy rates	3.50
3.30	Occupational structure	3.51
4.1	Identification of probable Impact due to development phase	4.3
4.2	Identification of operation and maintenance activities and probable impacts	4.9

4.3	Details of existing & proposed stack emissions	4.12
4.4	Twenty four hours mean meteorological data (Oct 2017 to Dec 2017)	4.12
4.5	Post project scenario (µg/m^3)	4.13
4.6	Water requirement, wastewater generation details (KLD)	4.13
4.7	Water and Wastewater Details (KLD)	4.17
4.8	Technical specifications of the MEE, ATFD	4.17
4.9	Impact quantification &mitigation on land environment	4.19
5.1	Location criteria	5.2
5.2	Site evaluation of the proposed site - (HAZWAMS/25/2002-2003)	5.3
6.1	Environmental measures during construction phase	6.2
6.2	Environmental monitoring during operational phase	6.4
6.3	Environmental monitoring during post operation phase	6.5
6.4	Equipment required for environmental monitoring	6.6
6.5	Budget for implementation of Environmental Management Plan	6.8
7.1	Nature of possible hazards	7.2
7.2	Toxicity values of chemicals	7.2
7.3	Details of chemicals and applicability of GoI rules	7.3
7.4	Hazardous chemicals at project site	7.3
7.5	Physical properties of chemicals at site	7.4
7.6	F&EI of fuels used for the proposed Project	7.5
7.7	F&EI category	7.5
7.8	Effect of heat radiation	7.6
7.9	Heat radiation and fatality	7.6
7.10	Effect of heat radiation due to HSD storage tank – 20kL (Pool fire)	7.7
7.11	Effect of heat radiation due to HSD storage tank – 10kL (Pool fire)	7.7
7.12	Effect of heat radiation due to solvent leakage (Pool fire)	7.7
7.13	First aid for burns	7.17
7.14	Roles and responsibilities of the emergency personnel	7.17
7.15	Details of fire protection equipments	7.19
7.16	Location of lightening arrester	7.19
7.17	Location of first-aid boxes	7.19
7.18	Off-site emergency plan	7.23
8.1	Budgetary proposed for CER - Brownfield project	8.5
8.2	List of CSR measures undertaken by existing project (Dec-2016 to Dec' 2017)	8.7
8.3	Budget allotted for proposed expansion project: Jan to Mar'18	8.12
8.4	SWOT analaysis	8.14
9.1	Mitigation measures during construction period	9.3
9.2	Mitigation measures proposed during operation period	9.6
9.3	Mitigation measure proposed during post operation period	9.7
9.4	List of plants suggested for greenbelt and avenue plantations	9.12
9.5	Action Plan for Greenbelt Development	9.13
9.6	Record keeping particulars	9.14
9.7	EMP budget Summary	9.14
9.8	Budget for implementation of Environmental Management Plan	9.15
9.9	Compliance as per E-Waste Management and Handling Rules, 2016	9.16

9.10	Action plan for monitoring TSDF	9.17
9.11	Compliance with Hazardous Waste Management Rules, 2016	9.17
10.1	Details of Proposed and Existing Project Capacities	10.1
10.2	Budgetary proposed for CER - Brownfield project	10.7

List of Figures

Fig. No.	Title	Page No.
1.1	Location map of the site	1.6
1.2	Topographical map of the project site	1.7
2.1	Existing and proposed site boundary layout Plan	2.3
2.2	Topo map showing 10 Km radius around proposed project site	2.4
2.3	Photographs of existing facilities	2.5
2.4	Water balance flow chart	2.8
2.5	Waste criteria for disposal to landfill	2.12
2.6	Flow charts showing pathway of waste to disposal	2.12
2.7	Typical Landfill cell baseliner & Cross section of Lanfill	2.20
2.8	Typical layout of Incineration	2.25
2.9	Layout of typical autoclave sterilization process	2.28
2.10	Proposed flowchart of E-waste processing	2.30
2.11	Flowchart of spent solvent recovery	2.34
2.12	Alternative Fuels and Raw Material Facility	2.36
2.13	Process flow sheet of plastic recycling	2.37
2.14	Schematic diagram of waste paper recycling	2.38
3.1	Topographical map of the study area	3.2
3.2	Onsite wind-roses for Post Monsoon Season (Sep to Nov 2018)	3.6
3.3	AAQ Monitoring Locations	3.7
3.4	Noise monitoring Locations	3.14
3.5	Water Sampling Locations in the study area	3.18
3.6	Soil Sampling Locations	3.24
3.7	Pie-diagram of study area (10 Km radius)	3.27
3.8	Land-Use Maps of Buffer and Core Zone	3.28
3.9	Contour map	3.30
3.10	Drainage Map	3.31
3.11	Sensitivity map of the project site with 15km radius	3.47
4.1	Predicted 24- hourly average GLCs of PM (µg/m3) at 10 km radius	4.14
4.2	Predicted 24- hourly average GLCs of SO2 (µg/m3) at 10 km radius	4.14
4.3	Predicted 24- hourly average GLCs of NO_x (µg/m^3) at 10 km radius	4.15
4.4	Water balance diagram	4.18
4.5	Leachate treatment plant	4.20
4.6	Schematic flow chart of proposed ETP	4.20
6.1	Organization setup for environmental management	6.7
7.1	Thermal radiation threat zone for HSD	7.7
7.2	ALOHA source point on the layout-20 kL	7.8
7.3	ALOHA source point on the layout-10 kL	7.9
7.4	Thermal radiation threat zone for solvents	7.10

7.5	Thermal radiation threat zones for acetylene	7.11
7.6	Organogram for emergency operation	7.18
7.7	Fire hydrant system layout	7.21
S.No	**Annexures**	
I	Protocol for Performance evaluation and monitoring of the Common Hazardous Waste Treatment Storage and Disposal facilities including common Hazardous Waste incinerators	
II	Status of compliance to the provisions of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	
III	Status of compliance to the provisions of the BMW Rules, 2016.	
IV	Lechate report	
V	Action plan for excessive leachate generation during monsoon period	
VI	Analysis report of Incinerator stack	
VII	Locations of peizometric wells around the landfill site	

QCI –NABET Accreditation Certificate of Consultant

Quality Council of India

National Accreditation Board for Education & Training

Certificate of Accreditation

Ramky Enviro Services Private Limited

Ramky Grandiose, Ramky Towers Complex, Gachibowli,
Hyderabad – 500032

Accredited as Category - A *organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA-EMP reports in the following Sectors:*

Sl.No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals including opencast/ underground mining	1	1 (a) (i)	A
2	Onshore oil and gas exploration, development & production	2	1 (b)	A
3	River Valley projects	3	1 (c)	A
4	Thermal power plants	4	1 (d)	A
5	Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes)	20	5 (e)	A
6	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	21	5 (f)	A
7	Industrial estates/ parks/ complexes/ Areas, export processing zones(EPZs), Special economic zones (SEZs), Biotech parks, Leather complexes	31	7 (c)	A
8	Common hazardous waste treatment, storage and disposal facilities (TSDFs)	32	7(d)	A
9	Bio-Medical Waste Treatment Facilities	32 A	7 (da)	B
10	Ports, harbours, jetties, marine terminals, break waters and dredging	33	7(e)	B
11	Common municipal solid waste management facility (CMSWMF)	37	7 (i)	B
12	Building and construction projects	38	8 (a)	B
13	Townships and Area Development projects	39	8 (b)	A

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in SA AC minute dated Jan 19, 2018 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/18/0595 dated March 28, 2018.The accreditation needs to be renewed before the expiry date by Ramky Enviro Services Private Limited, following due process of assessment.

Sr. Director, NABET
Dated: March 28, 2018

Certificate No.
NABET/EIA/1518/ SA 061

Valid upto
May 20, 2019

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

ACCREDITATION CERTIFICATE OF LABORATORY (MoEF) (Ramky - S. No: 57)

रजिस्ट्री सं० डी० एल०-33004/99 REGD. NO. D. L.-33004/99

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अधिसूचना

नई दिल्ली, 3 जनवरी, 2014

का.आ. 21 (अ).—केन्द्रीय सरकार, पर्यावरण (संरक्षण) नियम, 1986 के नियम 10 के साथ पठित पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 12 और धारा 13 की उपधारा (1) के खंड (ख) द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, पर्यावरण और वन मंत्रालय, भारत सरकार की अधिसूचना संख्यांक का. आ. 1174(अ) तारीख 18 जुलाई, 2007 का और संशोधन करती है, अर्थात् :—

उक्त अधिसूचना से संलग्न सूची में, —

(क) क्रम संख्यांक 3, संख्यांक 46, संख्यांक 55, संख्यांक 57, संख्यांक 58, संख्यांक 61, संख्यांक 65, संख्यांक 68 और संख्यांक 69 और उससे संबंधित प्रविष्टियों के स्थान पर निम्नलिखित संख्यांक और प्रविष्टियां रखी जाएंगी, अर्थात् :—

(1)	(2)	(3)	(4)
"3	मैसर्स भगवती अन्ना लैब्स प्रा0 लि0, रजिस्ट्रीकृत कार्यालय और केन्द्रीय प्रयोगशाला, प्लाट सं0 7-2 सी7 और 8, एग्रोमेक औद्योगिक एस्टेट संतनगर, हैदराबाद-500018 (आंध्र प्रदेश)	(1) श्री भगवती हरि बाबू (2) श्री ए.वी.हनुमंता राव (3) श्री वी.राघवाचार्यलू	3.01.2014 से 2.01.2019
46	मैसर्स कोसमो कॉशियस रिसर्च लैबोरट्री "सर्वे हाउस" # 121, 2nd क्रॉस, नेहरु कालोनी, बैलारी-583103 (कर्नाटक)	(1) श्री जी.धावलेश्वर (2) श्रीमती वी.स्वर्णलता (3) श्री के.सोमशेखर राव	3.01.2014 से 2.01.2019
55	मैसर्स अनाकॉन लैबोरट्रीज़ प्रा0लि0, एफपी-34, 35 फूड पार्क, 5 स्टार ओद्यौगिक एस्टेट, बुटीबोरी, नागपुर-441122 (महाराष्ट्र)	(1) डा. (सुश्री) सुगंधा डी.गर्वे (2) सुश्री कविता सेगांवकर (3) श्री के.वेंकटेश्वर राव	3.01.2014 से 2.01.2019

57	मैसर्स रामकी एनवाईरो इंजीनियर्स लि. हैदराबाद वेस्ट मैनेजमेंट प्रोजक्ट, सर्वे नं. 684/1, डंडीगल (वी) कुतुबल्लापुर (एम) रंगारीडी जिला-रामकी-500 043 (आंध्र प्रदेश)	(1) श्री वी.विजय कुमार (2) श्री मदन कुमार डी.तिवारी (3) श्री के.वेंकटेश्वर राव	3.01.2014 से 2.01.2019
58	मैसर्स इंटरनेशनल टेस्टिंग सेंटर प्लॉट नं0 86, इंडसट्रीयल एरिया फेस-1, पंचकुला-134109 (हरियाणा)	(1) डा. प्रकाश कौर (2) श्री प्रेम कुमार (3) सुश्री पूनम शर्मा	3.01.2014 से 2.01.2019
61	मैसर्स मित्रा एस.के. प्राइवेट लि. (बेहाला लैबोरट्री) 620, डायमंड हार्बर रोड बेहाला इंडस्ट्रीयल एस्टेट, टूल रूम नं. 2/3/, 2/4 और 2/5, कोलकाता-700034 (पश्चिमी बंगाल)	(1) श्री सुदीप मुखुटी (2) सुश्री सुतापा भोमिक (3) सुश्री मौसमी सेनगुप्ता	3.01.2014 से 2.01.2019
65	मैसर्स एनवाइरोडिज़ाइन ईको लैब्स इको टावर, जानथा जंक्शन, पलारीवोत्तम, कोच्ची-682025 केरल	(1) श्री के.एल.एंटनी (2) सुश्री सुज़न अब्राहम (3) सुश्री सिमी के.के.	3.01.2014 से 2.01.2019
68	मैसर्स सांईटिफिक रिसर्च लैबोरट्रीज़ "श्यामली अपार्टमेंट" 90, लेक ईस्ट 4th रोड संतोषपुर, कोलकाता-700075 (वेस्ट बंगाल)	(1) डा. जोइरमोय मजुमदार (2) श्री कल्याण घोष (3) सुश्री पुर्बा खुखर्जी	3.01.2014 से 2.01.2019
69	मैसर्स साडेकर एनवाइरो इंजिनीयर्स प्रा.लि., बी-306/307, प्लाट नं. 61, पटेल एस्टेट, रेइस मगोस, वेरेम, आल्टो, ओल्ड बेटिम रोड, बर्डेज़, पोरवोरिम,पणजी-403101 (गोवा)	(1) श्री विशाल बासावन्नी सन्नाकी (2) श्री विनायक गंगाराम कुडकर (3) श्री स्वाति वैभव मोरे	3.01.2014 से 2.01.2019";

(ख) क्रम संख्यांक 113 और उससे संबंधित प्रविष्टियों के पश्चात्, निम्नलिखित क्रम संख्यांक और प्रविष्टियां अंतःस्थापित की जाएगी, अर्थात् :--

(1)	(2)	(3)	(4)
"114	मैसर्स इकोमेन लैबोरट्रीज़ प्रा.लि., फ्लैट नं0 8, 2nd फ्लोर, आरिफ चैंबर-v, सैक्टर- H, अलिगंज, लखनऊ-226024 (उत्तर प्रदेश)	(1) सुश्री रीना त्रिपाठी (2) डा0 ओम प्रकाश शुक्ला (3) श्री प्रवीण कुमार दुबे	3.01.2014 से 2.01.2019
115	मैसर्स टीम लैब्स एंड कंसलटेंटस् बी-115 तथा 509, अण्णापूर्ण ब्लाक आदित्य एन्कलेव, अमीरपेट हैदराबाद-500038 आंध्र प्रदेश	(1) श्री अंबावती रवि पवन कुमार (2) श्री एस.रमेश (3) श्री टी.रवि किरन	3.01.2014 से 2.01.2019
116	मैसर्स टीयूवी एसयूडी साउथ एशिया प्रा0 लि0, सी-153/1, ओखला ओद्यौगिक एस्टेट, फेस-1, नई दिल्ली-110020	(1) श्री प्रमोद कुमार (2) श्री अजय कुमार प्रमाणिक (3) श्री विजयानंद	3.01.2014 से 2.01.2019";

[फा.सं. क्यू-15018/23/2013-सीपीडब्ल्यू]

डा. राशिद हसन, सलाहकार

टिप्पण : मूल अधिसूचना भारत के राजपत्र, असाधारण, में संख्यांक. का.आ. 1174(अ), तारीख 18 जुलाई, 2007 द्वारा प्रकाशित की गई थी और तत्पश्चात् अधिसूचना सं0 का.आ. 1539(अ), तारीख 13 सितंबर, 2007, का.आ. 1811(अ), तारीख 24 अक्तूबर, 2007, का.आ. 55(अ), तारीख 9 जनवरी, 2008, का.आ. 428(अ), तारीख 4 मार्च, 2008, का.आ. 865(अ), तारीख 11 अप्रैल, 2008, का.आ. 1894(अ), तारीख 31 जुलाई, 2008, का.आ. 2728(अ), तारीख 25 नवंबर, 2008, का.आ. 1356(अ), तारीख 27 मई, 2009, का.आ.1802(अ) तारीख 22 जुलाई, 2009, का.आ.2399(अ) तारीख 18 सितंबर, 2009, का.आ. 3122(अ), तारीख 7 दिसंबर, 2009, का.आ. 3123(अ), तारीख 7 दिसंबर, 2009, का.आ. 142(अ), तारीख 21 जनवरी, 2010, का.आ. 619(अ), तारीख 19 मार्च, 2010, का.आ. 1662(अ), तारीख 13 जुलाई, 2010, का.आ. 2390(अ), तारीख 30 सितंबर, 2010, का.आ. 2904(अ), तारीख 8 दिसंबर, 2010, का.आ. 181(अ), तारीख 28 जनवरी, 2011, का.आ. 692(अ), तारीख 5 अप्रैल, 2011, का.आ. 1537(अ), तारीख 6 जुलाई, 2011, का.आ. 1754(अ), तारीख 28 जुलाई, 2011, का.आ. 2609(अ), तारीख 22 नवंबर, 2011, का.आ. 264(अ), तारीख 13 फरवरी, 2012, का.आ. 1150(अ), तारीख 22 मई, 2012, का.आ. 2039(अ), तारीख 5 सितंबर, 2012, का.आ. 2802(अ), तारीख 27 नवंबर, 2012 और का.आ. 2850(अ), तारीख 7 दिंसबर, 2012 तथा का.आ. 592(अ), तारीख 8 मार्च, 2013, का.आ. 945(अ), तारीख 8 अप्रैल, 2013, का.आ.2287(अ), तारीख 27 जुलाई, 2013, का.आ.2288(अ), तारीख 27 जुलाई, 2013, और का.आ.3489(अ), तारीख 26 नवंबर, 2013, द्वारा उसका संशोधन किया गया था ।

MINISTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi, the 3rd January, 2014

S.O. 21 (E).—In exercise of the powers conferred by clause (b) of sub-section (1) of section 12 and section 13 of the Environment (Protection) Act, 1986 (29 of 1986) read with rule 10 of the Environment (Protection) Rules, 1986, the Central Government hereby makes the following further amendments in the notification of the Government of India in the Ministry of Environment and Forests, number S.O. 1174(E), dated the 18th July, 2007, namely :—

In the Table appended to the said notification,—

(a) for serial numbers 3, 46, 55, 57, 58, 61, 65, 68 and 69 and the entries relating thereto, the following serial numbers and entries shall be substituted, namely :—

(1)	(2)	(3)	(4)
"3	M/s Bhagavati Ana Labs Pvt. Ltd., Regd. Office and Central Laboratory Plot No. 7-2-C7 & 8/4, Industrial Estate Near Agromech Industries Santhnagar, Hyderabad - 500018 (Andhra Pradesh)	(1) Mr. Bhagavathi Hari Babu (2) Mr. A.V. Hanumantha Rao (3) Mr. V. Raghavacharyulu	3.01.2014 to 2.01. 2019
46	M/s Cosmo Conscious Research Laboratory" SURVEY HOUSE" # 121, 2nd Cross, Nehru Colony, Bellary - 583103 (Karnataka)	(1) Mr. G. Dhavaleshwar (2) Smt. V. Swarnalatha (3) Mr. K. Somasekhar Rao	3.01.2014 to 2.01. 2019
55	M/s Anacon Laboratories Pvt. Ltd., FP-34, 35 Food Park, 5 Star Industrial Estate, Butibori, Nagpur - 441122 (Maharashtra)	(1) Dr. (Ms.) Sugandha D. Garway (2) Ms. Kavita Saygaonkar (3) Mr. Yogesh Dhoke	3.01.2014 to 2.01.2019
57	M/s. Ramky Enviro Engineers Ltd. Hyderabad Waste Management Project, Survey No.684/1, Dundigal (V), Qutabullapur (M) Rangareedy District – 500 043 (Andhra Pradesh)	(1) Mr.V. Vijay Kumar (2) Mr.Madan Kumar D. Tiwari (3) Mr. K. Venkateswara Rao	3.01.2014 to 2.01.2019";
58	M/s. International Testing Centre, Plot No. 86, Industrial Area Phase-1, Panchkula-134109 (Haryana)	(1) Dr. Prakash kaur (2) Mr. Prem Kumar (3) Ms. Poonam Sharma	3.01.2014 to 2.01.2019
61	M/s Mitra S.K. Private Ltd., (Behala Laboratory) , 620, Diamond Harbour Road,	(1) Mr. Sudip Mukhuty (2) Ms. Sutapa Bhowmik	3.01.2014

	Behala Industrial Estate, Tool Room No. 2/3, 2/4 & 2/5, Kolkata – 700034 (West Bengal)	(3) Ms. Mousumi Sengupta	to 2.01. 2019
65	M/s Envirodesigns Eco Labs Eco Tower, Janatha Jn. Palarivattom, Kochi – 682025 Kerala	(1) Mr. K.L. Antony (2) Ms. Susan Abraham (3) Ms. Simi K.K.	3.01.2014 to 2.01. 2019
68	M/s Scientific Research Laboratory "SHYAMALI APARTMENT" 90, Lake East 4th Road 'Santoshpur, Kolkata - 700075 (West Bengal)	(1) Dr. Jyotirmoy Majumdar (2) Shri Kalyan Ghosh (3) Ms. Purba Mukherjee	3.01.2014 to 2.01. 2019
69	M/s Sadekar Enviro Engineers Pvt. Ltd., B-306/307, Plot No.61, Patel Estate, Reis Magos, verem, Alto, Old Betim Road, Bardez, Porvorim, Panaji – 403101 (Goa)	(1) Mr. Vishal Basawanni Sannakki (2) Mr. Vinayak Gangaram Kudkar (3) Ms. Swati Vaibhav More	3.01.2014 to 2.01.2019

(b) after serial number 113 and the entries relating thereto, the following serial numbers and entries shall be inserted, namely :—

(1)	(2)	(3)	(4)
"114	M/s Ecomen Laboratories Pvt. Ltd., Flat No. 8, 2nd Floor, Arif Chamber - V, Sector - H, Aliganj, Lucknow - 226024 (Uttar Pradesh)	(1) Ms. Reena Tripathi (2) Dr. Om Prakash Shukla (3) Mr.Praveen Kumar Dubey	3.01.2014 to 2.01.2019
115	M/s Team Labs and Consultants B-115 & 509, Annapurna Block Aditya Enclave, Ameerpet Hyderabad – 500038 Andhra Pradesh	(1) Mr. Ambati Ravi Pavankumar (2) Mr. S. Ramesh (3) Mr. T. Ravi Kiran	3.01.2014 to 2.01. 2019
116	M/s TUV SUD South Asia Pvt. Ltd., C-153/1, Okhla Industrial Estate, Phase-1, New Delhi - 110020	(1) Mr. Pramod Kumar (2) Mr. Ajay Kumar Pramanik (3) Mr. Vijayanand	3.01.2014 to 2.01. 2019";

[F. No. Q.15018/23/2013-CPW]

Dr. RASHID HASAN, Advisor

Note.- The principal notification was published in the Gazette of India, Extraordinary *vide* number S.O. 1174 (E), dated the 18th July, 2007 and subsequently amended *vide* notification numbers S.O. 1539 (E), dated the 13th September, 2007, S.O.1811(E), dated the 24th October, 2007, S.O.55(E), dated 9th January, 2008, S.O.428(E), dated the 4th March, 2008, S.O.865(E) dated the 11th April, 2008, S.O.1894(E), dated the 31st July, 2008, S.O.2728(E) dated the 25th November, 2008, S.O.1356(E), dated the 27th May, 2009, S.O.1802(E), dated the 22nd July, 2009, S.O.2399(E), dated the 18th September, 2009, S.O. 3122(E), dated the 7th December, 2009, S.O. 3123(E), dated the 7th December, 2009, S.O.No.142(E), dated the 21st January, 2010, S.O.619(E), dated the 19th March, 2010, S.O.1662(E) dated the 13rd July, 2010, S.O.2390(E), dated the 30th September, 2010, S.O.2904(E), dated the 8th December, 2010, S.O.181(E), dated the 28th January, 2011, S.O. 692(E), dated the 5th April, 2011, S.O.1537(E), dated the 6th July, 2011, S.O.1754(E), dated the 28th July, 2011. S.O.2609 (E) dated the 22nd November, 2011, S.O.264 (E), dated the 13 February, 2012, S.O.1150(E), dated the 22nd May, 2012, S.O.2039(E), dated the 5th September, 2012, S.O. 2802(E) dated the 27th November, 2012, S.O. 2850(E), dated the 7th December, 2012, S.O. 592 (E), dated the 8th March, 2013, S.O.945(E), dated the 8th April, 2013,S.O.2287(E), dated the 27th July, 2013, S.O.2288(E), dated the 27th July, 2013 and S.O.3489(E) dated the 26th November, 2013.

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Declaration by Experts contributing to the EIA – Proposed Expansion of Existing "Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF)" by M/s. Mumbai Waste Management Limited.

I hereby, certify that I was a part of the EIA team in the following capacity that developed this EIA report.

EIA coordinator:

Name : Mr. Subash Koduri

Sign & Date : 26/12/2018

Period of involvement : March, 2018 - Till date

Contact person : subash.k@ramky.com

Functional Area Experts:

S.No	Functional Area	Name of the Expert	Involvement		Sign & Date
			Period	Task	
1	AP	Mr. V.Vijay Kumar	Mar,2018 to till date	Selecting ambient air monitoring sites based on IMD data, Review of the meteorological data and AAQ data, suggesting air pollution control measures.	26/12/18
2	WP	Mr. A. Satyanarayana	Mar,2018 to till date	Identification of water monitoring sites, estimating water requirements, suggesting Recycling of water and waste water treatment methods	
3	SHW	Mr. A. Satyanarayana	Mar,2018 to till date	Inventorization of wastes, suggesting treatment measures.	
4	SE	Dr. V.Harish Srivatsava	Mar,2018 to till date	Generating primary data and estimating economic, infrastructure and employment benefits.	26.12.18
5	EB	Dr.K. Bayapu Reddy	Mar,2018 to till date	Collected secondary data from forest department, filed studies for generation of primary flora and fauna data & suggested species for greenbelt development	
6	HG	Mr. B. Mallikarjuna Rao	Mar,2018 to till date	Well inventory to understand the depth of weathering, thickness of fracture zones, yield of wells, depth to water level monitoring data analysis, water level fluctuation based on pre monsoon and post monsoon depth to water level data collected from secondary sources. Physiography of the site area, general trend of surface water and ground water flow direction, ground	26/12/18

				water utilization status, identification of anticipated impacts on environment and suggest suitable conservation/mitigation measures – monitoring mechanism.	
7	GEO	Mr. B. Mallikarjuna Rao	Mar,2018 to till date	Describe the regional geology and structure of the area which will have bearing on the ground water occurrence and movement - vulnerability to seismicity – assessment of possible impacts due to the geological setting of the area.	
8	AQ	Dr. B. Chakradhar	Mar,2018 to till date	Meteorological and Air pollution dispersion studies, Suggesting environmental management plan for air pollution control.	
9	LU	Mr. R.Venkateswarlu	Mar,2018 to till date	Collection of GPS readings for identification of topo sheets and satellite imagery, preparation of base map from topo sheets, preparation of monitoring location map.	
10	RH	Dr. B.Chakradhar	Mar,2018 to till date	Estimating risks such as construction failures, electrical or civil accidents, fires etc. and suggesting control measures.	

Declaration by the Head of the accredited consultant organization/authorized person:

I, **Dr. B.Chakradhar**, hereby, confirm that the above mentioned experts prepared the EIA Report for the **Proposed Expansion of Existing "Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF)" by Mumbai Waste Management Limited**. I also confirm that the consultant organization shall be fully accountable for any misleading information mentioned in this statement.

Signature	:	
Name	:	Dr. B. Chakradhar
Designation	:	Director
Name of the EIA Consultant Organization	:	Ramky Enviro Services Private Limited
NABET Certificate No. & Issue Date	:	NABET/EIA/1518/SA 061

Ramky Enviro Services Private Limited
(Wholly Owned Subsidiary Company of
Ramky Enviro Engineers Ltd.)
Corporate Office: 12th Floor, Ramky Grandiose
Ramky Towers, Gachibowli,
Hyderabad - 500 032, Telangana, India.
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Towards sustainable growth

UNDERTAKING BY CONSULTANT

We, Ramky Enviro Services Private Limited (A Subsidiary of Ramky Enviro Engineers Limited), accredited EIA Consultants involved in the preparation of EIA/EMP report after accreditation with by QCI/NABET (Certificate No. NABET/EIA/1518/SA 061), hereby declare that we have prepared the EIA/EMP Report based on prescribed Terms of Reference (ToR) issued by MoEF&CC (IA/MH/MIS/73479/2018; F. No. 10-36/2018-IA-III) dated: 17th October, 2018 for the Expansion of Existing Integrated Common Hazardous Waste Treatment Storage and Disposal Facility, MIDC Taloja, Panvel, Raigad District, Maharashtra . In this regard, we hereby certify that the EIA/EMP reports prepared by us and data provided by Laboratories including our status of approvals presented in the report is factually correct. The laboratory used for analysis of samples is approved under EPA 1986 and Rules made there under.

26.12.18

Dr. B. Chakradhar
Director
Ramky Enviro Services Private Limited
Gachibowli, Hyderabad - 32

Mumbai Waste Management Ltd.
Plot No. P-32, MIDC Taloja, Dist. Raigad,
Tal. Panvel Maharashtra 410 208, India
Tel.: 022-2740 1468 to 71 & 2741 1473
Fax: 022-2740 1474
Email: mbdmwml@ramky.com
www.mumbaiwastemanagement.com
CIN:U90001AP2001PLC37829

UNDERTAKING BY PROJECT PROPONENT

We, Mumbai Waste Management Limited project proponent of the Expansion of Existing ICHWTSDF project, MIDC Taloja, Panvel, Raigad District, Maharashtra State, hereby declare that, we have engaged Ramky Enviro Services Pvt. Ltd. by QCI/NABET (Certificate No. NABET/EIA/1518/SA 061), valid till date: May 20, 2019 as EIA consultant for preparation of EIA report. The EIA report has been prepared in compliance with the Terms of Reference issued by MoEF&CC (Proposal No. IA/MH/MIS/73479/2018; F.No. 10-36/2018-IA-III) dated: 17th October, 2018. We hereby certify the data/information presented in the EIA report is factually correct and we own the contents (information and date) of EIA report.

Yours faithfully

Authorized Signatory

Project Head 21/12/18

For Mumbai Waste Management Limited,

F.No.10-36/2018-IA-III
Government of India
Ministry of Environment, Forest and Climate Change
(IA.III Section)

Indira Paryavaran Bhawan,
Jor Bagh Road, New Delhi - 3

Date: 17th October, 2018

To,

M/s Mumbai Waste Management Limited,
Plot No P-32, MIDC Taloja, Panvel Taluk, Raigad District,
Navi Mumbai - 410 208, Maharashtra
E Mail: smalgar@ramky.com

Subject: Expansion of Existing 'Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF)' at P-32 & P-32 (part), MIDC Taloja, Panvel Taluk, Raigad District, Maharashtra by M/s Mumbai Waste Management Limited - Terms of Reference - reg.

Sir,

This has reference to your proposal No. IA/MH/MIS/73479/2018 dated 6th April, 2018, submitted to this Ministry for seeking Terms of Reference (ToR) in terms of the provisions of the Environment Impact Assessment (EIA) Notification, 2006 under the Environment (Protection) Act, 1986.

2. The proposal for grant of Terms of Reference (ToR) to the project 'Expansion of Existing 'Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF)' at P-32 & P-32 (part), MIDC Taloja, Panvel Taluk, Raigad District, Maharashtra by M/s Mumbai Waste Management Limited was considered by the Expert Appraisal Committee (Infra-2) in its 32nd meeting held on 2-4 July, 2018.

3. The details of the project as per the documents submitted by the project proponent, and also as informed during the above said meeting, are under:-

(i) Mumbai Waste Management Limited (MWML), a subsidiary of Ramky Enviro Engineers Limited is proposing to expand the existing Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF) along with addition of new units for the recovery of solvents, recycling of paper, plastics and MS drums as well as facilities for E-waste management and alternate fuel & raw material recovery. The existing project activities includes secured landfill (1,20,000 MTPA), two incinerators (combined capacity of 30,000 MTPA) and bio-medical waste treatment facility (150 TPM with 1X250 kg/hr incinerator, 2X600 lit/batch autoclaves and 2X100 kg/hr shredders).

(ii) M/s Mumbai Waste management Ltd. located at Plot No. P32 & P32 (Part), Taloja Industrial Area, District Raigarh falls under Notified Taloja industrial Area (vide MIDC letter no. MIDC/Env. Section/405 of 2001 dated 10.09.2001.

(iii) The proposed expansion will be developed within the existing Mumbai Waste Management Limited (MWML) site located at P-32 & P-32 (part), MIDC, Taloja, Panvel Taluk, Raigad District, Maharashtra (within notified industrial area). The total land area of the project is 39.40 Ha (97.35 Acres) and the proposed facilities will be developed within existing area. Greenbelt meeting MoEFCC guidelines will be developed with a minimum 10 m width all around the boundary of proposed site.

(iv) The ICHWTSDF, after the proposed expansion, will have the following components: secured landfill (3,50,000 MTPA), three (3) incinerators (combined capacity of 45,000 MTPA), bio-medical waste treatment facility (250 TPM with 2X250 kg/hr incinerators, 2X3,000 lit/batch autoclaves and 2X200 kg/hr shredders),E-waste Management (5,400 MTPA), Plastics Recycling (5,000 MTPA), Paper Recycling (30,000 MTPA), Solvent Recovery (9,000 KLPA), AFRF (70 MTPD) and MS Drum Recycling (15 MTPD).

(v) The total water requirement of the project is 582 KLD will be sourced from MIDC, which includes existing requirement of 361 KLD and proposed requirement of 221 KLD. The total power required for operations is 2220 kVA which is sourced from Maharashtra State Electricity Distribution Co. Ltd (MSEDCL), which includes existing requirement of 500 kVA and proposed requirement of 1720 kVA. The DG sets of 875 kVA (existing) and 500 kVA (proposed) will be used as a power backup for emergency requirement.

(vi) The capital cost of the proposed expansion project is Rs.40.05 Crores (Existing project cost is Rs.155.82 Crores). The capital cost allocated for EMP is around Rs. 3.5 Crores with a recurring cost of Rs. 35 lakhs/annum. The CSR budget allotted during FY 2017-18 is around Rs. 20 lakhs.

(vii) Employment potential: Due to the project, employment options to the locals will be increased which improve their livelihood.

(viii) Benefits of the project: the proposed project will have a positive impact on the people and its surroundings.

4. The project/activity is covered under category A of item 7(d) 'Common hazardous waste treatment, storage and disposal facilities (TSDFs)' of the Schedule to the EIA Notification, 2006 and its amendments, and requires appraisal at Central level by sectoral EAC.

5. The EAC, in its 32nd meeting held on 2-4 July, 2018, after detailed deliberations, recommended the project for grant of ToR as specified by the Ministry as Standard ToR in April, 2015 for the said project/activity and the following ToR in addition to Standard ToR for preparation of EIA-EMP report. As per the recommendation of the EAC, the Ministry of Environment, Forest and Climate Change hereby accords ToR to the project 'Expansion of Existing 'Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF)' at P-32 & P-32 (part), MIDC Taloja, Panvel Taluk, Raigad District, Maharashtra by M/s Mumbai Waste Management Limited for preparation of the Environment Impact Assessment (EIA) Report and Environment Management Plan (EMP) with the following specific and general conditions in addition to Standard ToR provided at ***Annexure -1***:-

(i) Importance and benefits of the project.

(ii) The E.I.A. would address to the conformity of site to the stipulations as made in the Hazardous and other Wastes (Management, handling and trans-boundary movement) Rules, 2016 and will have a complete chapter indicating conformity to the said rules.

(iii) Project proponents would also submit a write up on how their project proposal conform to the stipulations made in the "Protocol for Performance evolution and monitoring of the Common Hazardous Waste Treatment Storage and Disposal

facilities including common Hazardous Waste incinerators", published by the CPCB on May 24, 2010.

(iv) Status of compliance to the provisions of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and Bio-Medical Waste Management Rules, 2016.

(v) Compliance to the conditions of the consent to operate and authorization for the existing facilities. The EIA will discuss the compliance to the Pollution Control Laws and the notifications under the E.P. Act 1986 and get a certified report from the Pollution Control Board.

(vi) Details of various waste management units with capacities for the proposed project.

(vii) List of waste to be handled and their source along with mode of transportation.

(viii) Other chemicals and materials required with quantities and storage capacities.

(ix) Details of temporary storage facility for storage of hazardous waste at project site.

(x) Details of pre-treatment facility of hazardous waste at TSDF.

(xi) Details of air emissions, effluents, hazardous/solid waste generation and their management.

(xii) Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).

(xiii) Process description along with major equipments and machineries, process flow sheet (quantitative) from waste material to disposal to be provided.

(xiv) Hazard identification and details of proposed safety systems.

(xv) Details of Drainage of the project up to 5 km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided.

(xvi) Ground water quality monitoring in and around the project site.

(xvii) The Air Quality Index shall be calculated for base level air quality.

(xviii) Status of the land purchases in terms of land acquisition Act and study the impact.

(xix) Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.

(xx) R&R details in respect of land in line with state Government policy.

(xxi) Details of effluent treatment and recycling process.

(xxii) Leachate study report and detailed leachate management plan to be incorporated.

(xxiii) Action plan for measures to be taken for excessive leachate generation during monsoon period.

(xxiv) Action plan for any pollution of ground water is noticed during operation period or post closure monitoring period.

(xxv) Detailed Environmental Monitoring Plan as well as Post Closure Monitoring Plan.

(xxvi) A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project.

(xxvii) A detailed Plan for green belt development.

(xxviii) A certificate from the local body supplying water, specifying the total annual water availability with the local authority, the quantity of water already committed the quantity of water allotted to the project under consideration and the balance water available. This should be specified separately for ground water and surface water sources, ensuring that there is no impact on other users.

(xxix) Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.

(xxx) The project proponents shall satisfactorily address to all the complaints/suggestions that have been received against the project till the date of submission of proposals for Appraisal.

(xxxi) Plan for Corporate Environment Responsibility (CER) as specified under Ministry's Office Memorandum vide F.No. 22-65/2017-IA.III dated 1st May 2018 shall be prepared and submitted along with EIA Report.

(xxxii) A tabular chart with index for point wise compliance of above ToRs.

General Guidelines

(i) The EIA document shall be printed on both sides, as for as possible.

(ii) All documents should be properly indexed, page numbered.

(iii) Period/date of data collection should be clearly indicated.

(iv) Authenticated English translation of all material provided in Regional languages.

(v) The letter/application for EC should quote the MoEF&CC File No. and also attach a copy of the letter prescribing the ToR.

(vi) The copy of the letter received from the Ministry on the ToR prescribed for the project should be attached as an annexure to the final EIA-EMP Report.

(vii) The final EIA-EMP report submitted to the Ministry must incorporate the issues mentioned in ToR. The index of the final EIA-EMP report, must indicate the specific chapter and page no. of the EIA-EMP Report where the specific ToR prescribed by Ministry. Questionnaire related to the project (posted on MoEF&CC website) with all sections duly filled in shall also be submitted at the time of applying for EC.

(viii) Grant of ToR does not mean grant of EC.

(ix) The status of accreditation of the EIA consultant with NABET/QCI shall be specifically mentioned. The consultant shall certify that his accreditation is for the sector for which this EIA is prepared.

(x) On the front page of EIA/EMP reports, the name of the consultant/consultancy firm along with their complete details including their accreditation, if any shall be indicated. The consultant while submitting the EIA/EMP report shall give an undertaking to the effect that the prescribed ToRs (ToR proposed by the project proponent and additional ToR given by the MoEF&CC) have been complied with and the data submitted is factually correct (Refer MoEF&CC Office memorandum dated 4th August, 2009).

(xi) While submitting the EIA/EMP reports, the name of the experts associated with/involved in the preparation of these reports and the laboratories through which

the samples have been got analysed should be stated in the report. It shall clearly be indicated whether these laboratories are approved under the Environment (Protection) Act, 1986 and the rules made there under (Please refer MoEF&CC Office Memorandum dated 4th August, 2009). The project leader of the EIA study shall also be mentioned.

(xii) All the ToR points as presented before the Expert Appraisal Committee (EAC) shall be covered.

6. The above ToR should be considered for the project 'Expansion of Existing 'Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF)' at P-32 & P-32 (part), MIDC Taloja, Panvel Taluk, Raigad District, Maharashtra by M/s Mumbai Waste Management Limited, in addition to all the relevant information as per the 'Generic Structure of EIA' given in Appendix III and IIIA in the EIA Notification, 2006. Public hearing is exempted for the project as per para 7(i) III Stage (3)(i)(b) of EIA Notification, 2006 for preparation of EIA/EMP Report, being site is located in the Notified industrial area.

7. The project proponent shall submit the detailed final EIA/EMP prepared as per ToR to the Ministry for considering the proposal for environmental clearance within 3 years as per the MoEF&CC O.M. No.J-11013/41/2006-IA-II(I) (P) dated 08.10.2014.

8. The consultants involved in preparation of EIA/EMP report after accreditation with Quality Council of India/National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other Organization(s)/ Laboratories including their status of approvals etc. vide Notification of the MoEF&CC dated 19.07.2013.

9. The prescribed ToR would be valid for a period of three years for submission of the EIA/EMP Reports.

10. This issues with the approval of Competent Authority.

(Kushal Vashist)
Director

Copy to:

The Member Secretary, Maharashtra Pollution Control Board, Kalpataru Point, 3rd and 4th Floor, Opp. Cine Planet, Sion Circle, Mumbai - 400 022.

Annexure-I

7(d): STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR COMMON HAZARDOUS WASTE TREATMENT, STORAGE AND DISPOSAL FACILITIES (TSDFS) AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT

1) Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental damages, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.

2) Submit the details of the road/rail connectivity along with the likely impacts and mitigative measures

3) Submit the present land use and permission required for any conversion such as forest, agriculture etc

4) Examine the details of transportation of Hazardous wastes, and its safety in handling.

5) Examine and submit the details of on line pollutant monitoring.

6) Examine the details of monitoring of Dioxin and Furon.

7) MoU for disposal of ash through the TSDF.

8) MoU for disposal of scrubbing waste water through CETP.

9) Examine and submit details of monitoring of water quality around the landfill site.

10) Examine and submit details of the odour control measures.

11) Examine and submit details of impact on water body and mitigative measures during rainy season.

12) Environmental Management Plan should be accompanied with Environmental Monitoring Plan and environmental cost and benefit assessment. Regular monitoring shall be carried out for odour control.

13) Water quality around the landfill site shall be monitored regularly to examine the impact on the ground water.

14) The storage and handling of hazardous wastes shall be as per the Hazardous Waste Management Rules.

15) Submit details of a comprehensive Disaster Management Plan including emergency evacuation during natural and man-made disaster.

16) Public hearing to be conducted for the project in accordance with provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing should be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the web-site.

17) A detailed draft EIA/EMP report should be prepared in accordance with the above additional TOR and should be submitted to the Ministry in accordance with the Notification.

18) Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.

19) The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.

20) Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website http://moef.nic.in/Manual/Incinerator

****

Terms of Reference Compliance

32nd ToR meeting of EAC (Infra-2) held on 2- 4 July, 2018; ToR date: 17.10.2018		
i.	Importance and benefits of the project	▪ Secured landfill as a part of Common Hazardous Waste Treatment, Storage and Disposal facility would minimize the risk involved in hazardous waste management by way of transportation and waste movement through manifest and regular monitoring of such facility would be better and feasible as compared to captive facilities by individual industries. ▪ These factors as well as a strong desire to come up as a single window solution provider for waste management issues to embark setting up and expanding this Common Hazardous Waste Treatment, Storage and Disposal facility (CHWTSDF), apart from achieving other social objectives. ▪ The Hazardous Waste (Management & Handling) Rules, 1989 and its subsequent amendments bar the industries from dumping their solid wastes indiscriminately. ▪ At the same time they permit the industries to dispose of their wastes in safe & secured manner. It has been made mandatory by the government to dispose of Hazardous waste in systematic and scientific disposal way and pollution control boards have been asked to ensure it. ▪ For systematic & scientific disposal of solid wastes, a facility has to be developed where care is to be taken to avoid any negative effects on the environment.
ii.	The E.I.A. would address to the conformity of site to the stipulations as made in the Hazardous and other Wastes (Management, handling and trans boundary movement) Rules, 2016 and will have a complete chapter indicating conformity to the said rules.	The site conformity to stipulations as per Hazardous and other Wastes (Management, handling and trans boundary movement) Rules, 2016 have given in a separate chapter indicating conformity to the said rules in **Chapter 5, Section 5.1.2, Page No. 5.1.**
iii.	Project proponents would also submit a write up on how their project proposal conform to the stipulations made in the "Protocol for Performance evolution and monitoring of the Common Hazardous Waste Treatment Storage and Disposal facilities including common Hazardous Waste incinerators", published by the CPCB on May 24, 2010.	The "Protocol for Performance evaluation and monitoring of the Common Hazardous Waste Treatment Storage and Disposal facilities including common Hazardous Waste incinerators" is attached as Annexure I.
iv.	Status of compliance to the provisions of the Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016 and Bio-Medical Waste Management Rules, 2016.	Yes, complying with the provisions. The approved "Status of compliance to the provisions of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016", and Biomedical waste management Rule, 2016 by MPCB is attached as Annexure II.
v.	Compliance to the conditions of the consent to	A copy of the certified compliance report to the

<table>
<tr><td></td><td>operate and authorization for the existing facilities. The EIA will discuss the compliance to the Pollution Control Laws and the notifications under the E.P. Act 1986 and get a certified report from the Pollution Control Board.</td><td>consent to operate for both air and water and the authorization received from the MSPCB for the existing facilities is attached as Annexure III.</td></tr>
<tr><td>vi.</td><td>Details of various waste management units with capacities for the proposed project.</td><td>
<table>
<tr><th>Name of the Facility</th><th>Existing capacity</th><th>After Proposed Expansion</th></tr>
<tr><td>Secured Landfill *</td><td>1,20,000 TPA</td><td>3,50,000 TPA</td></tr>
<tr><td>Incinerator 1</td><td>15,000 TPA</td><td>15,000 TPA</td></tr>
<tr><td>Incinerator 2</td><td>15,000 TPA</td><td>15,000 TPA</td></tr>
<tr><td>Incinerator 3</td><td>-</td><td>15,000 TPA</td></tr>
<tr><td>Bio medical waste</td><td>150 TPM</td><td>250 TPM</td></tr>
<tr><td>Incinerator</td><td>1x250 kg/hr</td><td>2x250 kg/hr</td></tr>
<tr><td>Autoclave</td><td>2x600 l/batch</td><td>2x3000 l/batch</td></tr>
<tr><td>Shredder</td><td>2x100 kg/hr</td><td>2x200 kg/hr</td></tr>
<tr><td>E-waste</td><td>-</td><td>5400 TPA</td></tr>
<tr><td>Plastic Recycling</td><td>-</td><td>5000 TPA</td></tr>
<tr><td>Paper Recycling</td><td>-</td><td>30000 TPA</td></tr>
<tr><td>Solvent Recovery</td><td>-</td><td>9000 KLPA</td></tr>
<tr><td>Alternate Fuel & Raw Material Facility</td><td>-</td><td>70 TPD</td></tr>
<tr><td>MS Drum Recycling</td><td>-</td><td>15 TPD</td></tr>
</table>
</td></tr>
<tr><td>vii.</td><td>List of waste to be handled and their source along with mode of transportation.</td><td>Hazardous waste comprising viz. ETP sludge, still bottom residues, process sludge, spent carbon, evaporation salts, incineration ash, slags, spent catalysts & resins, expired drugs, etc. will be handled.

The sources of the hazardous waste are industries present in various districts of Maharashtra.

The mode of transportation is through dedicated trucks. Specially designed fleets are available at site and deployed for collection of waste from industries, so that chance of spillage is minimized during transit. Articulated Cranes and Hook Lifts mounted vehicles are used for carriage of containers.

The seven copy manifest system and TREM card system as per Hazardous and Other Waste (Management and Transboundary Movement) Rules 2016, shall be implemented. The details are given in Chapter 2, under section 2.10.2.</td></tr>
<tr><td>viii.</td><td>Other chemicals and materials required with quantities and storage capacities.</td><td>Except for construction material for the newly proposed facilities, no other major raw materials are required for proposed project.

However for stabilization process, typical materials that would be used and stored include lime, fly ash,</td></tr>
</table>

		bentonite (clay), cement, saw dust, etc., in combination with sodium silicate solution, if required to create additional binding properties of the wastes. The details are given in **Chapter 2, Table 2.10.5.1.** High speed diesel (30 KLD) will be used for fuel-DG sets and incinerator start-up activity purpose. Five solvents (1 KLD each) recovered from the proposed Solvent Recovery Unit (SRU) will be stored. Oxygen and acetylene cylinders will be used for internal welding purpose. The detailed quantities and storage capacities are given in **Chapter 7, Table 7.4**.
ix.	Details of temporary storage facility for storage of hazardous waste at project site.	Presently two temporary storage sheds with 2100 m^2 & 3528 m^2 were available in existing facility. For proposed expansion three sheds of each 1000 m^2 capacity were proposed. The details of temporary storage facilities are given in **Chapter 2; Section 2.10.4; Table 2.3 & 2.4**.
x.	Details of pre-treatment facility of hazardous waste at TSDF.	Details of pre-treatment facility and chemicals used for pre-treatment/stabilization are given in **Chapter 2; Section 2.10.5 & Table 2.14 & 15**
xi.	Details of air emissions, effluents, hazardous/solid waste generation and their management.	Briefly, the major source of air emission during the construction phase is fugitive dust generation. Other sources include loading and unloading of materials, top soil removal, vehicle movement on unpaved roads, civil constructions etc. During operational phase, gaseous emissions would be discharged from incinerator stack which would be treated using APCDs. The predicted GLCs for PM, SO_2 and NOx are **1.4, 3.4 and 7.6** ($\mu g/m^3$) respectively. The details of air emissions and their management during development and operation phases are given in **Chapter 4, Section 4.6.3.** About 69 KLD of effluents would be generated. Details of effluents and treatment are given in **Chapter 4, Section 4.7**. Solid Waste Management for the proposed project is given in **Chapter 4, Section 4.5.5.**
xii.	Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).	The total water requirement of the project is 582 KLD which includes the existing requirement of 361 KLD and proposed expansion required 221 KLD. The detailed source of water, water break up, wastewater generation and water balance diagram are given in **Chapter 2, Section 2.7, Table 2.7, 2.8 & Figure 2.4.** Required power sourced from Maharashtra state electricity distribution Co. Ltd. The existing power requirement is 500kVA and proposed maximum demand is 1720 kVA. The detailed power requirement is given in **Chapter 2, section 2.8.**

		572 persons including skilled and unskilled workers are estimated. The detailed manpower requirement is given in Chapter 2, section 2.6.
xiii.	Process description along with major equipment's and machineries, process flow sheet (quantitative) from waste material to disposal to be provided.	Process description for the newly proposed facilities for the treatment of Hazardous waste, Bio-medical wastes, processing of E-waste, recycling of used oil, spent solvent, paper and plastic as well as Alternative Fuel and Raw Material recycling are given in Chapter 2. The equipments and machineries, process flow sheet & waste material to disposal are discussed under Sections 2.10
xiv.	Hazard identification and details of proposed safety systems.	Hazard identification Assessment of pool fire scenario based on leakage of HSD and other solvents proposed has been carried out. Contamination of soil and water due to leakage of contaminants, release of toxic gases from incinerator/landfill and various situations like spillage of waste during transport, collision of vehicles etc. have been studied. The proposed safety systems for various emergency situations like fire/foam hydrants, warning systems and control centres, fire pumps etc. have been recommended. The details are given in Chapter 7, Section 7.2 General prevention measures for other hazards like fire, electrical accidents and mock drill monitoring is given in Section 7.3
xv.	Details of Drainage of the project up to 5 km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided.	The drainage network of an area is principally governed by the topography of the land, whether a particular region is dominated by hard or soft rocks, and the gradient of the land. Natural surface drainage network is present within the study area, in the form of first and second order streams. Based on the drainage map, the drainage pattern of the study area can be described as sub-parallel to parallel. There are no river or stream presents near by the proposed site. The Bava malang River flows adjacent west from the site. The Taloja River is located 0.7 Km south from the site. The detailed map of natural drainage system occurring 5km study area of proposed site is presented in Figure 3.10
xvi.	Ground water quality monitoring in and around the project site.	Total of 10 ground water samples and 2 surface water samples were collected from the study area in order to assess the water quality. Ground water samples were drawn from hand pumps and bore wells used by the villagers for their domestic needs. Surface water sampling was carried out from the river/nallas/lake in the study area. Details of the sampling locations are given in Table 3.11 The results are shown in Table 3.12 and Table 3.13.
xvii.	The Air Quality Index shall be calculated for base	Air quality index has been calculated for base level air

	level air quality.	quality data collected in 10 location and found to be Satisfactory (51-100) – Minor breathing discomfort to sensitive people and presented in **Chapter 3 Table 3.6a**
xviii.	Status of the land purchases in terms of land acquisition Act and study the impact.	The total land of 39.40 Ha. (97.35 acres) allotted by MIDC Govt. of Maharashtra on Built Own and Operate basis (BOO) in 2001 for developing CHWTSDF. The proposed expansion not required any additional land acquisition.
xix.	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.	The total land 39.40 Ha. (97.35 acres) was acquired under Maharashtra Industrial Development Act, 1961.
xx.	R&R details in respect of land in line with state Government policy.	No R&R involved. Hence the project land in line with state Govt. policy.
xxi.	Details of effluent treatment and recycling process.	The effluents generation is expected to be around 114 KLD which will be treated in ETP and the treated waste water will be reused in the process. Sludge generated in the pond shall be disposed in the secured landfill as per landfill disposal regulations. 23 KLD from domestic sewage will be disposed off to septic followed by soak pit. Detailed Water balance table given in **Chapter 4 Table 4.4 and Water Balance flow diagram in Figure 4.4.**
xxii.	Leachate study report and detailed leachate management plan to be incorporated.	Currently, the leachate generated is transferred to a leachate collection pond/ solar evaporation pond. The decanted liquid is directly reused as sprayer on the landfill or pumped to the incinerator and the residue is disposed in landfill. However, after the integrated facility is established, the leachate would be directed to the ETP along with wastewater generated from other units a portion of which will be recycled back for use in waste stabilization. The details are given in **Chapter 2** under section **2.10.5.3**. Leachate study report is attached as Annexure-IV
xxiii.	Action plan for measures to be taken for excessive leachate generation during monsoon period.	The landfill cells which are in operation shall be temporarily covered with 1mm HDPE lines to prevent rain water contact during monsoon. The landfill cells which have been completely filled with waste shall be capped before onset of monsoon. The waste shall be stored in the temporary storage sheds during rainy days. The stored waste shall be quickly shifted into the operational part of the landfill during non-rainy days and immediately covered with liners without any gaps in between. Major portion shall be covered under temporary liners to avoid generation of any leachate.

		Proper storm water drainage shall be ensured. Garland drainage shall be provided. The landfill and the same shall be connected to a lined first flush retention pond. The water in the pond shall be tested to ensure the quality meeting to the discharge standards for utilizing for green belt or else the same shall be shifted to solar evaporation pond for disposal as waste water/leachate. **Action plan for excessive leachate generation** during monsoon period is attached as Annexure V
xiv.	Action plan for any pollution of ground water is noticed during operation period or post closure monitoring period.	Ground water monitoring shall be carried out as per Annexure 5 of the CPCB Protocol. Piezometer bore wells have been made around landfill facility from which samples are drawn at regular intervals and analysed for the quality.
xv.	Detailed Environmental Monitoring Plan as well as Post Closure Monitoring Plan.	Environmental Monitoring Plan as well as Post Closure Monitoring Plan have been given in detail in **Chapter 6**
xvi.	A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project.	The existing CHWTSDF is located in MIDC, Taloja industrial area; the power supply is sourced from Maharashtra Electricity Distribution Co. Ltd.
xvii.	A detailed Plan for green belt development.	Detailed greenbelt plan is given in **Chapter 9 section 9.7**
xviii.	A certificate from the local body supplying water, specifying the total annual water availability with the local authority, the quantity of water already committed, the quantity of water allotted to the project under consideration and the balance water available. This should be specified separately for ground water and surface water sources, ensuring that there is no impact on other users.	MIDC (Maharashtra Industrial Development Corporation) is operating a water supply scheme to supply 32 MLD of water to Taloja Industrial Area from Barvi Dam grid, owned by MIDC. CIDCO has developed a residential and commercial area known as Navi Mumbai, 2 km from Taloja Industrial Area. A CETP (Common Effluent Treatment Plant) of 18 MLD capacity has been undertaken and completed by MIDC in order to make the area eco-friendly.
xxix.	Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.	As per the present status, there are no litigations pending against the project.
xxx.	The project proponents shall satisfactorily address to all the complaints/suggestions that have been received against the project till the date of submission of proposals for Appraisal.	Noted and followed.
xxxi.	Plan for Corporate Environment Responsibility (CER) as specified under Ministry's Office Memorandum vide F.No. 22-65/2017-IA.III dated 1st May 2018 shall be prepared and submitted along with EIA	Corporate Environment Responsibility (CER) as specified under ministry's office memorandum vide F.No 22-65/2017-IA.III; dated: 1st May 2018, Rs. 40 Lakhs (i.e 1% of the project cost) shall be allotted for

	Report.	CER activities. Details are given in the **Chapter 8, Section 8.9.**
xxxii	A tabular chart with index for point wise compliance of above ToR.	Noted and followed
Standard ToR		
1	Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental damages, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.	The proposed project of expansion is going to be established within the existing MWML Common Hazardous Waste Treatment Storage and Disposal Facilities. Hence no alternate sites were considered. However, complete evaluation of the site as per the site evaluation criteria given in HAZWAMS/25/2002-2003, according to the CPCB guidelines is carried out and presented in **Chapter 5**, **Table 5.1**. Based on the analysis of site evaluation criteria, the site got a weightage of 62.79 on a scale of **100** and it is falls under class Good. The details are given under **section 5.1.2**.
2	Submit the details of the road/rail connectivity along with the likely impacts and mitigative measures	The proposed site is well connected by road rail and Airways. The nearest National highway (NH-48) 2.8km (West) from the site. Traffic details are given in **Chapter 3 Section 3.6.** In addition to this, the proposed project being an expansion of existing facility, the service for the roads is very good and hence there is no adverse effect due to this project.
3	Submit the present land use and permission required for any conversion such as forest, agriculture etc.	The land for proposed project comes under Industrial category. It has been provided by MIDC, Govt. of Maharashtra. Present land use is presented in **Chapter 3 Section 3.9.**
4	Examine the details of transportation of Hazardous wastes, and its safety in handling.	The Transportation of hazardous waste & safety measures during handling will be followed as per the guidelines prescribed for transportation of Hazardous Waste – Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. The transport of hazardous wastes shall be in accordance with the provisions of these rules and the rules made by the Central Government under the Motor Vehicles Act. 1988 and other guidelines issued from time to time in this regard. The occupier shall provide the transporter with the relevant information in **Form 9**, regarding the hazardous nature of the wastes and measures to be taken in case of an emergency and shall label the hazardous wastes containers as per **Form 8**. The seven copy manifest system and TREM card system are followed as per 2016 Rules. The details are given in **Chapter 2**, under section **2.10.2**.

		With regards to safety, the occupier handling hazardous or other wastes and operator of TSDF shall ensure that the hazardous and other wastes are packaged in a manner suitable for safe handling, storage and transport as per the guidelines issued by the Central Pollution Control Board from time to time. Labelling shall be done as per **Form 8.**
5	Examine and submit the details of on line pollutant monitoring.	Online pollutant monitoring will be provided as per CPCB guidelines for particulate matter, SO_2, NOx and CO from the incinerator stack. The results obtained will be uploaded into SPCB server on regular intervals.
6	Examine the details of monitoring of Dioxin and Furon.	Monitoring of Dioxins and Furans in the Stack emission is carried out by third party MoEF&CC recognized laboratory as per MoEF&CC guidelines. Analysis report of Incinerator stack is attached as Annexure VI.
7	MoU for disposal of ash through the TSDF.	The ash generated from the incinerator will be disposed to the secured landfill area of the project site. Hence MoU for ash disposal is not required.
8	MoU for disposal of scrubbing waste water through CETP.	As this is a zero discharge facility, the scrubbed wastewater generated from alkaline scrubber will be disposed through spray drier / quencher which will be further used for control of Dixon and Furan generation. Hence there is no need of MoU for disposal of scrubbing waste water.
9	Examine and submit details of monitoring of water quality around the landfill site.	Water quality around the landfill site will be monitored regularly to examine the impact on groundwater as per CFE/CFO conditions given by SPCB at regular intervals (monthly) by providing piezometers in all directions of landfill including upstream and downstream sides. The quality of piezometric wells water is monitored and the results are given as Annexure VII.
10	Examine and submit details of the odour control measures.	Generally, odors can be managed by dilution of odorant by odor counteraction or neutralized by spraying herbal spray around odor generation areas at regular intervals. The landfill area under operation will be covered daily with layer of earth, clay or a similar material. Details of odour control measures are given in **Chapter 9, Section 9.3.2.**
11	Examine and submit details of impact on water body and mitigative measures during rainy season.	There are no water bodies in the proposed site. Water from storm water collection pond will be utilized for green belt and other applicable purposes.
12	Environmental Management Plan should be accompanied with Environmental Monitoring Plan and environmental cost and benefit assessment. Regular monitoring shall be carried out for odour	Detailed Environmental Management Plan is provided in **Chapter 9.** Budgetary provision of **Rs.1558 Lakhs** (capital cost) and **Rs. 155.8 Lakhs** (recurring cost) for existing project and Rs 350

	control.	Lakhs (Capital cost) and Rs 35 Lakhs (recurring cost) for proposed expansion is allocated towards EMP for environmental protection and safety measures. Details of EMP cost given in **Chapter 9, Table 9.5.** Detailed Environmental Monitoring Plan and budget implementation for EMP is given in **Chapter 6, Table 6.5**.
13	Water quality around the landfill site shall be monitored regularly to examine the impact on the ground water.	Compliance to this point is discussed under **Standard TOR point 9**.
14	The storage and handling of hazardous wastes shall be as per the Hazardous Waste Management Rules.	The operator of TSDF shall design and set up the treatment, storage and disposal facility as per technical guidelines issued by CPCB in this regard from time to time. The operator of TSDF shall also maintain records of hazardous and other wastes handled by him in **Form 3** and file annual returns in **Form 4** to the concerned SPCB. Compliance with Hazardous Waste Management Rules, 2016 and Other details of storage and handling of hazardous wastes are given in **Chapter 9, Table 9.6 & 9.8.**
15	Submit details of a comprehensive Disaster Management Plan including emergency evacuation during natural and man-made disaster.	In view of the hazardous nature of products/process handled at the project site, MWML has prepared an Emergency Preparedness Plan (EPP). The plan is based on various probable scenarios like fire, explosion, natural calamities etc. The consequences arising out of such incidents are accurately predicted with the help of latest techniques available. The EPP is discussed in **Chapter 7, Section 7.6** and the disaster management plan including precautions to be taken during natural and manmade disasters are given in **Section 7.7.**
16	Public hearing to be conducted for the project in accordance with provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing should be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the web-site.	Public Hearing is exempted for the project as per Para 7(i) III Stage (3) (i) (b) of EIA Notification, 2006 for preparation of EIA/EMP report, being site is located in the notified industrial area. The same also mentioned in the ToR issued by EAC.
17	A detailed draft EIA/EMP report should be prepared in accordance with the above additional TOR and should be submitted to the Ministry in accordance with the Notification.	Yes. Noted and followed as suggested. The EIA report is prepared in accordance MoEF&CC notification.
18	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	As per the current status, there are no litigations/judicial issues pending against the proposed project.

19	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Compliance to this point is discussed under **Standard TOR point 12**.
20	Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website "http://moef.nic.in/Manual/Incinerator"	All the studies/activities in the TOR were completed in detail and presented in the EIA report. No further clarification is required for carrying out the studies suggested.
General Guidelines for ToR		
(i)	The EIA document shall be printed on both sides as far as possible	Noted and Complied
(ii)	All documents should be properly indexed, page numbered.	Noted and Complied
(iii)	Period/date of data collection should be clearly indicated.	The baseline study was carried out during Post Monsoon season from September 2018 – November 2018. Details of period/date of study have been mentioned clearly in the report.
(iv)	Authenticated English translation of all material provided in Regional languages	Noted and Complied
(v)	The letter/application for environmental clearance should quote the SEAC file no. and also attach a copy of the letter prescribing the ToR.	Noted and Complied
(vi)	The copy of the letter received from Ministry on the ToR prescribed for the project should be attached as an Annexure to the Final EIA – EMP Report.	MoEF&CC has given **ToR vide F.No. 10-36/2018-IA-III; Date: 17th October 2018.** Copy of the letter received from Ministry, on the ToR prescribed is attached after Declaration of Experts.
(vii)	The final EIA-EMP report submitted to the Ministry must incorporate the issues mentioned in ToR and that raised in Public Hearing. The index of the EIA-EMP report must indicate the specific ToR prescribed by the Ministry and the issue raised in the Public Hearing have been incorporated. Questionnaire related to the project (posted on MoEF&CC website) with all sections duly filled in shall also be submitted at the time of applying for EC.	The EAC exempted Public Hearing for the project as per Para 7(i) III Stage (3)(i)(b) of EIA Notification, 2006 for preparation of EIA/EMP report, being site is located in the notified industrial area.
(viii)	Grant of ToR does not mean grant of EC	Noted
(ix)	The status of accreditation of the EIA consultant with NABET or QCI shall be specifically mentioned. The consultant shall certify that his accreditation is for the sector for which this EIA is prepared.	Noted and Complied
(x)	On the front page of EIA/EMP reports the name of the consultant/ consultancy firm along with their complete details including their accreditation, if any shall be indicated. The consultant while submitting the EIA/EMP report shall give an undertaking to the effect that the prescribed ToRs (ToR proposed by Project proponent and additional ToR given by MoEF&CC) have been complied with and the data submitted is factually correct. (Refer MoEF&CC Office Memorandum dated 4th August,2009).	Noted and Complied
(xi)	While submitting the EIA/EMP reports, the name of	Noted and Complied

	the experts associated with/involved in the preparation of these reports and the laboratories through which the samples have been got analysed should be stated in the report. It shall clearly be indicated that these laboratories are approved under the Environment (Protection) Act, 1986 and the rules made there under (Please refer MoEF&CC Office Memorandum dated 4th August, 2009). The project leader of the EIA study shall also be mentioned.	
(xii)	All the ToR points as presented before the Expert Appraisal Committee (EAC) shall be covered.	Noted and Complied

Executive Summary

1. Project name and location

Mumbai Waste Management Project located at Industrial P-32 & P-32 (part), MIDC Taloja, Panvel Taluk, Raigad District, Maharashtra is the site where existing Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF) is established and is operational since 2002. Land area of the existing ICHWTSDF is 97.35 acres. The proposed expansion will be within the existing area.

2. Products and capacities. If expansion proposal then existing products with capacities

The project is established and operational since 14.11.2002, now the project is going for expansion where the details of the proposed and existing are given in **Table 1.**

Table 1 Details of Proposed and Existing Project Capacities

S.No	Name of the Facility	Existing	After Proposed Expansion
1	Secured Landfill *	1,20,000 MTPA	3,50,000 MTPA
2	Incinerator 1	15,000 MTPA	15,000 MTPA
	Incinerator 2	15,000 MTPA	15,000 MTPA
	Incinerator 3	-	15,000 MTPA
3	Bio medical waste	150 TPM	250 TPM
	Incinerator	1X250 kg/hr	2X250 kg/hr
	Autoclave	2X600 lit/batch	2X3000 lit/batch
	Shredder	2X100 kg/hr	2X200 kg/hr
4	E-waste	-	5400 MTPA
5	Plastic Recycling	-	5000 MTPA
6	Paper Recycling	-	30000 MTPA
7	Solvent Recovery	-	9000 KLPA
8	Alternate Fuel & Raw Material Facility	-	70 MTPD
9	MS Drum Recycling	-	15 MTPD
*Stabilization & land fillable hazardous waste & incinerated ash at the rate of 20% of hazardous waste incinerated Existing incinerator capacity is 30,000 MTPA with two operating incinerators. One new incinerator is proposed with a capacity of 15,000 MTPA. With this the total capacity of the incinerator will become 45,000 MTPA. Autoclave from 1200 lit/batch to 6000 lit/batch. Shredder from 200 kg/hr to 400 kg/hr.			

3. Requirement of land, raw material, water, power, fuel, with source of supply (Quantitative)

The proposed expansion is within the existing project site, no additional land is required to the existing land area of 97.35 acres, there is no major raw material required for the project, hazardous waste generated in the member industries is transported to the project site for treatment and disposal. The water required for the project after expansion is 582 KLD, Power required after expansion is 2220 kVA. For emergency power requirement there is one existing DG set of 875 kVA and one additional DG set of 500 kVA is proposed. The water and power are supplied by the MIDC Taloja, as the project is located within the industrial estate.

4. Process description in brief, specifically indicating the gaseous emission, liquid effluent solid and hazardous wastes.

Depending on the nature and characteristics of hazardous waste sent by the member industries based on the preliminary analysis results the method of treatment is proposed and the following disposal methods are followed:

- ETP sludge is sent directly to landfill or after stabilization.
- Depending on the characteristics of the impurities, bottom residues, process residues and other organic wastes including spent carbon can be sent for incineration.
- Incineration ash, slags, asbestos and glass fibers are essentially inorganic in nature and can go to landfill directly or with simple stabilization techniques.
- Spent catalysts and resins would have to be characterized on a case-by-case basis to assess their nature and characteristics. However, the percentage of wastes generated through these sources is likely to be very small as most of it is taken back by the manufacturers.
- Salts will have to be bagged and land filled.

The leachate generated from the secured landfill is been sent to solar evaporation pond, rest is been sent to the incinerator. The ash generated from incineration is sent to secured landfill. The gases generated during incineration are treated in air pollution control devices (Spray drier, multi cyclones, bag filters, scrubbers, chimney).

On receipt of the bio medical waste at the facility, waste containers shall be unloaded. A mechanical shredder shreds the bio-medical waste. All incinerable wastes shall be directly loaded into the incinerator, while autoclave required wastes shall be loaded into the autoclave for disinfection. Ash, residues from high temperature incineration and other materials from the process shall be collected into containers and disposed into a secured landfill.

The E-waste collected will sent to destruction followed by dismantling it will be segregated into various types of waste and sent to suitable recycling process. Recycling facilities for plastic waste, paper waste, mild steel drums and solvent recovery facilities are also proposed.

5. Capital cost of the project, estimated time of completion.

The capital cost of the proposed expansion is Rs.40.05 Crores (Existing project cost is Rs.155.82 Crores). The capital cost allocated for EMP is around Rs. 3.5 Crores with a recurring cost of Rs. 35 lakhs/annum. The CER budget proposed is Rs 40 Lakhs as per MoEF&CC OM dated 1st May 2018. The CSR budget will be as per companies' act 2013.

As per initial estimate around 6 months is required for implementation of the project considering the starting date i.e. from the date of receiving all the statutory clearances from concerned departments of state and central government.

6. Site selected for the project

To share the developed existing infrastructure facilities like power connection, water supply, roads equipments of MWML with expansion due to following advantages:

1. The project site is located within the notified industrial area of MIDC, Taloja, Maharashtra.
2. Existing facility is under operation. Infrastructure facilities such as land, water, roads etc., are available.
3. Required land is available for expansion. No additional land acquisition is involved.
4. There is no forest land involved for the project
5. Since existing facilities are being used, such facilities were used in common.

7. Baseline environmental data - air quality, surface and ground water quality, soil characteristic, flora and fauna, socio-economic condition of the nearby population

Baseline monitoring studies were carried out during the Post-monsoon period (September to November, 2018). Following are the observations made for quality of air, water, soil, noise, biological, social studies and traffic study etc.

Air environment

- The predominant wind direction during study period was W to SW. Ambient air quality monitoring stations were installed at 10 different locations. The maximum and minimum (98^{th} Percentile) values recorded for all the pollutants- PM_{10}, $PM_{2.5}$, SO_2, NO_x, O_3, CO, C_6H_6, NH_3 were found to be within the permissible limits. The AQI is calculated for the all the location and found to be falling in Satisfactory Category (51-100µg/m^3) minor breathing discomfort to sensitive people.

Surface water & Ground water

- A total of 10 ground water samples and 2 surface water samples were collected from the study area in order to assess the water quality.

- pH of the ground water samples varied between 6.9 to 8.1. Total dissolved solids varied from 194 mg/l to 812 mg/l. Chloride levels ranged from 25 mg/l to a maximum of 214 mg/l. Hardness values varied from 120 mg/l to 503 mg/l. Fluoride values were in the range of <0.5 mg/l.

- pH of the surface water was in the range of 7.9to 8.2. The total dissolved solids were in the range of 194 to 335 mg/l. Chlorides were in the range of 30 to 55 mg/l. Hardness as $CaCO_3$ varied between 155 to 259 mg/l. Fluorides in the samples were found to be in the range of 0.65to 0.85 mg/l. BOD values ranged from 12 to 24 mg/l.

- In conclusion all the parameters are above acceptable limits and below permissible limits for ground water samples, however surface water samples are found to be not suitable for drinking.

Noise:

- Baseline noise levels have been monitored at ten locations within the study area, using a continuous noise measurement device. The day equivalents during the study period ranged between 50.6 to 55.2 dB (A) whereas the night equivalents were in the range of 40.7 to 44.1 dB (A). It was observed that the day equivalents and the night equivalents were within the AAQ standards in respect of Noise SO 123 (E) date. 14th Feb 2000 for Residential and Commercial area.

Traffic

- The MIDC Taloja is well planned industrial area with well-developed roads and well planned wide internal roads. The traffic survey was carried out near the project site (in both the cases to and fro). From the study, it was observed that the highest peak on approach road near project site was observed 618 PCU/hr during peak period of 9AM to 10 AM. As per the IRC the existing level of service is good. This implies that traffic will not have a major impact due to the proposed expansion to the existing traffic load.

Soil Quality

- Baseline soil samples have been monitored at eight locations within the study area. The pH values of the soil varied from 7.4 to 8.3 indicating that soils fall under normal to saline category. Electrical conductivity is varied from 132 to 245 µS/cm indicating that the soils fall under normal category. The organic carbon is varied from 0.28 to 0.65% indicating medium levels of total organic carbon. Nitrogen is varied from 72 to 150 kg/Ha. Available phosphorus varied from 6.3 to 9.4 kg/Ha. Potassium is ranged between 47 to 123 kg/Ha indicating that all samples are falling under medium category, whereas nitrogen is falling under low category.

Flora & fauna

- There are no National Parks, Wildlife Sanctuaries, Biosphere Reserves and Important Bird Areas (IBA) within the study area. Except 2 scrub jungle reserve forest patches namely; RF near Malangadh village-4.3 km (East) &RF near Rohinjan village- 5.1 km (West) have been found within the 10 km of study area. There are no reports of occurrence of any rare or endangered or endemic or threatened (REET) fauna is listed in the study area as per Indian Wildlife (Protection) Act 1972.

Socio-economic condition

- As it is an existing TSDF facility and the land use is under industrial category, there is no need for conversion of agricultural or forest area for the project.

- The proposed project will additionally lead to direct and indirect employment opportunities. In addition, the company shall also earmark fund of Rs. 40 Lakhs towards CER and other developmental activities which will benefit the villagers in and around the project site.

- Around 70 skilled and 200 unskilled manpower are employed in the existing project. For proposed expansion another 61 skilled manpower and 245 unskilled manpower requirement is estimated. Around 576 skilled and unskilled local surrounding villagers will be get employment.

8. Identification of hazards in handling, processing and storage of hazardous material and safety system provided to mitigate the risk.

During operation of the proposed expansion of site, following activities can pose hazards and risk to human and surrounding environment:

- Loading and unloading hazardous waste - mechanical movements;
- Storage of HSD (High Speed Diesel), incinerable & hazardous waste
- Handling of hazardous chemicals;
- Landfill gas leakage
- Toxic gas release from incinerator

Worst case scenario, such as pool fire by tank rupture resulting in complete leakage of fuel, was used for simulation in ALOHA software. It predicted that for HSD storage, with 4 cm will have high radiation level of 8 kW/m^2 which is less than 10 m.

Some of the risk mitigation measures to be taken:

During construction

- Safety PPE will be provided and usage will be supervised
- Safety practices, guidelines and norms will be followed
- Hygiene and sanitary facilities will be provided

During transportation

- Transportation of hazardous waste by covered vehicles;
- Regular training to drivers to handle emergency situation during transportation of waste;
- Implementation of TREM card.

9. Likely impact and mitigation measures for the project on air, water, land, flora-fauna

The mitigation measures for various environmental attributes are collectively presented below:

During Construction phase

- Regular water sprinkling on haulage roads to deliver continuous moisture to suppress dust in dust prone areas.

- Temporary tin sheets of sufficient height will be erected around the site of dust generation or all around the project site as barrier for dust control.

- During site development, necessary precautions will be taken, so that the runoff water from the site gets collected to working pit and if any, over flow will be diverted to nearby greenbelt/ plantation area.

- All noise generating equipment will be used during day time for brief period of its requirement. Equipment will be provided with noise control measures such as acoustic insulation etc., to ensure noise abatement. Personnel Protective Equipment's (PPE) like ear plugs/muffs shall be provided to all the workers at site and their usage is ensured during their work.

- Sufficient greenbelt development around the noise source area and along the boundary of premises will be done.

- The project will result in employment opportunities for labourers, semi/unskilled workers.

- The impact of the proposed project on the local as well as regional ecology is not very significant.

During Operation phase

- The gases coming out of the incinerator stack are passed through multi cyclone separator for the removal of particulates. For proper dispersion of SO_2 and NOx emissions into atmosphere, incinerator stack height meeting MoEF&CC/CPCB guidelines will be provided.

- Flue gases are passed through bag filters for the complete removal of particulates and further to wet alkaline scrubber for neutralization. To prevent the formation of dioxins, the flue gas temperature is rapidly lowered from 500°C to less than 200°C by adopting rapid quench/catalyst/adsorption by activated carbon.

- ETP is proposed to treat wastewater generated from scrubbing, floor washings and wastewater generated from various facilities. The treated water shall be reused for circulation into the scrubber.

- Currently, the leachate generated is transferred to a leachate collection pond/ solar evaporation pond/Incinerator. The decanted liquid is directly reused as sprayer on the landfill or pumped to the incinerator and the residue is disposed in landfill. However, after the integrated facility is established, the leachate would be directed to the MEE along with wastewater generated from other units a portion of which will be recycled back for use in waste stabilization.

- During operation, part of the secured land fill will be daily covered with soil/ash and during rainy period with temporary cover (HDPE/Plastic sheets) to minimize the odor and gases generation.

- 33% of total land will be utilized to develop greenbelt including open spaces.

a. Emergency preparedness plan in case of natural or in plant emergencies

On-site and off-site emergency plans are prepared to respond in various emergency situations. In case of emergency necessary roles and responsibilities, assembly points, organizational setup etc. are formed. Safety equipments like extinguishers, hydrant system, alarm and siren of adequate number are kept at required locations. Mock drills are organized to be prepared for emergencies.

b. Issues raised during public hearing (if applicable) and response given:

Public hearing is exempted for the project as per para 7(i) III Stage (3)(i)(b) of EIA Notification, 2006 for preparation of EIA/EMP Report, being site is located in the Notified industrial area.

c. CSR/CER plan with proposed expenditure:

Activities Planned for proposed expansion project:

The activities carried under CSR during last few years are as follows: Organized trainings programs on industrial hazardous waste, bio medical waste and domestic waste management. Donated sport materials and laboratory equipment's to need organizations, Financial support for construction of building of Dharna camp school, Organized Republic day – sports competitions, youth development sessions, career guidance sessions, support women's group income generation program, donate Surgical Kit and conducted general health camp in schools and nearby villages. On women's day conducted - health checkup, seminar and awards/recognition, TB awareness rally and seminar. Conducted awareness sessions for factory workers and employees, distributed awards for recognition, carried out campus beautification and tree plantation.

The following Table 2 is the activities proposed under CER for proposed expansion:

Table 2 Budgetary proposed for CER - Brownfield project

S. No	Item	Rs (in Lakhs)	Remarks
1	Drinking water supply	5	The budget breakup is tentative, allotment will be based on the requirement of villagers and district collector advise.
2	Health camps and facilities	5	
3	Skill development	4	
4	Roads & Cross drains	4	
5	Electrification, Solar power	4	
6	Sanitation, Solid waste management	4	
7	Scientific support to farmers	4	
8	Rainwater harvesting, soil conservation	3	
9	Plantation (Avenue, community, schools, etc.)	3	
10	Others as per the requirement	4	
	Total	40	
Cost of the proposed expansion is Rs 40.05 Crores, CER fund is 1.0 % (Rs 40 Lakhs) maximum based on EAC recommendation			

d. Occupational health measures

Health of the employees would be regularly monitored as the workers are exposed to various operations. All employees are sent to medical checkup before joining the facility. Medical checkups will be conducted on regular basis and the health conditions will be monitored. First aid facilities are provided for immediate needs in emergency situations, personal protective equipment's for required workers as per there day to day activities.

e. Post project monitoring plan

Post project monitoring shall conduct as per the environmental monitoring programme suggested for construction and operation phases as discussed in chapter-6. Specific requirement of post project monitoring will be carried in accordance with compliance to EC/CTE/CTO, emissions/discharges and soil and hazardous waste generation. The ambient as well as stack monitoring data will be sent online with the help of concerned web portal from time to time. Industry specific critical pollutants will be monitored at industry level. Specific requirement of monitoring will be carried out as a part of compliance to CTE/CTO.

Chapter 1

Introduction

1.1 Introduction and background

Environmental Impact Assessment (EIA) is a process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made. These studies integrate the environmental concerns of developmental activities into the process of decision-making. EIA has emerged as one of the successful policy innovations of the process of ensuring sustained development.

Environmental Impact Assessment (EIA) serves as useful tool in prediction of potential impacts on the surrounding environment due to development project. It helps the project proponent, impact assessment authorities, regulatory agencies and other stakeholders in understanding the project, environmental impacts and mitigation measures and establishing emission requirements and other measures early in the project cycle. This report describes the project location, baseline environmental scenario, potential impacts of the project on the environment and proposed measures for effective environment management during the project cycle (environmental management plan during construction and operation stage of the project).

M/s. Mumbai Waste Management Limited (MWML), a subsidiary of Ramky Enviro Engineers Limited is operating Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF) consisting of secured land fill, two incinerators and bio-medical waste treatment facility (incinerator, autoclaves and shredders) located at P-32 & P-32 (part), MIDC, Taloja, Panvel Taluk, Raigad District, Maharashtra (within notified industrial area). This is the first common landfill facility developed in India, under the guidance of National Productivity Council, New Delhi. The CHWTSDF has been notified by Government of Maharashtra.

1.2 Purpose of the report

Due to rapid industrialization, the generation of waste all over the country including the state of Maharashtra is growing exponentially. Mumbai, being a business capital of the country, the waste generation in and around the Mumbai is considerably high. In this connection, the existing facility will be strengthened by increasing the capacities of few facilities handling hazardous wastes and proposing few new facilities to handle the wastes viz e-waste, plastic waste, paper waste, etc., in scientific manner meeting the new guidelines issued by Government of India.

The proposed enhancement of capacities and adding additional recycling facilities the project falls under category “A” as per EIA Notification 2006. The project falls under activity 7 (d) listed in EIA Notification dated 14th September, 2006, under Common Hazardous Waste Treatment, Storage and Disposal Facility (TSDF).

As part of the above process, the ToR application (Form-1 along with Pre-feasibility Report) was submitted for the proposed enhancement in capacity and adding additional facility of existing CHWTSDF. The project was considered by the Expert Appraisal Committee (EAC) (Infra – 2) in its 32nd Meeting held during 2nd – 4th July, 2018 for determination of the Terms of Reference (ToR) for undertaking detailed EIA Study in accordance with the provisions of the EIA notification dated September 14, 2006 and subsequent amendments. The EAC has recommended the project for grant of ToR as specified by the Ministry as standard ToR and ToR in addition for preparation of EIA-EMP report vide its F. No. 10-36/2018-IA-III; dated: 17th October, 2018.

1.3 Identification of project and project proponent

1.3.1 Project

Mumbai Waste Management Limited (MWML) primarily address the issue of Common hazardous waste disposal. Mumbai Waste Management Project located at Industrial P-32 & P-32 (part), MIDC Taloja, Panvel Taluk, Raigad District, Maharashtra is the site where existing Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF) is established and in operational since 2002. Land area of the existing ICHWTSDF is 97.35 acres. The proposed expansion will be within the existing area.

Mumbai Waste Management Limited is an existing Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF) Currently, the existing facility has secured landfill and incinerator for land fillable hazardous & bio-medical waste. MWML is proposing to expand its existing facilities along with addition of new units for the recovery of solvents, recycling of paper, plastics and MS drum as well as facilities for E-waste management and alternate fuel & raw material recovery in compliance with the statutory guidelines.

The Integrated Common Hazardous Waste Management Facility is being proposed for Recycle / Recovery, Alternate Destruction, Treatment, Storage and Disposal of all kinds of hazardous wastes that are generated in the state of Maharashtra. Proposed project activities consist of collection, transportation, treatment, storage, re-use, recycle, blending and disposal of industrial hazardous wastes, biomedical waste, spent solvent recovery, alternate fuel & raw material facility, waste plastic & paper and e-waste, generated in Maharashtra.

1.3.2 Project proponent

MWML belongs to Ramky Group and started its operations in year 2002. The project was awarded by Maharashtra Industrial Development Corporation (MIDC) to Ramky Group through global tender.

The Ramky group today is the leader in waste management in India, with 15 bio-medical waste management facilities located at Hyderabad, Bangalore, Ludhiana, Ahmedabad, Mumbai, Chennai, Madurai, Salem, Durgapur, Kalyani, Haldia, Kolkata, Mangalore and Ghaziabad. Few are under construction. The company is today operating fifteen hazardous waste management facilities established and operated (some are under construction stage) under the name of:

- Hyderabad Waste Management Project located at Hyderabad
- Mumbai Waste Management Limited located at Mumbai
- West Bengal Waste Management Limited located at Haldia
- Tamil Nadu Waste Management Limited located at Chennai
- Uttar Pradesh Waste Management Project located at Kanpur
- Coastal Waste Management Project located at Visakhapatnam
- Rajasthan Waste Management Project located at Udaipur
- Punjab Waste Management Project located at Chandigarh
- Karnataka Waste Management Project located at Bangalore
- Odisha Waste Management Project
- Balotra Waste Management Project
- Madhya Pradesh Waste Management Project Located at Indore
- West Bengal Waste Management Limited located at Saltora
- Tamil Nadu Waste Management Limited located at Chennai
- Bihar Waste Management Project.

The hazardous waste management facilities in operation are integrated facilities catering to over 6000 industrial establishments and catering to over 7,00,000 TPA of industrial hazardous wastes. All the facilities are equipped with the state-of-the-art laboratories capable of performing comprehensive and fingerprinting analysis. Ramky's experience in Municipal Solid Waste (MSW) is also exhaustive in terms of various consultancy projects rendered for various cities in India. All the waste management facilities established are operated and maintained with high priority towards environment and occupational health and safety aspects. Wherever possible, the operations have been automated or mechanized and all the staff working with the waste are provided with adequate and suitable personnel protective equipment (PPE). Regular health check-ups are also being organized as a matter of employee's safety.

1.4 Brief description of the project

As per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended, of Environment Protection Act, 1986, the hazardous waste generated by industries has to be collected, transported, treated and disposed in a properly designed TSDF Facility. Under aforesaid Rules, CPCB guidelines have laid down a procedure for collection, storage, transportation and disposal of hazardous wastes. The scientific disposal of incinerable & landfillable hazardous waste can be done at a TSDF site, which requires proper design and operation according to existing guidelines.

1.4.1 Size of the project

The present proposal is for the enhancement in capacities of the facilities furnished in **Table 1.1.** Details of the hazardous waste handled by the existing facility are given in **Table 1.2.**

Table 1.1 Details of Proposed and Existing Project Capacities

S.No	Name of the Facility	Existing	After Expansion
1	Secured Landfill *	1,20,000 MTPA	3,50,000 MTPA
2	Incinerator 1	15,000 MTPA	15,000 MTPA
	Incinerator 2	15,000 MTPA	15,000 MTPA
	Incinerator 3	-	15,000 MTPA
3	Bio medical waste	150 TPM	250 TPM
	Incinerator	1x250 kg/hr	2x250 kg/hr
	Autoclave	2x600 lit/batch	2x3000 lit/batch
	Shredder	2x100 kg/hr	2x200 kg/hr
4	E-waste	-	5400 MTPA
5	Plastic Recycling	-	5000 MTPA
6	Paper Recycling	-	30000 MTPA
7	Solvent Recovery	-	9000 KLPA
8	Alternate Fuel & Raw Material Facility	-	70 MTPD
9	MS Drum Recycling	-	15 MTPD

*Stabilization & land fillable hazardous waste & incinerated ash at the rate of 20% of hazardous waste incinerated

- Existing incinerator capacity is 30,000 MTPA with two operating incinerators. Proposed incinerator with capacity of 15,000 MTPA. Total capacity of the incinerator – 45,000 MTPA.
- Autoclave from 1200 lit/batch to 6000 lit/batch. Shredder from 200 kg/hr to 400 kg/hr.

Table 1.2 Status of waste disposal in secured landfill facility at Taloja.

Landfill Cell Nos.	Totals	Period of Operations	Remarks
Cell-1	101,506	Oct 2002 to 28th April 2005	Permanent Capping
Cell-2	72,250	29th April 2005 to 27th March 2006	
Cell-3	58,747	28th March 2006 to 31st Dec 2006	
Cell-4	92,932	1st Jan-07 to 31st Dec.2007	
Cell-5	89,972	1st Jan2008 to 03rd Feb. 2009	
Cell-6	81,064	4th Feb'2009 to 26th February 2010	
Cell-7	106,372	27th February 2010 to 04th February 2011(01.10.15 To 30.11.15)	Temporary capping in Monsoon
Cell-8	73,737	05th February2011 to 03rd June 2011(01.12.15 To 31.12.15)	
Cell-9	169,687	12th October 2011 to 06th May 2013	
Cell-10	102,815	07th May 2013 to 9th May 2014	
Cell-11	168,651	10th May 2014 to 10th June 2015(01.01.16 To 31.01.16)	
Cell-11A (Extension)	301,811	1st February 2016 To 22nd December 2017	
Cell-10A (Extension)	91,197	22nd December 2017 To 20 May-2018	
Cell-13	16,474	21st May 2018 To 30 June 2018	Under operation

1.4.2 Location of the project

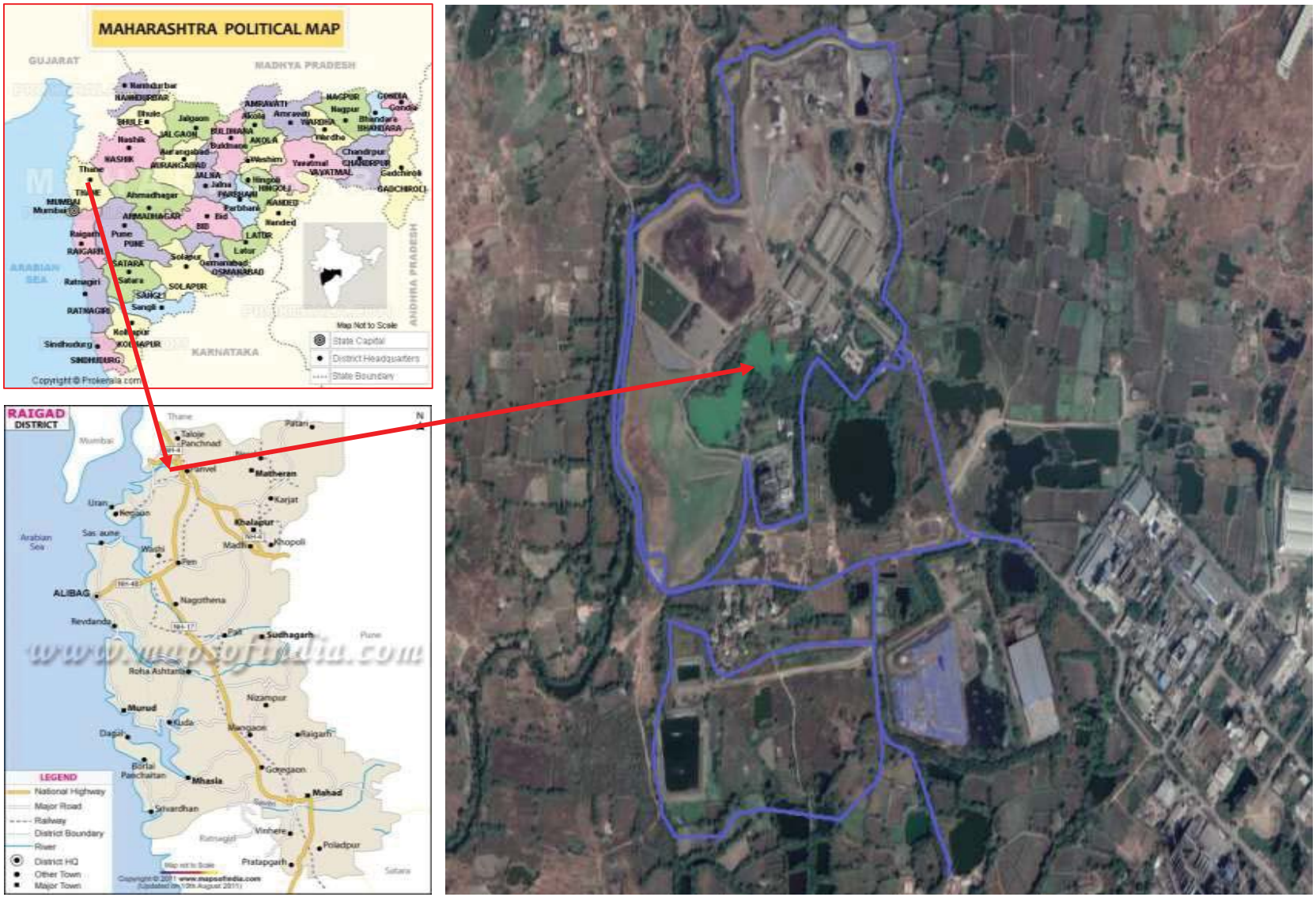
The proposed expansion is carried out within the boundary of existing Mumbai Waste Management Project site which is in the notified industrial estate of MIDC, Taloja. No new land has been acquired for the proposed expansion. The location map of the project site is given as **Figure 1.1** and Google image of the project site is shown in **Figure 1.2**.

The environmental settings around the project are given in **Table 1.3.** The details of the statutory clearance obtained by the existing project are given in **Table 1.4** and chronologies of various stages for the proposed expansion are given in **Table 1.5.**

Table 1.3 Environmental settings of the project site

S.No	Particulars	Details	
1	Plant Location	Industrial Plot-32 & Plot-32 (part), MIDC Taloja, Panvel Taluk, Raigad District, Maharashtra.	
2	GSI Toposheet No.	E43 B 04	
3	Site Coordinates	19° 06' 04.69"N; 73° 06' 54.86"E	19° 05' 54.78"N; 73° 06' 36.07"E
		19° 05' 23.07"N; 73° 06' 39.24"E	19° 05' 26.06"N; 73° 06' 53.92"E
4	Plant Site elevation MSL	6 - 11 m	
5	Plant Site Topography	highly even and undulating	
7	Present Land use at site	Industrial Land with scrub and without scrub.	
8	Nearest Highway	NH 48 at 2.8 km (W)	
9	Nearest Railway station	Taloja Panchnand railway station -2.7 km (W).	
10	Nearest Airport	Chatrapati Shivaji International airport, 49 km (W)	
11	Nearest major water body	Bava Malang Nadi-Adjacent (W); Taloja River-0.7 km (S), Kasadi River – 3.4 km (S); Lendi River – 8.6 km (SE), Ulhas River – 12.6 km (NW),	
12	Water source to the Project	MIDC Taloja	
13	Nearest habitation	Karavale – 0.4 km (NW)	
14	Nearest Town	Taloja - 5.2Km(SW)	
15	Archaeological places	None within 15 Km radius	
16	Reserved/Protected Forest	Reserved & Protected Forest (Malangadh village) - 4.3 km (E), Reserved Forest (Rohinjan) - 5.1 km (W); Reserved Forest (Vajapur) – 13.1 km (S), Reserved Forest (Panvel) - 13 km (S),	
17	Defense Installations	Nil	
18	Protected areas as per WPA, 1972 (Tiger / Elephant reserve, Biospheres, National Parks, WLS, Community reserves & Conservation reserves).	Mangrove – 10.3 km (NW); Karnala Bird Sanctuary – 13 km (S)	
19	Seismicity	Seismic zone III as per (IS 1893-2002).	
20	List of surrounding Industries in 10 Km radius	Proposed expansion of MWML is within the notified Industrial Estate of Maharashtra industrial development corporation, Taloja Industrial Estate.	
21	List of Eco / other sensitive areas within 15Km buffer from site	Panvel Creek – 9.6 km (SW); Thane Creek – 13.4 km (W)	

Figure 1.1 Location Map



610

Figure 1.2 Topographical map of the project site

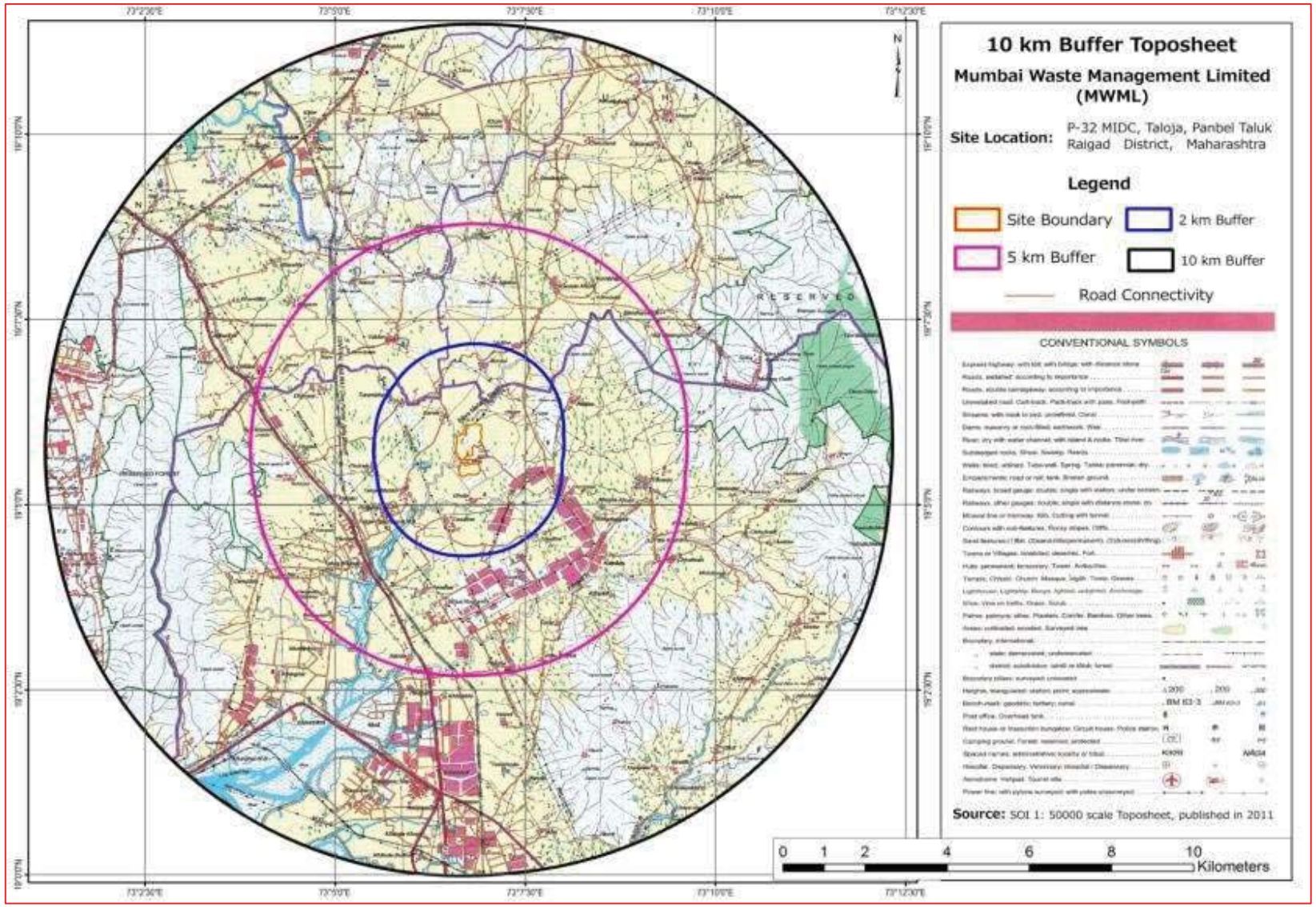


Table 1.4 Details of the statutory clearance of existing unit

Consent for Establishment from SPCB	Consent order no BO/RONM/HWM/Raigad/cc-220; dt: 20.07.2002
1st Consent for Operation from SPCB	Consent order no BO/RONM/Raigad/cc-346; Dt: 14.11.2002
Current Consent for Operation from SPCB	Consent order no BO/RO(HQ)/HWMD/EIC No.NM-5729-15/CR/CC-492 dt: 11.01.2016; Valid up to 01/03/2020

Table 1.5 Chronology of events for obtaining EC

Form-1, Pre-Feasibility report uploaded in MoEF&CC online portal	Proposal No. IA/MH/MIS/73479/2018 dated on 06th April 2018
EAC meeting for issue of TOR	32nd EAC meeting held on 2-4th July, 2018.
ToR Granted	F. No 10-36/2018-IA-III; dated on 17th October, 2018
Baseline Studies	Post Monsoon – (September – November, 2018)

1.4.3 Importance of the project country & region

Due to increase in various chemical, agro, mineral etc., industrial activities in the region and due to limited number of TSDF & incineration facilities in state, suitable disposal facility for industrial waste have become need of hour. There is no TSDF & incineration facility for suitable treatment of industrial hazardous waste in Raigad district. Hence, the proposed expansion should be caters the need of proper waste treatment facility for industries in the region.

The wastes such as hazardous, e-waste, plastic, etc. need to be disposed of in a secured manner in view of their hazardous nature, environmental pollution and wide range of health hazards they pose. At present, the waste generated from industries, commercial and residential activities are either indiscriminately disposed in open areas or within their units or given to small recyclers. The waste generators find it difficult to dispose their wastes without causing environmental disturbance, as very few appropriate disposal facilities are available.

The ineffective hazardous waste management can be attributed to the following factors:

- Absence of systematic qualitative and quantitative assessment (inventory) of wastes generated
- Improper storage and disposal practices of wastes
- Absence of proper treatment, storage and disposal facilities (TSDFs)

The Government of India has promulgated the Hazardous Waste (Management &Handling) Rules in 1989 through the Ministry of Environment and Forests, Climate Change (MoEF&CC) under the aegis of Environment (Protection) Act, 1986. Also in order to encourage the effective implementation of these rules, the MoEF&CC has further amended the rules several times. Since then, there is a growing concern on disposal of hazardous wastes generated from anthropogenic sources all over the country. The Government of India during 2016 has issued rules to handle e-waste, plastic waste, etc.

Having an integrated facility would minimize the risk involved in waste transportation and waste movement. This project will also cater the needs of industries, commercial establishments, etc., situated in various districts of Maharashtra by facilitating a one stop solution for management of all types of wastes at a common treatment facility. At this ICHWTSDF, the wastes would be collected from the waste generators, treated as per their characteristics and finally disposed off.

Others

Investment

An investment of Rs. 155.82 crores for existing project and Rs. 40.05 Crores for proposed expansion will be invested in the project.

Direct Jobs

Existing operational lifecycle around 270 jobs were created. For proposed expansion around 306 jobs will be created.

Indirect Jobs

Approx. 50-60 jobs will be indirectly created by the setting up of the expansion during its construction & operational period.

Taxes & levies

The existing and proposed projects will be added to the local and state tax collection, enlarging the tax base of the state and National exchequer.

Skill Creation

Local persons will be given an opportunity to upgrade their skills.

1.5 Scope of the Study

The scope of the study is to carry out the Environmental Impact Assessment (EIA) studies to identify, predict and evaluate potential environmental and socio-economic impacts which may result from the Integrated Common Hazardous Waste Treatment, Storage and Disposal including Incineration & Recycling Facilities and to develop suitable Environment Management Plan (EMP) to mitigate the undesirable effects.

The study is aimed at:

- Establishing the existing environmental conditions, identifying potential environmental impacts and identifying areas of significant environmental concerns due to the project
- Prediction of impacts on environment, socio-economic conditions of the people residing close to and within the proposed project area.
- Preparation of Environmental Management Plan (EMP)
- Development of post project environmental monitoring program.

The EIA study shall be conducted as per the applicable rules/guidelines of Ministry of Environment, Forests & Climate Change (MoEF&CC), Govt. of India.

The EIA study will necessarily include but not get restricted to the following:

(a) Literature review (b) Field studies (c) Impact assessment and preparation of the EIA/EMP. A brief outline of the activities carried out (in stages A, B, C) is briefly described below.

Stage A: Brief of the project and baseline data generation

The study area shall be up to 10 km radial distance from the proposed project with reference to air, water, soil, noise, socio economic and ecological studies. The baseline environmental conditions shall be established using top sheets, through literature survey and field investigations. In addition to the above, information on the location of towns/cities, national parks, wildlife sanctuaries and ecologically sensitive areas like tropical forests, important lakes, bio-sphere reserves and sanctuaries within impact area shall be furnished.

A review and analysis of the information available with various governmental organizations, educational and other institutions shall be carried out for each discipline. Based upon preliminary review of the available data, detailed field work shall be planned to collect information on the parameters critical to characterize the environment of the area. The baseline environmental studies shall be undertaken for meteorology, air quality, noise, water quality, water use etc. The list of various aspects to be covered under different disciplines for EIA studies are as given below.

1. Meteorology

Following meteorological parameters of the area shall be measured at the project site. In addition, data shall also be collected from the nearest IMD observatory for reference.

- Temperature
- Rainfall
- Relative humidity
- Wind speed and direction

2. Air Quality

Ambient air quality shall be monitored at requisite number of locations considering the prevailing meteorological conditions, topography, nearby villages etc. The parameters for monitoring shall be PM_{10} and $PM_{2.5}$, SO_2, NO_x, CO, NH_3, O_3, Lead, Nickel, Arsenic, Benzene & Benzo (a) Pyrene. Adequacy of the existing air pollution control measures shall be studied.

3. Noise

Noise monitoring shall be carried out to characterize the noise environment in the study area. The noise level shall be measured using high level precision sound meters at suggested number of locations. Attenuation model shall be developed to predict the noise level in the surrounding areas.

4. Water

Surface water samples and ground water samples within study area shall be collected and analyzed for physic chemical analysis covering major, minor ions, some important heavy metals.

5. Land Environment

Soil samples were collected from the plant site, not only at its immediate vicinity but also in the surrounding villages in a 10 km radius area. Physico - chemical properties of the soils were determined. Information on land use pattern in the study area was also collected. Information regarding existing cropping pattern, their types and yield of the crop was collected from various sources. Based on the attenuation factors for dust, aerosols and air pollutants, green belt species have been identified.

6. Eco System

Information on eco-system within 10 km radius was collected from the state agricultural and forest departments. The important floral species native to the area was enumerated. A test check survey was also undertaken to judge the correctness of the data collected.

7. Socio Economic Environment

A field survey was conducted within 10 km radius of the proposed project. The parameters selected under socio-economic component included demographic structure of the study area, provision of basic amenities, industries likely to come up in the study area, welfare facilities

proposed by the project proponent, safety training and management, community and occupational health hazards. Relevant information was collected from selected villages and analyzed.

Stage B: Assessment of Environmental Impacts of Proposed Project

With the knowledge of baseline conditions in the study area and proposed project activities, impact on the environment shall be discussed in detail covering air emissions, discharge of liquid effluents and particulates emission during construction, noise & solid waste generation etc. Detailed projections shall be made to reflect influence of the proposed project on different environmental components.

Assessment of potential damage to terrestrial and aquatic flora and fauna due to air emissions, discharge of effluents, noise pollution, ash disposal, and change in land use pattern, habitat degradation and fragmentation, anthropogenic activities from the proposed project and delineation of guidelines to minimize adverse impacts etc. Assessments of economic benefits arising out of the project have been carried out.

Stage C: Environmental Management Plan

The mitigation measures necessary to offset the impacts from the proposed project were discussed. Environmental management plan and pollution control measures necessary to meet the requirements of the regulatory agencies have been suggested.

Environmental Management Plan shall consist of mitigation measures for item-wise activity to be undertaken for construction and operation of the facility for its entire life cycle to minimize adverse environmental impacts. It also delineates the environmental monitoring plan for compliance of various environmental regulations.

1.6 Regulatory Framework

1.6.1 Environmental Clearance for proposed expansion

The company has received ToR letter vide dated 17th October, 2018 (F.No. 10-36/2018-IA-III) based on the application submitted of form-1 along with prefeasibility report, Standard ToR & other relevant documents vide proposal No. IA/MH/MIS/73479/2018 dated 6th April, 2018 and the presentation made for ToR during its 32nd EAC (Infrastructure Development, Coastal Regulation Zone, Building/ Construction and Miscellaneous projects) meeting held on 02nd July, 2018. Ministry issued ToR and its compliance was incorporated in this EIA/EMP report.

Chapter 2

Project Description

2.1 Type of project

The project proposed is "Expansion of Common Hazardous Waste Treatment Storage and Disposal Facilities (CHWTSDF) to Integrated Common Hazardous Waste Treatment Storage and Disposal Facilities (ICHWTSDF)" at Taloja, Maharashtra. The proposed expansion consists of increasing the capacities of the existing hazardous waste and biomedical waste treatment, storage and disposable facilities and adding facilities to handle e-waste, plastic/paper recycling, solvent recovery, alternate fuel & raw material, MS drums.

As per EIA Notification S.O. No 1533 dated 14th Sep 2006 and its subsequent amendments, the proposed project falls under Project / Activity 7 (d) Common Hazardous Waste Treatment, Storage and Disposal Facility (TSDFs), Category "A" (All integrated facilities having incineration and landfill or incineration alone). The salient features of the proposed project are presented in **Table 2.1.**

Table 2.1 Salient features of the proposed project

S.No	Parameters	Description
1	Land possession	Under MIDC Act 1961, MIDC allotted 39.40 Ha. (97.35 Ac) of land on Built Own & Operate basis (BOO) at MIDC Taloja. For expansion no additional land is required.
2	Environmental clearance for existing CHWTSDF	Existing facility established in 2002 before EIA notification S.O. No. 1533, dt: 14th Sep 2006, EC is not applicable. The consent to operate granted for the facility is valid up to 01/03/2020. [Consent No. BO/RO (HQ)/HWMD /EIC No. NM-5729-15/CR/CC-492, date: 11.01.2016].
3	Survey No.	61 (part) to 66, 68 to 74, 77 & 85
4	Site coordinates	19° 06'04.69"N 73° 06'54.86"E 19° 05'54.78"N 73° 06'36.07"E 19° 05'23.07"N 73° 06'39.24"E 19° 05'26.06"N 73° 06'53.92"E
5	Elevation	6-11 m
6	Water requirement	582 KLD (Existing 361 KLD + Proposed 221 KLD)
7	Power requirement	2220 kVA (Existing 500 kVA + Proposed 1720 kVA)
8	DG sets details (emergency use)	875 kVA (Existing) + 500 kVA (Proposed)
9	Manpower requirement	576 (Existing – 270) + (Proposed – 306)
10	Project capital cost	Existing Rs. 155.82 Cr. Proposed Rs.40.05 Cr.
11	Capital cost allotment for EMP	Rs. 3.5 Cr. (recurring Cost – 35 Lakhs/annum)
12	CER as per OM dt 01.05.2018	Rs 40.05 Lakhs (1% of the project cost)

2.2 Need of the project

The wastes such as hazardous, e-waste, plastic, etc. need to be disposed of in a secured manner in view of their hazardous nature, environmental pollution and wide range of health hazards they pose. At present, the waste generated from industries, commercial and residential activities are either indiscriminately disposed in open areas or within their units or given to small recyclers. The waste generators find it difficult to dispose their wastes without causing environmental disturbance, as very few appropriate disposal facilities are available.

This ineffective hazardous waste management can be attributed to the following factors:

- Absence of systematic qualitative & quantitative assessment (inventory) of wastes generated
- Improper storage and disposal practices of wastes
- Absence of proper treatment, storage and disposal facilities (TSDFs)

The Government of India has promulgated the Hazardous Waste (Management &Handling) Rules in 1989 through the Ministry of Environment and Forests, Climate Change (MoEF&CC) under the aegis of Environment (Protection) Act, 1986. Also in order to encourage the effective implementation of these rules, the MoEF&CC has further amended the rules several times. Since then, there is a growing concern on disposal of hazardous wastes generated from anthropogenic sources all over the country. The Government of India during 2016 has issued rules to handle e-waste, plastic waste, etc.

Having an integrated facility would minimize the risk involved in waste transportation and waste movement. This project will also cater the needs of industries, commercial establishments, etc., situated in various districts of Maharashtra by facilitating a one stop solution for management of all types of wastes at a common treatment facility. At this ICHWTSDF, the wastes would be collected from the waste generators, treated as per their characteristics and finally disposed of.

2.3 Location & specific location of the project boundary

Mumbai Waste Management project is located in plot P-32 and P-32 (part), survey no. 61(Part) to 66, 68 to 74, 77 & 85; which was subsequently within notified Industrial area of Maharashtra Industrial Development Corporation (MIDC), Taloja, Panvel Taluk, Raigad dist. Maharashtra.

The land also further notified under section 8 (I, II, III) of Hazardous Waste (Management & handling) rules 1989 and amendment Hazardous Waste (Management & handling) Rules 2016 to the effect. MIDC has allotted for the development CHWTSDF and other uses as per approval provided by regulatory bodies for the purpose of Waste Management.

The layout plan showing existing and proposed facilities is shown as **Figure 2.1.** The topographical map showing 10 km radius around project site is given as **Figure 2.2.** Photographs of the few facilities of the existing project are shown in **Figure 2.3.**

Figure 2.1 Existing and proposed site boundary layout Plan

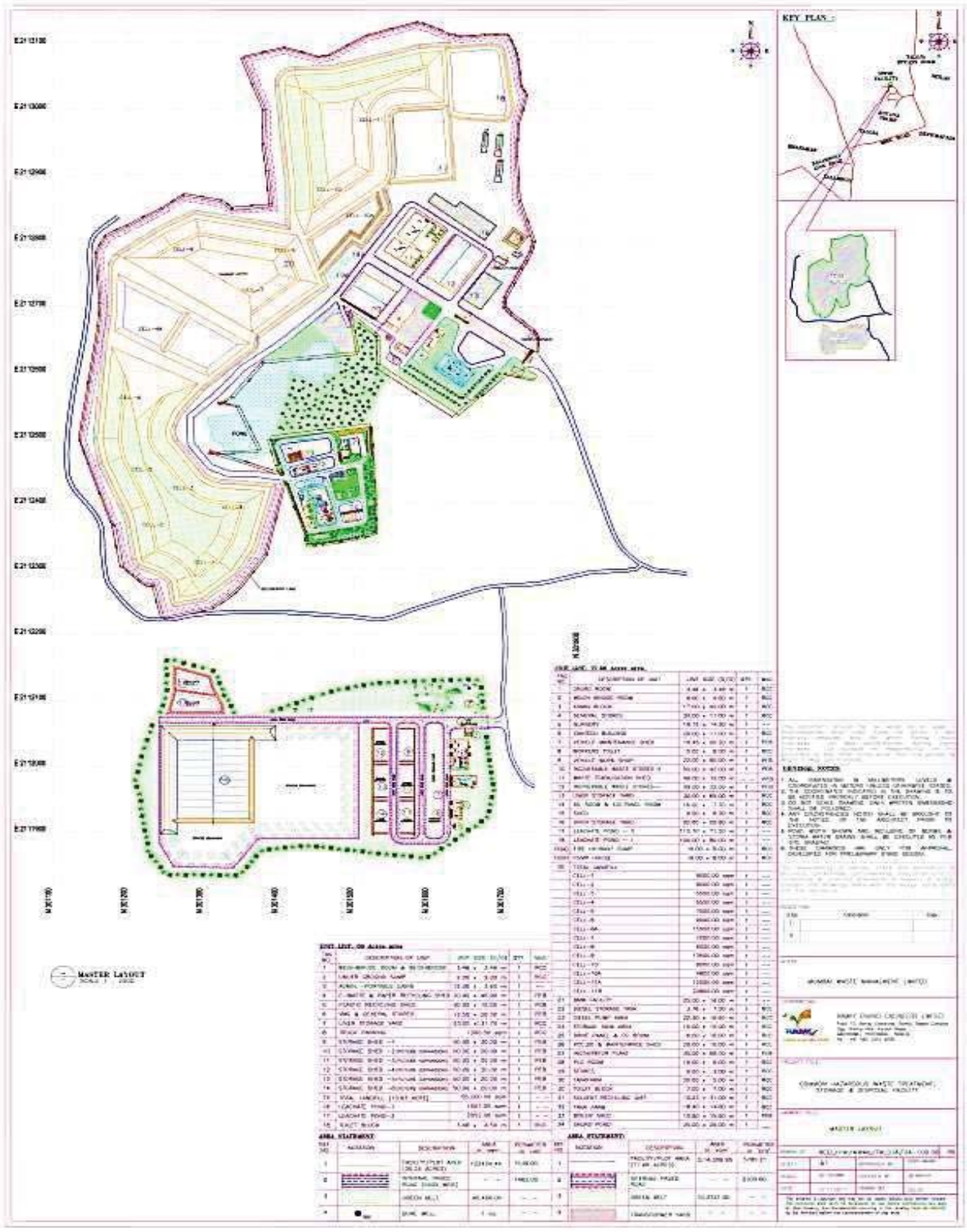
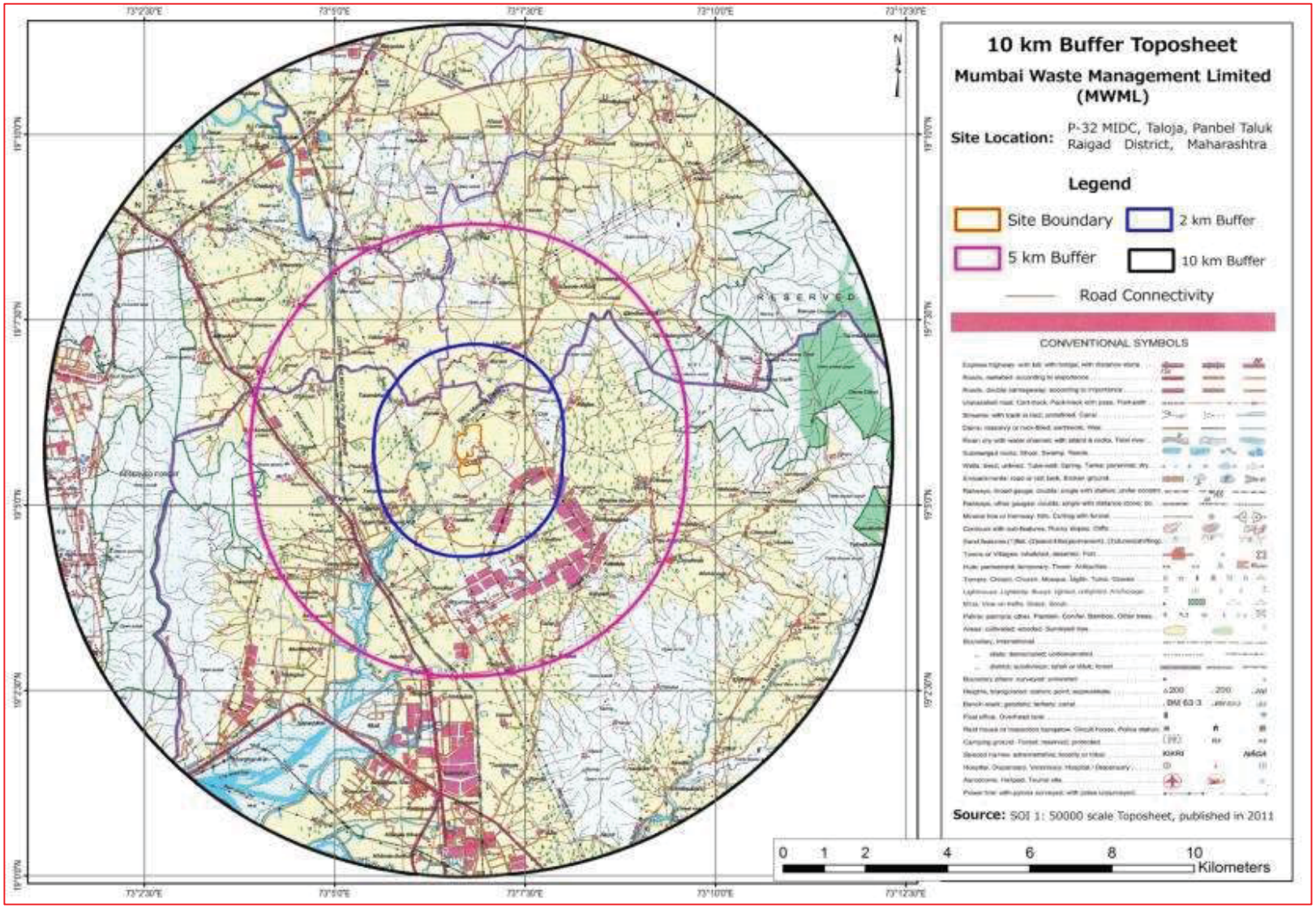


Figure 2.2 Topographical map showing 10 km radius around project site



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Figure 2.3 Existing site photographs



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2.4 Magnitude of operation & Its associated activities

The operations currently being handled are secured landfilling, incineration and bio-medical waste treatment facility. Proposed to expand the existing Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF) along with addition of new units for the recovery of solvents, recycling of paper, plastics and MS drum as well as facilities for e-waste management and alternate fuel & raw material recovery. The existing and after expansion project capacities is given in **Table 2.2.** The individual units of the existing and proposed facilities along with size and quantity are given in **Table 2.3 & Table 2.4** respectively.

Table 2.2 Existing and Proposed Project capacities

S. No	Name of the Facility	Existing	After Proposed Expansion
1	Secured Landfill *	1,20,000 TPA	3,50,000 TPA
2	Incinerator 1	15,000 TPA	15,000 TPA
	Incinerator 2	15,000 TPA	15,000 TPA
	Incinerator 3	-	15,000 TPA
3	Bio medical waste	150 TPM	250 TPM
	Incinerator	1X250 kg/hr	2X250 kg/hr
	Autoclave	2X600 l/batch	2X3000 l/batch
	Shredder	2X100 kg/hr	2X200 kg/hr
4	E-waste	-	5400 TPA
5	Plastic Recycling	-	5000 TPA
6	Paper Recycling	-	30000 TPA
7	Solvent Recovery	-	9000 KLPA
8	Alternate Fuel & Raw Material Facility	-	70 TPD
9	MS Drum Recycling	-	15 TPD

Table 2.3 Existing project **List of individual units**

S.No	Existing facilities	Area (m^2)	S.No	Existing facilities	Area (m^2)
1	Laboratory & Admin office	714.0	23	Toilet Block	49.0
2	Watch/Guard room	54.4	24	Leachate pond 1	8000.0
3	Scale room and Weigh Bridge	27.6	25	Leachate pond 2	7865.0
4	Canteen & rest room	220.0	26	compound wall	345.0
5	General Stores	330.0	27	Total Landfill	138100.0
6	Vehicle maintenance shed	211.1	28	Landfill 1	9000.0
7	Fabrication work shop	1320.0	29	Landfill 2	8000.0
8	Intractable waste stores 2	2100.0	30	Landfill 3	5500.0
9	Intractable waste stores 1	3528.0	31	Landfill 4	5500.0
10	Waste stabilization unit and reagent stores	3528.0	32	Landfill 5	7500.0
11	L.T and DG room	123.2	33	Landfill 6	9000.0
12	Bio medical shed	400.0	34	Landfill 6-A	15000.0
13	Incineration Unit	1960.0	35	Landfill 7	7000.0
14	Stores, Compressor, DG, substation room	218.0	36	Landfill 8	6000.0
15	MCC and control room	60.0	37	Landfill 9	13500.0
16	Liner storage yard	1950.0	38	Landfill 10	8000.0
17	PLC room	96.0	39	Landfill 10-A	4800.0
18	Fire Hydrant Sump	128.0	40	Landfill 11-A	12000.0
19	Pump house	128.0	41	Landfill 11-B	20800.0
20	Incinerator Tank farm	405.0	42	Landfill 13	6500.0
21	Diesel Storage Tank	28.2	43	Green belt	93485.0
22	Diesel Pump area	370.2	44	Road	11550.0

Figure 2.4 Proposed project **List of individual units**

S.No	Proposed facilities	Area (m^2)	S.No	Proposed facilities	Area (m^2)
1	Weigh Bridge room	12.0	13	Recycling facility	1836.0
2	Underground sump	9.0	14	Transformer yard	96.0
3	Admin Building	213.5	15	Metering Room	42.0
4	E-waste and paper recycling Shed	1606.5	16	Electrical panel & DG platform	30.0
5	Plastic recycling Shed	450.0	17	Leachate pond 1	1557.0
6	VMS and general stores	430.9	18	Leachate pond 2	2052.0
7	Liner storage yard	2365.0	19	Solvent recovery facility	317.13
8	Vehicle parking	1053.5	20	Boiler Shed	165.36
9	Storage shed-1	1000.0	21	Tank Farm Area	268.64
10	AFRF and drum recycling	1000.0	22	Landfill	55200.0
11	Storage shed-2	1000.0	23	Green belt	36535.0
12	Storage shed-3	1000.0	24	Road	8041.0

2.5 Land requirement and availability

Total available existing land with MWML is 39.4 ha. (97.3acres). Out of that 68.62 acres are developed existing project & development of proposed expansion in an area of 28.74 acres. Total greenbelt area allotted 32.13 acres i.e. 33% and remaining 4.84 acres are under approach roads. The detailed land breakup of the area is given in **Table 2.5.**

Table 2.5 Land breakup

Land use	Existing (Ac)	Proposed (Ac)	TOTAL		
			Ac	Ha	%
Facility	4.63	3.19	7.82	3.16	8.02
Leachate Pond	3.92	0.89	4.81	1.95	4.95
Landfill	34.12	13.64	47.76	19.32	49.05
Greenbelt	23.10	9.03	32.13	13.00	33.00
Road	2.85	1.99	4.84	1.96	4.98
Total	**68.62**	**28.74**	**97.36**	**39.4**	**100**

2.6 Manpower requirement

The details of the manpower available in the existing plant and the manpower required for expansion project is given in **Table 2.6.** Based on the need, unskilled workers will be hired from the nearby villages during construction phase.

Table 2.6 Manpower details – No's

S.No.	Description	Existing	Proposed	Total
1	Skilled Manpower/Management	70	61	131
2	Unskilled/semi-skilled Manpower	200	245	445
	Total	270	306	576
In addition to the above there will be indirect employment of around 100 people.				

2.7 Water requirement

Water requirement for the project is met from MIDC. The total water requirement of the project is 582 KLD which includes the existing requirement of 361 KLD and proposed requirement of 221 KLD.

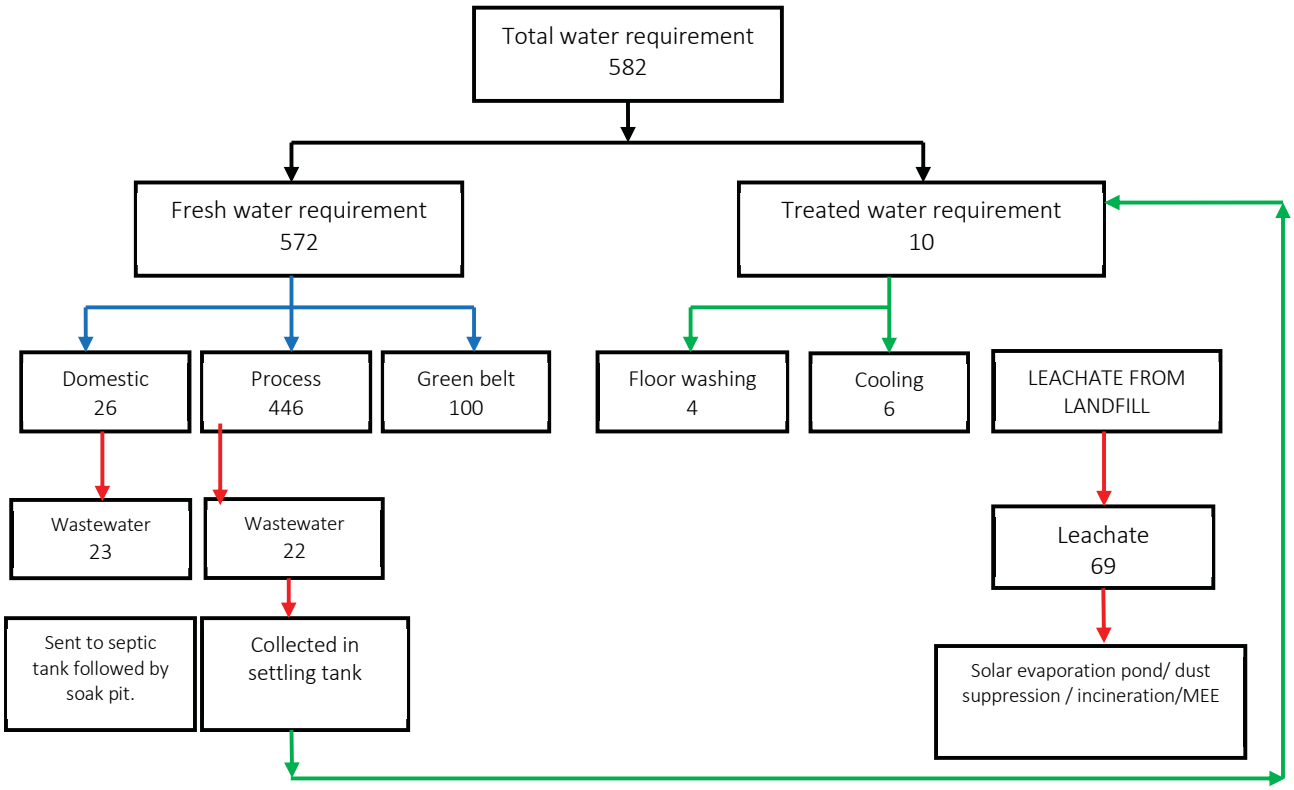
2.7.1 Source of Water

MIDC (Maharashtra Industrial Development Corporation) is operating a water supply scheme to supply 32 MLD of water to Taloja Industrial Area from Barvi Dam grid, owned by MIDC. CIDCO has developed a residential and commercial area known as Navi Mumbai, 2km from Taloja Industrial Area. A CETP (Common Effluent Treatment Plant) of 18 MLD capacities has been undertaken and completed by MIDC in order to make the area eco-friendly. The details of water requirement for various activities are given in **Table 2.7.** And the water balance flow chart given in **Figure 2.4.**

Table 2.7 Water requirement - KLD

Description	Existing	Proposed						Total
		Solvent Recovery	Plastic Recycling	Paper Recycling	Drum Decontamination	BMW	Incinerator	
Domestic	10	5	4	4	2	0	1	**26**
Process	251	50	2	0	2	15	126	**446**
Floor Washing	0		2	0	2	0	0	**4**
Cooling	0		1	0	0	0	5	**6**
Gardening	100	0	0	0	0	0	0	**100**
Total	**361**	**55**	**9**	**4**	**6**	**15**	**132**	**582**
Source: MIDC supply								

Figure 2.4 water balance flow chart



2.7.2 Wastewater generation

The quantities of waste water generated along with water requirement are given in Table 2.8. The wastewater will be treated in ETP/LTP/MEE, since the project adopts the concept of zero liquid discharge concept, the treated water will be reused within the facility.

Table 2.8 Wastewater details - KLD

Description	Water requirement	Wastewater generation	Remarks
Domestic	26	23	Septic tank followed by soak pit
Process	446	22	Treated in SEP and will be reused for dust suppression and spraying on landfill/ scrubbing liquid
Floor washing	4	0	
Cooling	6	0	Makeup water
Leachate from landfill	0	69	Incineration/MEE / spraying on landfill
Greenbelt	100	0	
Total	582	114	
Note: Process waste water includes e-waste – 0.5 KLD, Solvent recovery – 8 KLD, plastic recycling – 3 KLD, drum decontamination – 2 KLD			

The MWML proposes to install Multiple Effect Forced Circulation Evaporation (MEE) Plant of designed capacity @ 150 KLD effluents. Zero liquid discharge system consisting of a stripper for remover of organic volatiles if present in the industrial waste water, multiple effect evaporators for achieving energy economy and a sludge dryer for converting concentrated industrial waste water into solids. MEE plant comprises of stripper, four effected forced circulation evaporate and Agitated Thin Film Dryer (ATFD). The steam stipper for removing volatile solvents, multiple effect evaporators for concentrating effluent and ATFD for drying concentrated effluent to form solid waste. The distillate of ATFD is added for to the ETP for further treatment and the solids are disposed to secured landfill within the site.

2.8 Power requirement

The details of power requirement for operation of the facility and fuel required for running DG sets for emergency purpose/during power failure as backup are given in Table 2.9.

Table 2.9 Power requirement (kVA)

Description	Facilities	Total demand	Power Requirement
Existing Power Requirement	Plant & Amenities	500	500
Proposed Power Requirement	Plastic Recycling	300	1720
	Paper Recycling	50	
	E waste	350	
	Solvent Recovery Plant	300	
	AFRF	150	
	MS Drum Recycling plant	100	
	Bio medical	100	
	Landfill	50	
	Incinerator	320	
		Total	2220
DG set	Existing installed capacity		875
	Proposed capacity		500
Transformer	Existing		910
	Proposed		2000

2.9 Solid waste generation

The existing as well as proposed project activities, which the solid waste generated, is from incineration of hazardous waste. The details of the waste generated and its disposal methods proposed is furnished in Table 2.10.

Table 2.10 Details of Solid waste generation details

Description	Existing	Proposed	Total	Method of disposal
Ash from incinerator (HW)	1500 MTPA	750 MTPA	2250 MTPA	Landfill
Ash from incinerator (BMW)	64 MTPA	98 MTPA	162 MTPA	Landfill
Waste oil from DG sets	140 LPA	250 LPA	390 LPA	Incinerator
Municipal Solid waste	54 Kg/day	64 Kg/day	118 Kg/day	Municipal bin
Solvent sludge	-	50 KLPA	50 KLPA	Incinerator

2.10 Hazardous waste management and process description

The existing facility and after proposed expansion the facility will be handling the following categories of wastes:

- Waste oil/used oil/skimmed oil/ oil contaminated earth
- Discarded MS drums containers used for chemicals and hazardous substances
- ETP sludge, sulphur sludge, cooling water sludge, oily sludge
- Sludge from water treatment plants
- Date expired / off specific /discarded chemicals and products
- Ash from hazardous waste incineration
- Iron sludge
- Still Bottom residues and process sludge
- Spent Carbon
- Evaporation salts/ other process salts
- Incineration ash & lags
- Asbestos and glass fibers
- Spent catalysts and resin residues, spent resins from DM plant
- Other hazardous wastes

Depending on the nature and characteristics of hazardous waste, pre-treatment is given to the waste and the following disposal methods are followed:

- ETP sludge is sent directly to landfill or after stabilization.
- Depending on the characteristics of the impurities, bottom residues, process residues and other organic wastes including spent carbon can be sent for incineration.
- Incineration ash, slags, asbestos and glass fibers are essentially inorganic in nature and can go to landfill directly or with simple stabilization techniques.
- Spent catalysts and resins would have to be characterized on a case-by-case basis to assess their nature and characteristics. However, the percentage of wastes generated through these sources is likely to be very small as most of it is taken back by the manufacturers.
- Salts will have to be bagged and land filled.

Based on the above compiled information wastes have been classified by their pathway of disposal:

- Waste going to direct landfill
- Waste that require stabilization prior to landfill
- Waste requiring storage until alternate economically viable techniques are made available.
- Waste requiring incineration

2.10.1 Waste acceptance criteria and disposal pathways

As per Hazardous waste and other waste (Management, Handling and Transboundary Movement) Rules, 2016, the wastes accompanied by 7 copies of manifest are received. At the time of taking membership by the company complete analysis of hazardous solid waste is carried out and the sample of same is preserved for further physical verification. As soon as the transporting vehicle arrives at the facility, it is weighed and, samples are taken from 3 different locations and composite samples is made and analyzed for following quick parameters.

- pH
- PFLT test for moisture content as well as LRT
- TOC
- Ignitability (Flammability)
- Reactivity
- Physical checks: Color, Odour

Only if the sample passes through above quick tests, it is allowed to enter the disposal site. The waste criteria for disposal to landfill and the flowchart of waste pathway for final disposal are given in Figure 2.5 and 2.6 respectively. Wastes can be classified by their pathway of disposal as below:

- Waste going to direct landfill
- Waste that require stabilization prior to landfill
- Waste requiring storage until alternate economically viable techniques are made available.
- Waste requiring incineration with or without pre-treatment
- Waste requiring pre-treatment for co-incineration/AFRF

Figure 2.5 Waste criteria for disposal to landfill

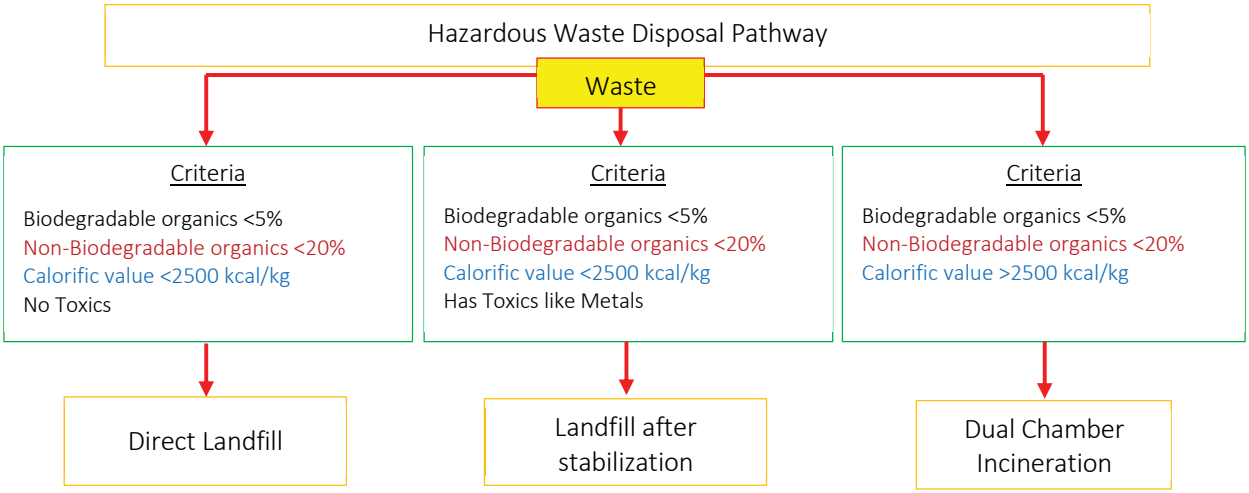
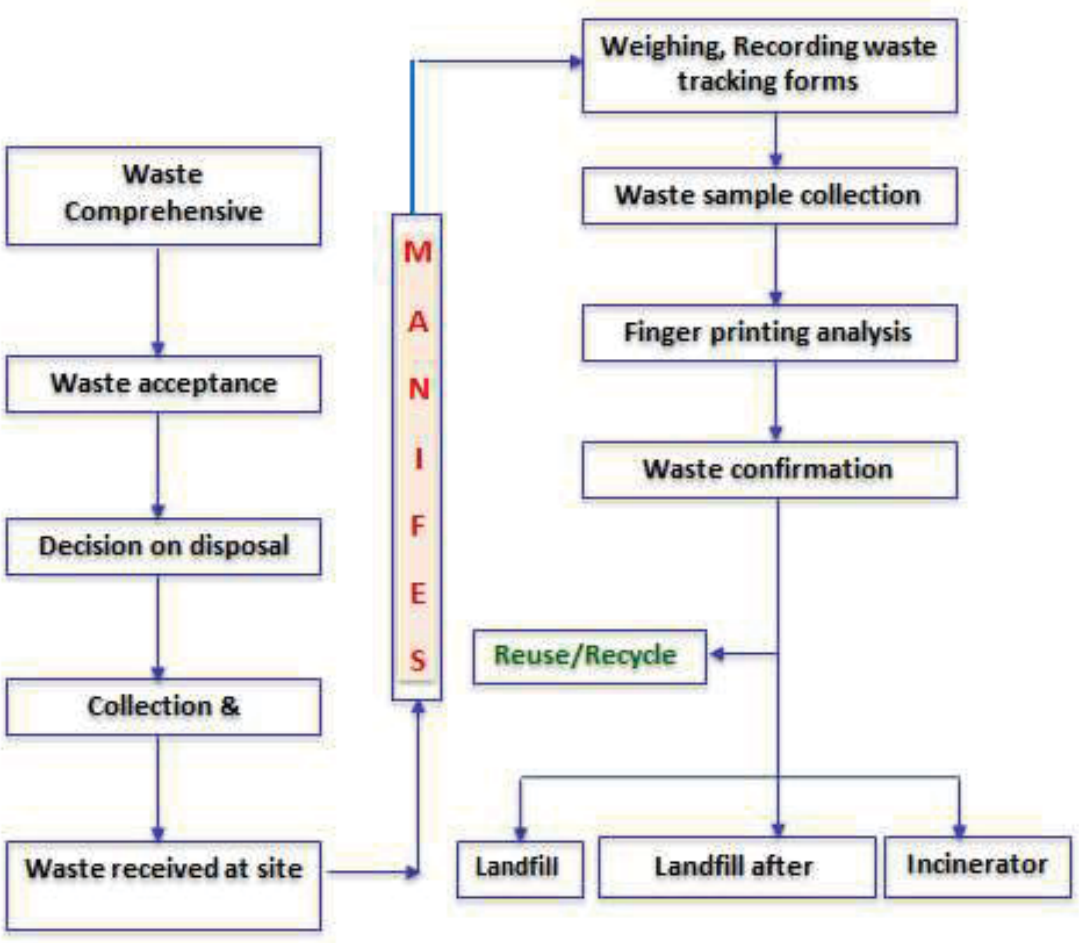


Figure 2.6 Flow charts showing pathway of waste to disposal



2.10.2 Waste collection and transportation

The existing TSDF of MWML has dedicated fleet of twenty one vehicles of capacities of 5MT to 20MT. On an average, the regular waste lifting capacity by repeating vehicle trips scheduling planning on call out is approximately 135 MT. As per the latest quarter (April'2018 to June2018) waste collected from 298 member industries and the quantity of waste will be 55578 MT.

The detailed statement w.r.t total quantity of HW received and disposed since commissioning of the facility is furnished in **Table 2.11.**

Table 2.11 Total quantity of hazardous waste received and disposed

S. No	Description	Type of HW & Quantity in Tons (Apr-Jun'2018)		
		Direct landfillable	Incinerable	Landfillable which require pre-treatment
1	Opening Stock of the Hazardous waste	818	839	4928
2	Total Quantity of HW received	10870	7001	37707
3	Total HW treated	0	0	37707
4	Waste disposed-off	7698	7309	31388
5	Closing stock of the HW at the end of the quarter	3990	531	11247
6	Cumulative receipt of HW since commissioning	617459	271418	924993
7	Cumulative HW disposed of since commissioning	613469	270887	913746
Source: Annexure VI: Protocol for CHWTSDF Part B for the period of April – June'2018				

All other records in respect of TSDF operation are maintained properly and kept available for regulators as and when required. Experienced drivers with a minimum qualification of S.S.C shall be hired for transportation of wastes. They shall be trained in operating the manifest system and management of TREM card system. As a practice, a trained driver and helper will accompany the truck to ensure that these systems are properly maintained. They shall also be trained to take care of emergency and first aid in case of injuries. Besides these precautions, each container of vehicle shall be washed thoroughly before collection of wastes. The collected water shall be treated and diverted to the leachate treatment facility. The vehicle details are given in below **Table 2.12.**

Table 2.12 List of vehicles available at MWML site

S.No	Type of Vehicle	Capacity	Quantity (No.'s)	S.No	Vehicle Type	Capacity	Quantity (No.'s)
1	Hook Loaders	05Plt	1	13	Backhoe Loader	JD-315	1
2	Hook Loaders	10Plt	3	14	Excavator	Js-205,Js-140,Z-axis210, Ex-70	4
3	Hook Loaders	13Plt	1	15	Fork lift	volts-3ton	2
4	Hook Loaders	15Plt	3	16	TRACTOR	Mahindra	1
5	Tippers	10 ton	1	17	Tanker	Ashok Leyland	1
6	Tippers	15 ton	4	18	LMV	Bolero	2
7	Open Truck	7.5ton	4	19	LMV	Indigo CS	1

S.No	Type of Vehicle	Capacity	Quantity (No.'s)	S.No	Vehicle Type	Capacity	Quantity (No.'s)
8	Open Truck	15ton	3	20	Good carrier LMV	Tata 207	1
9	Open Truck	20ton	3	21	Good carrier LMV	Tata Xenon	1
10	Dozers	D-80	1	22	Good carrier LMV	Mahindra Genio (Fire vehicle)	1
11	Vibro roller	L&T 1107	1	23	Ambulance	LMV	1
12	Backhoe Loader	JCB-3dx	2			**Total**	**43**

Table 2.13 Manifest system for HW as per HWM rules, 2016

S.No	Copy No. with color code	Purpose
1	Copy 1 (White)	To be forwarded by the sender to the SPCB after signing all the seven copies.
2	Copy 2 (Yellow)	To be retained by the sender after taking signature on it from the transporter and the rest of the five signed copies to be carried by the transporter.
3	Copy 3 (Pink)	To be retained by the receiver (actual user or treatment storage and disposal facility operator) after receiving the waste and the remaining four copies are to be duly signed by the receiver
4	Copy 4 (Orange)	To be handed over to the transporter by the receiver after accepting waste.
5	Copy 5 (Green)	To be sent by the receiver to the State Pollution Control Board.
6	Copy 6 (Blue)	To be sent by the receiver to the sender
7	Copy 7 (Grey)	To be sent by the receiver to the State Pollution Control Board of the sender in case the sender is in another State

- Precautions being taken to control spillages

  Vehicles used are dedicated vehicles which will be of relevant capacity (Crane mounted / containerized collection and loading vehicles /covered trucks / trucks having pneumatic loading / unloading arrangements). The vehicles are covered on top by tarpaulin sheets. HSE policies, training and drills are conducted and spillage control arrangement is kept as per norms.

- Frequency of collection

  The collection of wastes is on regular basis for CETPs and call out basis for individual industries.

- Manifest system followed - Seven copy manifest system and TREM card system are followed as per Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016.

- Safety norms being followed in the field during transportation - Experienced drivers with a minimum qualification of S.S.C shall be hired for transportation of wastes. They shall be trained in operating the manifest system and management of TREM card system. As a practice, a trained driver and helper will accompany the truck to ensure that these systems are properly maintained. They shall also be trained to take care of emergency and first aid in case of injuries. Besides these precautions, each container of vehicle shall be washed thoroughly before collection of wastes. The collected water shall be treated and diverted to the leachate treatment facility.

- Ground water sampling analysis
  The TSDF has provided monitoring wells at the site for ground water monitoring. There are twelve bore wells. The monitoring parameters are analyzed as per the guidelines given by the CPCB. The TSDF has provided laboratory facility for analysis of bore well water. Monitoring is done once in a month.
- Leachate Management System
  The TSDF has cell-wise leachate collection wells. There are 12 no.of leachate wells for closed Landfill and 12 no. for under temporary capped Landfill.

2.10.3 Laboratory facilities

A well-established laboratory exists at MWML to carry out comprehensive analysis of hazardous wastes, finger print analysis and treatability studies to decide the appropriate disposal pathway as per the waste acceptance criteria. Landfill QA/QC, environmental monitoring and any other analytical requirements are met through this facility.

2.10.4 Temporary storage

Until the pathway of waste disposal is determined for the wastes received, waste is stored at a temporary storage facility. Temporary storage of hazardous wastes will be done in a covered shed, having elevated concrete floor with drains all around to collect the leachate.

This storage facility ensures segregation of shipped wastes so that incompatible wastes do not get mixed with the compatible ones. All compatible wastes shall be stored in drums/containers. The incinerable wastes shall be labelled properly and stored in a storage shed as per the CPCB guidelines.

Wastes containing ignitable, reactive and non-compatible characteristics will be stored separately.

Wastes containing volatile solvents or other low vapor pressure chemicals will be adequately protected from direct exposure to sunlight. Temporary waste storage shed of three each 1000 m^2 is available. Separate storage sheds for incinerable, intractable and recyclable wastes are provided.

For incinerable wastes, adequate storage space will be provided with 15 m distance between storage sheds, fire break of at least 4 m between two blocks of stacked drums, maximum of 300 tons of waste storage limit in a block of drums and at least 1 m clear space between two adjacent rows of drums in a pair for routine inspection purpose.

At MWML, finger print analysis is done regularly for the incoming waste. Intractable waste storage Shed with Eight bins of 20 MT each and RCC flooring with Shed on top is facilitated. Chemicals used for treating waste under LAT category and daily requirement are stored properly. After expansion, the intractable wastes would be stored in a suitable storage area. The following precautions would be taken until alternate viable treatment technologies are identified and become available for these categories of waste.

- Proper ventilation shall be provided to prevent accumulation of hazardous gases.
- The floor shall be constructed with concrete slab or other impermeable, non-reactive material, properly bunded & graded towards one corner for the collection of accidental spillage & leakage.

- The storage area shall be built not less than 1 m above the 1:100 year flood level (nearest river) to avoid inundation.
- Bunding and/or drains shall be provided around the storage area to avoid storm water entering into this area.
- Fire control equipment shall be installed, in accordance with the characteristics of waste and as the situation demands.

2.10.5 Waste disposal operations

The hazardous waste as received will be segregated on the basis of the characteristics and subjected to either direct landfilling/stabilization followed by landfilling/ incineration.

The waste is pre-treated/stabilized into low leachable materials before it is deposited into a secured landfill. This involves immobilization of leachable materials by fixation as non-reactive solids. The treated wastes shall then be assessed for compatibility with other wastes before being landfilled and for compatibility with the HDPE and pipe network.

2.10.5.1 Waste stabilization

Waste stabilization is designed to convert industrial wastes in the form of liquids, semi-solids or reactive solids into low leachable materials that can be deposited into a secure landfill. The stabilization operation will be carried out for all waste that requires this to minimize their contaminant leaching potential. This will change the nature of these wastes to a less hazardous category. Stabilization involves the immobilization of leachable materials by fixation as non-reactive solids. The treated wastes shall be assessed for compatibility with other wastes before being landfill and for compatibility with the HDPE and the pipe network. Stabilization covers a number of mechanisms including:

- Immobilization / Chemical Fixation – Chemical binding of contaminants within a cementing structure to reduce the mobility or leachability of the waste.
- Encapsulation –Entrapment of contaminant particles within a solid matrix.
- Solidification – Conversion of slurries that do not readily de-water into solids by addition of adsorption agents.

Treatment facility utilizes a range of techniques and processes designed to change the physical, chemical or biological characteristics of the waste. This may include changing the composition so as to neutralize the waste, recover energy or natural resources from the waste and render the waste non-hazardous or less hazardous, safer to transport, store & dispose of or to reduce its volume. Typical reagents used, the infrastructure proposed and operations for waste stabilization unit are presented in Table 2.14.

Table 2.14 Reagents, infrastructure and operations for waste stabilization unit

Typical reagents	Infrastructure	Typical operations
Cement, lime, fly ash, bentonite clay, saw dust Sodium silicate solution would be used as an additive binding agent wherever required	• Storage facilities for regents • Tanks/Drums for storage of reagents as required • Stabilization bins for mixing the wastes • Earth moving equipment for movement of wastes and mixing. • Place for curing the treated waste • Trucks for hauling the wastes.	• Receiving the waste • Addition of reagents • Mixing • Curing • Analysis of the stabilized wastes • Approval by laboratory for disposal • Transfer of waste materials to the truck • Disposal in landfill

Application criteria: A study of the waste characteristics carried out as an integral part of the project indicates the following applicability to the process as shown in **Table 2.15.**

Table 2.15 Stabilization mechanism based on waste characteristics

Mechanism	Applicability
Immobilization / Chemical Fixation	• Heavy metal and metal plating sludge • Copper-chromium-arsenic wood preservative wastes • Mercury waste • Bag house dust • Tannery wastes • Spent catalysts and others
Solidification	• Effluent treatment plant sludge • Oil and paint sludge • Bitumen wastes • Textile industry sludge • Wool scouring slurries
Encapsulation	• Aluminum powder • Asbestos • Filler aids

2.10.5.2 Secured Landfill (SLF)

The landfill is constructed according to the design approved by MPCB. It is constructed in such a way that it is secured and retains any waste material and leachate formed by entrapped moisture or by infiltration of rainfall. To meet the above requirements, the base of the landfill is provided with a liner, prior to placement of waste and an engineered capping is provided over the surface after completion of filling.

The base liner of the landfill containment system is provided with a double composite liner along with synthetic geo-membrane and clay. Adequate leachate collection system is incorporated at the base to collect and remove the leachate.

These include HDPE pipes embedded in drainage layers of sand/ gravel and / geo-net/ geotextile. The typical SLF cross section image given in **Figure 2.7 A**. And details of SLF are given below in **Table 2.16.**

Table 2.16 Cross section details of secured landfill

Base Liner System (Double Composite Liner System)
Waste Disposal volume (in b/w base liner system & temporary capping or permanent capped by landfill cover system)
Geo textile Base Portion
Primary leachate collection system, 300mm thickness. Filter media with 160mm OD embedded perforated HDPE Pipe network
Geo-textile on top of HDPE geo-membrane
HDPE Geo-membrane 2 mm thickness.
Compacted clay or amended soil of 450 mm thickness of primary liner system
Geo-textile filter acts as a barrier between the waste and the drainage system
Secondary leachate collection system, 300 mm thickness. Filter media with 160 mm OD embedded in a perforated HDPE pipe network
Geo textile base portion on top of HDPE geo membrane
Primary liner comprising of clay layer and HDPE membrane
Complete drainage system consisting of HDPE liner with permeability less than 10^{-14} m/s
Composite secondary liner made of compacted clay or amended soil of 450mm thickness compacted to permeability less than 10^{-9} m/s

Baseliner system (Double Liner System)

The landfill is designed and constructed as a secure facility to contain the waste material and any leachate, which is formed by the entrapped moisture or by infiltration of rainfall. To meet these requirements the base of the landfill has been designed as an engineered liner constructed prior to the placement of waste and also an engineered capping over the surface after completion of filling to minimize the infiltration of rainfall.

The base liner of the landfill containment system is a double composite liner with synthetic geo-membrane plus clay. Adequate leachate collection system is incorporated at the base to collect and remove the leachate. HDPE pipes embedded in drainage layers of sand/ gravel and /or geonet/ geotextile. The composite liner (Secondary liner) comprise of a 450 mm thick clay compacted to a permeability less than 10^{-9} m/s and above this a HDPE liner with permeability less than 10^{-14} m/s above which a complete drainage system is placed. Above the secondary base liner primary liner is placed comprising of primarily clay layer and HDPE membrane which prevents infiltration into the secondary layer.

A leachate collection and removal system is also placed over the primary liner to collect and remove any leachate generated by infiltration of precipitation or by the moisture entrapped in the waste. This makes the secondary system to serve as a leak detection system and an early warning of potential future liabilities to necessitate action for remediation. Above the drainage system of the primary liner a geo-textile filter is placed to act as a filter/ barrier between the waste and the drainage system. This entire system would make the base liner a double composite liner meeting the national laws.

Clay Liner consists of a varying proportions of hydrated aluminum silicates (e.g. kaolnite, bentonite, illite and montmorillonite) which, when properly compacted, form a soil mass with a very low hydraulic conductivity. The clay material for use as the liner at this landfill is analyzed and permeability testing has been carried out to ascertain its low permeability. Design permeability of the clay liner has been fixed at

10^{-09} m/s and with availability of clay liner; we are able to achieve better results than the design values. Placement of clay liner is most critical in terms of its efficiency of functioning. Clay should be placed in layers not exceeding 600 mm and compacted to attain the required permeability. The clay layer after attaining the 450 mm thickness should be then checked for its permeability. Further to this, clay shall be kept moist to ensure that it does not dry up and cause cracks to the lining system. To ensure this we intend to keep the clay for the purpose at +4% wet of optimum moisture content.

Synthetic liners consist of various synthetic flexible membrane liners have been considered for use as the primary liner at the landfill. Both Poly-Vinyl Chloride (PVC) and High – Density Polyethylene (HDPE) liners are generally suitable for this landfill. Tensile strength is a fundamental design consideration in order to assess the ability of the liner to resist uniaxial and biaxial strains, which occurs in the landfill. Another stress strain consideration is the coefficient of thermal expansion.

Considering various membrane properties it is decided to use HDPE liner with appropriate thickness as primary liner for the base of the landfill. HDPE was selected for the following reasons:

- Adequate strength to withstand mechanical strength during construction, placement and operations.
- Acceptable weathering performance.
- Superior physical properties under chemical and environmental exposure to wastes capability to withstand the seaming process.
- The hydraulic conductivity of HDPE is of the order of $0.5 * 10^{-16}$ m/sec, which is effectively impermeable. Construction of the seam welding process shall be subjected to strict QA/QC measures to ensure the integrity of the liner.

Secure landfill is the final placement area for land fillable hazardous wastes which are treated or wastes does not require treatment. Waste directly or after treatment is disposed in the landfill as per the laboratory advice. Waste spread in the landfill using heavy earth machinery and then compacted using vibro compactor. At the end of the landfill operations 450 mm soil cover will be placed as a daily cover.

During rainy season a flexible geo-membrane cover shall be placed over the uncapped area of the landfill minimize infiltration of rainfall into the landfill; the rain water shall be diverted to join the surface water drains. At the end of the total landfill operations the final capping shall be done using composite liner with clay and synthetic geo-membrane, with vegetative soil cover grass cover.

Figure 2.7 A. Cross section of the landfill

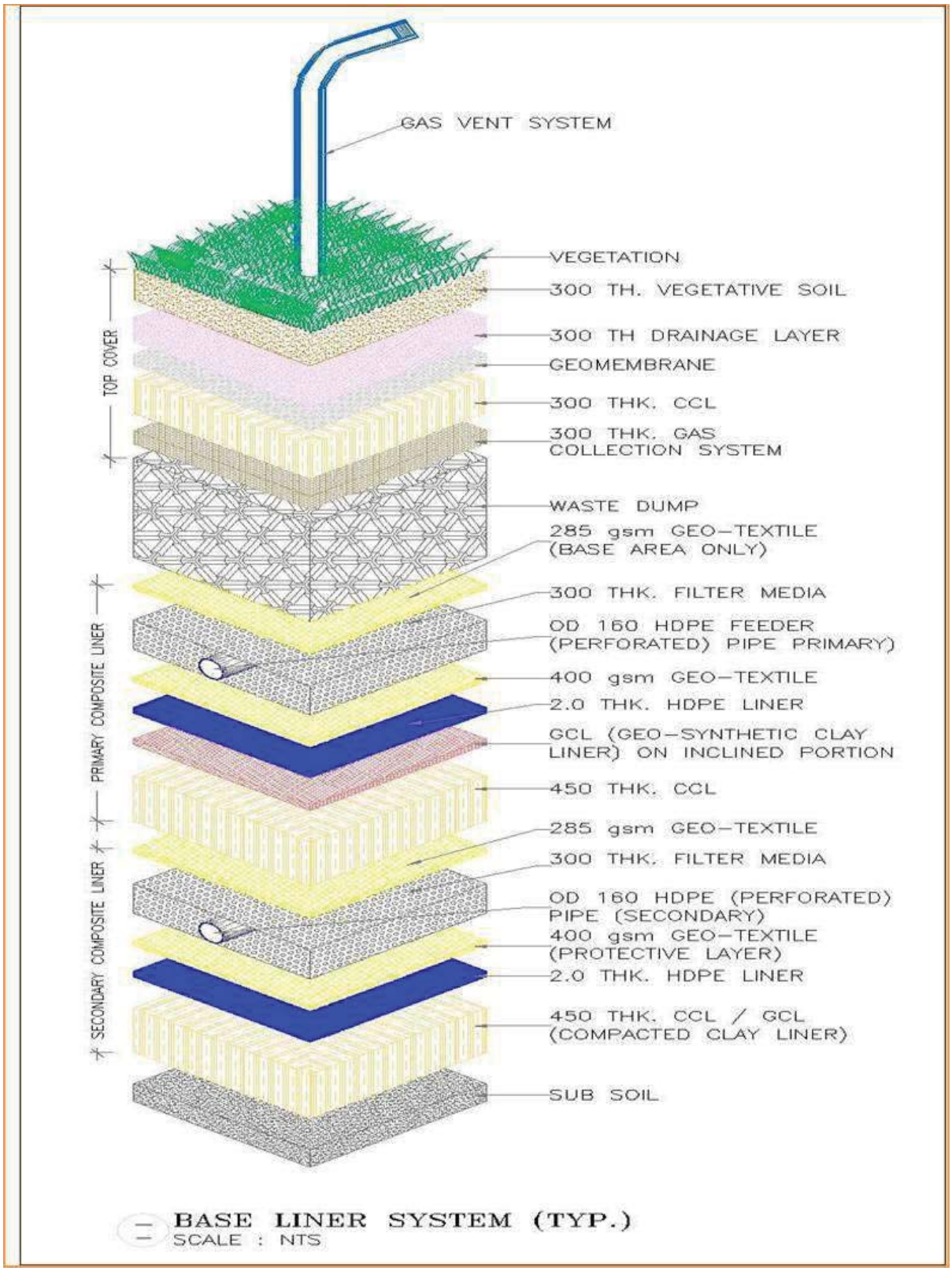
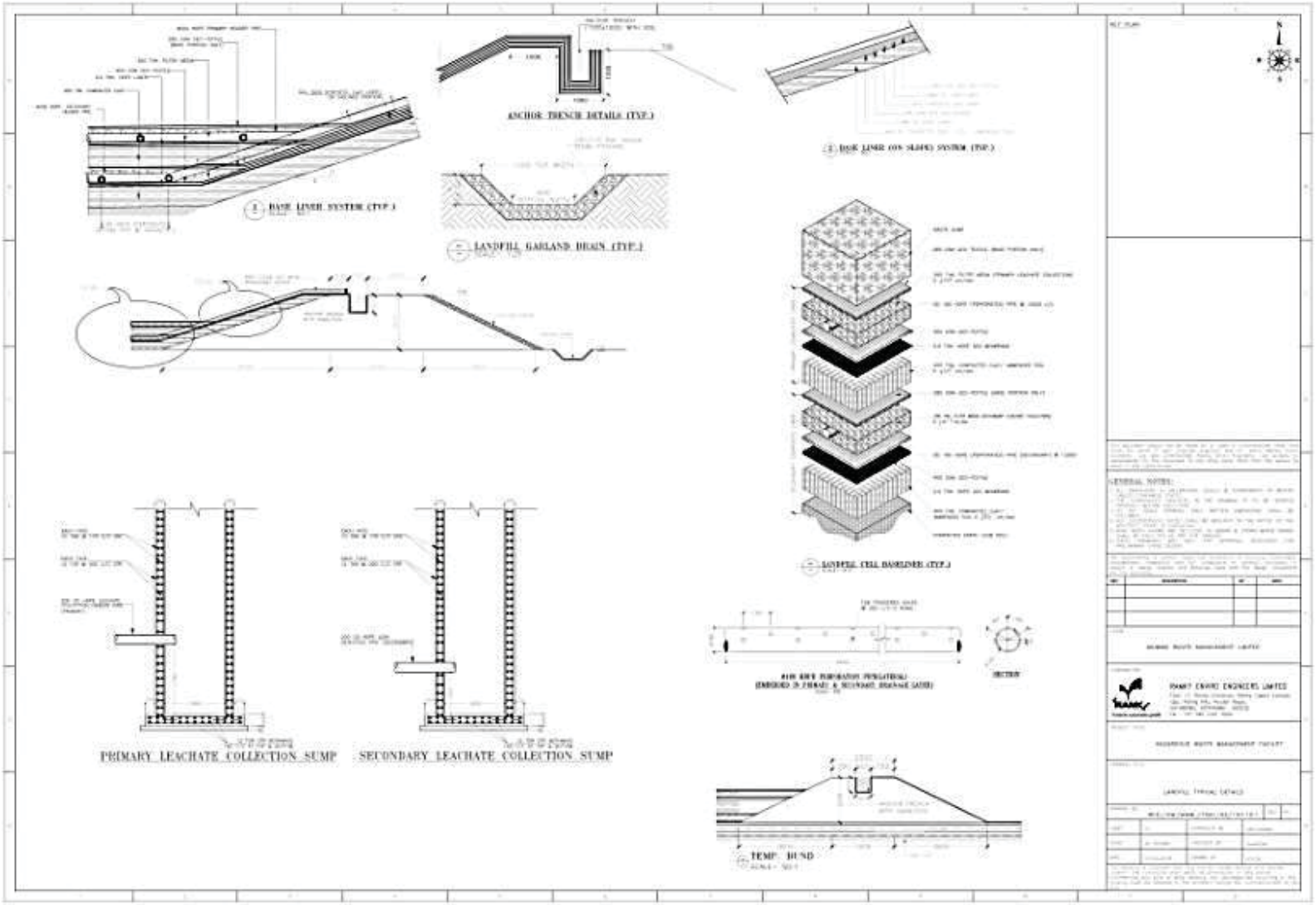


Figure 2.7 Typical Landfill cell baseliner



2.10.5.3 Leachate management (collection treatment & disposal)

Leachate generated from the landfill is effectively collected and disposed without causing any adverse effect to the environment. Currently, the leachate generated is collected by a network of lateral and header pipes embedded in a drainage layer, all of which is eventually drained into a leachate collection sump. The collected leachate is transferred to a leachate collection pond/ solar evaporation pond where it is given a retention time of one to two days during which all the residue will be settled down. The decanted liquid is directly reused as sprayer on the landfill and the residue is disposed of in landfill. However, after the integrated facility is established, the leachate would be directed to the leachate collected sump. Some portion of the treated effluent will be recycled back to the waste stabilization unit and a portion would be sprayed in the incinerator.

Leachate collection and removal is provided above the geo-membrane in two layers viz., the primary and the secondary liners. The primary liner shall serve as leachate collection and removal system, while the secondary liner shall serve as leak detection system and a signal of potential liabilities in terms of environmental pollution. Leachate is collected by a network of lateral and header pipes embedded in a drainage layer, all of which shall eventually drain into a leachate collection sump. The collected leachate is transferred to a leachate treatment system.

The leachate collection system in an engineered landfill takes the form of an under-drain beneath the waste material it is required to ensure there is no more than a limited head of pressure above the base liner to cause leakage of liquid from the base of the landfill. The design maximum pressure head in the landfill shall be limited to 300mm.

2.10.5.4 Leachate collection system

The leachate collection system in an engineered landfill takes the form of an under-drain beneath the waste material it is required to ensure there is no more than a limited head of pressure above the base liner to cause leakage of liquid from the base of the landfill. The design maximum pressure head in the proposed landfill shall be limited to 300 mm.

Drainage is affected by a layer of about 300 mm thick of graded sand/gravel having a high permeability. Within this layer a network of HDPE pipes are placed to collect leachate and conduct it quickly to the collection sump for removal from landfill. The pipes are typically perforated only over the upper half to allow the leachate to enter the pipe and thereafter to be contained within the pipe network system. The layout of the pipe network generally includes sufficient redundancy to ensure that if a blockage occurs somewhere in the network the leachate simply backs-up a little then flows into the system a little further up-gradient. Two layers of the leachate collection system shall be provided one over the other. Slotting area of the pipe shall be done only on the top 120^{o} portion of the pipe and to an extent of 100 Sq. cm per running meter of the pipe. The key design features of the leachate collection system to be installed at the proposed landfill comprise the following:

- A network of semi perforated HDPE pipes lay out directly over the primary and secondary liners and graded towards the collection sump at no less that 1 and 2% slope, with a slotting area of 100 Sq. Cm per running meter of the pipe.
- A drainage layer 300mm thick of graded sand/gravel placed over the entire base of the landfill, covering the pipe network.

- A geo-textile placed over the primary liner serving the purpose of filter/ barrier between the waste and the drainage media.

The pipe shall have sufficient strength to withstand the load imposed by the overlying waste and the earth moving activities associated with the placement and the compaction of the waste (Min 6 Kg/ Sq.cm). The main pipe (headers) feeding leachate to the sump shall have the capability to be cleaned out in case of clogging. However, the design shall include sufficient redundancy of pipe work to ensure alternative drainage paths are available in the event of localized clogging of any part of the system. Leachate treatment plant design is discussed in the subsequent sections.

Quantity of Leachate Generated from Landfill: I = P – PCR/O – AET +/- S

Where,
I - Rate of Infiltration
P -Precipitation
PCR/O- Coefficient of Runoff
AET -Actual Evapo-Transpiration
S -Soil Moisture Content Retention Capacity

Empirically,
For Capped portion of landfill: I = 0.01 P
For Uncapped Portion of landfill: I = 0.7 P
Landfill with temporary cover: I = 0.3 P

Drainage of surface run-off, its collection, treatment and disposal

Network of open channels have been designed and shall be constructed around the land fill to intercept surface runoff of rainwater and divert it around the facility/ collect it for the use at the facility/for disposal. Storm water collected on the land fill site will be directed to a first flush retention pond which shall be designed for a sufficient capacity to cover a one in 100 years 10 minutes storm event.

Storm water drainage system

Storm water drainage is one of the main components of landfill facility. The arrangement shall be such that the storm water from landfill facility has to be collected effectively in drainage system and conveyed away from facility quickly. Storm water drain shall be of trapezoidal shape/rectangular with concrete/Pitching. The inside part of drain has to be plastered with cement mortar. Storm water drain shall be constructed all along between the road and the green belt.

First flush retention Pond

Surface water runoff is a significant component in a landfill design and shall be clearly designed. The design includes a garland drainage system all around the landfill which shall be lined and shall be connected to a storm water collection pond. Water collected in the pond shall be tested for storm water quality parameters and shall be discharged if it meets the discharge standards. Otherwise the same shall be considered as leachate and sent to the wastewater treatment plant.

2.10.6 Incineration

The Incineration is an ultimate treatment process, applied to certain wastes that cannot be recycled, reused or safely deposited into a landfill. It is a high temperature, thermal destruction oxidation process in which hazardous wastes are converted in the presence of oxygen in air into gases and incombustible solid residue. The gases are vented into the atmosphere with cleaning as deemed necessary while the solid residue is sent to landfill for disposal. The proposed incinerator would enhance the treatment capacity of following wastes:

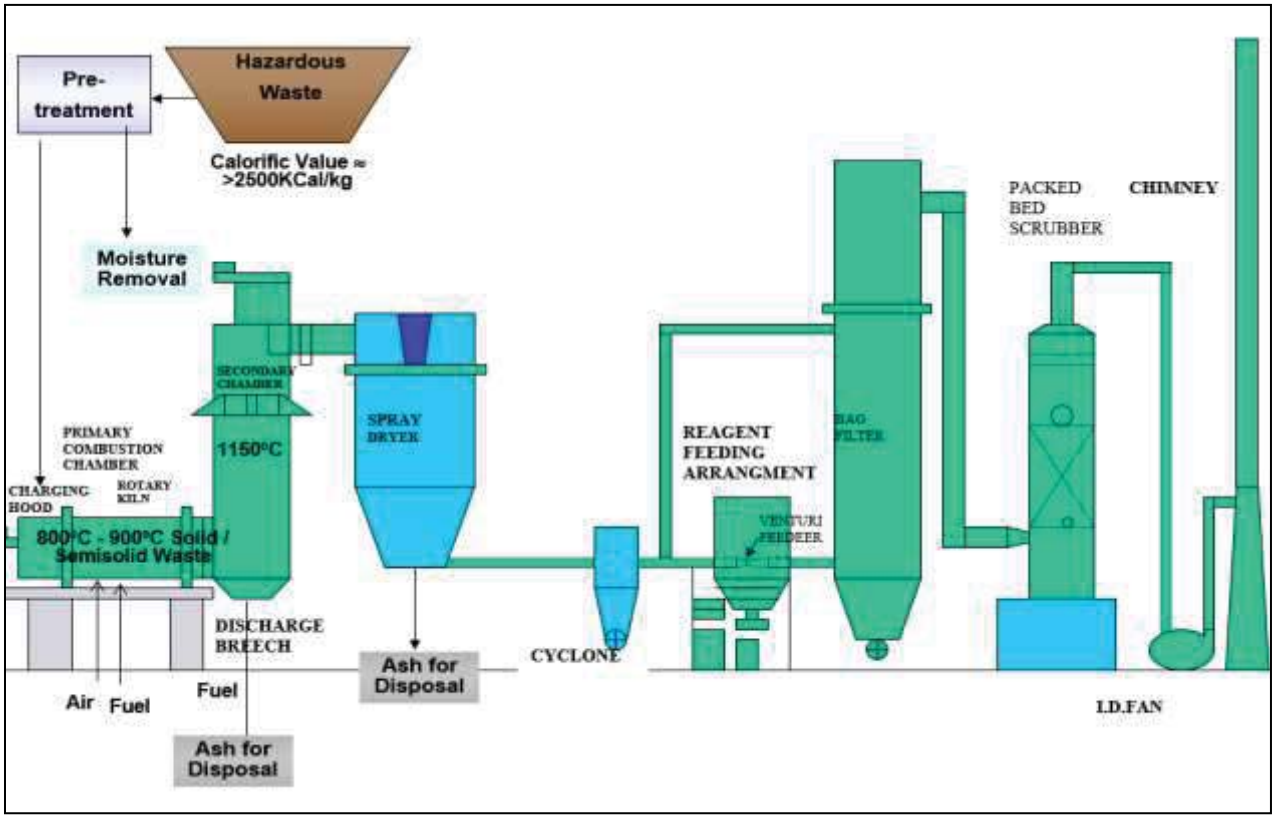
- Bio-medical wastes
- Spent solvents
- Waste oils, oil emulsions and oil mixtures
- Pesticide wastes
- Refinery wastes
- Pharmaceutical wastes
- Phenolic wastes
- Grease and wax wastes
- Organic wastes containing halogens, sulphur, phosphorous or nitrogen compounds
- Solid materials contaminated with oils.
- Organics with high calorific value

Wastes which are not suitable for disposal in the landfill are disposed in the incinerator. The primary objective of incinerator is to destroy the wastes as completely as possible, to have end products (solids and gases) that are harmless when released from the incinerator and to minimize the formation of new hazardous organic compounds. To achieve the same, the incinerator is proposed with sufficient temperature, time and turbulence and in presence of excess air. The waste is pre-processed to make it uniform in calorific value and maintain the norms of halogen concentrations less than 1% and all.

Wastes are fed through cart dumper and ram feeder into the rotary kiln and the hot gases are sent to the secondary combustion chamber. The residence time and the desired temperatures are maintained in both primary and secondary combustion chambers for complete combustion as per CPCB guidelines for hazardous waste incineration. The gases after complete combustion are sent to spray drier / evaporative cooler for cooling followed by gas cleaning equipment.

The gases are passed through multi cyclones for removal of particulates. Then dry lime and activated carbon are injected for neutralization of acidic gases and removal of organic constituents if any. The flue gases then passed through bag filters for complete removal particulates and then through wet alkaline scrubber for neutralization. The flue gases after completely cleaned in all respects are sent out through stack. The ash generated during the combustion process and collected at the bottom of the hopper will be send to landfill facility. The typical layout of incinerator is shown in Figure 2.8.

Figure 2.8 Typical layout of Incineration



2.11 Bio-medical waste treatment

In order to regulate the environmental threat due to mismanagement of BMW, the MoEF&CC, Government of India, has notified the Bio-medical waste (Handling & Management) Rules in 1998, which were amended in 2003, 2011 and 2016. But, all Health Care Units (HCUs) cannot afford to set up treatment and disposal facilities due to the high costs involved. Therefore the need for a centralized system for treatment was felt. Accordingly, in September 2003, the Central Pollution Control Board enunciated the "Guidelines for Common Bio-Medical Waste Treatment Facility" which in addition to providing common facilities discouraged the setup of individual incineration facilities by health care establishments.

2.11.1 Categories of BMW as per BMW Rules, 2016

According to the BMW Management Rules 2016, the waste is classified in to four categories. A brief description of different categories of BMW, type and colour coding of bags/container along with treatment and disposal are given in Table 2.17.

Table 2.17 Categories, types, colour coding and treatment options for BMW

Category	Type of Waste	Type of Bag/ Container	Treatment and Disposal options (as per BMW Rules, 2016)	Treatment / Disposal
Yellow	(a)Human Anatomical Waste	Yellow coloured non-chlorinated plastic bags	Incineration or Plasma Pyrolysis or deep burial	Incineration
	(b)Animal Anatomical Waste			Incineration
	(c)Soiled Waste		Incineration deep burial or Plasma Pyrolysis/ Autoclaving or micro-waving/ Treated waste to be sent for energy recovery.	Incineration
	(d)Expired/Discarded Medicines antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials	Yellow coloured non-chlorinated plastic bags	Expired cytotoxic drugs to be returned back to the manufacturer for incineration at temperature >1200^{0}C or to Common facility for incineration or Encapsulation or Plasma Pyrolysis.	Incineration
	(e)Chemical Waste Chemicals used in production of biological and used or discarded disinfectants.	Yellow coloured containers/ non-chlorinated plastic bags	Disposed of by incineration/or Plasma Pyrolysis/ Encapsulation in hazardous waste treatment, storage and disposal facility.	Incineration
	(f)Chemical Liquid Waste: Liquid waste generated due to use of chemicals in production, Silver X-ray film developing liquid, discarded Formalin, infected secretions	Separate collection system leading to effluent treatment system	After resource recovery, the chemical liquid waste shall be pre-treated before mixing with other wastewater. The combined discharge shall conform to the discharge norms	Not accepted at the CBWTF
	(g)Discarded linen, mattresses, beddings contaminated with blood or body fluid.	Non-chlorinated yellow plastic bags or suitable packing material	Non- chlorinated chemical disinfection followed by incineration/Plasma Pyrolysis/ for energy recovery.	Incineration
	(h)Microbiology, Biotechnology and other clinical laboratory waste: Blood bags Lab cultures, stocks or specimens of micro- organisms, live or attenuated vaccines, human and animal cell cultures used in research, industrial laboratories, residual toxins, dishes and devices used for cultures.	Autoclave safe plastic bags or containers	Pre-treat to sterilize with non-chlorinated chemicals on-site as per National AIDS Control Organisation or World Health Organisation guidelines thereafter for Incineration.	Incineration
Red	Contaminated waste (recyclable) Wastes generated from disposable items such as tubing, bottles, intravenous tubes	Red coloured non-chlorinated plastic bags or containers	Autoclaving/microwaving/hydroclaving followed by shredding or mutilation Treated waste to be sent to registered or authorized recyclers or for energy recovery	Autoclave

Category	Type of Waste	Type of Bag/ Container	Treatment and Disposal options (as per BMW Rules, 2016)	Treatment / Disposal
	and sets, catheters, urine bags, syringes (without needles			
White (Translucent)	**Waste sharps including metals:** Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded & Contaminated metal sharps	Puncture proof, Leak proof, tamper proof containers	Autoclaving/Dry Heat Sterilization followed by shredding/mutilation/ encapsulation in metal container or cement concrete, combination of shredding cum autoclaving, and sent for final disposal to iron foundries or sanitary landfill or designated concrete waste sharp pit.	Autoclave
Blue	**(a)Glassware**: Broken or discarded & contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes.	Cardboard boxes with blue coloured marking	Disinfection by soaking the washed glass waste after cleaning with detergent & Sodium Hypochlorite treatment/autoclaving/microwaving & then sent for recycling.	Autoclave
	(b)Metallic Body Implants	Cardboard boxes with blue coloured marking		

2.11.2 Collection & transportation

Collection and transportation shall be done in accordance with the BMW Management Rules 2016. In brief, BMW shall be collected from each healthcare establishment on a regular basis. Before transportation; all HCUs should ensure that the wastes are segregated into the appropriate colour-coded bins/bags, labeled properly as waste type, site of generation and date of generation. The wastes thus segregated are placed at a secured designated point from where it will be collected. It is the duty of the operator of common bio-medical waste treatment facilities (CBMWTF) to transport BMW from the premises of HCUs to any offsite CBMWTF. Only the vehicles complying as per the existing rules shall be to carry secured load, clearly marked with the name and address of the waste carrier and bio-hazard sign. BMW shall be transported through designated route, with colour coded, covered and leak proof trolleys to avoid spillage on road.

2.11.3 Disinfection and destruction

Upon receipt of the waste at the facility, waste containers shall be unloaded. A mechanical shredder equipped with sufficient motor capacity shall be installed for shredding the bio-medical wastes. The treatment or disposal options are further decided on the basis of category/nature of the waste. All incinerable wastes shall be directly loaded into the incinerator, while autoclaveable wastes shall be loaded into the autoclave for disinfection. Ash, residues from high temperature incineration and other materials from the process shall be collected into containers and disposed into a secured landfill.

2.11.4 Biomedical waste Incineration

A common incineration facility is proposed for the incineration of both hazardous and bio-medical waste. The details of operating conditions of the incinerator and the process description are already discussed under Section 2.10.6.

2.11.5 Autoclave

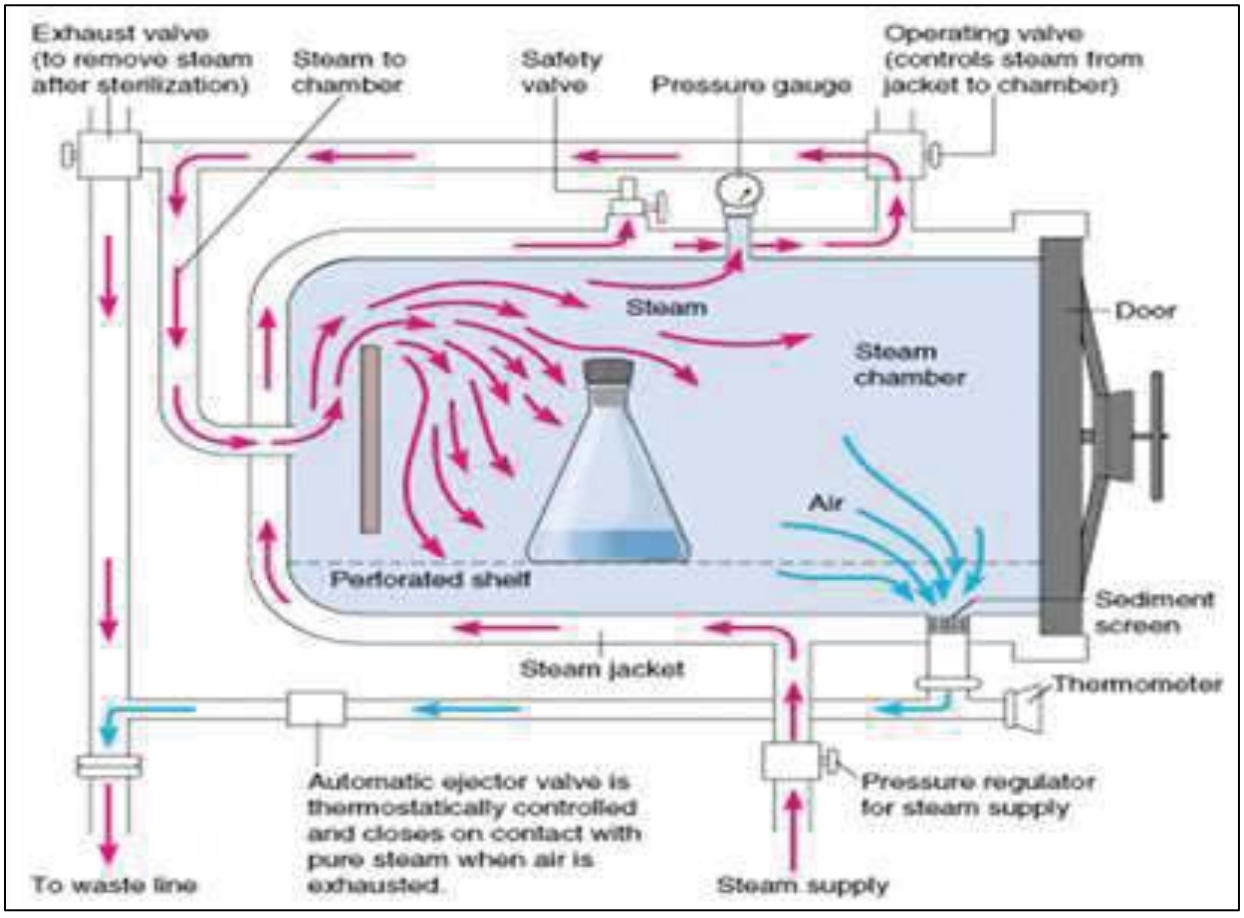
The primary purpose of autoclave is to sterilize/disinfect the waste with steam. MoEF&CC has stipulated a temperature of 120°C with 15 psi pressure and 60 min duration. Under these conditions, microorganisms are completely destroyed and thus render the wastes infection free. The disinfected waste shall then be segregated into HDPE, PP, rubber, latex, glass and metal which will be further shredded completing the process of disinfection and ensuring non-recycling of the waste materials for medical/food grade purposes. All the process control conditions will be as per the applicable Bio-medical rules.

A vacuum type (programmable) autoclave which can operate at all the specifications mentioned by MoEF&CC shall be proposed. Every batch shall be monitored with a strip chart recorder and once in a month the spore validation test and/or spore monitoring shall be done. The key features of the proposed autoclave are shown in Table 2.18 and the layout of typical autoclave sterilization process is given in Figure 2.9.

Table 2.18 Features of the proposed autoclave

Type	Vacuum type, automatic with documentation
Capacity	3000 liters per batch
Temperature	121°C
Pressure	15 psi
Time	60 min
Automation	PLC with MMI (Man-Machine interface)
Documentation/ Recording	Computerized recording

Figure 2.9 Layout of typical autoclave sterilization process



2.12 E-waste management

India has witnessed an exponential growth of electronic market over the past few years. It is estimated that e-waste occupies 2% share among all other wastes and assumed to be the fastest growing portion of the municipal solid waste streams. E-wastes generally contain base metals, rare/noble metals, glass and plastics which have a high recovery value. In majority of the cases, these activities are carried out by unauthorized/informal recyclers, where the labors are unskilled. The heavy metals and toxins released during processing not only cause considerable occupational health hazards to the workers but also deteriorate the quality of the environment.

In view of this, the MoEF&CC has taken an initiative to tackle the problem of e-waste and a new legislation was framed for management and handling of these waste. These rules came in to existence in 2011 and subsequent amendments were made in 2016. The rules are applicable to all stake holders associated with manufacturing, handling, utilizing, processing and recycling of Electrical and Electronic Equipment's (EEE) and waste items. At present, there are no large scale organized e-waste recycling facilities in India except a few. This gives us an opportunity to serve the industries by handling their e-waste. The objectives of the proposed e-waste facility are given below:

- To provide safe & secured destruction services at project site to ensure intellectual property assurance.
- To provide innovative and pollution-free technology for management of e-waste.
- To provide Environmental management system and solutions.
- To conserve natural resources and ensure working towards sustainable development.

The proposed project consists of the following:

- Fully integrated state-of-art e-waste management facility
- World class security systems
- Certified, Safe and Secured destruction services
- Comprehensive EHS practices
- Logistics, warehousing facility
- Highly skilled manpower

2.12.1 Methodology

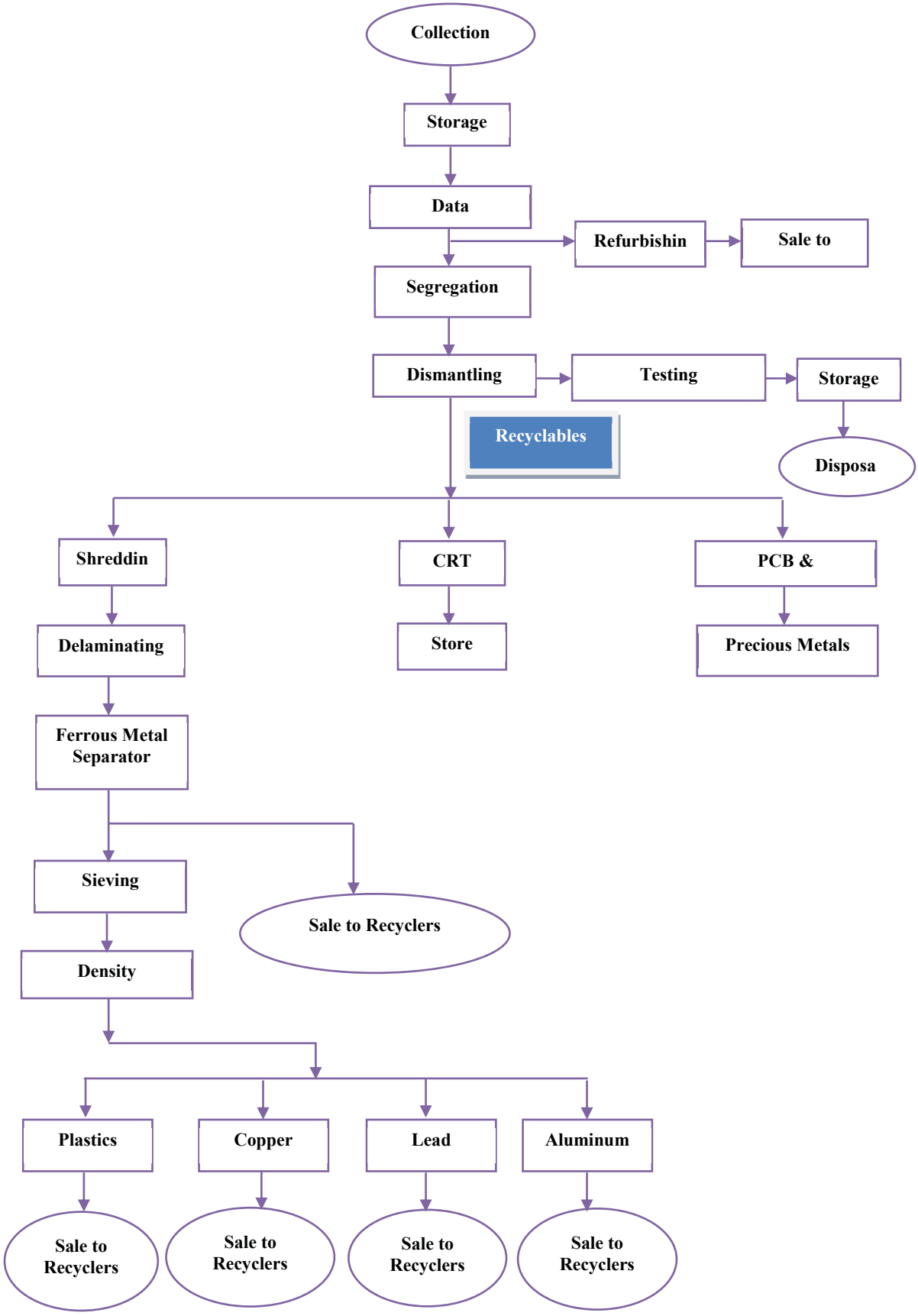
The methodology proposed to be followed at the e-waste facility is as follows:

- Upon client's request, project management shall arrange a suitable and secured transport to collect the material from his premises.
- Delivery order will be issued by the client, prior to collection from his premises. If desired, the collected material shall be weighed at client's premises using their own weighing machine and witnessed by both the parties.

2.12.2 Process description

The process involved in proposed integrated e-waste management facility is basically physical destruction and shredding to downsize. The steps of proposed process are described in following paragraphs and the process flow sheet is given in Figure 2.10.

Figure 2.10 Proposed flowchart of e-waste processing



- The transportation of e-waste shall be carried out as per the manifest system whereby the transporter shall be required to carry a document (three copies) prepared by the sender as per Form-6, EWM Rules 2016.

- Collected material has to be provided in good packaging condition and thereafter will be transported to the facility.

- After inspection by project security guard, material shall be weighed at site weighbridge to determine the gross weight of the material and will then be sent to its warehouse for acceptance.

- Goods Receive Note (GRN) for the gross weight will be issued upon receiving the material at the warehouse.

- Material will then be sent for dismantling section under IDO (Internal Delivery Order). If required, destruction process can be witnessed by client.

- Upon data destruction, official destruction certificate will be issued to client for records. Finally the dismantled material will then be sent to suitable recycling process.

- E-waste received from the generator shall be stored at earmarked covered shed having concrete floor and leak proof roof. Wooden or plastic pallets shall be provided to store the waste.

- Waste which may contain electronic and electrical material like monitors of computer or TV's, shall be shifted to manual dismantling section in hand trolleys.

- A set of 8 to 10 number of work stations are proposed with a suction hood for any dust particle coming out of the dismantling process. A team of experts in dismantling shall be deputed for dismantling purpose with all the required tools and tackles. The tools and tackles shall be identified with best available brand to ensure optimization in working and to avoid small accidents in the process. The employees at this section shall be provided with all the required PPE's i.e. apron, safety shoes, gloves, dust mask etc. Fire extinguishers shall be provided in the working area.

- The team deputed shall dismantle all the waste articles eg: Computer CPU box, hard drive, CD ROM, cables, PCB's etc. and monitors into back cover and picture tube. The hard drive, PCB's shall be further dismantled into components attached and naked PCB's.

- The dismantled PCB's shall be sent for shredding followed by crushing and pulverizing. The product shall be powder of PCB from which metal and non-metal part which shall be segregated by physical process. Both the products shall be stored in bags for disposal for recovery (metal part) and for making of toys and monuments (non-metal part). In case the non-metal part fails to be recycled, the same shall be disposed into incinerator.

- The dismantled picture tube shall be sent to Cathode Ray Tube (CRT) cutting m/c, which is a closed chamber attached with a hood connected to cyclone and bag house.

- The CRT shall be put into the control panel connected automatic CRT cutting frame. The CRT shall be cut into two pieces i.e. front glass and funnel glass.

- The glass which is free from all coating etc. shall be crushed further and stored in bags to be dispatched for recycling. The components removed from PCBs shall be segregated and stored in bags for further disposal and/or reuse.

- The ferrous material i.e. cabinet, body of monitor etc., shall be baled and disposed for recycling.

- Plastic from cabinet, monitor shall be shredded in the shredder and sold out for recycling to authorized recyclers

- As of now, the recovered metals in its crude form are exported to other countries for the precious metal refining.

- The waste generated from above process shall be stored at earmarked area and not allow the waste to be exposed to the environment.

2.13 Recycling facilities

The following types of wastes are subjected for processing/recycling/recovery by the proposed project:

- E-waste such as TV's, computers devices, Lap tops, smart phones, pen drives, hard disks etc.

- Spent Solvents such as isopropyl alcohol, butanol, toluene, ortho dichloro benzene, dimethyl formamide.(spent solvent recycling)

- Liquid and solid type incinerable waste (Alternative fuel and raw material facility)

- Waste plastic recycling & Waste paper/plastic & Mild Steel (MS) drums (MS drum recycling

The following general guidelines shall relate to daily activities associated with the operations of TSDF:

- The secured landfill facility shall operate only during day.

- The landfill will be filled progressively, cell wise and capped to minimize infiltration of wastes.

- The weigh bridge at the main entrance will record all movements and weights and receive waste tracking receipt as required by the waste manifest system.

- The standpipe forming part of the leachate collection system shall be checked regularly for the presence of leachate. Once leachate is detected, it shall be regularly pumped out and transferred to the leachate treatment facility on-site. The level of leachate in the standpipe shall not be allowed to rise above the level of the leachate collection system.

- Materials Safety Data Sheets (MSDS) for every chemical used or handled at the landfill shall be provided at the premises. Monitoring and auditing of the facility shall be performed periodically as per CFE issued by CPCB. Met-station shall be installed with continuous recording system.

- A security system shall be maintained to avoid trespassing of public.

- Once waste is received at the TSDF, a sample of waste shall be collected at the sampling bay/temporary storage facility and shall be subjected to laboratory analysis based on which its pathway of treatment/ disposal shall be determined.

- A waste manifest system shall be developed in accordance with the requirement of the regulatory agencies to cover transportation of waste to TSDF and to provide for record of waste manifestation. The manifest system shall include details of the waste generator, waste transporter, quantity of waste, characteristics of waste, description, consistency of waste in terms of physical state and waste category number as per HW (M&H) Rules, 2016 and subsequent amendments.

- Each load of waste arriving at the facility shall be located properly and logged to identify its pathway of treatment/ storage/ disposal.

- An inventory shall be maintained at the arrival and departure dates of waste loads in and out of the intractable waste storage area.

2.13.1 Spent solvent recovery

Spent solvents are recovered using a distillation methodology. A few solvents proposed to be separated /distilled initially are: Isopropyl alcohol, Butanol, Dimethyl formamide, Toluene and Ortho dichlorobenzene.

2.13.1.1 Storage of spent solvents

- The waste solvent shall be received in drums (MS/Plastic) and shall be stored in shed which will be provided with garland drain, fire hydrant system, lined floor etc.

- The drums shall be stacked as per the best practices. The leakages shall be avoided at any point of time.

- A separate storage shed is proposed adjacent to facility to store the solvent drums.

- The stacking of drums shall be in the manner that mixing of solvent drums shall be avoided at maximum extent.

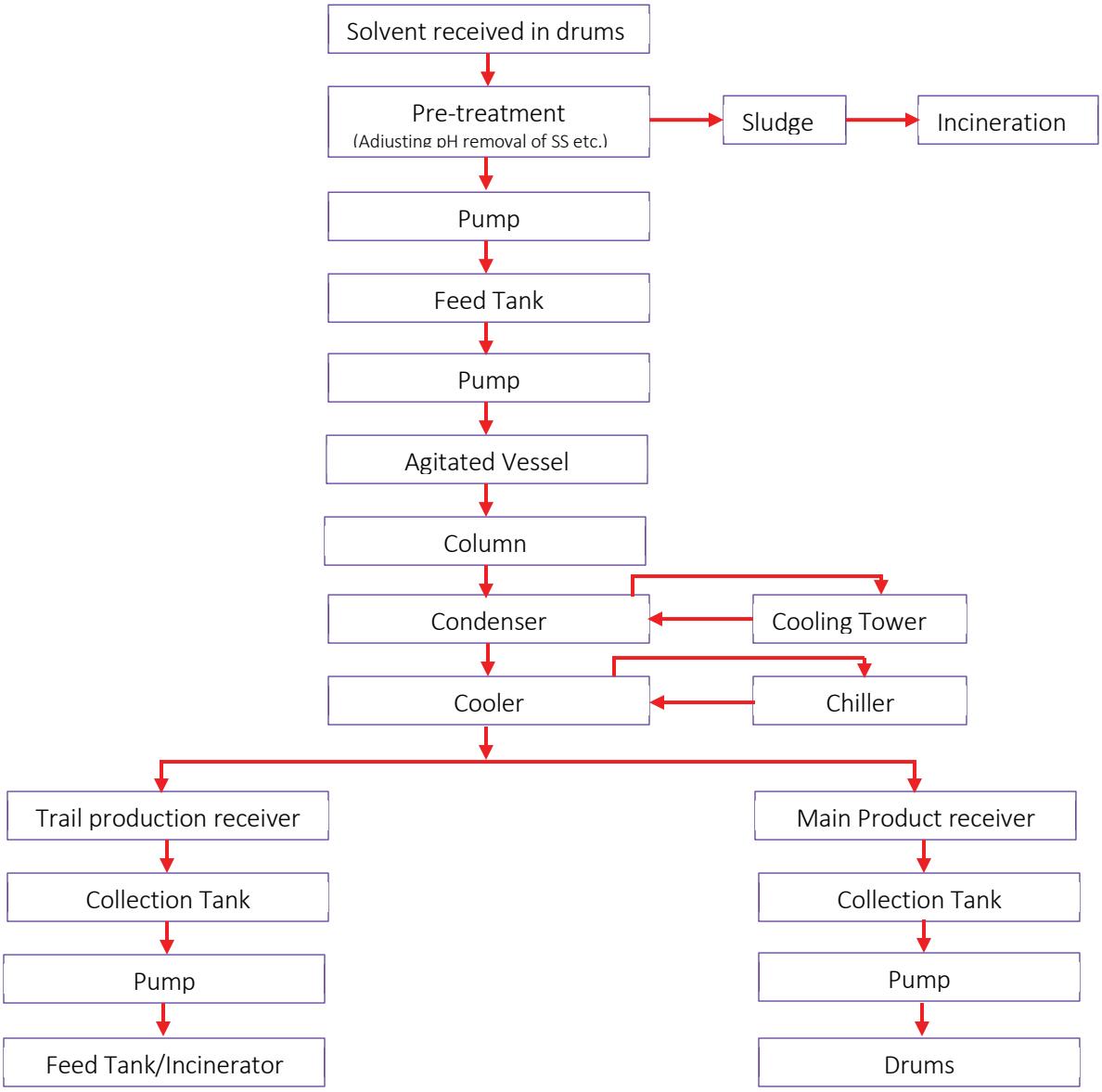
2.13.1.2 Process description

Distillation process is the most suitable for the recovery of most of the spent solvents which can be either a batch or continuous operation. However, it is proposed to adopt batch process in the proposed facility. The process involves pre-treatment, followed by neutralization and separation of spent solvent feed mixture in a reactor. After layer separation, the spent solvent mixture will be sent to distillation connected to distillation column.

The solvent mixture is heated by steam and the distillation column will be under total reflux for a specific period. Fractionation of solvent takes place and solvent / water as the case may be are separated initially under atmospheric pressure and later under vacuum (if required).

Distilled solvents are analyzed, stored and recycled, liquid effluent which is mostly condensate will be recycled back into system and solid residue sent for incineration / landfill. Steam for heating will be from the boiler. Flow chart for Spent Solvent recovery is shown in Figure 2.11.

Figure 2.11 Flow chart of spent solvent recovery



2.13.2 Alternative fuel and raw material facility

The disposal of hazardous waste creates major economic and environmental problems. The ideal way of handling and disposal of hazardous waste is to look for options such as reuse, recycle/recovery. In line with this concept, utilization of hazardous waste as a fuel or raw material in the manufacture of cement is one of the best options. Central Pollution Control Board (CPCB) in the year 2010, issued "Guidelines on Co processing in Cement/Power/Steel Industry" to encourage utilization of selected hazardous waste in cement kilns as a fuel or raw material while protecting the environment from the control of emissions and without impacting the quality of cement.

2.13.2.1 Wastes Handling in AFRF

A careful approach is desired in view of the hazardous nature of the substances that are handled in the process such as:

i. Selection of right materials
ii. Transportation of waste

iii. On-site storage
iv. Handling and disposal
v. Emission control
vi. Compliance, health and safety management

The hazardous wastes for co-processing need to be handled in an environmentally sound manner avoiding the possibilities of contaminating the nearby environment and eliminate the chances of accidents. CPCB has identified and prescribed suitable wastes for co-processing in cement kilns.

2.13.2.2 Categories of wastes handled

Alternative fuel platforms will be developed within the site as below:

"S" Type Alternative fuel preparation facility	"L" Type Alternative fuel preparation Facility

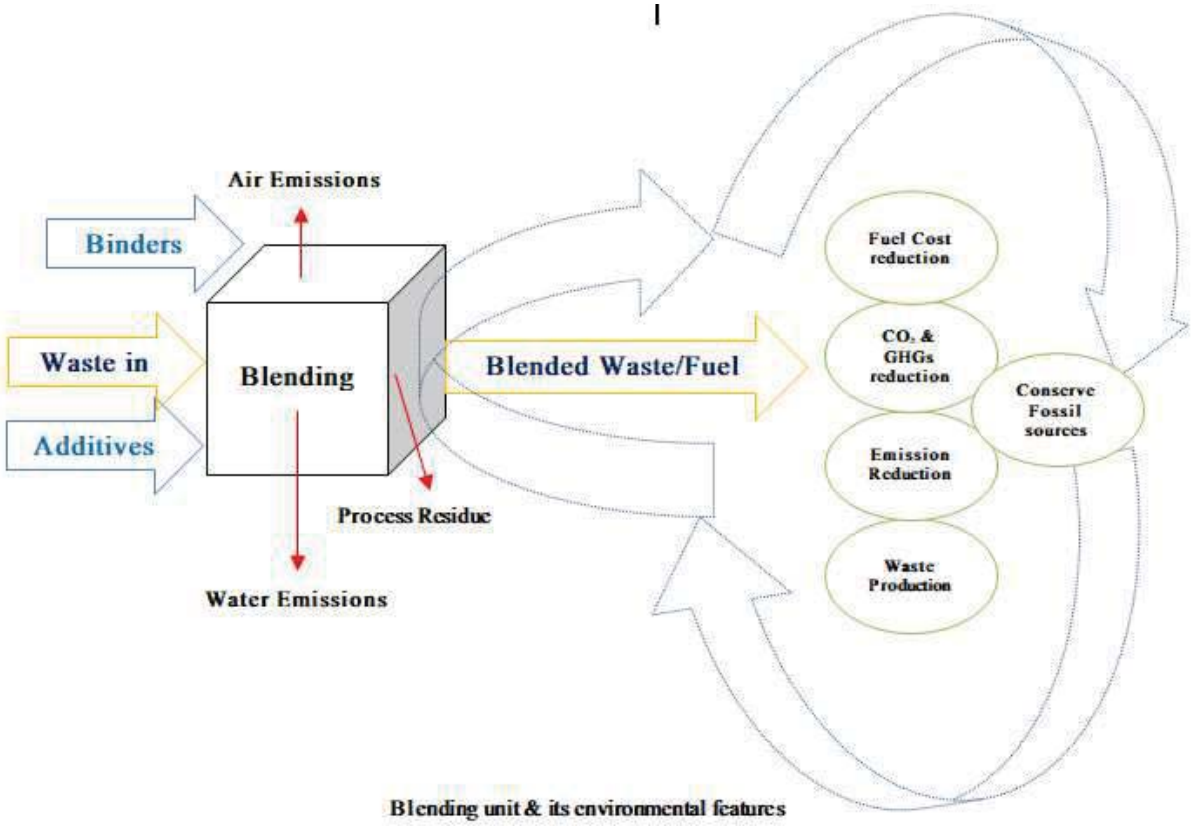
- L - Type Alternative Fuels Area
  'L' type alternative fuels are basically liquid type incinerable waste which are >2500 Kcal. Common neutralization tank to maintain pH level 7; 25KL mixing tank with cooling coil and external jacket to control the heat for exothermic liquid waste; 25 KL mixing tank for the non-exothermic liquid waste; Agitator set up made by stainless steel Pump.

- S - Type Alternative Fuels Area:
  'S' type alternative fuels are basically solid type incinerable waste which are >2500 Kcal Common neutralization tank to maintain pH level 7; Mixing pit of 5 x 5 m; Jaw mixer for premixing of the solid and semisolid Waste.

Solid blend is prepared through mixing in an appropriate quantity of solid/ semi solid waste with binders. The first step of preparing solid blend is to selection of waste. The segregation of waste according to their pH & calorific value helps in it. Source materials for solid substitute fuel include paint sludge, oily filter cake, spent carbon, organic waste, tarry waste, biomass, resin, distillation residues, grease, ETP sludge, and alumina sludge etc.

Assortment of waste is done according blending norms. A general waste selection criteria for high calorific value fuel is Low moisture content, high LOI & TOC, High calorific value, good compressibility, less ash content, non-toxic, less pollutant, sustainable combustion. Schematic diagram for the alternative fuel recovery is shown in Figure 2.12.

Figure 2.12 Alternative fuels and raw material facility



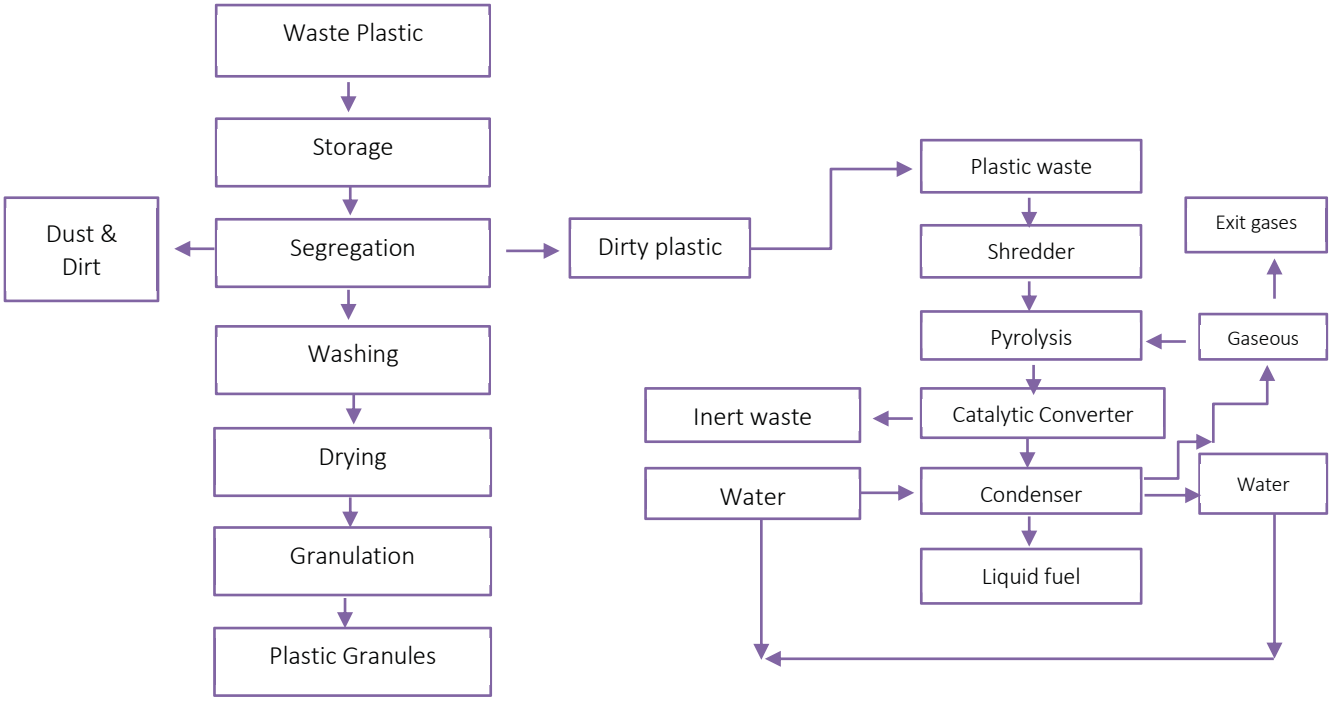
Blending unit & its environmental features

2.13.3 Waste plastic recycling

A plastic recycling plant uses several steps to turn plastic trash into recycled plastic. The process flow sheet of waste plastic recycling is given in Figure 2.13. Following is a brief explanation of recycling.

- Segregation: The plastic shall be segregated manually into two major components i.e. dirty plastic not suitable for granulation and plastic can be used for granulation.
- Mechanized Cleaning: Mechanized cleaning is done with some cleaning agents to remove any types of hazardous substances in the drum. The cleaned drums can be re-used or further processing based on the requirement.
- Chopping: The washed drums are chopped into flakes for further processing.
- Drying: The plastic flakes are dried in a tumble dryer.
- Melting: The dried flakes are fed into an extruder, where heat and pressure melt the plastic. Different types of plastics melt at different temperatures.
- Filtering: The molten plastic is forced through a fine screen to remove any contaminants that slipped through the washing process. The molten plastic is then formed into strands.
- Pelletizing: The strands are cooled in water and chopped into uniform pellets. Manufacturing companies buy them from recyclers to make new products.

Figure 2.13 Process flow sheet of plastic recycling



2.13.4 Waste paper recycling

Waste paper recycling is the process of recovering waste paper and remaking it into new paper products. There are three categories of paper that can be used as feedstock for making recycled paper:

- Mill broke: Paper trimmings and other paper scrap from the manufacture of paper, and is recycled internally in a paper mill.
- Pre-consumer waste: Material which left the paper mill but discarded before it was ready for consumer use.
- Post-consumer waste: Post-consumer waste are the material discarded after consumer use such as old magazines, old newspaper, office wastes, old telephone directories, residential mixed paper, industrial packaging, waste multi-wall cement paper bags.

Processing of waste paper for recycling

Waste paper recycling facility focuses on recovering waste paper and sending to paper manufacturing industry. It is proposed to carryout waste paper processing in the following steps:

- Waste Paper Collection: Collection of waste paper material shall be done through special color coded recycling bins (segregated directly at generator's premises). However, at some locations all kinds of papers may be collected in a single bin.
- Manual Segregation: The waste paper (newspaper, office stationary, packaging paper, card boards) collected is segregated according to variety/thickness of paper.

- **Compaction and Baling:** The waste paper is manually fed to the Baling press. It is Equipment which utilizes Hydraulic pressure on the loose paper in an enclosed chamber to compact them into Bales. The bale weight can be varied from 40 – 60 kg, making them very convenient to handle manually.

- **Transportation:** Transportation of bales to paper mills and other paper related product manufacturing units.

The schematic of waste paper recycling is given in **Figure 2.14.**

Figure 2.14 Schematic diagram of waste paper recycling



2.13.5 MS (Mild Steel) drums recycling

Different types of used MS drums in various industries and commercial establishments after reaching their end life will be cleaned for any waste present and segregated as per the type of the material, cut into small pieces and sent for further recycling process for making end use products. Recycling of various scrap materials helps in reducing the consumption of fresh raw materials and prevents excess consumption of power and energy.

Metal recovery process

- Collection of metal drums
- Cleaning of the drums
- Shredding
- Baling
- Storage of baled material
- If the waste is opaque, the drums with waste shall be pyrolysed.
- Selling it for further processing.

Chapter 3
Description of Baseline Environment

3.1 Introduction

Baseline environmental status in and around the proposed project depicts the existing environmental conditions of air, water, noise, soil, biological and socio-economic environment. With proposed project as the center, a radial distance of 10 km is considered as 'study area' for baseline data collection. Baseline data was collected for various environmental attributes so as to compute the impacts that are likely to arise due to proposed developmental activity.

The main aim of the impact assessment study is to find out the impact of the project on the environment. This study is carried out during the expansion project planning stage itself, so that the proponent can implement the project in a technically, financially and environmentally sustainable.

The success of any impact assessment study depends mainly on two factors. First is estimation of impact from proposed project on the environment and the second is assessment of the environmental condition. Both are key factors to arrive at the post project scenario. The estimated impact due to the proposal can be superimposed over the existing conditions to arrive at the post project scenario.

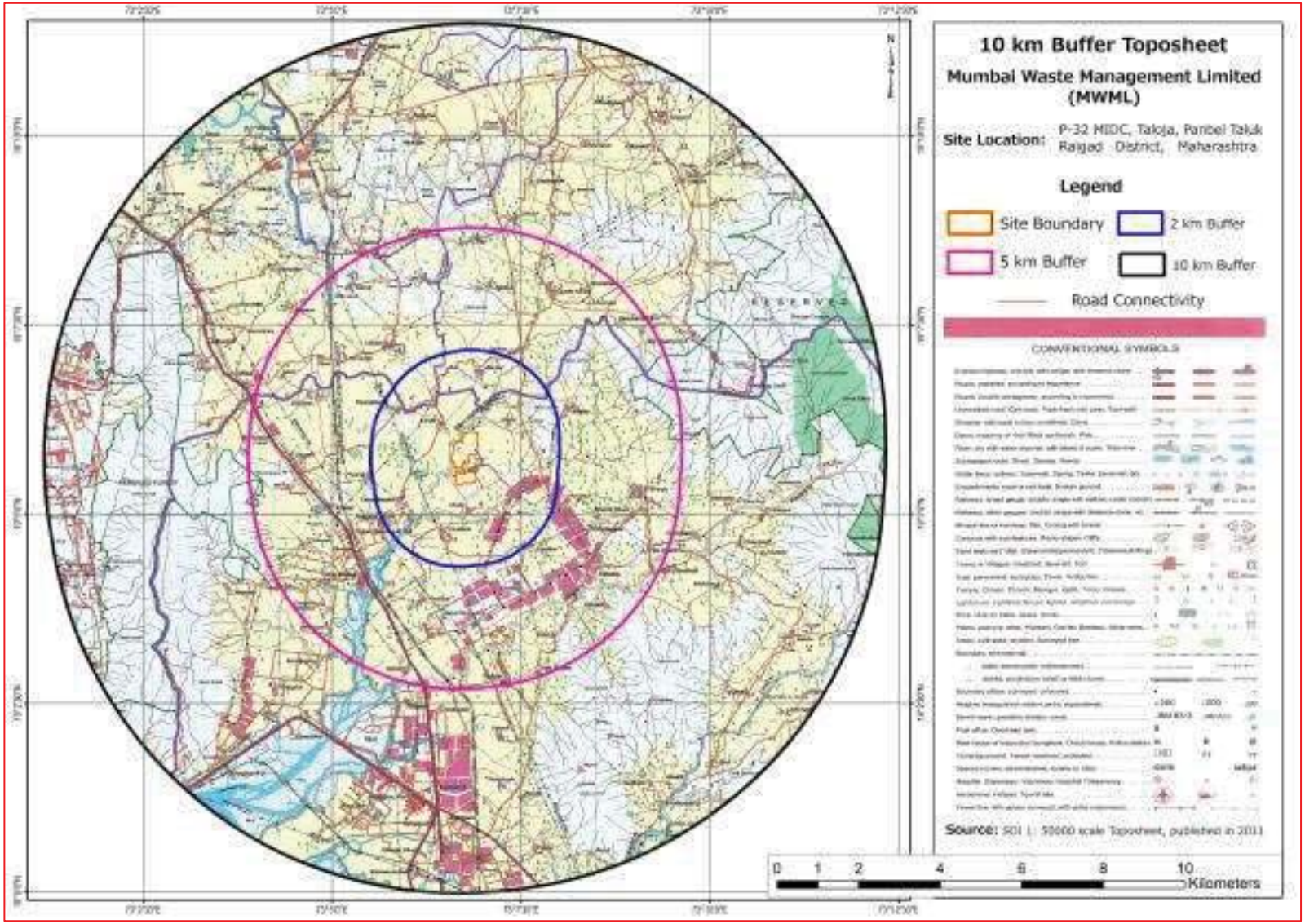
3.2 Study period and methodology

The baseline study was conducted during the Post-monsoon period **(September to November of 2018)**. The map for the study area is given in **Figure 3.1.** The methodology used for sample collection and analysis is described in **Table 3.1.**

A meteorological station was setup in Taloja. Wind speed, wind direction, ambient temperatures, relative humidity and general weather conditions were recorded throughout the study period in an automated data logger. In order to assess the Ambient Air Quality (AAQ), samples of ambient air were collected by installation of Respirable Dust Sampler & Fine Particulate Sampler at different locations in the study area during study period and analysed for primary air pollutants to work out the existing status of air quality.

The ground water samples collected were analysed to determine water quality based on standards of IS 10500:2012 for drinking water, while surface water collected from available existing surface water bodies like rivers and ponds in the buffer zone. The surface water samples were analysed for parameters necessary to determine water quality based on standards of IS: 2296:1982 (Class A, B, C, D or E) for surface water, particularly for parameters relevant from the point of view of environmental impact of the proposed expansion site. Soil samples were collected and analysed for relevant physical and chemical characteristics in order to assess the impact of the proposed expansion project on soil. The noise level measurements were also made at various locations in different intervals of time with the help of sound level meter to establish the baseline noise levels in the impact zone. Socio-economic data was collected from field studies and secondary sources like Census of India 2011, BPL Lists, Revenue Department data, etc.

Figure 3.1 Topographical map of the study area



655

Table 3.1 Methodology for sample collection and analysis

S. No.	Component	Frequency of sampling	No. of Locations	Parameters	Instrument	Method	Secondary sources/References
1	Meteorology	Continuous for whole season on hourly basis (Sep, Oct & Nov - 2018)	1	Temp., Humidity, Rainfall, wind speed & direction	Automatic weather monitoring machine with data logger	-	30- Years IMD data from Climatological Tables (1981-2010)
2	Ambient Air Quality	24 hourly samples twice a week for 3 months	10	PM10	Respirable dust sampler (APM 460 BL) with gas attachment	Gravimetric	-
				PM2.5		-	
				SO2		West & Gaek	
				NOx		Jacobs & Hochheiser	
				O3			
3	Noise Levels	Once each in study period	10	-	Integrated sound level meter	Measurements were taken by following CPCB procedure	-
4	Water Quality	Once each in study period	10 GW 5 SW	Physical, Chemical, heavy metals & Biological	Spectro-photometer AAS Flame Photometer	Titrimetric, Gravimetric Photometric AAS	APHA IS 10500: GW IS 2296: SW
5	Soil Quality	Once each in study period	10	Soil Classification	Kjeldal Nitrogen, pH meter, conductivity meter, hydrometer	Gravimetric, Photometric	Agricultural Hand book
6	Ecology	Once in study period	Study area	Flora & Fauna	-	Quadrant	Forest Working Plan
7	Socioeconomic	Once in study period	Core zone & buffer zone	Demographic, social, economic & infrastructure	Survey schedule	Village level survey, self-help group & Group discussion	Census of India 2011, BPL list, Revenue dept. data.
Source: On-site monitoring/sampling							

656

3.3 Meteorological condition

The study of meteorological conditions forms an intrinsic part of the environment impact assessment study. The meteorological conditions of an area and the industrial process are both intertwined and each has a definite influence over the other. Favorable weather conditions and the surroundings help the successful operation of an industry, while the industrial activity influences the weather in both positive as well as negative ways.

Dispersion of different air pollutants released in to the atmosphere has significant impacts on neighborhood air environment. The dispersion/dilution of the released pollutant over a large area will result in considerable reduction of the concentration of a pollutant. The dispersion in turn depends on the weather conditions like the wind speed, direction, temperature, relative humidity, mixing height, cloud cover and also the rainfall in the area.

3.3.1 Climate condition - 30 Years IMD data (1981-2010)

Regional meteorological scenario helps to understand the climatic factors. It also helps in determining the sampling stations in predicting the post project environmental scenario. Meteorological scenario exerts a critical influence on Air Quality as the pollution arises from the interaction of atmospheric contaminants with adverse meteorological conditions such as temperature inversions, atmospheric stability and topographical features like hills, canyons and valleys. The climatological data of the study area is based on recently published long-term climatological tables (1981 – 2010) by IMD, for Mumbai – Colaba (Station ID: 43057).

The observatory is situated at the regional meteorological centre at Colaba almost at the extreme south end of the narrow ridge of the land extending about 5 km to the southwest of the fort of Bombay and separating the harbour from the Back Bay. The Temperature, Humidity, Rainfall and wind speed as per IMD, Mumbai - Colaba climatologically Tables shown in **Table 3.2.**

Table 3.2 Climatology and meteorology of the region

IMD Station Mumbai - Colaba: Lat:18^0 54' N & Lon: 72^0 49' E, MSL 11 m, Distance from site 28 Km W.										
Month	Temperature °C				Humidity %		Rainfall		Mean Wind speed (m/s)	1st pre dominant direction
	Mean Min	Mean Max	Lowest	Highest	Min	Max	Monthly mm	No of rainy days		
Jan	19.3	30.2	16.0	34.4	62	78	0.9	0.1	1.3	NW
Feb	20.2	30.2	17.1	34.9	62	76	0.2	0.0	1.5	NW
Mar	22.7	31.5	20.0	35.8	63	78	0.4	0.1	1.6	NW
Apr	25.0	32.7	22.9	35.1	66	77	0.5	0.1	1.6	NW
May	27.1	33.8	25.0	35.4	68	76	20.2	0.7	1.7	NW
Jun	26.5	32.2	23.3	35.0	77	83	530.2	13.8	2.1	W
Jul	25.4	30.0	23.3	32.1	85	89	711.6	21.2	2.5	W
Aug	25.1	29.7	23.3	31.7	84	89	493.8	19.7	2.4	W
Sep	25.0	30.6	23.1	32.7	80	89	330.4	13.4	1.4	W
Oct	24.8	33.0	22.8	36.4	72	84	78.4	3.4	1.2	NW
Nov	23.2	33.5	20.7	36.3	65	78	14.9	0.5	1.2	NW
Dec	20.9	32.2	17.7	35.3	63	77	2.6	0.1	1.2	NW
Source: GOI, Ministry of Earth Sciences, IMD, Climatological Tables 1981-2010										

3.3.2 Site specific meteorology

Baseline meteorological data has been collected hourly by installing meteorological station at roof top of existing building within the project site. The data collected during Post-monsoon season are presented in **Table 3.3.**

Table 3.3 Summary of the site specific meteorological data

Period	Temp (^{o}C)		Relative Humidity (%)		Predominant wind Direction
	Min	Max	Min	Max	
Sep-18	27.1	32.5	64	78	W
Oct-18	25.1	36.5	31	76	NW
Nov-18	24.1	33.7	59	89	NW

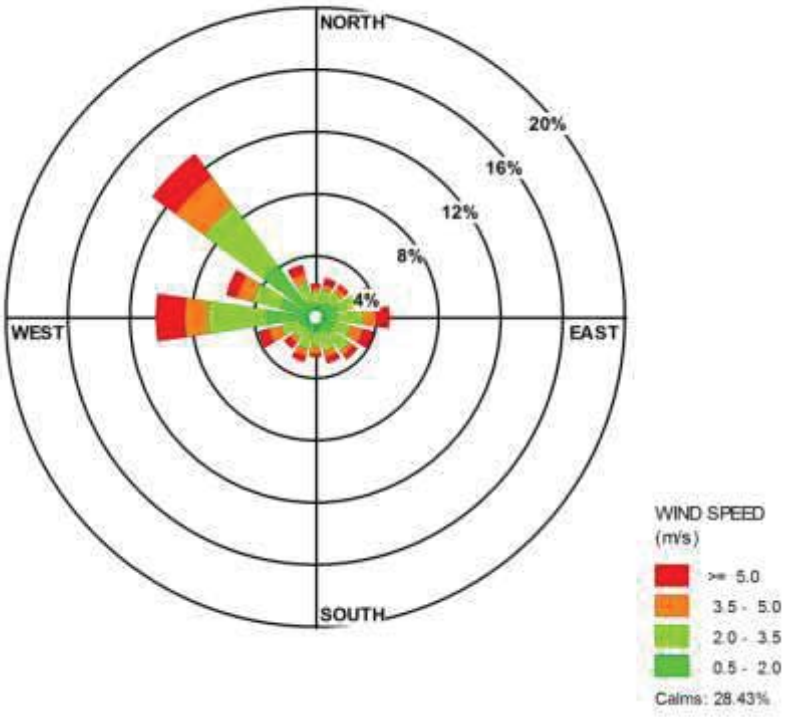
The minimum & maximum temperature recorded is 24.1^{0}C & 36.5^{0}C whereas relative humidity was 31% to 89%. The average wind-speed was found 1.98 m/sec. The wind rose diagram (Frequency distribution) of Post monsoon season is given in **Table 3.4 & Figure 3.2.** The predominant wind direction observed during the study period was mainly N followed by W & SW.

Table 3.4 Frequency distribution table for post monsoon season (Sep 2018 to Nov 2018)

Wind directions	Wind classes (m/s)				Total
	0.5 - 2.0	2.0 - 3.5	3.5 - 5.0	> 5.0	
N	0.64	1.05	0.27	0.23	2.20
NNE	0.92	0.96	0.37	0.41	2.66
NE	1.28	0.78	0.37	0.27	2.70
ENE	1.56	1.33	0.46	0.46	3.80
E	1.37	1.74	0.87	0.82	4.81
ESE	1.33	1.05	0.82	0.73	3.94
SE	1.37	1.37	0.37	0.32	3.43
SSE	0.96	1.33	0.46	0.37	3.11
S	1.01	0.87	0.55	0.18	2.61
SSW	0.96	1.19	0.50	0.37	3.02
SW	0.92	0.82	0.37	0.46	2.56
WSW	1.10	1.24	0.82	0.69	3.85
W	3.16	3.75	1.56	1.83	10.3
WNW	2.34	1.83	1.10	0.69	5.95
NW	4.17	4.72	2.38	1.83	13.1
NNW	1.01	1.33	0.64	0.55	3.53
Sub-Total	24.08	25.37	11.9	10.21	71.57
				Calms (<0.5 m/s)	28.43
				Total	100

Note: 1. Average wind speed is 1.98 m/s
2. All values are in percentages

Figure 3.2 Onsite wind-roses for post monsoon season (Sep to Nov 2018)



3.4 Air environment

The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality network. The design of monitoring network in the air quality surveillance program has been based on the following considerations.

- Meteorological conditions on a synoptic scale
- Topography of the study area
- Representation of the regional background levels
- Representation of the plant site
- Influence of the existing sources
- Major settlements in the study area

Ambient air quality monitoring stations were set up for 10 different locations with consideration in the above mentioned points. The locations were selected in downwind, cross wind and up wind of the proposed project. The details of monitoring stations is given **Table 3.5** and air quality monitoring location on base map is represented in **Figure 3.3**.The common air pollutants namely Particulate matter (PM10 & PM2.5), Sulphur dioxide (SO2), the oxides of nitrogen (NOX), Carbon Monoxide (CO), Ammonia (NH3) and Ozone (O3) were sampled (2 days/week during study period) on 8/24 hourly and results were averaged to 24 hours to meet the requirements of the MoEF and compared with the standards stipulated by CPCB.

Table 3.5 Air quality monitoring stations

		W.R.T. Site			
Code	Monitoring Locations	Wind Type	Distance (km)	Direction	Remarks
A1	Site	--	--	--	
A2	Tondhre	Cross wind	1.1	S	
A3	Vaklan	Up wind	2.7	NW	
A4	Kelpada	Down wind	3.3	SE	
A5	Dhame	Up wind	3.5	W	
A6	Varanje	Down wind	3.6	E	
A7	Narhen	Cross wind	3.6	N	
A8	Bandhanwadi	Cross wind	4.4	NE	
A9	Kharpada	Cross wind	5.4	S	
A10	Chandna	Down wind	6.6	SE	

3.3.1 Analysis of baseline concentrations

The analysis was carried out as per the method described in the applicable IS codes and the results of the analysis has been summarized in Table 3.6.

Figure 3.3 AAQ monitoring locations

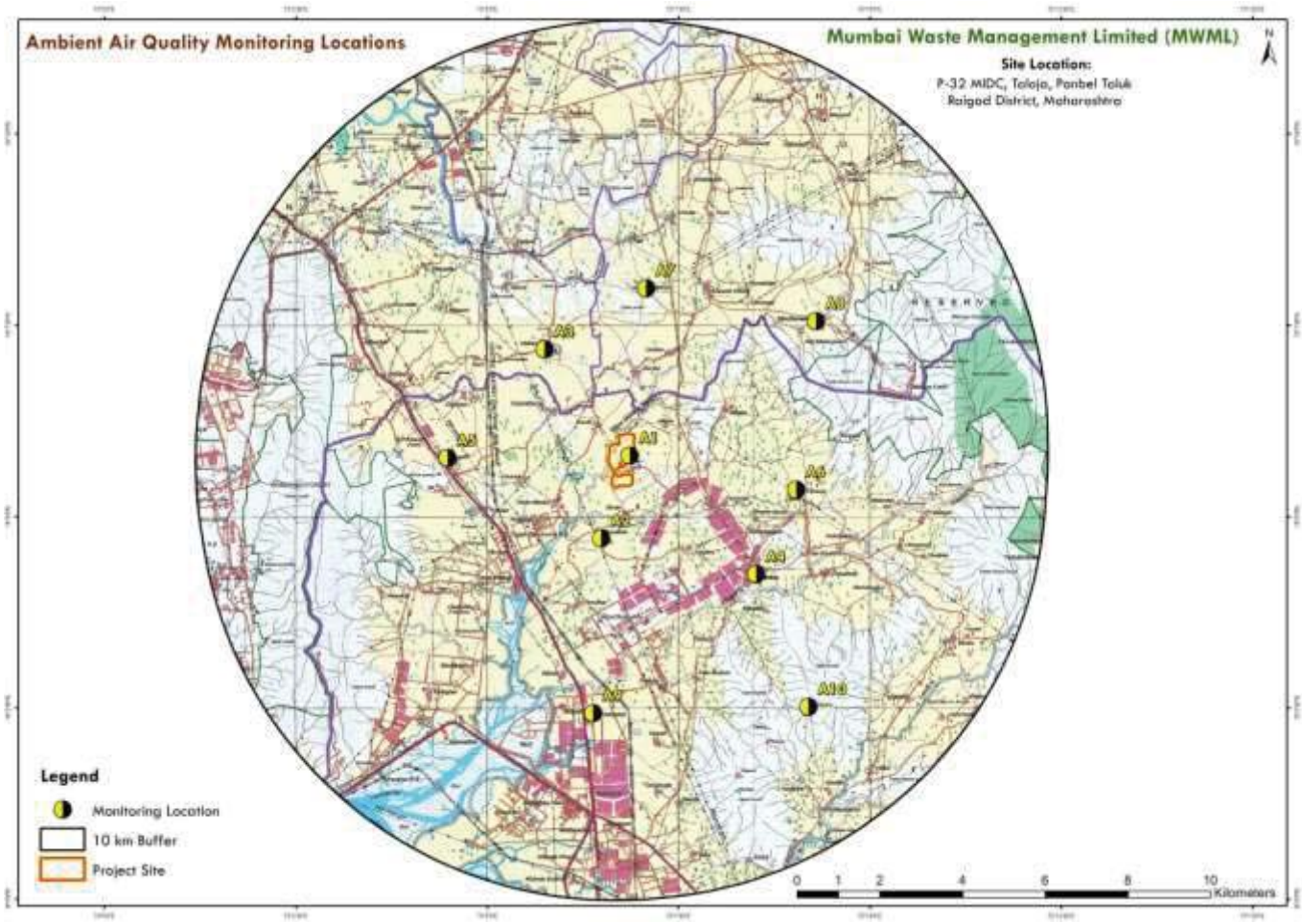


Table 3.6 Ambient air quality levels in the study area

Location	PM-10, µg/m^3			PM-2.5 µg/m^3		
	Min	Max	98th Percentile	Min	Max	98th Percentile
Site	62.3	68.9	68.9	35.6	45.9	45.9
Tondhre	63.2	72.1	72.1	39.6	48.9	48.9
Vaklan	52.2	60.9	60.9	30.4	37.8	37.8
Kelpada	66.2	75.1	75.1	43.1	51.2	51.2
Dhame	58.9	67.5	67.5	35.8	44.4	44.4
Varanje	57.8	62.9	62.9	34.7	39.8	39.8
Narhen	59.9	65.4	65.4	36.8	41.9	41.9
Bandhanwadi	49.0	58.1	58.1	28.3	34.1	34.1
Kharpada	62.1	68.6	68.6	39.0	45.5	45.5
Chandna	60.1	65.9	65.9	36.6	42.8	42.8
98 Percentile	58.1 to 75.1			34.1 to 51.2		
NAAQ Standards 2009 (24 hr)	100			60		

Location	SO2, µg/m^3			NOx µg/m^3		
	Min	Max	98th Percentile	Min	Max	98th Percentile
Site	15.2	18.8	18.8	21.3	26.6	26.6
Tondhre	14.4	17.5	17.5	22.3	25.5	25.5
Vaklan	9.4	12.9	12.9	19.6	23.1	23.1
Kelpada	14.2	16.6	16.6	24.4	27.5	27.5
Dhame	10.2	13.8	13.8	21.5	23.9	23.9
Varanje	9.8	14.6	14.6	22.3	24.8	24.8
Narhen	10.8	13.2	13.2	21.1	25.2	25.2
Bandhanwadi	8.7	11.6	11.6	18.9	21.8	21.8
Kharpada	12.6	15.7	15.7	22.8	25.9	25.9
Chandna	10.1	12.8	12.8	20.3	24.1	24.1
98 Percentile	11.6 to 18.8			21.8 to 27.5		
NAAQ Standards 2009 (24 hr)	80			80		

Location	O3, µg/m^3			CO µg/m^3			NH_3		
	Min	Max	98th Per'ile	Min	Max	98th Per'ile	Min	Max	98th Per'ile
Site	14.2	18.2	18.2	430	515	515	24.3	32.4	32.4
Tondhre	15.5	20.9	20.9	460	560	560	23.4	28.6	28.6
Vaklan	12.3	16.5	16.5	440	505	505	20.5	25.6	25.6
Kelpada	17.6	21.2	21.2	465	570	570	25.8	30.4	30.4
Dhame	12.9	16.0	16.0	390	470	470	18.5	24.3	24.3
Varanje	14.1	17.1	17.1	390	485	485	16.4	22.3	22.3
Narhen	15.8	19.4	19.4	410	510	510	17.8	23.4	23.4
Bandhanwadi	10.9	14.4	14.4	370	495	495	15.2	20.2	20.2
Kharpada	15.6	19.6	19.6	440	540	540	19.4	24.5	24.5
Chandna	13.3	16.3	16.3	395	475	475	18.5	23.3	23.3
98 Percentile	14.4 to 21.2			470 to 570			20.2 to 30.4		
NAAQ Standards 2009 (8 hr/24 hr)	100			2000			400		

Table 3.6a Air quality index base level air quality

Pollutant	Site		Tondhre		Vaklan		Kelpada		Dhame	
	Concentration	Sub Index	Concentration	Sub Index	Concentration	Sub Index	Concentration	Sub Index	Concentration	Sub Index
PM10	68.9	69	72.1	72	60.9	61	75.1	75	67.5	68
PM2.5	45.9	77	48.9	82	37.8	63	51.2	85	44.4	74
SO2	18.8	24	17.5	22	12.9	16	16.6	21	13.8	17
Nox	26.6	33	25.5	32	23.1	29	27.5	34	23.9	30
CO (mg/m3)	0.52	26	0.56	28	0.51	26	0.57	29	0.47	24
O3	18.2	18	20.9	21	16.5	17	21.2	21	16	16
NH_3	32.4	8	28.6	7	25.6	6	30.4	8	24.3	6
AQI	77		82		63		85		74	

Pollutant	Varanje		Narhen		Bandhanwadi		Kharpada		Chandna	
	Concentration	Sub Index	Concentration	Sub Index	Concentration	Sub Index	Concentration	Sub Index	Concentration	Sub Index
PM10	62.9	63	65.4	65	58.1	58	68.6	69	65.9	66
PM2.5	39.8	66	41.9	70	34.1	57	45.5	76	42.8	71
SO_2	14.6	18	13.2	17	11.6	15	15.7	20	12.8	16
NOx	24.8	31	25.2	32	21.8	27	25.9	32	24.1	30
CO (mg/m3)	0.49	25	0.51	26	0.50	25	0.54	27	0.47	24
O_3	17.1	17	19.4	19	14.4	14	19.6	20	16.3	16
NH_3	22.3	6	23.4	6	20.2	5	24.5	6	23.3	6
AQI	66		70		58		76		71	

Category AQI: Good (0–50) – Minimal Impact; **Satisfactory (51-100)** – Minor breathing discomfort to sensitive people; **Moderate (101-200)** – Breathing discomfort to the people with lung, heart disease, children and older adults; **Poor (201-300)** – Breathing discomfort to people on prolonged exposure; **Very Poor (301-400)** – Respiratory illness to the people on prolonged exposure; **Severe (>401)** – Respiratory effects even on healthy people.

1. Particulate matter: 2.5µm & 10µm

Particulate Matter (PM) is the term used for a mixture of solid particles and liquid droplets suspended in the air. These particles originate from a variety of sources, such as power plants, industrial processes, and diesel trucks. They are formed in the atmosphere by transformation and gaseous emissions. Their chemical and physical compositions depend on location, time of year and weather. Particulate Matter is composed of both coarse and fine particles. Coarse particles (PM_{10}) are formed by mechanical disruption (e.g. crushing, grinding, and abrasion of surfaces) evaporation of space and suspension of dust.PM_{10} is composed of alumina silicate and other oxides of crustal elements. Major sources include fugitive from roads, industry, agriculture, construction and demolition and Fly ash from fossil fuel combustion. The life time of PM_{10} is from minutes to hours and the travel distance varies from <1Km to 10Km.

Fine particles have an aerodynamic diameter less than 2.5µm ($PM_{2.5}$). They differ from PM_{10} in origin & chemistry. These particles are formed from gas and condensation of high temperature vapors during combustion; they are composed of various combinations of Sulphate compounds, Nitrate compounds, and Carbon compounds ,Ammonium, Hydrogen ion, Organic compounds, Metals (Pb,Cd,V,Ni,Cu.Zn,Mn and Fe) and Particle bound water. The major sources of $PM_{2.5}$ are fossil fuel combustion, vegetation burning, smelting & processing of metals. Their life time is from days to weeks & travel distance ranges from hundreds to thousands Km.

The 98^{th} percentile of Particulate Matter <2.5µm recorded with in the study area were in the range of 34.1 to 51.2 µg/m^3. The 98^{th} Percentile of Particulate Matter<10µm recorded with in the study area were in the range of 58.1 to 75.1 µg/m^3. The 24 hourly average values of Particulate Matter <2.5µm & Particulate Matter <10µm were compared with national ambient air quality standards and found that all sampling locations recorded values within the applicable limits of residential and rural area limits for all locations in the study area.

2. Sulphur dioxide

Sulphur dioxide gas is an inorganic gaseous pollutant. Sulphur dioxide emissions are expected to emit wherever combustions of any fuel containing sulphur takes place .the sulphur in the fuel will combine with oxygen to form sulphur dioxide. Sulphur trioxide and Sulphuric acid mist are the other important pollutants in the sulphur group. In general some of the important sources of sulphur dioxide are power stations, sulphuric acid plants, oil refining, boilers in the utilities in any industry and domestic use of coal. The following sources of sulphur dioxide in the study area identified:

- Emissions from domestic fuel (coal, diesel etc)
- Emissions from DG sets used by industries and local residents

Sulphur dioxide in the atmosphere is significant because of its toxicity. Sulphur dioxide is capable of producing illness and lung injury. Further it can combine with water in the air to form toxic acid aerosols that can corrode metal surfaces, fabrics and the leaves of plants. Sulphur dioxide is irritating to the eyes and respiratory system. Excessive exposure to sulphur dioxide causes Bronchial asthma and other related diseases as it affects the lungs. The 98th Percentile of SO_2 recorded within the study

area was in the range of 11.6 µg/m^3 to 18.8 µg/m^3. The 98th percentile values of SO_2 were compared with the national ambient air quality standards and it was found that all sampling locations recorded values much lower than the applicable limit to 80 µg/m^3 for industrial, residential and rural areas.

3. Oxides of Nitrogen

Oxides of Nitrogen are also an inorganic gaseous pollutant like Sulphur dioxide. Oxides of Nitrogen emissions are expected to be emitted wherever combustion at high temperatures takes place. Nitrous oxide and Nitric acid mist are the other important pollutants in the inorganic nitrogen group. In general some of the important sources of Oxides Nitrogen are boilers (Utilities) in any industry and Auto exhaust. In a metropolitan town NO_x levels are predominantly due to automobile emissions. The following sources of Oxides of Nitrogen in the study area are identified:

- Emissions from industrial and domestic burning of coal
- Emissions from automobiles

Oxides of Nitrogen have far greater significance in photochemical smog reaction than any of the other inorganic gaseous contaminants. NO_x in the presence of sun light will undergo reactions with a number of organic compounds to produce all the effects associated with photochemical smog. NO_x has inherent ability to produce deleterious effects by themselves like toxicity. It acts as asphyxiate when in concentrations great enough to reduce the normal oxygen supply from the air.

The 98th Percentile of NO_x recorded within the study area was in the range of 21.8 µg/m^3 to 27.5 µg/m^3. The 24 hourly average values of NO_x were compared with national ambient air quality standards and it was found that all the sampling locations recorded values much lower than the applicable limit of 80 µg/m^3 for industrial, residential and rural areas.

4. Ozone (O_3)

Ozone (O_3) or Trioxygen, is a triatomic molecule, consisting of three oxygen atoms. It is an allotrope of oxygen that is much less stable than the diatomic allotrope (O_2). Ozone in the lower atmosphere is an Air pollutant with harmful effects on the respiratory systems of animals and will burn sensitive plants; however the Ozone layer in the upper atmosphere is beneficial, preventing potentially damaging ultraviolet light from reaching the Earth's surface. Ozone is present in low concentrations throughout the Earth's atmosphere.

The 98th Percentile of O_3 recorded within the study area was in the range of 14.4 µg/m^3 to 21.2 µg/m^3 The 8 hour average values of Ozone were compared with the national ambient air quality standards and found that the recorded values were within the applicable limits of residential and rural area limits for all the locations in study area.

5. Carbon Monoxide (CO)

Carbon monoxide is present in small amounts in the atmosphere, chiefly as a product of volcanic activity but also from natural and man-made fires (such as forest and bushfires, burning of crop

residues, and sugarcane fire-cleaning). The burning of fossil fuels also contributes to carbon monoxide production.

Carbon monoxide is colorless, odorless, and tasteless, but highly toxic. It combines with hemoglobin to produce carboxyhemoglobin, which takes the space in hemoglobin that normally carries oxygen, but is ineffective for delivering oxygen to bodily tissues. A level of 50% carboxyhemoglobin may result in seizure, coma, and fatality.

The 98th Percentile of CO recorded within the study area was in the range of 470 µg/m^3 to 570 µg/m^3. The 8 hourly average values of CO were compared with national ambient air quality standards and it was found that all the sampling locations recorded values much lower than the applicable limit of 2000 µg/m^3 (2 mg/m^3) for industrial, residential and rural areas.

6 Ammonia (NH_3)

The most important source of ammonia is the ammonification of organic matter. Sewage has large quantities of nitrogenous matter, thus its disposal tends to increase the ammonia content in atmosphere.

The 98th Percentile of CO recorded within the study area was in the range of 20.2µg/m^3 to 30.4 µg/m^3. The 8 hourly average values of CO were compared with national ambient air quality standards and it was found that all the sampling locations recorded values much lower than the applicable limit of 400 µg/m^3 for industrial, residential and rural areas.

3.5 Noise Levels

Noise can be defined as unwanted sound or sound in the wrong place at the wrong time. It can also be defined as any sound that is undesirable because it interferes with speech and hearing, is intense enough to damage hearing or is otherwise annoying. The definition noise as unwanted sound implies that it has an adverse effect on human beings and their environment including land, structures, and domestic animals. Noise can also disturb natural wildlife and ecological systems.

Sound can be transmitted through gases, liquids, and solids. Noise impacts can be of concern during the construction and the operational phases of projects. Noise should also be considered in relation to present and future land use zoning and policies.

Construction noise can be a significant source of community noise. Of concern are impacts on people near the construction site, who are totally unrelated to construction activities (e.g. area residents, office workers, school children, staff, etc.) Factors which are important in determining noise levels that will potentially impact such populations include distance from the noise source, natural or man-made barriers between the source and the impacted population, weather conditions which could potentially absorb, reflect or focus sound (such as wind speed, direction, temperature inversions), the scale and intensity of the particular construction phase (excavation, erection, or finishing).

The Environment/health impacts of noise can vary from Noise Induced Hearing Loss (NIHL) to annoyance depending on loudness of noise levels and tolerance levels of individual.

While measuring the day-night equivalent noise levels (L_{dn}), it is considered that one event at night is equivalent to ten similar events during the day time. L_{dn} is similar to 24 hours equivalent sound level (L_{Eq}) except that, during the daytime 10 dB (A) weighing is added. The L_{dn} for a given location in a community may be calculated from the hourly (L_{Eq}) equivalent sound levels with a 10 dB (A) correction added to the night time value (L_n).

L_{dn}= 10 Log (0.0416 [15 (10Ld/10] + 9 (10Ln+10/10]) + ...
Where L_d is the Equivalent noise levels at day (6.00 A.M to 10.00 P.M) and
L_n is the Equivalent noise levels at night (10.00 P.M to 6.00 A.M)

3.5.1 Sampling and analytical techniques with selection of sampling locations

Base noise levels are monitored in 10 different locations within study zone, using a continuous noise measurement device. The day levels of noise have been monitored during 6 AM to 10 PM and the night levels during 10 PM to 6 AM. The noise monitoring locations are given in the Table 3.7, the NAAQ standards are given in **Table 3.8** and the results obtained are given in **Table 3.9**, noise monitoring locations are represented in **Figure 3.4**

Table 3.7 Noise level monitoring locations

S.No	Location Name	Distance in Km	Direction	Remarks
N1	Site	--	--	Adjacent existing TSDF site
N2	Karvle	0.5	NW	Near School
N3	Nakzari	0.7	NE	Village Centre
N4	Tondhre	1.1	S	Tondhre Junction
N5	Taloje mazkur	2.1	SW	Near School
N6	Vaklan	2.7	NW	Vaklan Junction
N7	Kelpada	3.3	SE	Village entrance
N8	Dhame	3.5	W	Village centre
N9	Vavanje	3.6	E	Vavanje Junction
N10	Narhen	3.6	N	Narhen bus stop

Table 3.8 Standard for monitoring ambient noise level as per CPCB

AAQ Standards in Respect of Noise	Area Code	Category	Limits in dB(A) Leq*	
			Day Time	Night Time
The noise Pollution (Regulation & Control) Rules, 2000	A	Industrial	75	70
	B	Commercial	65	55
	C	Residential	55	45
	D	Sensitive	50	45
Note:				
• Day time 6:00 AM to 10:00 PM; Night Time 10:00 PM to 06:00 AM				
• dB(A) Leq*: denotes the time weighted average of the level of sound in decibels in scale A which is relatable to human hearing				
Source: S.O.123 (E) date. 14.02.2000 & it's subsequent amendements				

Figure3.4 Noise monitoring Locations

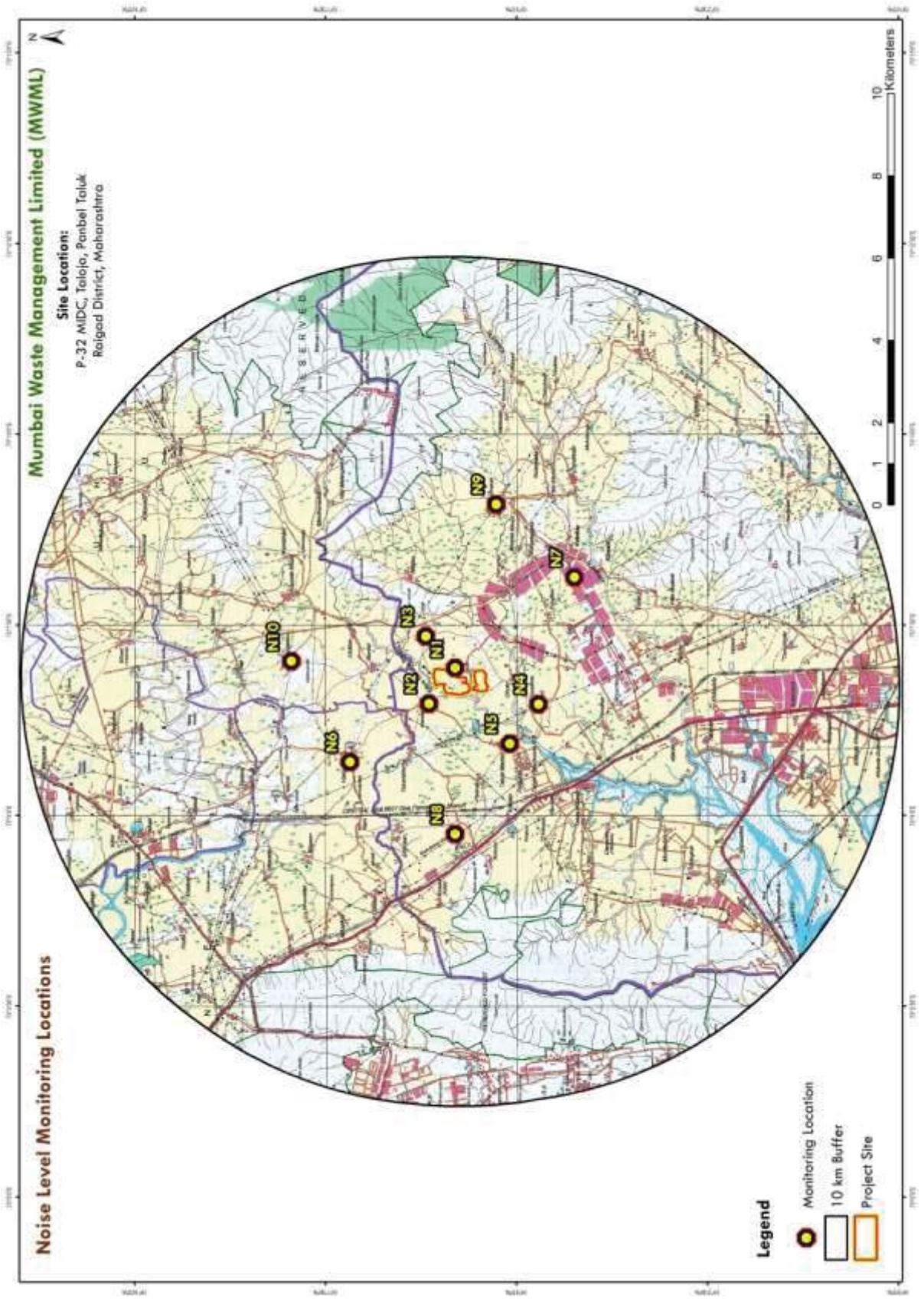


Table 3.9 Ambient noise level results

Location Code	Day		Night		L_{eq} dB (A)	
	Min	Max	Min	Max	L_{Day}	L_{Night}
N1	48.4	58.2	43.1	48.4	55.2	44.1
N2	44.7	54.3	40.3	44.7	50.6	40.7
N3	51.1	57.4	42.1	51.1	53.9	43.5
N4	47.5	57.5	41.2	47.5	53.8	43.1
N5	44.9	54.5	40.5	44.9	50.8	40.9
N6	45.3	54.6	40.5	45.3	52.2	41.9
N7	50.3	57.2	42.3	50.3	54.7	43.6
N8	49.8	56.4	41.8	49.8	53.9	43.5
N9	48.9	56.8	41.8	48.9	53.8	43.2
N10	48.7	56.7	40.3	48.7	53.4	42.8
				Range	50.6 to 55.2	40.7 to 44.1

The values of noise observed in some of the areas are primarily owing to vehicular traffic and other anthropogenic activities. The day equivalents during the study period are range between 50.6 to 55.2 dB (A), whereas the night equivalents were in the range of 40.7 to 44.1 dB (A). From the results it can be seen that the day equivalents and the Night equivalents were within the Ambient Noise standards of residential/commercial respectively.

3.5.2 Vibration

Vibration is a mechanical phenomenon whereby oscillations occur about an equilibrium point. The oscillations may be periodic such as the motion of a pendulum or random such as the movement of a tire on a gravel road. Major sources of vibration are blasting due to mining activities, vibration caused by motions of engines, electric motors, or any mechanical device in operation theses are typically unwanted. Such vibrations can be caused by imbalances in the rotating parts, uneven friction, the meshing of gear teeth, etc. such vibrations can be reduced by proper designing.

During construction phase other than constructing structures, no major sources of vibrations are envisaged due to proposed expansion project.

3.6 Traffic & transportation study

The traffic studies have been conducted to know the prevailing traffic volumes on the existing roads. It is essential to consider these details for assessing the anticipated future traffic volumes as a part of overall impacts assessment for the plant. The variations of traffic densities depend upon the working days and time and also vary in day and night times. In order to assess the prevailing traffic volumes on the roads, the survey was conducted during normal working days of the week by avoiding local holidays or abnormal situations to reflect the true picture of the traffic densities.

3.6.1 Methodology & results

The vehicles passing through the road (in both ways) were counted at the selected location from 06:00 hrs to 22:00 hrs continuously. Category-wise vehicle counting has been done continuously and recorded in the traffic volume count on hourly basis under respective categories.

The engine driven vehicles were categorized into various heads viz. trucks/bus, light carriage vehicles (LCV), Car, multi axle vehicles, two/three wheelers. The number of vehicles per hour were counted and converted into passenger car unit (PCU) using factor given in IRC:106-1990.

Traffic study was done near site road within the MIDC.

Location Number : T-1
Details of Location : Near site road within the MIDC.

The hourly vehicular traffic densities for continuous normal day at the location observed was given in **Table 3.10**.

Table 3.10 Traffic volume in PCU per day

Time (Hours)	Two wheeler		Three wheeler		Passenger cars & pick-up vans		Heavy commercial vehicles (HCV)		Total vehicles	
	v/hr	PCU/hr	v/hr	PCU/hr	v/hr	PCU/hr	v/hr	PCU/hr	Total	Total PCU/hr
06:00-07:00	93	70	15	30	128	128	23	85	**259**	**313**
07:00-08:00	145	109	23	46	120	120	31	115	**319**	**389**
08:00-09:00	132	99	34	32	143	143	48	178	**357**	**452**
09:00-10:00	184	138	45	90	158	158	63	233	**450**	**619**
10:00-11:00	156	117	35	70	147	147	51	189	**389**	**523**
11:00-12:00	136	102	31	62	141	141	48	178	**356**	**483**
12:00-13:00	103	77	26	52	136	136	35	130	**300**	**395**
13:00-14:00	113	85	21	42	134	134	28	104	**296**	**364**
14:00-15:00	125	94	25	50	102	102	38	141	**290**	**386**
15:00-16:00	134	101	26	52	106	106	46	170	**312**	**429**
16:00-17:00	140	105	25	50	114	114	42	155	**321**	**424**
17:00-18:00	154	116	27	54	124	124	34	126	**339**	**419**
18:00-20:00	160	120	22	44	142	142	25	93	**349**	**399**
20:00-21:00	134	101	18	36	132	132	22	81	**306**	**350**
21:00-22:00	122	92	15	30	115	115	18	67	**270**	**303**
22:00-23:00	112	84	11	22	98	98	15	56	**236**	**260**
23:00-24:00	94	71	8	16	65	65	13	48	**180**	**200**
2 lane (Two way) undivided as per IRC: 106-1990; Road capacity - 1500 PCU: Passenger Car Unit Width of the Road – 15 m										

3.6.1.5 Volume count

The traffic volume counts were conducted for 17 hours (from 6:00 to 23:00 on the day) in three shifts at specific point of the location. Manual count method was adopted for vehicular counts. At every one hour interval, the number and category of vehicles passing through each arm of the intersection were recorded in the survey form.

From the above table, it can be understood that the road corridor in the study area has a low medium traffic flow. This traffic corridor is the main source of communication and transportation for its proximity to the major highway and commercial areas in this locality.

As per IRC:106-1990 recommendations, a 2 lane undivided (two way) road (arterial road) can accommodate 1500 PCU's per hour design service volume. At the monitored location as per traffic survey, the no. of PCU's during peak hour is 619 numbers.

3.7 Water environment

The objective of monitoring surface and ground water in study area is to establish baseline water quality to identify impact due to proposed activity.

To assess baseline environment status in the study area, two surface and eight ground water samples were collected. The monitoring locations and parameters were selected as per the prescribed criteria of CPCB standards.

3.7.1 Methodology of sampling and analysis

All the basic precautions were taken care to avoid any contamination during the sampling. Analysis of the sample was carried out as per established standard methods and procedures prescribed by CPCB, IS 3025 Codes and APHA 22nd edition 2012. The samples were analysed for relevant physical and chemical parameters for baseline data generation. The water sampling locations are given in **Table 3.11** and shown as **Figure 3.5**

Table 3.11 Water sampling locations

S.No.	Locations Name	W.R.T. Site		Remarks
		Distance (km)	Direction	
Ground Water				
GW1	Site	NA	NA	Bore well
GW2	Tondhre	1.1	S	Hand pump used for domestic purpose
GW3	Vaklan	2.7	NW	Bore well from the Residential
GW4	Kelpada	3.3	SE	Bore well from the Residential
GW5	Dhame	3.5	W	Bore well from the Residential
GW6	Varanje	3.6	E	Open well used for Domestic purpose
GW7	Narhen	3.6	N	Bore well from the Residential
GW8	Bandhanwadi	4.4	NE	Bore well from the Residential
GW9	Kharpada	5.4	S	Hand pump used for Domestic purpose
GW10	Chandna	6.6	SE	Bore well from the Residential
Surface Water				
SW1	Bavamalang Nadi		W	Is next to the project site.
SW2	Panvel creek	7.0	N	

3.7.2 Groundwater quality

The water quality of the groundwater samples collected were analysed and found well within the acceptable limits as presented in **Table 3.12** and fit for human consumption. The groundwater quality was compared with drinking water standards (IS 10500:2012). The groundwater quality in the study area is good. All the parameters are observed to be within the permissible limits as per the drinking water standards. The groundwater can be used for drinking purpose.

Figure 3.5 Water sampling locations in the study area

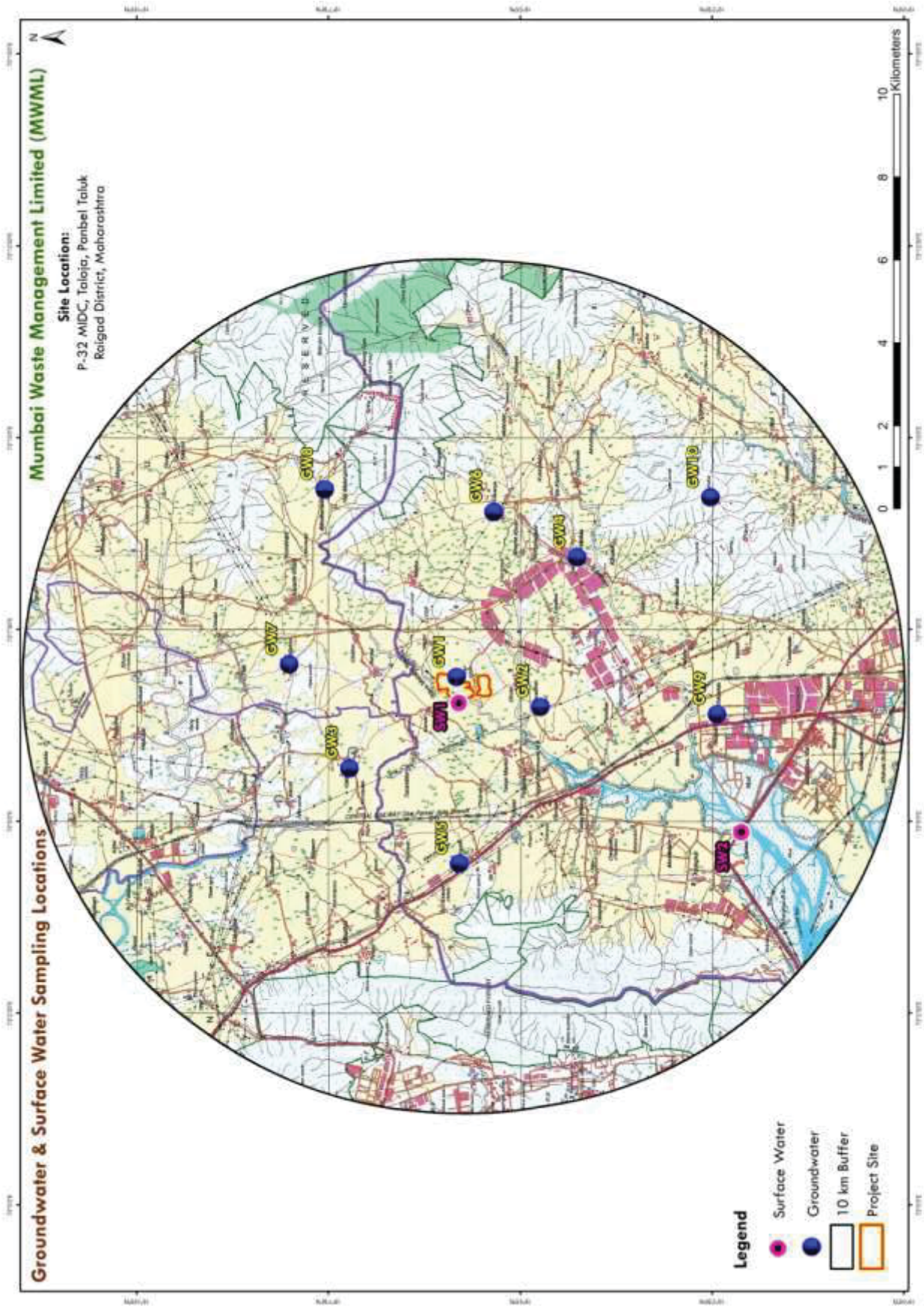


Table 3.12 Groundwater quality

Sl. No	Parameter	Unit	Analysis Results										Standard as per IS - 10500:2012	
			GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-8	GW-9	GW-10	Acceptable Limit	Permissible Limit
1	Odour	--	Agreeable										Agreeable	
2	pH Value	--	7.8	6.9	7.8	7.6	8.1	7.1	7.2	7.5	7.4	7.3	6.5-8.5	No Relaxation
3	Turbidity	NTU	1.2	0.5	1.5	1.5	2.5	0.5	0.8	0.5	1.5	1.5	1	5
4	Electrical Conductivity	µS/cm	1185	310	651	680	1150	360	415	531	845	670	--	--
5	Dissolved Solids	mg/l	812	194	435	450	765	245	264	345	580	445	500	2000
6	Alkalinity	mg/l	234	80	240	220	260	90	110	210	184	155	200	600
7	Chloride (as Cl)	mg/l	203	25	55	65	214	30	55	40	112	65	250	1000
8	Sulphate (as SO_4)	mg/l	65	35	20	15	28	15	12	20	45	35	200	400
9	Nitrate (as NO_3)	mg/l	1.2	1.5	1.8	1.5	2.5	6.5	2.8	1.5	4.5	5.4	45	No Relaxation
10	Phosphates	mg/l	<0.5	<0.5	<0.5	<0.5	0.8	1.2	0.5	<0.5	1.6	1.4	-	=
11	Total Hardness (as $CaCO_3$)	mg/l	503	120	258	300	490	154	187	225	329	254	200	600
12	Calcium (as Ca)	mg/l	128	28	60	70	116	45	58	65	95	85	75	200
13	Magnesium (as Mg)	mg/l	44	12	26	30	48	10	10	15	22	10	30	100
14	Sodium as Na	mg/l	28	16	25	18	25	16	16	22	28	25	--	--
15	Potassium as K	mg/l	8	6	8	10	12	5	5	8	12	5	--	--
16	Fluoride (as F)	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.0	1.5
17	Iron (as Fe)	mg/l	0.24	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	No Relaxation
18	Lead (as Pb)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	
19	Cadmium (as Cd)	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	
20	Total Chromium	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	
21	Mercury as Hg	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	
22	Copper (as Cu)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	1.5
23	Arsenic as As	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.05
24	Zinc (as Zn)	mg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	5	15
25	Boron as B	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	1

672

Results and discussion:

During the study period the ground water pH values were observed to be in the range of 6.9 to 8.1 all values are found to be within acceptable limits; with TDS in the range of 194 mg/l to 812 mg/l . TDS of all the 10 tested samples was found to be above acceptable limit but within the permissible limit.

Total Hardness was in the range of 120 mg/l to 503 mg/l . Total hardness of samples from three locations i.e., Narhen, Varanje & Tondhre were within the acceptable limit and for samples from remaining 7 locations was within the Permissible limit.

The concentration of chlorides was in the range of 25 mg/l to 214 mg/l. Chloride concentration in all sampled locations was found to be within the acceptable limits.

Sulphates ranged from 20 mg/l to 65 mg/l . Sulphate concentration in all sampled locations was found to be within the acceptable limits.

Fluorides were in the range of <0.5 mg/l. Chlorides from all sampled locations were found to be within the acceptable limits

The concentration of various heavy metals in the tested samples was found to be in the following range as: chromium: <0.05 mg/l, Copper: <0.05 mg/l, Mercury: <0.001 mg/l, Cadmium: <0.003 mg/l, whereas lead, iron, zinc, and Boron were below detectable limit in all the samples.

Based on the physico-chemical parameters and comparison with IS 10500-2012 drinking water standards all ground water samples were found to be fit for drinking, however some of the parameters in a few water samples were exceeding the acceptable limits but were within permissible limits.

3.7.3 Surface water quality

All the parameters are complying CPCB standards. The detailed water quality is presented in **Table 3.13** below.

Table 3.13 Surface water quality

Parameter	Units	Bavamalang Nadi	Panvel creek	IS 2296 – 1992 Inland surface water standards				
				A	B	C	D	E
pH	---	7.9	8.2	6.5-8.5	6.5-8.5	6.0-9.0	6.5- 8.5	6.5- 8.5
EC	µS/cm	312	550	-	-	-	-	2250
Odor	--	Unobjectionable		Unobj	-	-	-	-
TDS	mg/l	194	335	500	-	1500	-	2100
TSS	mg/l	<10	<10	-	-	-	-	-
Turbidity	NTU	0.5	1.5	-	-	-	-	-
Alkalinity as CaCO3	mg/l	120	180					
Chloride as Cl-	mg/l	30	55	250	-	600	-	600
Sulphate as $SO4^{-2}$	mg/l	12	22	400	-	400	-	1000
Nitrates as NO3	mg/l	1.5	1.8	20	-	50	-	-
Phosphates	mg/l	0.5	0.5	-	-	-	-	--
Total Hardness	mg/l	155	259	200	-	-	-	-

Parameter	Units	Bavamalang Nadi	Panvel creek	IS 2296 – 1992 Inland surface water standards				
				A	B	C	D	E
Calcium as Ca	mg/l	32	62	-	-	-	-	-
Magnesium as Mg	mg/l	18	25	-	-	-	-	-
Sodium as Na	mg/l	10	11	-	-	-	-	-
Potassium as K	mg/l	< 5	< 5	-	-	-	-	-
Fluoride as F-	mg/l	0.65	0.85	1.5	1.5	1.5	-	-
Iron as Fe	mg/l	0.25	0.29	0.3	-	0.5	-	-
Lead as Pb	mg/l	<0.01	<0.01	0.1	-	0.1	-	_
Cadmium as Cd	mg/l	<0.003	<0.003	0.01	-	0.01	-	_
Arsenic as As	mg/l	<0.01	<0.01	0.05	0.2	0.2	-	_
Chromium (as Cr)	mg/l	<0.05	<0.05	-	-	-	-	-
Boron as B	mg/l	<0.1	<0.1	-	-	-	-	-
Zinc as Zn	mg/l	< 1	< 1	15	-	15	-	_
Copper as Cu	mg/l	<0.05	<0.05	1.5	-	1.5	-	_
Mercury as Hg	mg/l	<0.001	<0.001	0.001	-	-	--	-
DO	mg/l	5.1	4.8	6	5	4	4	-
COD	mg/l	46	68	-	-	-	-	-
BOD	mg/l	12	24	2	3	3	-	-
E- coil	MPN/100ml	24	26	-	-	-	-	-
Total coliform	MPN/100ml	240	350	**50**	**500**	**5000**	-	-

Observations of analysis results:

- pH of surface water was found to be in the range of 7.9 and 8.2;
- TDS were in the range of 194 mg/l and 335 mg/l.
- BOD observed to be in the range of 12 mg/l and 24 mg/l.
- COD observed to be in the range of 46 mg/l and 68 mg/l.
- DO observed to be in the range of 5.1 mg/l and 4.8 mg/l.
- Hardness observed to be in the range of 155 mg/l and 259 mg/l.
- Nitrates observed to be in the range of 1.5 mg/l and 1.8 mg/l.
- Potassium was observed in the range of <5 mg/l.

3.8 Soil quality

Soil quality of the study area is one of the important components of the environment. The study on soil quality establishes the baseline characteristics in the study area surrounding the project site. The study has been addressed with the following objectives.

- To determine the baseline characteristic.
- To determine the soil characteristics of the proposed project site.
- To determine the impact of industrialization/urbanization on soil characteristics.
- To determine the impacts on soils from agricultural productivity point of view.

The composite soil samples were collected from the study area and analysed for different parameters. The locations of the monitoring sites are depicted in Table 3.14 and Figure 3.6.

Table 3.14 Soil sampling locations

S.No	Locations	Distance (km)	Direction	Coordinates		Description
				Latitude	Longitude	
S1	Site	NA	NA	19° 5' 49.350"	73° 6' 54.032"	Open Barren land
S2	Tondhre	2.1	S	19° 4' 43.274"	73° 6' 29.513"	Agricultural land
S3	Vaklan	2.7	NW	19° 7' 13.452"	73° 5' 44.544"	Barren land
S4	Kelpada	3.3	SE	19° 4' 15.432"	73° 8' 26.147"	Barren land
S5	Dhame	3.5	W	19° 5' 47.608"	73° 4' 27.973"	Barren land
S6	Vavanje	3.6	E	19° 5' 23.571"	73° 9' 2.085"	Barren land
S7	Narhen	3.6	N	19° 8' 0.550"	73° 7' 2.784"	Barren land
S8	Bandhanwadi	4.4	NE	19° 7' 32.915"	73° 9' 18.474"	Barren land
S9	Kharpada	5.4	S	19° 2' 26.877"	73° 6' 22.827"	Barren land
S10	Chandna	6.6	SE	19° 2' 32.090"	73° 9' 13.541"	Barren land

3.8.1 Methodology

The soil samples were collected in the month of October, 2018. Soil samples were collected from 8 locations. The samples were collected by ramming a core –cutter into the soil up to 30 cm depth. 8 locations were selected for soil sampling on the basis of soil types, vegetative cover, industrial & residential activities including infrastructure facilities, which would accord an overall idea of the soil characteristics. The samples were analysed for physical and chemical characteristics. The sealed samples were sent to laboratory for analysis. The samples were filled in polythene bags, coded and sent to laboratory for analysis and the details of methodology in respect of sampling are given in below Table 3.15 and Standard classification of soil in Table 3.16

Table 3.15 Methodology of sampling collection

Particulars	Details
Frequency	One sample from each location during the study period
Methodology	Composite grab samples of the topsoil were collected from 30 cm depths and mixed to provide a representative sample for analysis. They were stored in airtight polythene bags and analysed at the laboratory.

Table 3.16 Standard classification of soil

S.No	Soil Test	Classification
1	pH	<4.5 Extremely acidic 4.51 – 5.50 Very strongly acidic 5.51 – 6.0 Moderately acidic 6.01-6.50 Slightly acidic 6.51 – 7.30 Neutral 7.31 – 7.80 slightly alkaline 8.81 – 8.50 moderately alkaline 8.51 – 9.0 strongly alkaline 9.01 very strongly alkaline
2	Salinity Electrical Conductivity (mmhos/cm) (1 ppm = 640 mmhos/cm)	Up to 1.00 ppm Average 1.01 – 2.00 harmful to germination 2.01 – 3.00 harmful to crops (sensitive to salts)
3	Organic Carbon %	Up to 0.2 Very less 0.21 – 0.4 less

S.No	Soil Test	Classification
		0.41 – 0.5 medium 0.51 – 0.8 on an average sufficient 0.81 – 1.00 sufficient >1.0 more than sufficient
4	Nitrogen (Kg/ha as N	Up to 50 very less 51 – 100 less 101 – 150 good 151 – 300 better >300 sufficient
5	Phosphorus (Kg/ha as P)j	Up to 15 very less 16 – 30 less 31 – 50 medium 51 – 65 on an average sufficient 66 – 80 sufficient >80 more than sufficient
6	Potassium (Kg/ha as K)	0 – 120 very less 120 – 180 less 181- 240 medium 241 – 300 Average 301 – 360 better >360 more than sufficient
Source: handbook of Agriculture, Indian Council of Agriculture Research, New Delhi		

3.8.2 Soil quality analysis

The samples were analysed as per the standard methods prescribed in "Soil Chemical Analysis (M.L. Jackson, 1967), Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India". The important properties analysed for physical and chemical analysis (bulk density, Porosity, infiltration rate, pH and organic Matter, kjeldahl nitrogen, phosphorous and potassium). The physico-chemical characteristics of the soils as per the analysis of samples are presented below in Table 3.17.

Figure 3.6 Soil sampling locations

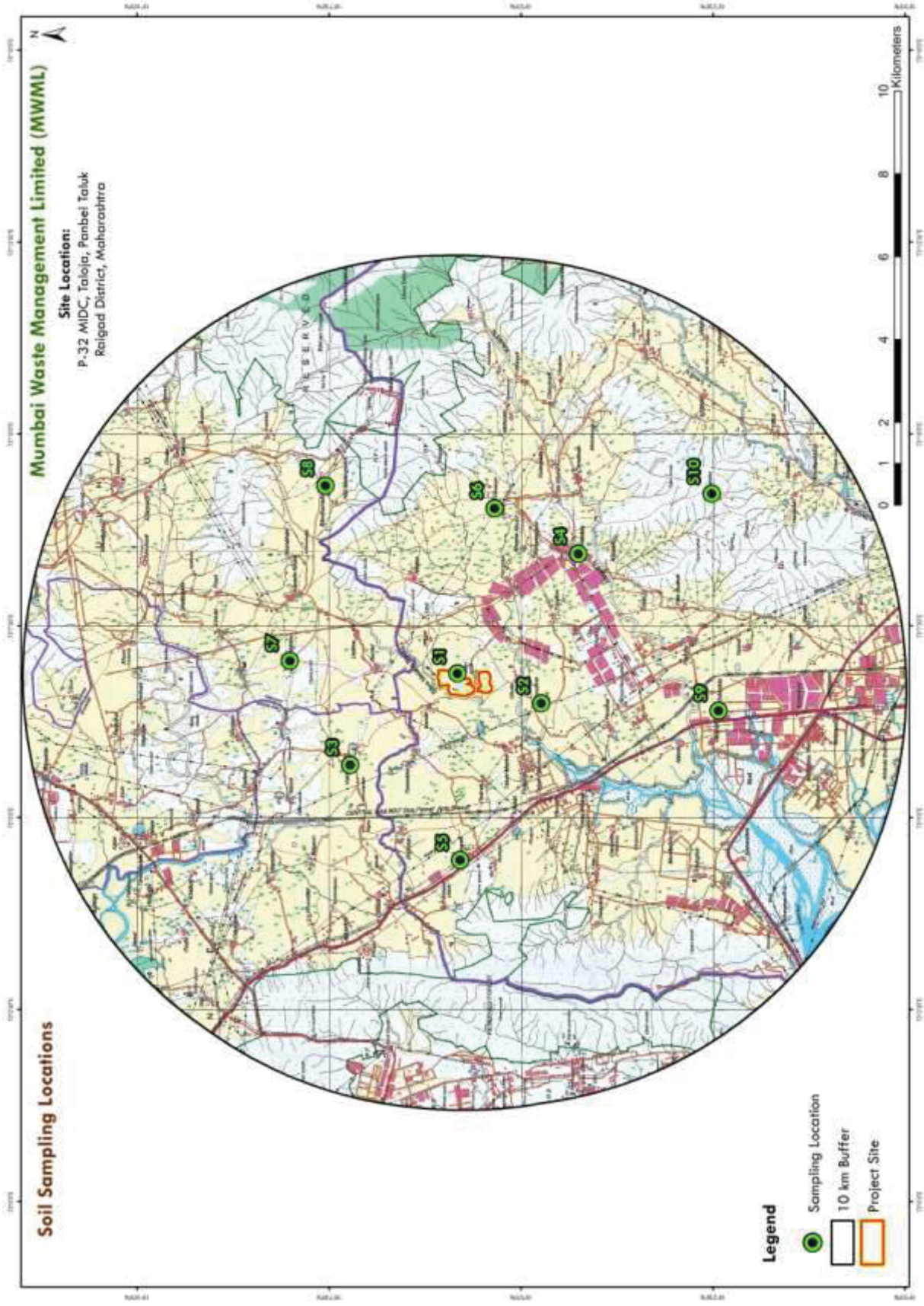


Table 3.17 Soil quality of the study area

Parameters	Unit	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Standard Soil Classification (Indian Council of Agricultural Research, New Delhi)
Texture	--	Sandy loam		Sandy loam			Sandy loam					-
Color	-	Brown						Light Brown				-
pH (1:5 Extraction)	--	8.1	7.4	8.2	7.8	8.3	7.5	7.6	7.8	7.6	7.8	Acidic<6.0, Normal to Saline 6.0-8.5, Tending to become Alkaline8.6 to 9.0, Alkaline above 9.
EC (1:5 Extraction)	µS/cm	132	145	160	175	245	150	155	180	164	144	Normal <1000, Critical for germination 1000-2000, Critical for growing 2000 - 4000, Injurious to most crops >4000
Organic Carbon	%	0.45	0.53	0.48	0.35	0.52	0.28	0.36	0.65	0.45	0.63	Low < 0.5 , Medium 0.5 – 0.75, High > 0.75
Bulk density	gr/cc	1.23	1.34	1.06	1.32	1.25	1.32	1.33	1.13	1.23	1.05	-
Calcium as Ca	mg/kg	245	335	423	456	484	320	280	345	288	265	-
Magnesium as Mg	mg/kg	43	65	125	143	155	76	80	94	58	65	-
Available Nitrogen as N	kg/Ha	101	76	96	108	125	72	101	139	150	116	Low <280, Medium 280-560, High >560
Available Potassium as K	kg/Ha	72	52	63	76	101	63	85	56	123	47	Low <110, Medium 110-280 High >280
Available Phosphorus as P	kg/Ha	7.6	6.3	7.2	8.5	9.4	6.9	9.2	7.8	8.1	8.7	Low <10, Medium 10-25,High >25
Zinc as Zn	mg/kg	43	32	30	28	35	45	38	42	30	28	-
Lead as Pb	mg/kg	2.7	3.2	4.2	2.8	3.5	2.8	3.2	3.8	4.2	4.4	-
Copper as Cu	mg/kg	23	15	18	22	12	16	18	12	14	12	-
Boron as B	mg/kg	<0.1	<0.1	<0.1	<0.1	<0. 1	<0.1	<0.1	<0.1	<0.1	<0.1	-
Chromium as Cr	mg/kg	2.2	6.1	1.1	1.2	0.9	1.9	0.5	1.6	2.2	1.5	-
Arsenic as As	mg/kg	<0.1	<0.1	<0.1	<0.1	<0. 1	<0.1	<0. 1	<0.1	<0.1	<0.1	-

879

3.8.3 Soil Characteristics

Physical Characteristics

- **Texture:** Texture of soil along the proposed study area samples was found predominantly sandy loam.
- **Bulk density:** Bulk density of soil varies from 1.05 to 1.34 g/cm^3 in study area.

Chemical Characteristics

- **PH:** It has been observed that the pH of the soil ranged from 7.4 to 8.3 indicating that the soils are normal to saline in nature.
- **Available Nitrogen:** The available nitrogen concentrations were found to be in the range of 52 to 150 kg/ha indicating of low nitrogen content.
- **Available Phosphorous**: The available phosphorous concentrations were in the range of 6.3 to 9.4 kg/ha indicating low phosphorus content.
- **Available Potassium:** The available potassium concentrations were found to be between 47 and 123 kg/ha, which indicate the some soils (6) are falling in low and some (2) in medium potassium content.
- **Total organic carbon:** The available Total Organic Carbon concentrations were found to be between 0.28 and 0.65 %, indicate the medium concentration of organic carbon.

3.9 land use

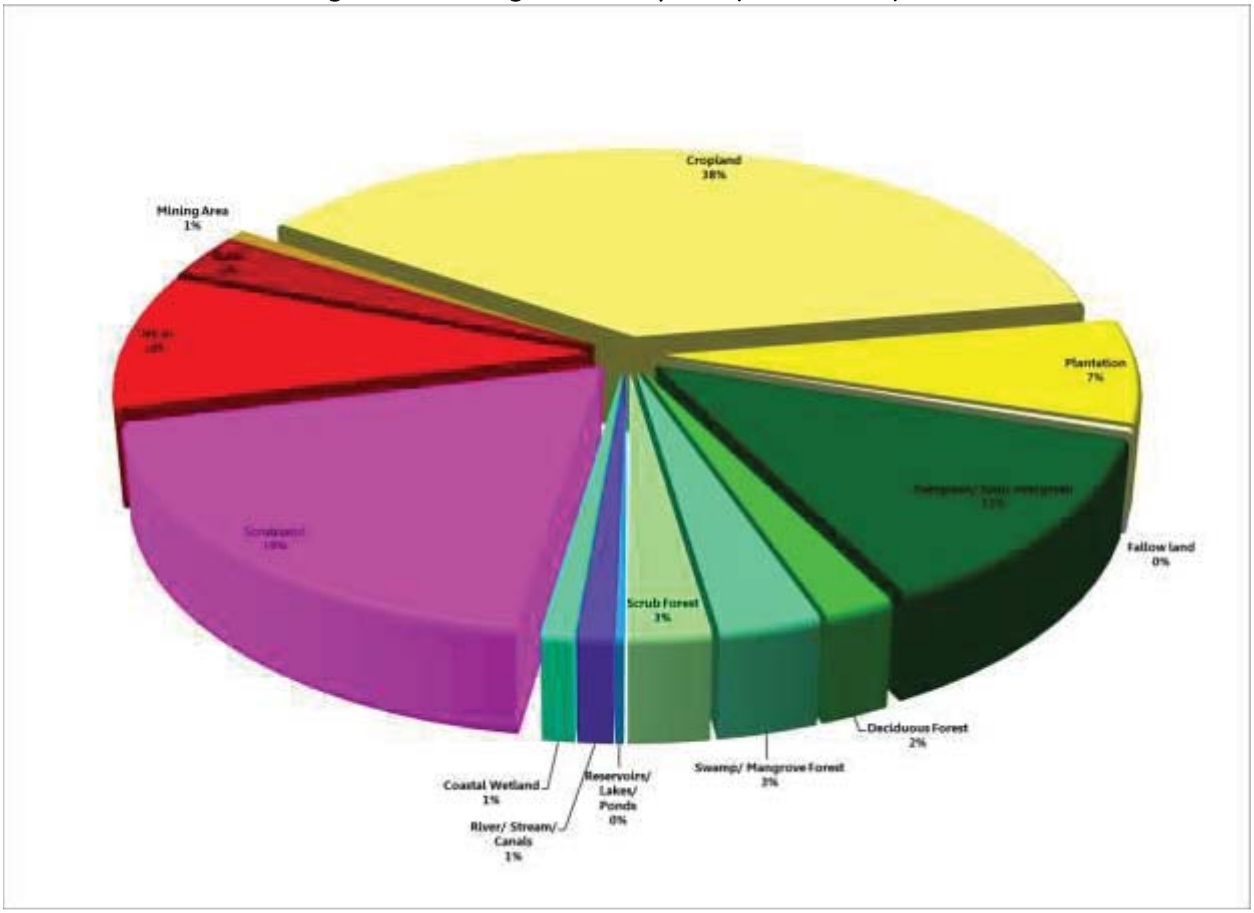
3.9.1 Land use of study area

The definition "Land use" in the present report highlights both land use and land cover. The land use of the study area was ascertained by utilizing there principal resources, namely, (i) SOI Topo-sheet No. E43 B 04of 1:50,000 scale (ii) Satellite imageries without cloud cover supplied by NRSA, Hyderabad from IRS P6-LISS IV and (iii) Ground validation for the interpretation of the FCC imagery through site visits. The description of the land-use for the buffer zone is represented in **Table 3.18** while the land-use maps of buffer and core zone is given in **Figure 3.7 & 3.8** respectively.

Table 3.18 Land use pattern of Study area (10 Km buffer zone)

S.No	Land Use Classes	Area in Hectare	Area in %
1	Urban	3171.4	9.6
2	Rural	989.9	3.0
3	Mining Area	255.7	0.8
4	Cropland	12440.5	37.8
5	Plantation	2439.3	7.4
6	Fallow land	96.1	0.3
7	Evergreen/ Semi-evergreen	4075.0	12.4
8	Deciduous Forest	693.9	2.1
9	Swamp/ Mangrove Forest	998.6	3.0
10	Scrub Forest	797.1	2.4
11	Reservoirs/ Lakes/ Ponds	86.5	0.3
12	River/ Stream/ Canals	344.0	1.0
13	Coastal Wetland	317.9	1.0
14	Scrub land	6170.2	18.8
	Total	32876.2	100.0

Figure 3.7 Pie-diagram of study area (10 Km radius)



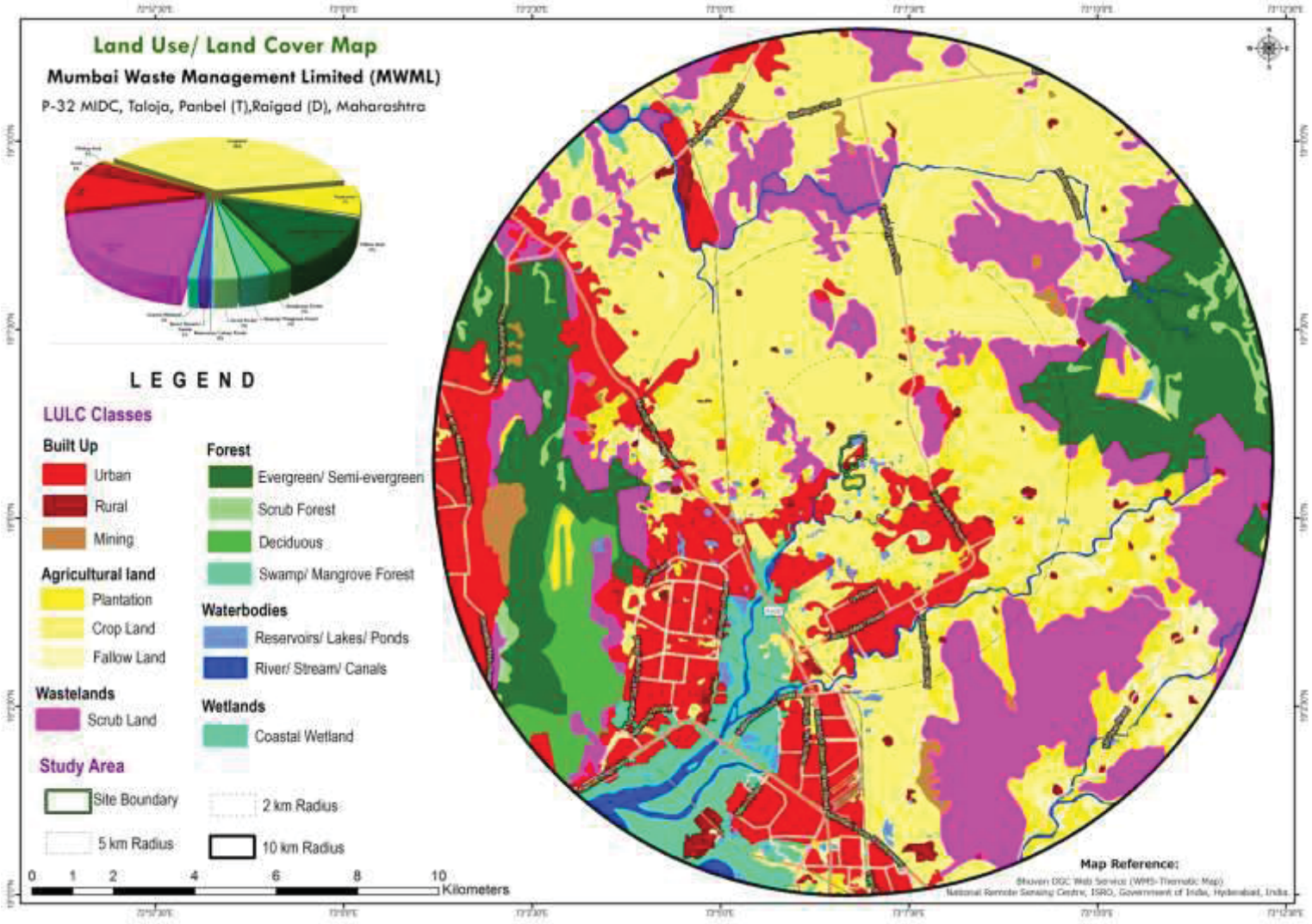
3.9.2 Land use of project site

The core zone is dominated by the scrub forest land which is 96.37% of total area of 697.979. The land use description of the project site is given in Table 3.19.

Table 3.19 Land use pattern of project site (Core zone)

Land use	Existing (ac)	Proposed (ac)	Total		
			Ac	Ha	%
Facility	4.63	3.19	7.82	3.16	8.02
Leachate Pond	3.92	0.89	4.81	1.95	4.95
Landfill	34.12	13.64	47.76	19.32	49.05
Greenbelt	23.10	9.03	32.13	13.00	33.00
Road	2.85	1.99	4.84	1.96	4.98
Total	**68.62**	**28.74**	**97.36**	**39.4**	**100**

Figure 3.8 Land-Use Maps of Buffer and Core Zone



3.10 Physical environment

3.10.1 Topography

The project site area is located in the southeast part of the state. Physiographically, the region falls in eastern hill physiographic zone, and lies on an undulating terrain. The hills are part of Sahayadri hill ranges (or Western ghats). The hills traversing on western side forming headlands for the part of Konkan coast on its western side. The topographic elevation, in the 5 km (kilometres) radius surrounding of project site, is ranging from 0 to 310 m amsl and, at the project site area it is 10 m amsl and the site is located on plain land gentle slopping towards southeast in general (as per elevation data of Shuttle Radar Topography Mission (SRTM). The contour map surrounding the project site area of 5 km radius is shown in **Figure 3.9**

3.10.2 Drainage Pattern

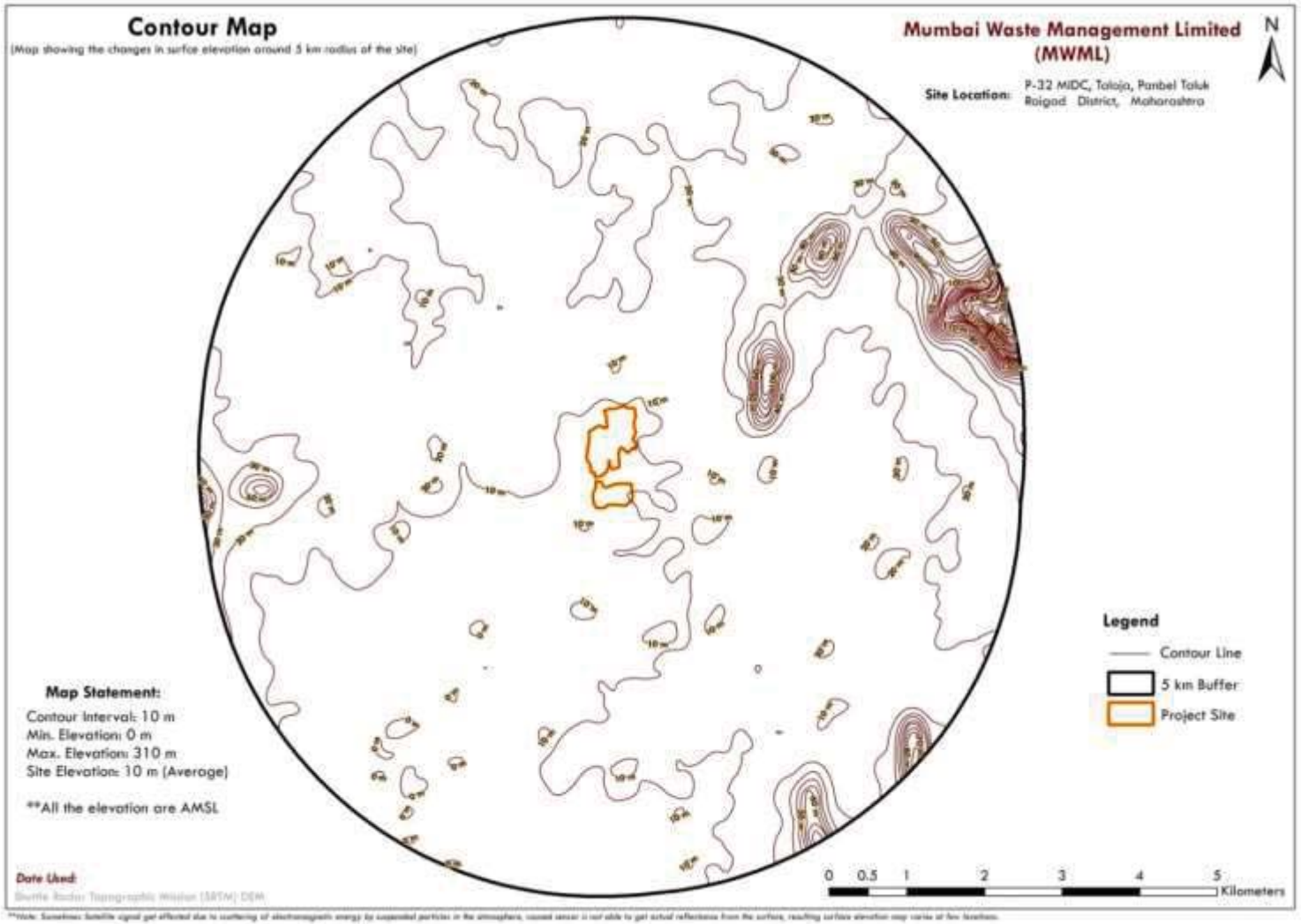
The natural drainage consists of network of streams, which are principally governed by topographic slope and dominated by nature of rock and rainfall, flowing with streams and minor rivers. The drainage system is showing radial, parallel and dendritic type of drainage patterns in which all the streams, also some originating at the hills in the study area, are flowing towards the major stream and finally draining in to a river. All the flowing streams and river are ephemeral in nature that is, they flow during rains. The drainage basin falls in the basin of 'west flowing rivers from Tapi to Tadri of rivers draining into Arabian Sea region'. There are no major rivers flowing in the study area of 10 km radius. All the rivers in the area are finally debauching in the Arabian Sea. The drainage map surrounding the project site area of 5 km radius is shown in **Figure 3.10.**

In the study area of 5 km radius, there are small ponds and lakes and, no major lakes and rivers. There is a creek known as Panvel creek in the southwest side into which minor rivers are joining. On the northwest side of project site area, a minor river known as Bava Malang Nadi (or Taloj river) is flowing from northeast towards southwest and finally draining into the creek. The river Kasadi is in the South and is flowing in direction from northeast to southwest and joins Bava Malang Nadi (or Taloj River) just before entering the Panvel creek.

This minor river is flowing adjacent and all along the northwest side of the project boundary. There is also a minor river known as Lendi Nadi (a tributary of Kalundri River) and Kalundri river flowing in South which is flowing from northeast towards southwest which both are also finally joining in the Panvel creek. In the north, there is also a minor rivulet flowing which is a tributary of Ulhas river and is at 5.5 km distance from project area. There are swamp areas of small aerial extents in the northwestern side from project area, spread on the adjoining land portions of this rivulet and before joining the Ulhas River.

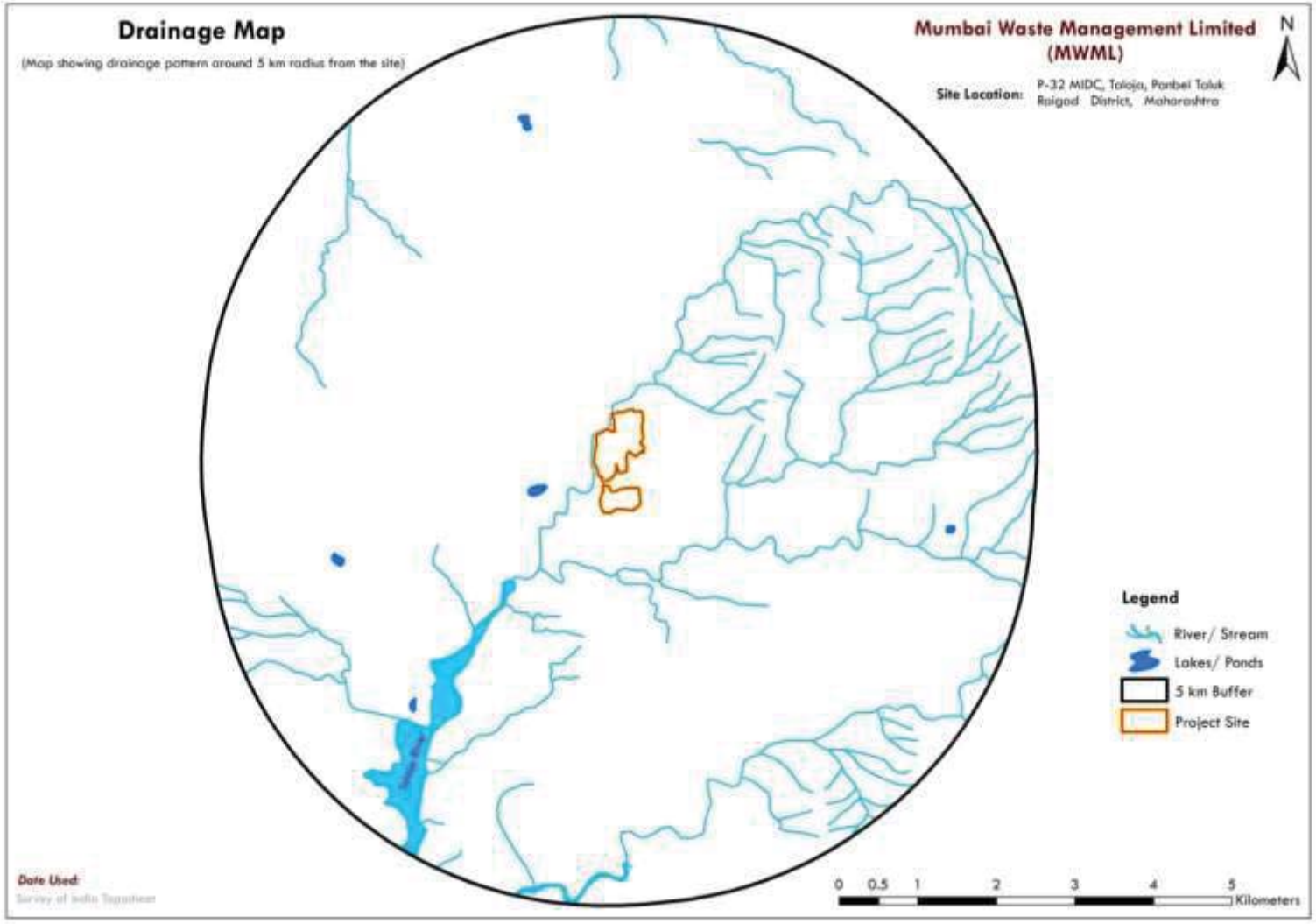
The soil in this area is spread mainly with black soil also known as black cotton soil which is derived from the surrounding basalt rocks. The colour of this soil will be medium black to dark black. They are mostly of fine varying with of sandy, silty, clayey loam textures. Their thickness varies from place to place. Also, found are the alluvial soil in the major stream, minor river portions and creek areas. They consist mostly of sand, silt and clay and are of narrow and limited aerial extent only. The soils found in the creek area are marine type in nature consisting mostly clay while the remaining soils found on the land side are of residual nature consisting mainly of loamy soil type.

Figure 3.9 Contour map



683

Figure 3.10 Drainage map



3.10.3 Geology

The rock formations belong to recent to sub-recent alluvium of quaternary period which are underlined by hard rock formations. The alluvium is consisting of sand, silt and clay and is of loose and unconsolidated sediments. The thickness of this formation is varying from place to place. It is spread and covered along the narrow major fluvial channels. In the creek areas, the alluvium found is of marine type consisting of unconsolidated fine detrital sediments of clay, silt and sand. Below the top soil layer lies beneath are the hard rock formations consisting of basalts or Deccan traps belonging to cretaceous to Eocene age. The basalts occur and spread as flows or beds. The basalt rocks are dark coloured, hard and compact. Their composition mainly consists of silica, feldspars and glass; and their rock texture varies from fine to medium grained. Below is the general stratigraphic succession of study area.

Age	Formation	Lithology
Quaternary	Alluvium	Alluvium consisting of pebble, gravel, sand, silt and clay; top soil.
Cretaceous to Eocene	Deccan traps	Basalts.

The area is situated on a plateau and also consists of hills and mud flats. The plateau is high and slightly dissected and is moderately weathered. There are structural and denuded hills in the area. The hills traversing on western side and are structural hills with scarps on either side. Also, there are hills which are denuded and are of varying height in the eastern and southeastern sides. There are also mud flats in the creek area which consists of unconsolidated sand, silt and clay and covered with salt water.

3.10.4 Hydrogeology

The ground water occurs, in the alluvial formation occupying the minor and major streams portions also the minor rivers and rivulets, hydro-geologically, is occurring under unconfined conditions. In these, the groundwater occurs in the pore spaces of silt, clay and gravel and at shallow depth of below 5 m bgl and in the coarser granular strata more good water bearing aquifers would be found.

In the consolidated formations, the groundwater is also occurring under semi-confined to confined conditions. These water bearing aquifers would occur at deeper depths. Near the foot-hill areas and along the minor rivers and streams, the water bearing zones will be occurring under unconfined conditions at shallow depths depending on rainfall conditions. In hard rock area, the potential aquifer will be occurring in weathered, jointed and fractured zones below 15 m depth in general. The depths to water level, in Panvel taluk of Raigad district where the present project is located, the depth to water levels of pre- and post-monsoon season–2016 are ranging between 4 to 5 and 0.5 to 2 m bgl.

3.10.4.1 Groundwater resource and classification as per central ground water authority

The dynamic ground water resource potential of the district was estimated as per the methodology given by the Groundwater Estimation Committee–1997. According to the revised methodology the resource assessment is done based on the percentage of ground water utilization. Regarding the ground water resources, the stage of development in the Panvel taluk is 23% and is categorized as ‘safe’ (Central Ground Water Board of India report–2013).

3.10.4.2 Rain Water Harvesting, Surface Runoff Calculation and Water Conservation

Rain Water Harvesting and Water Conservation are mainly based on the rainfall intensity in the project area. Storm water drainage system is already designed and constructed. This project has well-designed network of open surface drains and rainwater harvesting pits. Storm water from all the places within the Project Site is efficiently drained-off without any water logging. Rainwater harvesting and recharge provisions are already provided in the present operating facility. The rainwater amount available and storm water runoff estimate for on-site harvesting and re-use is given below in Table 3.20.

Table 3.20 Rain Water Harvesting Calculations

Catchment Area	Area in Acre	Area in m^2	Runoff Co-efficient	Rainfall intensity in m/day	Total Harvested Rain water in m^3/day
Facility	7.82	31646	90%	0.03	854
Land Fill	47.76	193278	15%	0.03	870
Green Belt	32.13	130026	15%	0.03	585
Road	4.84	19587	80%	0.03	470
Total Nos. of Rainy days / annum – 73 days (Source: GoI, Ministry of Earth Sciences, IMD, Climatological Tables 1981 - 2010)					

Total Quantity of Surface Runoff from Land Fill Area will be 63,492 m^3/year. This rainwater can be harvested as surface storage within the natural pond (Capacity is about 66,000 m^3) within the project site. About 100 kld water is required for greenbelt development during non-monsoon season. Therefore about **29,200m^3** water will be required per year for greenbelt development which can be supplied from this pond.

From Facility 854 m^3/day + from greenbelt 585 m^3 / day + from road 470 m^3/day i.e. 1,909 m^3/day in total can be harvested during Rain.

For process 446 m^3/day + for floor washing 4 m^3/day + for cooling 6 m^3/day i.e. in total 456 m^3/day water is required. Actually harvested rain water will be stored and treated and then 456 m^3/day will be used in the project during monsoon and rest quantity of harvested rain water i.e. 1,453 m^3/day will be recharged to shallow aquifers. About 2 days storage facility will be provided onsite.

3.11 Biological & Ecological environment

Ecological studies are one of the important aspects of Environmental Impact Assessment with a view to conserve environmental quality and biodiversity. The present objective is to study an area of 10 km radius from the proposed project site. Ecological systems show complex inter-relationships between biotic and abiotic components including dependence, competition and mutualism. Biotic components comprise of both plant and animal communities, which interact not only within and between themselves but also with the abiotic components viz. physical and chemical components of the environment.

The assessment of flora and fauna of the study area was done as per the MoEF&CC guidelines. The main objective behind gathering information about the ecology and biodiversity of the study area was to assess the existing baseline ecological conditions in the study area, correlate it with the data available with the forest department and develop mitigation measures for possible impacts of the project on the existing ecology.

Objectives of Ecological and Biodiversity studies

The main objective of the survey is to collect the information about the ecology and biodiversity of the project site and its surroundings within 10 km radius of the site, to measure the below features.

- To assess the distribution of flora and fauna in and around of the project site
- Comparing of primary data with authentic past records to understand diversity changes.
- Characterize the environmental components like land, water, flora and fauna.
- To assess the impacts of the project on the immediate ecology and biodiversity.

3.11.1 Methodology adopted for the survey

To accomplish the above objectives, a general ecological survey covering an area of 10 km radius from the proposed project boundary was done as follows:

1. Reconnaissance survey for selection of sampling sites in and around the site on the basis of meteorological conditions;

2. Compilation of secondary data from Forest Department.

3. Primary data generated through systematic studies, which covers generation of primary data to understand baseline ecological status, fauna structure and important floristic elements;

    - Preparing a checklist of plants observed at the site.
    - Determining the bird population by taking random readings at every location.
    - Observing mammals, reptiles, amphibians, insects through their calls, droppings, burrows, pugmarks and other signs.
    - Interaction with local residents

4. Primary data collected from core and buffer zone of the project site.

3.11.2 Ecology and Biodiversity: Baseline information:

The project/activity is covered under category A of item 7(d) 'Common hazardous waste treatment, storage and disposal facilities (TSDFs)' of the Schedule to the EIA Notification, 2006 and its amendments, and requires appraisal at Central level by sectorial EAC. As per the standard Terms of reference, detailed survey of Ecology, flora and fauna is not envisaged. In view of the NABET requirements, baseline information is provided.

The proposal is for expansion of existing Integrated Common Hazardous waste treatment storage & disposal facility (ICHWTSD&F) at P-32, MIDC, Taloja, Panvel Taluk, Raigad District, Maharashtra by M/s Mumbai Waste Management Limited. The aforesaid project site is referred to hereafter as the core area while its surroundings extending up to 10 Km radius is referred as the buffer zone. The assessment of flora and fauna of the study area was done as per the MoEF&CC guidelines from during the month of November 2018.

3.11.3 Terrestrial Vegetation and Flora of the core zone:

The core area is a part of existing MIDC industrial area, Taloja which comprises of existing industries, non-forest wastelands and fallow lands. It is sparsely covered by a few shrubs, bushes and also

existing greenbelt along the boundaries, internal roads and open spaces etc. tree species observed in the project site are namely Neem (*Azadirachta indica*), and Royal palm (*Borassus flabellifer*), Champa(*Magnolia champaca*) etc., all along the roads and also covered boundaries of the site.

The core zone is covered with Poaceae family (Grasses) like *Digitaria sanguinalis* (Large crabgrass, *Brachiaria mutica, Aristida setacea* and other tree species like, *Arabian jasmine* (*Jasminum sambac*), *Alstonia scholaris* (Saptaparni) , Black plum (*Syzygium cumini*), flame tree (*Delonix regia*) Bougainvillea (*Bougainvillea spectabilis*) Weeping fig (*Ficus benjamina*) etc. and other ornamental & flowering plants observed in core zone. List of existing green belt found within the project area is given in **Table 3.21.**

Table 3.21 List of existing green belt of the project area

Botanical Name	Family Name	Common Name
Roystonea regia	Arecaceae	Royal palm
Borassus flabellifer	Arecaceae	Palmyra Palm
Cycas revolute	Cycadaceae	Sago palm
Bambusa vulgaris	Poaceae	Bamboo
Azadirachta indica	Meliaceae	Neem
Dypsis lutescens	Arecaceae	arecea palm
Hibiscus rosa-sinensis	Malvaceae	China Rose
Jasminum sambac	Oleaceae	Arabian Jasmine
Rosa x damascena	Rosaceae	Damask Rose
Catharanthus roseus	Apocynaceae	Periwinkle
Plumeria obtuse	Apocynaceae	White Frangipani
Magnolia champaca	Magnoliaceae	Champa
Delonix regia	Caesalpiniaceae	Flame Tree
Ocimum tenuiflorum	Lamiaceae	Holy basil
Madhuca longifolia	Sapotaceae	Indian Butter Tree
Casuarina equisetifolia	Casuarinaceae	Casuarina

3.11.4 Vegetation and Flora of the Buffer zone:

Land use and land cover of the buffer zone reveals the absence of any National Parks or Wildlife Sanctuaries or Biosphere Reserves or Important Bird Areas (IBAs) or Protected Wetlands within 10 km radius of the project site. There are 2 scrub jungle reserve forest patches namely; RF near Malangadh village-4.3 km (East) &RF near Rohinjan village- 5.1 km (West) have been found within the 10 km of study area. Since therefore the biological environment will not have significant impact due to proposed project activity. The impact on the biological environment due to the air emissions generated is minimised by well-developed green belt in and around the project area.

The buffer zone is surrounded mainly by croplands, scrub lands, evergreen/green vegetation and scrub. Reserved forests etc., and also many non-cultivable, fallow lands sparsely covered with vegetation like Khair(*Acacia catechu*), Neem*(Azadirachta indica),* Eucalyptus (Eucalyptus clones),*Ficus religiosa* (Pipal tree), Palmyra Palm (*Borassus flabellifer*), Bougainvillea (*Bougainvillea spectabilis*) Gum arabic tree (*Acacia nilotica*), *Calotropis gigantea, Calotropis procera*, Guava (*Psidium guajava*) &

Mango(*mangifera indica*) etc., and other floral species were observed in the buffer zone. List of plants species found in the buffer area is given in Table 3.22.

Table 3.22 List of trees, shrubs and perennial climbers found in the Buffer Zone

Botanical name	Common / local name	Family
Acacia auriculiformis	Australian wattle	Mimosaceae
Acacia catechu	Khair	Mimosaceae
Acacia leucophloea	White babul	Mimosaceae
Acacia nilotica	Black babul	Mimosaceae
Adenanthera pavonia	Red bead tree	Mimosaceae
Aegle marmelos	Bilva	Rutaceae
Agave americana	Agave	Agavaceae
Ailanthus excels	Maha Neem	Simaroubaceae
Alangium salvifolium	Azhinji	Alangiaceae
Albizia lebbeck	Siris / Vagai	Mimosaceae
Allamanda cathartica	Golden Trumpet Wine	Apocynaceae
Alstonia scholaris	Indian Tree of Heaven	Apocynaceae
Anthocephalus cadamba	Kadamb	Rubiaceae
Araucaria columnaris	Christmas tree	Araucariaceae
Artabotrys odoratissimus	Champak	Annonaceae
Artocarpus heterophyllus	Jackfruit	Moraceae
Asclepias currasavica	Milk weed	Asclepiadaceae
Avicennia alba	White Avicennia	Acanthaceae
Azadirachta indica	Neem	Meliaceae
Bambusa vulgaris	Yellow Bamboo	Poaceae
Barringtonia acutangula	Barringtonia	Lecythidaceae
Bauhinia purpurea	Purple Orchid Tree	Caesalpiniaceae
Bauhinia variegate	Mandaarai	Caesalpiniaceae
Beaucarnea recurvate	Ponytail Palm	Arecaeae
Bixa orellana	Lipstick tree	Bixaceae
Bombax malabaricum	Silk Cotton Tree	Bombacaceae
Borassus flabellifer	Palmyra palm	Arecaeae
Bougainvillea glabra	Bougainvillea	Nyctaginaceae
Bougainvillea spectabilis	Bougainvillea	Nyctaginaceae
Brassaia actinophylla	Octopus tree	Araliaceae
Brugmansia sp.	Tree Datura	Solanaceae
Butea monosperma	Palas	Fabaceae
Caesalpinia pulcherrima	Peacock Flower	Caesalpiniaceae
Callistemon lanceolatus	Bottle brush tree	Myrtaceae
Calophyllum inophyllum	Alexandrian laurel	Clusiaceae
Calotropis gigantean	Crown flower	Asclepiadaceae
Calotropis procera	Apple of Sodom	Asclepiadaceae
Carissa spinarum	Bush Plum	Apocynaceae

Botanical name	Common / local name	Family
Caryota urens	Fishtail Palm	Arecaceae
Cassia fistula	Golden Shower Tree	Caesalpiniaceae
Cassia javanica	Java Cassia	Caesalpiniaceae
Cassia siamea	Siamese Cassia	Caesalpiniaceae
Cassia spectabilis	Golden Cassia	Caesalpiniaceae
Castanospermum australe	Black Bean	Fabaceae
Casuarina equisetifolia	Casuarina	Casuarinaceae
Chamaedorea sefritzii	Bamboo palm	Arecaceae
Chromolaena odorata	Siam weed	Asteraceae
Cocos nucifera	Coconut	Arecaceae
Colvillea racemosa	Colville's Glory	Caesalpiniaceae
Conocarpus lancefolius	Lanceleaf buttonwood	Combretaceae
Cordia sebestena	Scarlet Cordia	Boraginaceae
Cycas revoluta	Sago palm	Cycadaceae
Cymbopogon citratus	Lemon grass	Poaceae
Dalbergia sissoo	Shisham	Fabaceae
Decalepis hamiltonii	Peru Nannari	Periplocaceae
Delonix elata	Gulmohar	Caesalpiniaceae
Delonix regia	Gulmohar	Caesalpiniaceae
Dendrocalamus strictus	Bamboo	Poaceae
Dodonaea viscosa	Hop Bush	Sapindaceae
Dolichandrone platycalyx	Nile Tulip Tree	Bignoniaceae
Duranta plumieri	Golden dew drops	Shrub
Dypsis decaryi	Triangle Palm	Arecaceae
Dypsis lutescens	Areca palm	Arecaceae
Emblica officinalis	Amla	Euphorbiaceae
Erythrina crista-galli	Cockspur Coral Tree.	Fabaceae
Erythrina indica	Indian Coral tree	Fabaceae
Erythrina suberosa	Corky coral tree	Fabaceae
Eucalyptus citriodora	Lemon Scented Gum	Myrtaceae
Eucalyptus globulus	Blue gum	Myrtaceae
Eucalyptus tereticornis	Red Gum	Myrtaceae
Euphorbia nivulia	Leafy Milk Hedge	Euphorbiaceae
Ficus hispida	Hairy Fig	Moraceae
Ficus benghalensis	Banyan Tree	Moraceae
Ficus racemosa	Cluster fig	Moraceae
Ficus religiosa	Arali mara	Moraceae
Filicium decipiens	Fern tree	Sapindaceae
Firmiana colorata	Coloured Sterculia	Sterculiaceae
Furcraea foetida	Mauritius hemp	Agavaceae
Gardenia jasminoides	Cape Jasmine	Rubiaceae

Botanical name	Common / local name	Family
Geranium sp.	Geranium	Geraniaceae
Gmelina arbrea	Gamhar	Laminaceae
Golphimia gracilis	Rain of Gold	Malpighiaceae
Grevellia robusta	Silver oak	Proteaceae
Guazuma ulmifolia	West Indian Elm	Sterculiaceae
Heterophragma roxburghii	Bara Kalagoru	Bignonaceae
Hiptage benghalensis	Vasantakaala Malligai	Malpighiaceae
Holoptelea integrifolia	Kaladri	Ulmaceae
Hyophorbe lagenicaulis	Bottle palm	Arecaceae
Ipomoea biloba	Rubber wine	Convolvulaceae
Ipomoea carnea	Pink Morning glory	Convolvulaceae
Ipomoea palmata	Railway Creeper	Convolvulaceae
Ixora singaporensis	Ixora	Rubiaceae
Jacaranda mimosaefolia	Jacaranda	Bignonaceae
Jasminum sambac	Jasmine	Oleaceae
Jatropha curcas	Wild Castor	Euphorbiaceae
Jatropha gossypifolia	Siria Amanakku	Euphorbiaceae
Kigelia pinnata	Sasega mara	Bignoniaceae
Lagerstroemia flos-reginae	Pride of India	Lythraceae
Lagerstroemia speciosa	Pride of India	Lythraceae
Lantana camara	Lantana	Verbenaceae
Lawsonia inermis	Mehendi	Lythraceae
Leucaena leucocephala	Subabul	Mimosaceae
Limonia acidissima	Wood apple / Vilam	Rutaceae
Mangifera indica	Mango	Anacardiaceae
Manilkara hexandra	Ceylon Iron wood	Sapotaceae
Manilkara zapota	Sapota	Sapotaceae
Markhamia lutea	Nile Tulip Tree	Bignoniaceae
Michelia champaka	Champak	Magnoliaceae
Millingtonia hortensis	Tree Jasmine	Bignoniaceae
Mimusops elengi	Maghizham	Sapotaceae
Morinda pubescens	Nuna / Ivory Wood	Rubiaceae
Morus alba	White mulberry	Moraceae
Muntingia calabura	Singapore cherry	Muntingiaceae
Murraya paniculata	Vengarai	Rutaceae
Mussanda frondosa	Paper chase tree	Rubiaceae
Nerium odorum	Oleander	Apocynaceae
Nyctanthes arbor-tristis	Paarijatham	Oleaceae
Ochna obtusata	Golden Champak	Ochnaceae
Parkia biglandulosa	Shivalinga	Mimosaceae
Pelargonium graveolens	Rose Geranium	Geraniaceae

Botanical name	Common / local name	Family
Peltophorum pterocarpum	Copper Pod	Caesalpiniaceae
Pentas lanceolata	Pentas	Rubiaceae
Petrea volubilis	Purple wreath	Verbenaceae
Phoenix acaulis	Dwarf Date Palm	Arecaceae
Phoenix sylvestris	Wild date	Arecaceae
Phyllanthus acidus	Star Gooseberry	Euphorbiaceae
Phyllanthus emblica	Nelli	Euphorbiaceae
Phyllanthus reticulatus	Karu Nelli	Euphorbiaceae
Pithecellobium dulce	Madras Thorn	Mimosaceae
Plumeria alba	Champa	Apocynacae
Plumeria pudica	White Frangipani	Apocynacae
Plumeria rubra	Champa	Apocynacae
Poinsettia pulcherrima	Poinsettia	Euphorbiaceae
Polyalthia longifolia	Ashoka	Annonaceae
Polyalthia pendula	Ashoka	Annonaceae
Pongamia pinnata	Honge	Fabaceae
Prosopis juliflora	Mesquite	Mimosaceae
Prosopis spicigera	Banni	Mimosaceae
Psidium guajava	Guava	Myrtaceace
Pterospermum acerifolium	Naradu	Sterculiaceae
Punica granatum	Pomeganate	Punicaceae
Putranjiva roxburghii	Indian Amulet Tree	Putranjivaceae
Pyrostegia purpurea	Flaming trumpet	Bignoniaceae
Pyrostegia venusta	Golden Shower	Bignoniaceae
Quisqualis indica	Rangoon Creeper	Combretaceae
Ricinus communis	Castor	Euphorbiaceae
Roystonea regia	Royal palm	Arecaceae
Russelia equisetiformis	Coral Plant	Srophulariaceae
Samanea saman	Rain Tree	Mimosaceae
Santalum album	Sandal wood	Santalinaceae
Saraca indica	Seetha Ashok	Caesalpiniaceae
Solanum trilobatum	Thoodhuvalai	Solanaceae
Spathodea companulata	Nirukai mara	Bignoniaceae
Sterculia foetida	Wild almond	Sterculiaceae
Syzygium cumini	Jamun /Naaval	Myrtaceae
Tabebuia argentea	Tree of Gold	Bignoniaceae
Tabebuia avellanedae	Pink Tabebuia	Bignoniaceae
Tabebuia rosea	Pink Trumpet Tree	Bignoniaceae
Tabernaemontana coronaria	Moon beam	Apocynaceae
Taliparitiliaceum	Sea or Beach Hibiscus	Malvaceae
Tamarindus indica	Tamarind	Caesalpiniaceae

Botanical name	Common / local name	Family
Tecoma stans	Yellow oleander	Bignonaceae
Tecomella undulata	Tecomella	Bignonaceae
Tectona grandis	Teak / Tekku	Verbenaceae
Terminalia arjuna	Arjun / Neer Marudhu	Combretaceae
Terminalipa catappa	Almond	Combretaceae
Thespesia populnea	Indian Tulip Tree	Malvaceae
Thevetia peruviana	Yellow oleander	Apocynaceae
Thunbergia grandiflora	Heavenly blue	Acanthaceae
Trachelospermum jasminoides	Star Jasmine	Apocynacae
Tylophora indica	Naippalai	Assclepiadacae
Vallaris solanacea	Bread Flower	Apocynaceae
Vernonia elaeagnifolia	Curtain creeper	Asteraceae
Vitex negundo	Nirgundi	Verbenaceae
Wattakaka volubilis	Sneeze Wort	Asclepiadaceae
Wisteria sinensis	Chinese Wisteria	Fabaceae
Wodyetia bifurcata	Fox tail palm	Arecaceae
Woodfordia fruticosa	Red bell bush	Lythraceae
Wrightia tinctoria	Sweet Indrajao	Apocynaceae
Zamia furfuracea	Cardboard Palm	Cycadaceae
Ziziphus mauritiana	Yalachi	Rhamnaceae
Source: primary field survey & secondary data sources		

3.11.5 Terrestrial fauna of the Core area and the Buffer zone:

As the animals, especially vertebrates and the winged invertebrates move from place to place in search of food, shelter, mate or other biological needs so separate lists for core and buffer area is not feasible. There are 2 scrub jungle reserve forest patches namely; RF near Malangadh village-4.3 km (East) &RF near Rohinjan village- 5.1 km (West) has been found within the 10 km of study area. Except that no other wildlife habitats, wetlands in the core area, whereas in 10km radius of the project. As such there are no chances of occurrence of any rare or endangered or endemic or threatened (REET) species in core zone of the project.

The mammal species observed during the survey are Squirrels, Mongoose, Rats, Bandicoots, Monkeys etc., among the reptiles Lizards, Garden lizards were common. No snakes or Monitor lizard was seen during the survey and the amphibians were observed near water bodies. There were no resident birds other than Crows, Parrots, Doves and Mynas etc., observed in the project area are listed below in Table 3.23.

Table 3.23 List Fauna either spotted or reported from the study area

Mammals			
S.No	Latin name	Common name	WPA Schedule
1	*Bandicota bengalensis*	Lesser Bandicoot	IV
2	*Bandicota indica*	Greater Bandicoot	IV
3	*Canis aureus*	Indian Jackal	IV
4	*Funambulus palmarum*	Three -striped squirrel	IV
5	*Hystrix indica*	Porcupine	IV
6	*Lepus nigricollis*	Indian hare	IV
7	*Macaca mulatto*	Rhesus Monkey	II
8	*Mus booduga*	Indian field rat	IV
9	*Mus muscuius*	House rat	IV
10	*Rattus rattus*	House Rat	IV
11	*Rousettus leschnaulti*	Fruit bat	V
12	*Sus scroffa*	Wild boar	III
13	*Varanus indicus*	Common Mongoose	IV
14	*Vulpes bengalensis*	Indian Fox	IV
Reptiles -Venomous *			
1	*Bungarus caeruleus*	Common Indian Krait *	II
2	*Calotes versicolor*	Garden lizard	IV
3	*Chameleo zeylanicus*	Chameleon	IV
4	*Dryophis nasutus*	Whip Snake	II
5	*Echis carinatus*	Saw scaled viper*	II
6	*Geochelone elegans*	Indian star tortoise	II
7	*Hemidactylus flaviviridis*	Indian wall lizard	IV
8	*Naja naja*	Nag / Cobra*	II
9	*Ptyas mucosa*	Dhaman / Indian Rat snake	II
10	*Varanus bengalensis*	Common Indian Monitor	II
11	*Vipera russselli*	Russell's viper*	II
Amphibians			
1	*Duttaphrynus melonosticatus*	Common Indian Toad	IV
2	*Lissemys punctata*	Turtle	IV
3	*Pangshura tentoria*	Turtle	IV
4	*Polypedates maculatus*	Tree Frog	IV
5	*Rana breviceps*	Indian burrowing frog	IV
6	*Rana cyanophlyctis*	Skipper frog	IV
7	*Rana limnocharis*	Indian cricket frog	IV
8	*Rana tigrina*	Indian Bull frog	IV
Birds(Aves)			
1	*Accipiter badius*	Shikra	IV
2	*Acridotheres tristis*	Common Myna	IV

3	*Alcedo atthis*	Common kingfisher	IV
4	*Ammomanes phoenicurus*	Rufous Tailed Finch	IV
5	*Anas acuta*	Pintail	IV
6	*Anas clypeata*	Shoveller	IV
7	*Anas crecca*	Common Teal	IV
8	*Anas penelope*	Wigeon	IV
9	*Anas poecilorhyncha*	Spot bill Duck	IV
10	*Anas strepera*	Gadwall	IV
11	*Anastmous ocitans*	Open bill stork	IV
12	*Anhinga rufa*	Darter	IV
13	*Anser indicus*	Bar Headed goose	IV
14	*Anthus novaeseelandiae*	Paddy field Pipit	IV
15	*Apus affinis*	House Swift	IV
16	*Ardea alba*	Large Egret	IV
17	*Ardea cinerea*	Grey Heron	IV
18	*Ardea purpuria.*	Purple Heron	IV
19	*Ardeola grayii*	Pond Heron	IV
20	*Athena brama*	Spotted owlet	IV
21	*Aythya fuligula*	Tufted Duck	IV
22	*Bubulcus ibis*	Cattle Egret	IV
23	*Burhinus oedicnemus*	Stone curlew	IV
24	*Butastur teesa*	White eyed buzzard	IV
25	*Butorides striatus*	Little Green Heron	IV
26	*Cacomantis merulinus*	Plaintive Cuckoo	IV
27	*Calidris minuta*	Little Stint	IV
28	*Caprimulgus asiaticus*	Indian Night jar	IV
29	*Centropus sinensis*	Crow pheasant	IV
30	*Ceryle rudis*	Lesser Pied Kingfisher	IV
31	*Charities dubious*	Little Ringed plover	IV
32	*Chloropsis aurifrons*	Green bulbul	IV
33	*Ciconia episcopus*	White necked stork	IV
34	*Circus aeruginosus*	Marsh harrier	IV
35	*Circus melanoleucos*	Pied harrier	IV
36	*Colomba livia*	Blue Rock pigeon	IV
37	*Copsychus saularis*	Magpie Robin	IV
38	*Coracias benghalensis*	Blue jay	IV
39	*Corvus macrorhynchos*	Jungle Crow	IV
40	*Corvus splendns*	House crow	V
41	*Coturnix coturnix*	Common quail	IV
42	*Cypsiurus parvus*	Palm swift	IV
43	*Dicaeum erythrorhynchos*	Pale billed flower pecker	IV
44	*Dicrurus adsimilis*	Black drongo	IV

45	*Dicrurus caerulescens*	White bellied drongo	IV
46	*Dicrurus remifer*	Lesser Rocket tail drongo	IV
47	*Dinopium benghalense*	Golden backed wood Pecker	IV
48	*Egretta garzetta*	Little Egret	IV
49	*Egretta gularis*	Indian reef heron	IV
50	*Egretta intermedia*	Median egret	IV
51	*Elanus caeruleus*	Black winged kite	IV
52	*Esacus magnirostris*	Great stone plover	IV
53	*Eudynamys scolopacea*	Asian Koel	IV
54	*Francolinus pondicerianaus*	Gray Patridge	IV
55	*Fulica atra*	Coot	IV
56	*Galerida cristata*	Indian crested lark	IV
57	*Gallicrex cinerea*	Water Cock	IV
58	*Gallinuta chloropus*	Mooehen	IV
59	*Halcyon smyrnesis*	White breasted Kingfisher	IV
60	*Haliaistur indus*	Brahminy kite	IV
61	*Hemiprocne longipennis*	Crested tree swift	IV
62	*Himantopus himantopus*	Black winged stilt	IV
63	*Hirundo daurica*	Striated swallow	IV
64	*Hirundo rustica*	Common Swallow	IV
65	*Lanius excubitor*	Grey Shrike	IV
66	*Larus brunnicephalus*	Brown headed gull	IV
70	*Lonchura punctulata*	Spotted munia	IV
71	*Megalaima haemacephala*	Copper smith	IV
72	*Merops orientalis*	Green bee-eater	IV
73	*Merops philippinus*	Blue tailed bee Eater	IV
74	*Micropternus brachyurus*	Rufous woodpecker	IV
75	*Milvus migrans*	Black Kite	IV
76	*Motacilla alba*	Pied wagtail	IV
77	*Motacilla flava*	Yellow wagtail	IV
79	*Nectarinia lotenia*	Loten's sunbird	IV
80	*Nectarinia asiatica*	Purple sunbird	IV
81	*Nectarinia zeylonica*	Plum rumped sunbird	IV
82	*Netta rufina*	Red crested Pochard	IV
83	*Nettapus coromandelianus*	Cotton Teal	IV
84	*Nycticorax nycticorax*	Night Heron	IV
85	*Oriolus oriolus*	Golden oriole	IV
86	*Orthotomus sutorius*	Tailor Bird	IV
87	*Parus major*	Grey Tit	IV
88	*Passer domesticus*	House sparrow	IV
90	*Pelargopis capensis*	Spot billed kingfisher	IV

91	*Phalacrocorax carbo*	Large Cormorant	IV
92	*Phalacrocorax niger*	Little Cormorant	IV
93	*Phoenicopterus roseus*	Greater Flamingo	IV
94	*Pioceus manyar*	Streaked weaver bird	IV
95	*Pitta porphyria*	Indian Pitta	IV
96	*Ploceus philippinus*	Baya	IV
97	*Podiceps ruficollis*	Dab Chick	IV
98	*Porphyrio porphyria*	Purple Moorhen	IV
99	*Pseudibis papillosa*	Black Indian Ibis	IV
100	*Psittacula krameri*	Rose ringed parakeet	IV
101	*Pterocles exustus*	Indian sand grouse	IV
102	*Pycnonotus cafer*	Red vented bulbul	IV
103	*Recuvirostra avosetta*	Avocet	IV
104	*Sarkidiornis melanotos*	Comb duck	IV
105	*Sterna aurantia*	Indian robin	IV
106	*Saxicoloides fulicata*	Indian River tern	IV
107	*Streptopelia chinensis*	Spotted dove	IV
108	*Streptopelia decaocto*	Collared dove	IV
109	*Sturnus contra*	Pied Myna	IV
110	*Tadorna ferruginea*	Brahminy duck	IV
111	*Tephrodornis pondicerianus*	Common wood shrike	IV
112	*Tringa glareola*	Wood sand piper	IV
113	*Tringa nebularia*	Green Shank	IV
114	*Tringa ochropus*	Green Sandpiper	IV
117	*Turdoides striatus*	Jungle babbler	IV
118	*Upupa epops*	Hoopoe	IV
119	*Vanellus cinereus*	Grey headed lapwing	IV
120	*Vanellus indicus*	Red wattled lapwing	IV
121	*Zosterops palpebrosus*	Oriental White eye	IV

NT- near threatened
Source: *primary field survey & secondary data sources Forest Department & information gathered from surrounding villagers*

3.11.6 Aquatic flora and fauna of the study area

There are several water bodies falling under buffer zone of the project area are Bava Malang Nadi-adjacent (West), Taloje River -0.7.km (South), Kasadi River -3.4km (south), Lendi River -8.6km (SE), Panvel Creek-9.6km (SW), Mangroove plantation is present out of study area i.e:10.3 km(NW). A list of Mangroves, Mangrove associates and halophytes found in the buffer zone along panvel creek is given in Table 3.24. Semi aquatic flora like macrophytes and fauna observed in the study area is given in the Table 3.25.

There is no reservoir, protected wetlands or other ecologically sensitive wetlands within the 10 km radius of the study area. As such, the area is not important from the point of aquatic ecology.

Table 3.24 List of Mangrove species and the halophytes found in the study area.

Scientific name	Family	Habit
Aeluropus lagopoides	Poaceae	Perennial grass
Avicennia alba	Avicenniaceae	Tree
Avicennia marina	Avicenniaceae	Tree
Acanthus ilicifolius	Acanthaceae	Shrub
Avicennia officinalis	Avicenniaceae	Tree
Caesalpinia bonduc	Caesalipiniaceae	Straggler
Caesalpinia crista	Caesalipiniaceae	Straggler
Clerodendron inerme	Verbenaceae	Shrub
Cyperus corymbosis	Cyperaceae	Sedge
Derris trifoliate	Fabaceae	Straggler
Excoecaria agallocha	Euphorbiaceae	Tree
Fimbristylis ferruginea	Cyperacee	Sedge
Heliotropium curassavicum	Boraginaceae	Herb
Myriostachya wightiana	Poaceae	Perennial grass
Pandanus fascicularis	Pandanaceae	Tree like
Phragmites karka	Poaceae	Sedge
Salvadora persica	Salvadoraceae	Shrub
Scirpus littoralis	Cyperaceae	Sedge
Sesuvium portulacastrum	Aizoaceae	Perennial herb
Suaeda maritima	Chenopodiaceae	Perennial herb
Tamarix troupii	Tamaricaceae	Tree
Thespesia populnea	Malvaceae	Tree
Xylocarpus granatum	Meliaceae	Tree

Table3.25 List of semi aquatic Macrophytes found in the surface water bodies of the study area

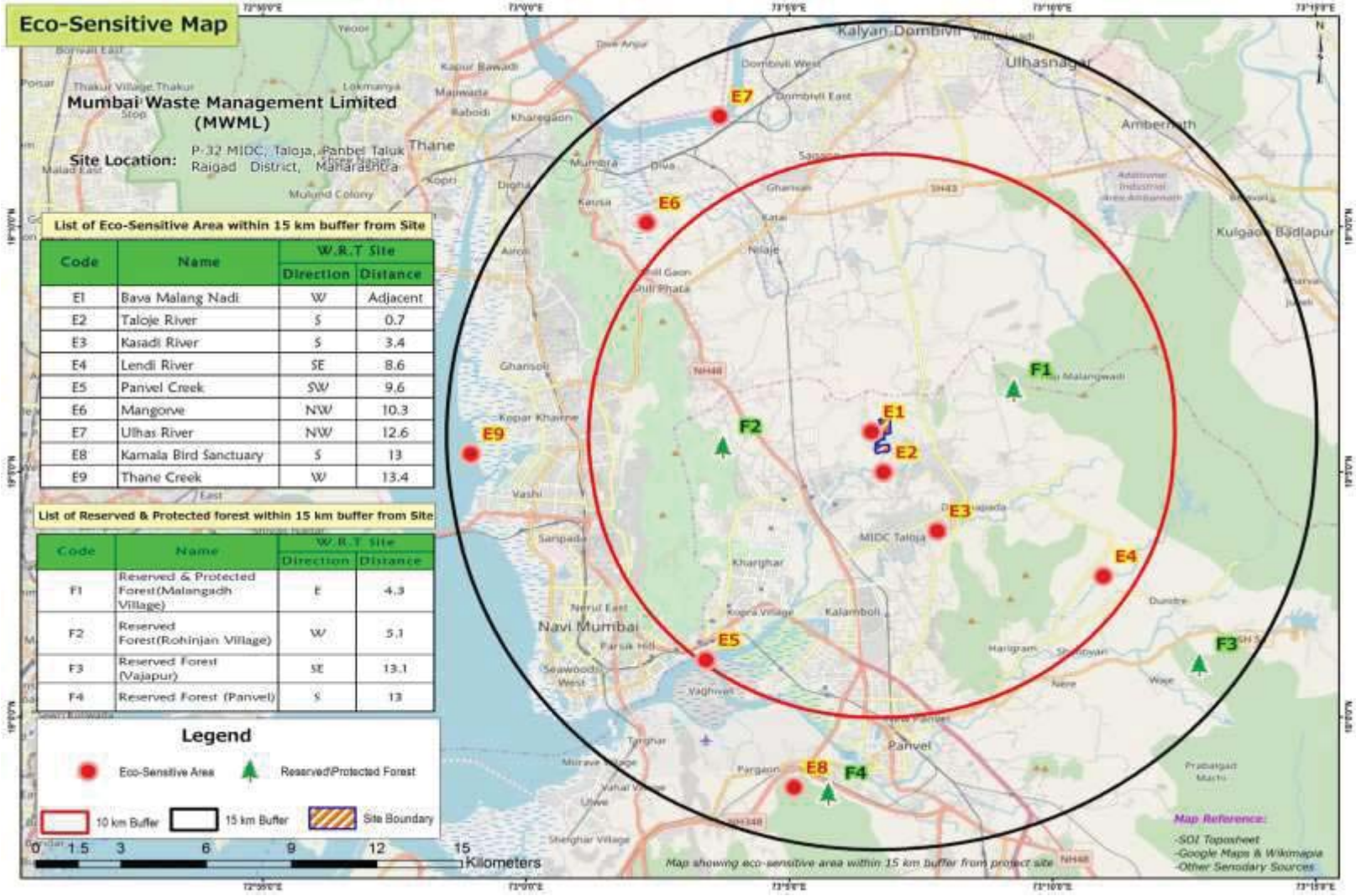
Latin name	Local / Common name	Family
Aponogeton natans	Driftin sword plant	Aponogetonaceae
Alternanthera philoxeroides	Alligator weed	Solanaceae
Alternanthera sessilis	Dwarf copperleaf	Solanaceae
Carex cruciate	Carex	Cyperaceae
Eichhornia crassipes	Gurrapu dekka	Pontederiaceae
Ipomoea aquatic	Tigabachhali	Convolvulaceae
Ipomoea carnea	Bush Morning Glory	Convolvulaceae
Limnophila indica	Indian Marsh weed	Scrophulariaceae
Typha angustata	Cattail	Typhaceae

List of Aquatic Fauna in the Study Area Pisces			
S.No	Scientific name	Common name	WPA Schedule
1	*Aspidoparia morar*	Chilwa	-
2	*Labeo angra*	Angra labeo	-
3	*Barilius vagra*	Barilius	
4	*Puntius dorsalis*	Long snouted barb	
5	*Silonia silondia*	Silond catfish	-
Source:- Fishery Department, information gathered from surrounding villagers and local markets during primary survey			

3.11.7 Wildlife Sanctuaries/ National Parks/ Biosphere Reserve/REET Species

There are no National Parks, Wildlife Sanctuaries, Biosphere Reserves and Important Bird Areas (IBA) within the study area. Except 2 scrub jungle reserve forest patches namely; RF near Malangadh village-4.3 km (East) &RF near Rohinjan village- 5.1 km (West) has been found within the 10 km of study area. There are no reports of occurrence of any rare or endangered or endemic or threatened (REET) fauna is listed in the study area as per Indian Wildlife (Protection) Act 1972. The sensitivity map of the project site with 15km radius is shown in **Figure 3.11**

Figure 3.11 Sensitivity map of the project site with 15km radius



3.12 Demography and Socio-economics (secondary data description)

This section illustrates the prevailing socio-economic aspects of villages in the 10 km radius of proposed expansion of TSDF facility at MIDC area, Taloja, Raigad District, Maharashtra. The following pages attempts to comprehend the social phenomenon so as to represent the demographic, occupational, gender and diversity among the project area villages, thereby postulate impactful developmental interventions.

3.12.1 Methodology Adopted for the Study

Afore mentioned, the Socio-Economic study covers villages in the 10 km radial distance from the periphery of the project site at MIDC area, Taloja, Raigad District, Maharashtra. The study area covers a total of 69 villages, Censes Towns in Panvel Tahsil of Raigad District, Maharashtra. The field area is a mix of rural and urban society in composition, covering major villages and towns. The Socio-Economic study categorizes these villages/towns/wards in to 3 Zones, namely Core Zone (0 to 2 Km radius), Buffer Zone (2 km to 5 km) and other villages which are in 5 to 10 km distance from the proposed site.

The study also adopts a two-fold methodology for data collection, namely, review of published secondary data and analysis of primary data. Secondary data was collected from district census statistics of 2011, which includes: demography, occupational structure, literacy profile and Social structure etc.

Similarly, the primary data was collected through a range of research techniques and tools like: transact walk, structured questionnaire, Focus group discussions, observations and key stakeholder interactions. The primary data was also collected through random survey covering a sample of 5% of households in the core project area villages.

The salient features of the demographic and socio-economic aspects in the Core and Buffer Zone (hereafter referred as Study area) has been described in the following sections. Similarly, village wise demographic data as per 2011 census is presented in subsequent annexure.

3.12.2 Demographic Aspects

This section illustrates the prevailing socio-economic aspects of villages in the 10 km radius of Integrated Common Hazardous Waste Treatment Storage and Disposal Facilities (ICHWTSDF)" at Taloja, Maharashtra .The following pages attempts to comprehend the social phenomenon so as to represent the demographic, occupational, gender and diversity among the project area villages, thereby postulate impactful developmental interventions.

3.12.2.1 Distribution of Population

As per 2011 census the study area consists of 411,681 people and the distribution of population in the study area is given in Table 3.26.

Table 3.26 Distribution of population in the study area

S. No.	Particulars	0-2km	2-5km	5-10km	Total (0-10 km)
1	Number of households	2889	53135	41458	97482
2	Male population	7088	123551	91710	222349
3	Female population	4800	102043	82489	189332
4	Total population	11888	225594	174199	411681
5	SC population	386	15968	12039	28393
6	ST population	1053	6959	11460	19472
7	Total population (0-6 years)	1573	31420	22584	55577
8	Average household size	4.1	4.2	4.2	4.2
9	Percentage of males to the total population	59.6	54.8	52.6	54.0
10	Percentage of females to the total population	40.4	45.2	47.4	46.0
11	Sex ratio (number of females per 1000 males)	677.2	825.9	899.5	851.5
Source: District Primary Census statistics of Maharashtra -2011					

As illustrated in the above table, the gender diversity, as percentage of men and women constitute about 54% and 46% in the study area respectively.

3.12.2.2 Average household size

According to the Census data of 2011, study area had an average family size of 4 persons per household. This represents nuclear family type and also in similarity with other parts of the district.

3.12.2.3 Population density and projections

It is estimated that the average density of population of the study area is 372 persons per km^2. The following Table 3.27. Population projections (based on percentage decadal variation) have been worked out based on available census data

Table 3.27 Population projections

Annual population projections in the project area				
Percentage Decadal Variation in Raigad Dist. (2001-11)	Year	Total population	Male	Female
Decadal Population Growth Rate 19.3%	2011	411681	222349	189332
	2012	419503	226796	192740
Total Annual Percentage Growth Rate 1.9%	2013	427473	231332	196209
	2014	435595	235959	199741
Male Annual Percentage Growth Rate 2%	2015	443872	240678	203336
	2016	452305	245491	206996
Female Annual Percentage Growth Rate 1.8%	2017	460899	250401	210722

3.12.2.4 Sex ratio

To reiterate; the male and female constitute 54% and 46% respectively and number of females per 1000 males as low as 851.

3.12.3 Social structure

The Socio-Economic study observed that only 11.6% of people belong to scheduled category, in which 4.7% belongs to Scheduled Tribes (ST), and Scheduled Castes (SC) comprises 6.9% of total population. The distribution of population in the study area by social structure is illustrated in **Table 3.28.**

Table 3.28 Distribution of population by social structure

S. No.	Particulars	0-2 km	2-5 km	5-10 km	0-10 km
1	SC population	386	15968	12039	28393
2	ST population	1053	6959	11460	19472
3	% of SC to the total population	3.2	7.1	6.9	6.9
4	% of ST to the total population	8.9	3.1	6.6	4.7
5	Total SC & ST Population	1439	22927	23499	47865
6	percentage to the total population	12.1	10.2	13.5	11.6
7	Total population	11888	225594	174199	411681
Source: District Primary Census statistics of Maharashtra - 2011					

3.12.4 Literacy levels

The analysis of the literacy levels in selected villages of study area, reveals that an average literacy rate of 75.9% as per 2011 census data. However, the male literacy of the study area is 56.6%, whereas literacy rate among women, which is an important indicator for social change, is also estimated as low as 43.4%. The distribution of literates and literacy rates in the study area is illustrated in **Table 3.29.**

Table 3.29 Distribution of literate and literacy rates

S.No.	Particulars	0-2 km	2-5 km	5-10 km	0-10 km
1	Male population	7088	123551	91710	222349
2	Female population	4800	102043	82489	189332
3	Total population	11888	225594	174199	411681
4	Male literates	5570	98404	72958	176932
5	Female literates	3077	72994	59446	135517
6	Total literates	8647	171398	132404	312449
7	Male literacy rate (%)	64.4	57.4	55.1	56.6
8	Female literacy rate (%)	35.6	42.6	44.9	43.4
9	% of Male literates to the male population	78.6	79.6	79.6	79.6
10	% of Female literates to the female population	64.1	71.5	72.1	71.6
11	Total literacy rate (%)	72.7	76.0	76.0	75.9
Source: District Primary Census statistics of Maharashtra -2011					

3.12.5 Occupational structure

The occupational structure of project area is studied with reference three categories via., main workers, marginal workers and non-workers. According to Census Department of India, the main workers include 4 categories of workers - cultivators, agricultural laborers, those engaged in manufacturing, processing and repairs in household industry; and others including those engaged in household industry, construction, trade and commerce, transport and communication and all other services.

The marginal workers are those workers engaged in some work for a period of less than six months during the reference year prior to the census survey. The non-workers include those engaged in unpaid household duties, students, retired persons, dependents, beggars, vagrants etc.; institutional inmates or all other non-workers who do not fall under the above categories.

As per 2011 census, there is a total of 34% people are engaged in main works in the study area. The marginal workers and non-workers constitute to 5% and 61% of the total population respectively. Therefore, non-workers are predominant in that of workers by occupation. The occupational structure of the study area is given in Table 3.30.

Table 3.30 Occupational structure

S. No.	Particulars	0-2 km	2-5 km	5-10 km	0-10 km
1	Total population	11888	225594	174199	411681
2	Total workers	5889	86228	68179	160296
3	Work participation rate (%) (Total workers/Total population)*100	49.5	38.2	39.1	38.9
4	Main workers	4826	76981	58085	139892
5	Percentage of main workers to total population	40.6	34.1	33.3	34.0
6	Marginal workers	1063	9247	10094	20404
7	Percentage of marginal workers to total population	8.9	4.1	5.8	5.0
8	Non-workers	5999	139366	106020	251385
9	Percentage of non-workers to total population	50.5	61.8	60.9	61.1
10	Dependency ratio	1.0	1.6	1.6	1.6
Source: District Primary Census statistics of Maharashtra - 2011					

3.12.6 Dependency ratio

Based on the occupational structure of the study area the dependency rate of non-workers on the workers category has been estimated at 1:6. The study also noted that overall work participation rate is only 39% in the project area. It is observed that many educated youth is part of the non-working population. Therefore there is a need for income generation activities to strengthen the livelihoods of local population.

3.12.7 Primary observations in the core zone

The following paragraphs illustrates the current Infrastructural details in project area villages which includes, presence of educational institutions, working profile, housing typology and social composition. The data represented in the graph has been collected through interactions and Focus Group Discussions (FGDs) with primary stakeholders in the project area villages.

- **Demographic aspects:**

As illustrated above, the Sex ratio is observed as low as 677 women for 1000 men, and population belongs to socially weaker sections amounts to 12.1%.

- **Occupational structure:**

Similarly, according to 2011 census, main workers constitute 40% of the total population whereas marginal workers and non-workers constitute to 8.9% and 50.5% of the total population respectively. To

reiterate, distribution of workers by occupation indicates that the non-workers are the predominant population. It is observed that majority of the population are dependent on agriculture, menial jobs in nearby industries and petty business activity for their sustenance.

- **Literacy profile:**

The villages in the core zone are has good education facilities. Except for few villages, majority villages have primary schools, middle schools, Collages etc. The male literacy rate is observed as 64% and female literacy rate is also observed as low as 35.3% and hence the total literacy has been recorded as low as 72.7%.

- **Health care facilities and accessibility:**

The data collected from the field revealed that only all of the villages surveyed have access to Govt. hospitals. These villages have PHC, SHCs and village level dispensaries.

- **Accessibility to educational institutions:**

It was observed during study that all villages/wards have Anganwadi, primary schools, middle schools and senior secondary schools. The villages in the buffer zone are also well connected to Tahsil headquarters - Panvel and other towns in the District thereby have an access to senior secondary, graduate & post-graduate courses.

- **Water and sanitation facilities:**

Regarding water facility in the studied villages the main source of drinking water Public Taps, Village Wells, Bore wells / Tube wells, Hand pumps, tank and Ponds. Similarly, the study area presents a fair picture when it comes to sanitation. Many villages have individual toilets, community water treatment plants etc.

- **Infrastructure facilities in the surveyed Villages:**

The primary data and village level focus group discussions also revealed that, 67% of villages have Sub-post offices and 35% of villages have community centers. However, all the villages have power Supply both for Domestic and Agricultural purposes.

- **Transport facilities:**

The villages in the core zone have good road connectivity. A large majority of the project villages have access to bus service with Pucca roads connecting to major towns and state highways. Almost all villages have all weather road connectivity.

- **Awareness about government schemes and programmes:**

Most of the villages surveyed are benefitted by government schemes such as MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Act), swatchch bharat mission, and convergence programs through community participation etc. The study observed that villagers are aware of the developments so far as the welfare schemes and programs of the Government.

- **Other observations:**

The socio-Economic study revealed that the youth in the project area are devoid of employment opportunities. They can be a potential source of workers with minimum handholding and vocational

education. The youth have expressed their willingness to setting up of industries in the area as it provides them gainful employment opportunities.

Similarly, this would also trigger many direct and indirect benefits for economic advancement and social development of project area.

The study also noted an active presence of local committees, Self-Help-Groups (SHG) in the project area villages. Many of these groups are acting as user groups, micro-finance entities, rotating small amount of loans among the group members.

Suggestions for improvement of Socio-economic status through CSR activities

The socio-Economic status of the population in the project area shall be improved through CSR and focused community development interventions. Some of the salient activities are illustrated below:

- Need to develop Sustainable water sources through Bore wells, village level overhead tanks for the consumption of people and their livestock
- Community toilets and individual toilets under Swatch Bharat Mission
- Periodical health checkup camps need to be conducted
- Convergence with finance institutions to provide loan facilities to the village youth to purchase auto rickshaws or small transport vehicles which not only provides them self-employment, but also strengthen rural transportation and agriculture incomes.
- Youth empowerment programs through awareness creation about various government schemes, providing appropriate opportunities with relevance to their qualification and skills, conducting skills inculcating programs etc.,
- Enhancing women empowerment through conducting skill training programmes for rural women in tailoring, manufacturing household items would enhance their income thereby create better livelihood opportunities for the rural women. These products can be purchased or marketed by company, which will provide additional employment opportunity of the rural women & adolescent girls.
- A number of CSR activities can be initiated in the project area villages on convergence mode whilst partnering with exiting Government schemes and financial support from developmental institutions like NABARD.

Annexure I: Demographic details in the study area of 10 Km radius

S.No	Name	No_HH	TOT_P	TOT_M	TOT_F	P_06	P_SC	P_ST	P_LIT	P_ILL	TOT_ WORK_P	MAIN WORK_P	MARG WORK_P	NON_ WORK_P
0-2 Km														
1	Valap	542	2236	1298	938	305	16	158	1594	642	967	845	122	1269
2	Pale Bk.	667	2632	1556	1076	352	72	226	1848	784	1437	1203	234	1195
3	Devichapada	1409	5574	3487	2087	691	291	27	4400	1174	2907	2454	453	2667
4	Kanpoli	142	727	370	357	93	3	18	516	211	336	148	188	391
5	Hedutane	129	719	377	342	132	4	624	289	430	242	176	66	477
	Total	**2889**	**11888**	**7088**	**4800**	**1573**	**386**	**1053**	**8647**	**3241**	**5889**	**4826**	**1063**	**5999**
2-5 km														
6	Vavanje	835	4017	2126	1891	527	108	446	2732	1285	1397	1075	322	2620
7	Kherane Kh.	847	3466	1997	1469	430	86	35	2323	1143	1781	1615	166	1685
8	Chindharan	474	2250	1174	1076	255	11	0	1731	519	777	734	43	1473
9	Mahalungi	68	333	195	138	47	0	132	203	130	117	41	76	216
10	Kevale	237	1180	607	573	129	8	544	814	366	622	333	289	558
11	Khanav	176	813	421	392	89	0	2	573	240	370	196	174	443
12	Harigram	358	1744	892	852	212	24	313	1116	628	1007	688	319	737
13	Nevali	330	1460	807	653	211	172	176	1025	435	511	478	33	949
14	Talode Panchnad (CT)	2749	14318	7668	6650	2570	567	336	10331	3987	4319	4030	289	9999
15	Navi Mumbai Panvel Raigarh (CT)	46920	195373	107342	88031	26873	14989	4793	150137	45236	75042	67522	7520	120331
16	Durshet	141	640	322	318	77	3	182	413	227	285	269	16	355
	Total	**53135**	**225594**	**123551**	**1E+05**	**31420**	**15968**	**6959**	**171398**	**54196**	**86228**	**76981**	**9247**	**139366**
5-10 Km														
17	Adivali	161	771	440	331	88	25	35	560	211	290	271	19	481
18	Dhansar	404	1881	979	902	258	44	2	1371	510	828	509	319	1053
19	Turbhe	127	673	362	311	114	14	19	472	201	228	214	14	445
20	Karavale Bk.	280	1403	717	686	167	17	0	1009	394	437	287	150	966
21	Nagzari	216	883	461	422	168	49	359	378	505	349	149	200	534
22	Rohinjan	901	4020	2138	1882	716	191	30	2935	1085	1451	1348	103	2569
23	Bid	24	118	57	61	21	0	16	77	41	35	26	9	83
24	Owe	1909	9746	5371	4375	1446	284	779	6679	3067	3531	3090	441	6215
25	Nitalas	362	1956	1024	932	241	69	80	1445	511	724	660	64	1232
26	Nitale	118	482	253	229	89	0	434	192	290	139	14	125	343
27	Kondap	24	114	59	55	19	0	114	40	74	67	6	61	47

S.No	Name	No_HH	TOT_P	TOT_M	TOT_F	P_06	P_SC	P_ST	P_LIT	P_ILL	TOT_ WORK_P	MAIN WORK_P	MARG WORK_P	NON_ WORK_P
28	Wangani Tarf Taloje	39	206	97	109	44	0	206	93	113	125	119	6	81
29	Karambeli Tarf Taloje	210	1041	521	520	221	0	1039	281	760	546	341	205	495
30	Shiravali	102	525	281	244	76	0	0	362	163	155	77	78	370
31	Ambe tarf taloje	68	370	198	172	43	0	0	284	86	206	167	39	164
32	Khairwadi	92	523	267	256	108	1	522	233	290	289	265	24	234
33	Tamsai	58	363	180	183	73	0	362	129	234	166	164	2	197
34	Kondale	110	492	251	241	93	41	168	215	277	263	208	55	229
35	Morbe	297	1463	757	706	211	66	410	842	621	615	272	343	848
36	Chinchavali Tarf Waje	119	583	300	283	74	2	35	407	176	219	181	38	364
37	Ritghar	253	1169	628	541	132	46	59	866	303	558	391	167	611
38	Dundre	436	2051	1092	959	251	14	41	1404	647	1019	872	147	1032
39	Dhamani	141	778	399	379	125	2	755	327	451	242	226	16	536
40	Gadhe	87	448	237	211	68	10	392	205	243	175	121	54	273
41	Ambe tarf waje	32	161	80	81	24	5	87	87	74	84	52	32	77
42	Shivansai	60	332	168	164	55	0	122	211	121	141	41	100	191
43	Umroli	164	866	427	439	97	0	0	633	233	467	353	114	399
44	Usarli Bk.	148	654	340	314	76	5	0	521	133	355	333	22	299
45	Vakadi	356	1569	800	769	206	69	450	980	589	762	592	170	807
46	Koproli	227	1026	571	455	136	65	93	756	270	387	347	40	639
47	Chipale	373	1629	857	772	169	96	380	1279	350	754	276	478	875
48	Bonshet	117	550	308	242	52	0	3	375	175	264	240	24	286
49	Vihighar	249	1175	596	579	104	22	0	855	320	507	385	122	668
50	Nere	768	3569	1850	1719	426	387	202	2613	956	1239	1158	81	2330
51	Ambivali	92	398	219	179	45	0	0	265	133	133	133	0	265
52	Sangatoli	66	321	154	167	46	38	102	188	133	161	146	15	160
53	Waje	345	1780	882	898	228	6	366	1161	619	636	573	63	1144
54	Cheravali	205	953	473	480	164	0	493	535	418	264	154	110	689
55	Akurli	813	3344	1850	1494	520	246	51	2502	842	1473	1346	127	1871
56	Shilottar Raichur	1409	5796	3178	2618	810	961	95	4550	1246	2330	2036	294	3466
57	Devad	803	3210	1765	1445	461	464	168	2288	922	1413	1187	226	1797
58	Moho	394	1822	925	897	199	90	22	1311	511	780	674	106	1042
59	Wangani Tarf Waje	108	618	321	297	59	0	147	355	263	275	265	10	343
60	Loniwadi	171	856	427	429	114	25	89	598	258	546	495	51	310

S.No	Name	No_HH	TOT_P	TOT_M	TOT_F	P_06	P_SC	P_ST	P_LIT	P_ILL	TOT_ WORK_P	MAIN WORK_P	MARG WORK_P	NON_ WORK_P
61	Pali Kh	108	531	277	254	67	0	6	352	179	156	152	4	375
62	Shivkar	527	2464	1297	1167	329	74	24	1719	745	812	763	49	1652
63	Vichumbe	1624	6332	3512	2820	783	1012	152	4856	1476	2615	2282	333	3717
64	Vaghivali	99	503	264	239	82	0	0	380	123	138	123	15	365
65	Kopar	328	1373	694	679	213	48	132	909	464	408	345	63	965
66	Pargaon	704	3161	1619	1542	445	216	340	2260	901	1053	883	170	2108
67	Kharghar (CT)	20737	80612	42001	38611	9488	5750	1534	66574	14038	31350	27643	3707	49262
68	Palidevad (CT)	2193	9194	4913	4281	1124	1142	297	7517	1677	3223	3088	135	5971
69	Vadghar (CT)	1700	7341	3873	3468	1216	443	248	4968	2373	2796	2042	754	4545
	Total	**41458**	**174199**	**91710**	**82489**	**22584**	**12039**	**11460**	**132404**	**41795**	**68179**	**58085**	**10094**	**106020**
	Grand Total	**97482**	**411681**	**222349**	**2E+05**	**55577**	**28393**	**19472**	**312449**	**99232**	**160296**	**139892**	**20404**	**251385**

Source: District Primary Census statistics of Maharashtra - 2011

Abbreviations

- No_HH: No. of House Holds
- TOT_P: Total Population
- TOT_M: Total Male
- TOT_F: Total Female
- P_06: Population below 6 years
- P_SC: Population belongs to SC
- P_ST: Population belongs to ST
- P_LIT: Population Literate
- P_ILL: Population Illiterate
- TOT_WORK_P: Total Working Population
- MAINWORK_P: Main working population
- MARGWORK_P: Marginal Working Population
- NON_WORK_P: Number of Non-Working population

Chapter 4

Anticipated Environmental Impacts & Mitigation Measures

4.1 Introduction

Environmental impacts are defined as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects or beneficial, wholly or partially. Environmental aspects selected for further study should be include activities that occur during normal, abnormal and emergency operations.

The objective of this section is to:

- Identify project activities that could beneficially or adversely impact the environment
- Predict and assess the environmental impacts of the such activities
- Examine each environmental aspect-impact relationship in detail and identify its degree of significance
- Identify possible mitigation measures for these project activities and select the most appropriate mitigation measure based on the reduction in significance achieved and practicality in implementation

4.2 Identification of impacts

Any developmental activity in its wake will bring about some impacts associated with its origin, which can be broadly classified as reversible, irreversible, long and short-term impacts. In this chapter, an endeavor has been made to identify various environmental impacts associated with the operation of facility and other activities wherein, there may be a chance of pollution. Based on the possible worst case emissions and waste generation from the proposed project and also taking into consideration the baseline environmental status at the proposed project site, the environmental factors that are likely to be affected (Impacts) are identified, quantified and assessed. Both instrumental (positive) and detrimental (negative) impacts are accounted for this purpose. The prediction of impacts helps in the preparation of a sound environmental management plan which has to be executed during the on-going activities for the proposed project to minimize the adverse impacts on the environmental quality.

The adverse impacts from operations facility are fatal accidents (e.g., scavengers buried under waste piles), infrastructure damage (e.g., damage to access roads by heavy vehicles), pollution of the local environment (such as contamination of groundwater and/or aquifers by leakage and residual soil contamination during landfill usage, as well as after landfill closure), off-gassing of methane generated by decaying organic wastes and harboring of disease vectors such as rats and flies, particularly from improperly operated landfills.

4.3 Methodology

The potential impacts on the environment from the proposed project are identified based on the nature of various activities associated not only with the project implementation and operation, but also on the current status of the environmental quality at the project site.

To carry out the impact assessment of the Common Hazardous Waste Treatment storage and disposal Facility for enhancement in capacities and adding additional new facilities, the methodology adopted for impact assessment is such that the whole project is divided into major activities and for each activity adverse or positive impact is identified and divided into the following sections hereunder:

- Identification of landfill activities
- Impact prediction, elevation due to these activities and its mitigation measures
- Impact analysis i.e. consequence/score analysis

4.4 Potential impacts

The potential significant environmental impacts associated with the project are grouped as below.

- **Air environment:** Impacts on ambient air quality and odor
- **Water environment:** Impacts on surface and ground water quality; and aquatic life
- **Land environment:** Impacts on land use, soil fertility and agriculture
- **Socio economics:** Impacts on infrastructure and employment
- **Indirect impacts:** Impacts on public health and safety; and aesthetics

4.5 Prediction of impacts

The impact assessment is carried out for the following phases and presented in the following paragraphs.

- Impacts during construction phase
- Impacts during operation phase

4.5.1 Impacts during construction phase

During construction phase works include site clearance, site preparation, civil works for secured landfill, machinery installation and commissioning activities like fabrication work, cutting, welding, lying of cables and pipelines etc. Other works include leveling of land, laying foundations, construction of buildings and other facilities, approach roads etc. However, the impacts due to construction activities are short term and are limited to the construction phase only. The impacts will be mainly on air quality, water quality, soil quality and socio-economic conditions.

Emissions are expected to result in temporary degradation of air quality, affecting construction employees in the working environment. However, dust generation and particulate matter rise in the ambient air will be coarse and will settle within a short distance close to the construction sites. Hence, dust and other emissions are unlikely to spread sufficiently to affect the surroundings of the construction site. The Identification of probable Impact due to development phase furnished in below Table 4.1.

4.1 Identification of probable Impact due to development phase

Construction Activities	Sector	Significant Impacts
1. Short Term Impacts		
Site clearing and leveling (excavation, cutting, stripping, compaction and earth movements)	Air	• Fugitive dust emissions • Noise/air emissions from construction equipment & machinery
	Water	• Run-off from construction area • Run-off from vegetative stripped area
	Land	• Change in drainage pattern • Loss of fertile top soil • Land pattern changes from open land to mixed development
	Ecology	• Loss of vegetation • Topographical transformations
	Noise	• Hearing Problem • Health issues • Sleeping disorders • Cardiovascular issues • Trouble communicating • Effect on wildlife
Storage of construction Materials/Equipments and Transportation	Air	• Fugitive dust emissions due to traffic movements • Noise and air emissions from vehicles • Spillage & fugitive emissions of construction materials
	Water	• Run-off from construction storage materials • Spillage of construction materials & flow into streams
	Soil	• Deposition of spilled construction materials on soil
	Public utilities	• Congestion on roads • Increased flow of traffic
Civil Construction Activities	Air	• Fugitive dust emissions due to traffic movements • Noise and air emissions from vehicles
	Water	• Run-off from construction storage materials
Mechanical & Electrical erection	Air	• Noise and air emissions from machinery activities
	Water	• Run-off from erection areas containing oils & paints
Influx of Labor & Construction of Temp. Houses	Socio-economic	• Stress on social relations • Stress on infrastructure
	Water	• Sanitary effluents from labour colonies
	Land	• Change in land use pattern of the area in labour colonies
Disposal of Construction debris & Transportation	Air	• Noise and air emissions from transport vehicles • Fugitive dust emissions due to movement of traffic • Spillage and fugitive emissions of debris materials
	Water	• Run-off from Disposal Areas • Spillage/spread of debris and flow into streams
	Soil	• Spillage/spread/deposition of debris • Conversion of land into waste land

4.5.2 Impact on air quality

The principal source of air quality impact arising from the construction of the proposed project is fugitive dust generation. The dust, measurable as Suspended Particulate Matter and Respirable Suspended Particulate matter generated as a result of construction activities will be coarse and settle within a short distance close to the construction sites. Other sources include- loading and unloading of materials, top soil removal, vehicle movement on unpaved roads, civil constructions and provision of infrastructure, wind erosion etc.

Among all the construction activities, site preparation has the highest potential to cause nuisance to the nearby air sensitive locations. During the construction of the project, existing human settlements nearby may be exposed to the potential dust impacts. Exhaust emissions from vehicles and equipment deployed during the construction phase is also likely to result in marginal increase in the levels of SO_2, NO_X, PM, CO and un-burnt hydrocarbons. However, the impact of such activities would be temporary and restricted to the construction phase. Moreover the emissions from above activities are expected to result in temporary degradation of air quality, primarily in the working environment and negligible outside the plant boundaries.

4.5.2.1 Mitigation measures proposed – air quality

For the proposed project, site leveling and grading will be carried out, where ever possible to maintain natural elevations. Leveling will be carried out only for laying roads, sewage network, storm water system and infrastructure for administrative and plant shed erection. According to the engineering assessment; most of the excavated material shall be reused within the project boundary. The movement of cut and fill material will be limited.

Most of the dust generated from construction activities is due to the movement of vehicles carrying materials. Unloading of materials and removal of soil shall also act as a potential source for dust emission. Following are the control measures proposed:

Dust emission control

- Regular water sprinkling on haulage roads to deliver continuous moisture to suppress dust in dust prone areas.
- Regulate speed of vehicles in unpaved areas to reduce fugitive dust created and reduce dust to a large extent.
- The duration of stockpiling will be as short as possible as most of the material will be used as backfill material for the open cut trenches for road development.
- Care will be taken to keep all material storages adequately covered and contained so that they are not exposed to situations, where winds on site could lead to dust / particulate emissions. Fabrics and plastics for covering piles of soils and debris is an effective means to reduce fugitive dust from the material stores/ warehouses.
- Spills of dirt or dusty materials will be cleaned up promptly so that the spilled materials do not become a source of fugitive emission. Similarly, spilled concrete slurries or liquid wastes will be cleaned up immediately before they can infiltrate into the soil/ ground or runoff in nearby areas.

- Temporary tin sheets of sufficient height (3m) will be erected around the site of dust generation or all around the project site as barrier for dust control.
- Trees will be planted all around the project boundary and regularly watered to keep the area moist for most part of the day.

Gaseous emission control

- Regular maintenance of machinery and equipment will be carried out
- All the vehicles used for construction activity shall have valid "Pollution under control" Certification
- Ambient air quality monitoring will be carried out during construction phase. If monitored parameters are above the prescribed limits, suitable control measures will be taken.

4.5.3 Impact on water quality

The proposed project will involve various construction activities. The following section summarizes the activities likely to be undertaken during the proposed development and describes the potential impacts on water quality from each activity.

Site preparation

During site preparation, along with other development activities, construction of temporary infrastructure such as drainage culverts may be required which may produce large quantities of run-off with high suspended solids loading in the absence of appropriate mitigation measures. This potential problem may be further aggravated during rainy season.

i) Construction of buildings

The construction of various civil structures and washing of various equipments results in site runoff especially during rainy season, causing significant pollution in the receiving water bodies.

ii) Site workshop

The used engine oil and lubricants have the potential to create impacts if spillage occurs. Waste oil may infiltrate into the surface soil layers, or runoff into local water courses, increasing hydrocarbon levels. Proper precautionary measures should be taken to prevent any spillage of the above materials and their subsequent runoff into the water bodies.

iii) Domestic activities

During construction, impacts from domestic activities include waste and wastewater generated from canteen/cafeterias as well as sewage from temporary sanitary facilities. Sewage is mainly characterized by high levels of BOD, COD and E.Coli. Significant water quality impact will happen only if the sewage is discharged directly into the receiving waters without any prior treatment.

4.5.3.1 Mitigation measures – water quality

During site development, necessary precautions will be taken, so that the runoff water from the site gets collected to working pit and if any, over flow will be diverted to nearby greenbelt/ plantation area. During construction activity, all the water resulting from the equipment's washed will be diverted to the working pit in order to arrest the suspended solids. The settled water will be reused

for construction purposes and for sprinkling on haul roads to control dust emissions. The domestic sewage generated will be treated in portable STP or sent to septic tank/soak pit.

4.5.4 Impact of noise

Construction activities are likely to produce noise up to some considerable extent. During construction phase of the project activity, there will be noise generation from earth moving equipment and material handling traffic.

The noise generation level will be confined within the surrounding area of construction site. There will be short term, localized and reversible impact on ambient noise levels during the construction activities. Typical mitigation measures for reducing noise levels will include the following:

4.5.4.1 Mitigation measures

- Low noise generating equipment will be selected to reduce noise levels.
- All noise generating equipment will be used during day time for brief period of its requirement. Equipment will be provided with noise control measures such as acoustic insulation etc, to ensure noise abatement. Wherever possible, the equipment will be kept away from human habitation.
- Proper mounting of equipment and machinery on strong non-vibrating foundation will be done.
- Regular maintenance of equipment and lubrication of machineries shall be carried out.
- Dense Greenbelt development around the noise source area and along the boundary of premises will be done.
- Personnel Protective Equipments (PPE) like ear plugs/muffs shall be given to all the workers at site and their usage is ensured during their work.
- Regulating the movement of vehicles to the site to maintain low noise levels.
- Sufficient engineering control during installation of equipments and machineries (like mufflers in DG sets) is to be ensured and all the openings like covers, partitions shall be acoustically sealed.

4.5.5 Impact due to solid waste generation

This category of waste generation in the proposed project is due to the use of different types of raw materials during construction stage which may comprise the following:

- Cement concrete
- Bricks, tiles,
- Cement plaster
- Steel (RCC, door/ window frames, roofing support, railings of staircase etc.)
- Rubble, sand, Stone (Marble, granite, sand stone)
- Timber/wood
- Paints/varnishes

Besides the above, there are some other major and minor components viz., conduits, pipes, electrical fixtures, panels, etc. which will be segregated and stored in the proper storage area at the site.

4.5.5.1 Mitigation measures for solid waste

The solid waste generated during construction phase is predominantly inert in nature. Hence maximum effort would be made to reuse and recycle them. All attempts shall be made to ensure the following:

- All construction waste shall be stored within the site itself. A proper screen will be provided so that the waste does not get scattered.
- Attempts will be made to keep the waste segregated into different heaps as far as possible so that their further gradation and reuse is facilitated.
- Materials which are to be sold or land filled will also be kept in separate heaps.
- Arrangements will be made from a local body or a private company to provide appropriate number of skip containers/ trolleys on hire.

The use of the construction material basically depends on their separation and conditions of the separated material. A majority of these materials are durable and therefore, have a high potential for reuse. It would, however, be desirable to have quality standards for the recycled materials. Construction waste can be used in the following manner.

- Reuse of bricks, tiles, stone slabs, timber, piping railings etc to the extent possible and depending upon their conditions.
- Sale/ auction of materials which cannot be used at the site due to design constraint
- Plastics, broken glass, scrap metals etc will be stored and processed within the site.
- Rubble/ brickbats can be used for building activity, such as levelling, under coat of lanes where the traffic does not constitute heavy moving loads.
- Larger unusable pieces can be sent for filling low lying areas.
- Fine material such as sand and dust can be used as cover material
- The unearthed soil can be used for levelling as well as for lawn development
- The broken pieces of the flooring material can be used for levelling in the building or can be disposed off
- The unused or remaining paints/varnishes/wood can either be reused or can be disposed off

4.5.6 Impact on soil and land use

Major impacts on soil and land environment during the construction phase are as follows:

- The project will involve cut and fill activity, which will involve removal of vegetation cover and removal of top soil during earthworks prior to building construction resulting in accelerated soil erosion.
- Pollution of surrounding land due to soil, clay and silt that will be carried by runoff during rainy season.
- Pollution caused by spilled oil/lubricants/fuel due to inadequate management and control of construction machinery, vehicles and allied equipment.
- Deterioration of surrounding lands due to improper disposal of packaging material, broken pieces of glass, tiles, municipal waste etc. from construction activity.
- The development of site may also result in increased surface run off.

4.5.6.1 Mitigation measures

- The proponents have opted to take the maximum advantage of the existing terrain topography and as such, the possibility of severe soil erosion and land disturbance are ruled out. Before commencement of earth work, a retaining wall with garland drains will be built all along the lower contours of the Site, to ensure trapping of soils in case occasional heavy rains.
- The land contours will be so developed that the flow of water is properly channelized and the drains out of site will have filter bunds made of Laterite stone and arrangement for polyelectrolyte dosing so as to ensure that any soil does not get washed out of the site and do not pollute nearby waters.
- The top soil cover removed from the areas being dug and/or levelled will be stored separately and used for the development of green belt and gardens.
- Substratum removed during foundation, broken pieces of concrete, bricks will be used for leveling of plot.
- Separate area will be earmarked for storage of solid and hazardous wastes generated.
- Wastes like broken glass, plastic drum/ bags / iron scrap etc. will be sold to scrap dealers for recycle
- Robust native tree species present on the site will be, as far as possible, transplanted in the green belt in lieu of felling

4.5.7 Demographic and socio-economic

The impact of the proposed unit on demography and socio economic conditions of the study area would be as follows.

- Additional strain on civic amenities like road, transport, communication, drinking water, sanitation and other facilities to meet the work force requirement.
- The project will result in giving business opportunities and increase in demand for services like hotels, lodges, public transport etc.
- Employment opportunities for laborers, skilled and unskilled workers etc., is anticipated.
- Economic up-liftmen of the area.
- More work to the civil construction and transportation companies

4.5.8 Potential impact on biological environment

During construction phase, there will be clearance of some natural vegetation in the form of shrubs, ground vegetation. However, most of the trees are local species and of low concern of conservation. While construction activity will temporarily affect flora and fauna in surrounding area by settlement of dust on the leaves and blocking the stomatal openings, noise machinery will scare away the sensitive fauna. The impact of the proposed project on the local as well as regional ecology is not very significant. The site selected for study lacks reserve forest, protected forest, planted forest, national park, bird sanctuary etc. which bears ecological significance. The existing ecology in the study comprises of manmade habitat dominated by agricultural sets up.

4.5.9 Impacts on wildlife habitat in the non-forested area

The land use data presented earlier in the baseline shows that most of the area of study area comes under man made ecosystem. No designated wild life habitat was reported during the site survey in

10km radius area of wells except for few small mammals and common birds recorded during faunal study. However, the proposed project, being a temporary activity, will not hamper the ecological balance of the area and will not cause permanent shifting of any birds or any faunal habitats. Uprooting of trees except shrubs and herbs will not be required during site preparation, so that impact on the vegetation will not be a major issue. Therefore the predicted impact due to proposed activity will be low.

4.6 Impact during operation phase

During the operation phase of the proposed project, there would be impacts on the air, water, land environment and socio-economic conditions. The Identification of operation and maintenance activities and probable impacts are given in Table 4.2.

4.2 Identification of operation and maintenance activities and probable impacts

Unit	Technology/Additional Information	Sector	Probable impacts
Secured Landfill	Double-liner composite system with leachate collection and leak detection systems (as per CPCB guidelines)	Air	Particulate Matter
		Water	Leachate generation
		Noise	No significant noise is generated, but noise is expected from loading and unloading of wastes
Incineration	Dual Chamber Incineration (Rotary Kiln and Secondary Chamber)	Air	Particulate Matter, HCl, SO2, NOx, CO, Total Organic Carbon, HF, Dioxins and Furans, Heavy Metals
		Water	No significant waste water is generated. Waste water is generated
		Noise	operation of incinerator and DG sets and also during stabilization of hazardous waste
		Solid waste	Bottom Ash, Solid waste from bag filter, Salts from spray drier
Bio-Medical Waste	Autoclave and Incineration	Air	Particulate Matter, NOx, HCl, Dioxins and Furans, and Mercury
		Water	The wastewater from vehicle/container washing, floor washing, Autoclave and Air Pollution Control Devices
		Noise	Noise is expected during unloading of bio-medical waste, incinerator, DG sets, pumps etc.
		Solid waste	Bottom Ash, Solid waste from bag filter, Salts from spray drier
AFRF	Neutralization, Mixing, & Blending	Air	Volatile Organic Compounds and Particulate Matter
		Noise	No significant noise is generated , but noise is expected from loading and unloading of wastes
		Solid waste	No regular process waste generation expected
E-Waste Recycling	Crushing, Dismantling, Shredding, Separation	Air	Particulate Matter, Lead, and Mercury
		Noise	Noise is expected during crushing, dismantling and shredding
		Solid waste	Scrap plastic materials, Card board, Wood etc.
Spent Solvent	Distillation	Air	Volatile Organic Compounds

Recycling		Water	Minimal amount of waste water is generated, from processing of solvents, containers cleaning etc.
		Noise	No significant noise is generated
		Solid waste	Spent Salts, Sludge
Paper Recycling	Segregation, Compaction, and Baling	Noise	No significant noise is generated, but noise is expected from compaction machines.
		Solid waste	Minor amount of unwanted extrudate
Plastics Recycling	Chipping, Washing, Drying, Agglomeration, Extrusion, and Granulation	Air	Volatile Organic Compounds
		Water	Minimal amount of waste water is generated from Mechanized Cleaning, cooling of furnace(boilers)
		Noise	No significant noise is generated , but noise is expected from loading and unloading of wastes
		Solid waste	Minor amount of unwanted extrudate
MS Drum Recycling	Collection, Cleaning, Shredding Baling, Storage, Selling	Air	No major air pollutants
		Water	Waste water is generated from the drum decontamination(cleaning)
		Noise	No significant noise is generated , but noise is expected from loading and unloading and shredding of wastes
		Solid waste	Minor amount of unwanted extrudate

4.6.1 Prediction of impacts on the air environment

Prediction of impacts from the proposed project on the air quality was carried out using air quality simulation models. The main sources of air pollution are as follows:

1. Area source emissions from landfill operations
2. Point source emissions from Incinerator, DG set.
3. Boilers for used solvent recovery, autoclave and MEE (Forced evoporation) facilities

The emissions from the Boilers, Incinerators, used oil recycling, spent solvent, E-waste facility and DG sets. The DG set is minimal since they will be operated only during power failure.

4.6.2 Atmospheric dispersion of stack emissions – Air quality Modeling

A detailed study on emission sources and quantification of pollutant concentration by means of dispersion modeling is required to access the environmental impact of TSDF. On the basis of the predicted increments to air pollutant concentrations, an effective mitigation and environmental plan can be devised for sensitive areas.

Air quality modeling has been attempted using AERMOD, EPA approved American Meteorological Society/Environmental Protection Agency Regulatory Model - AERMOD 7.0.3 dispersion Model has been used. AERMOD dispersion Model provides option to model emissions from a wide range of sources that are present at a typical industrial source complex.

The model considers the sources and receptors in undulated terrain as well as plain terrain and the combination of both. The basis of the model is the straight line steady state Gaussian Plume Equation,

with modifications to model simple point source emissions from stacks that experience the effect of aerodynamic down wash due to nearby buildings, isolated vents, multiple vents, storage piles etc.

AERMOD dispersion model with the following options has been used to predict the cumulative ground level concentrations due to the proposed emissions. Area being rural, the rural dispersion parameters are considered as below:

- Predictions have been carried out to estimate concentration values over radial distance of 10 km around the sources
- A combination of Cartesian and Polar receptor network has been considered
- Emission rates from the sources were considered as constant during the entire period
- The ground level concentrations computed were as is basis without any consideration of decay coefficient
- Calm winds recorded during the study period were also taken into consideration
- 24-hour mean meteorological data, extracted from the meteorological data collected during the study period as per guidelines of IMD/CPCB has been used to compute the mean ground level concentrations to study the impact of proposed activity.

4.6.3 Pollution sources

4.6.3.1 Area sources

Daily waste will be disposed by tipping at the working area on a landfill, within the area demarcated for the cell. Daily/weekly cover (optional) is primarily used for prevention of windblown dust, litter and odours, deterrence to scavengers, birds, reduction of infiltration (during unseasonal rain) and in improving the site's visual appearance. Soil used as daily / weekly cover shall give a pleasing uniform appearance from the site boundary. To achieve this, thickness of about 150 mm is usually adequate and shall be adopted.

4.6.3.2 Point sources

The point source emissions considered for the proposed project are Incinerator, boilers (for used oil and spent solvent recycling) and DG sets. The DG set will be used only during emergency situations like power failure. Hence the impacts from DG sets will be less.

In order to estimate the post project scenario which would prevail at the post operational phase, the predicted maximum Ground Level Concentration (GLC) of 24 Hour average PM, SO_2 and NOx concentrations (considering the 24 hour mean meteorological data of study season) are superimposed on the maximum baseline concentrations obtained during the study period. Twenty four hours mean meteorological data is given in Table 4.3.

Table 4.3 24hourly meteorological data (Sep-2018 to Nov-2018)

Hour	Temperature (°C)	Relative humidity (%)	Wind direction (Degree)	Wind speed (m/s)	Stability class
1	23.2	80	315	2.35	6
2	21.2	82	270	2.07	6
3	20.3	84	315	2.21	6
4	18.4	86	315	2.68	6
5	16.3	88	315	2.36	6
6	17.8	89	290	1.85	6
7	20.2	87	315	1.48	5
8	24.5	85	270	1.85	4
9	28.8	82	315	1.88	4
10	30.2	75	315	1.89	3
11	32.5	68	315	1.94	2
12	35.6	56	270	2.28	1
13	36.5	43	315	2.38	1
14	35.8	31	315	2.14	1
15	34.8	38	315	2.85	1
16	33.1	42	270	1.59	2
17	31.2	48	315	2.55	3
18	30.4	53	315	2.97	4
19	29.9	59	315	1.66	4
20	28.9	64	270	1.84	5
21	28.5	66	315	1.78	6
22	27.9	71	315	1.95	6
23	26.4	77	315	2.15	6
24	25.3	78	315	2.05	6

The inputs used to run the model are details of emissions from stacks of incinerator, DG sets and boilers details are given in **Table 4.4** and **Table 4.5.**

Table 4.4 Details of existing & proposed stack emissions

Details	Incinerator		DG Sets	
Existing		Proposed	Existing	Proposed
Plant capacity	36 TPD (2, No's)	36 TPD (3 No's)	825 kVA	500 kVA
Type of fuel	Hazardous waste		Diesel	
Height of the stack (m)	40	50	10	10
Diameter of the stack (m)	1.20	1.50	0.3	0.3
Temp of flue gas (°C)	110	110	400	410
Velocity of flue gas (m/s)	23.7	15.2	18	16
Volumetric flow rate (m^3/s)	27	27	1.27	1.13
PM emissions (g/s)	1.04/each	1.04/each	0.037	0.022
SO_2 emissions (g/s)	4.17/ each	4.17/each	0.028	0.017
NO_x emissions (g/s)	8.33/ each	8.33/each	0.73	0.44

Note: **Incinerator**: Emissions are calculated based on outlet emission standards (PM-50mg/Nm^3, SO_2-200mg/Nm^3& NO_x-400mg/Nm^3) consider in worst case

DG Set: 1. Sulphur content 350 mg/kg As per BS-III HSD Standards. 2. NO_x limit 4 g/kWh & PM 0.2 g/kWh (≤800 kW) as per Gazette of India - G.S.R .771(E) Environmental (Protection); 3rd Amended Rules dated 11th December 2013.

Table 4.5 Details of proposed Boiler stack emissions

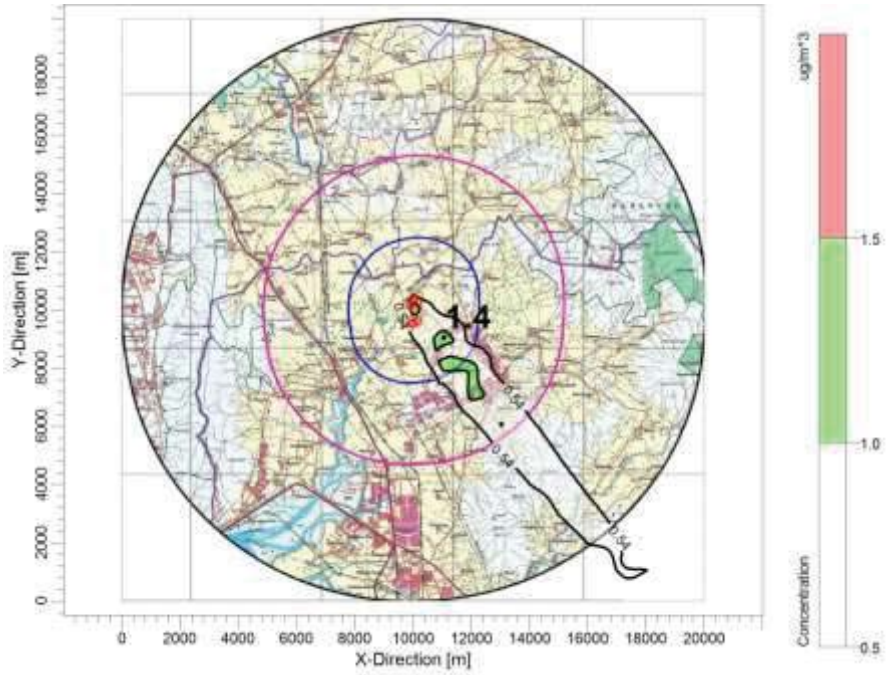
Boiler Specifications	
Boiler Capacity	Boiler -2 (3 TPH each)
Stack height, m	Minimum - 30
Stack diameter, m	0.5
Velocity, m/sec	16
Volumetric Flow rate m^3/sec	3.14
Temperature ^{0}C	120
PM emissions g/s	0.13
SO2 emissions g/s	0.95
NOx emissions g/s	0.58
Bag filters and Scrubbers efficiency	99.5%
Fuel Parameters	
Ash content in coal	36.4%
Sulphur content	0.55%
NOx	260 g/GJ
Boiler – 1 (3TPH) for MEE & Boiler – 2 (3 TPH) for Spent Solvent	
Note: **Boiler:** NOx is considered as 260 g/GJ – Pollution Prevention and Abatement Handbook (World Bank Group – Industry sector guidelines)	

The overall scenario with predicted concentrations over the maximum baseline concentrations is shown in **Table 4.6.** The isopleths are shown in **Figure 4.1 to 4.3.**

Table 4.6 Post project scenario (µg/m^3)

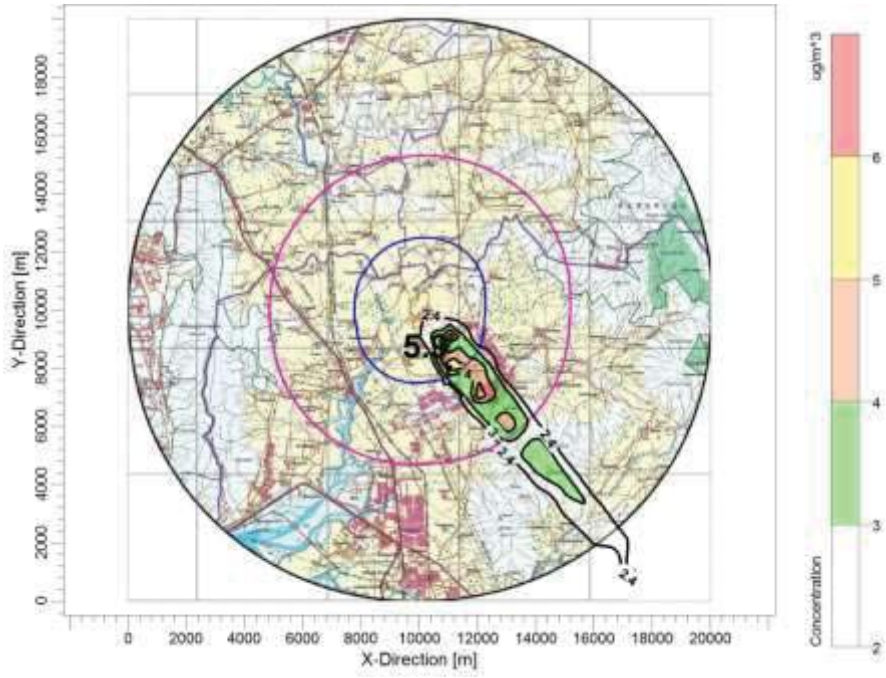
Particulars	Existing		
	Particulate Matter (PM_{10})	Sulphur dioxide (SO_2)	Oxides of Nitrogen (NO_X)
Contribution from existing plant to baseline	1.3	4.8	8.8
Baseline Scenario (Max)	75.1	18.8	27.5
Predicted GLC from proposed expansion	1.4	5.9	10.3
Future predicted GLC	**76.5**	**24.7**	**37.8**
MoEF&CC / CPCB Standards - 24 hourly	**100**	**80**	**80**

Figure 4.1 Predicted 24-hourly average GLCs of PM (µg/m^3)



Max Concentration of PM 1.4µg/m^3 @ at 0.8 km in SE direction

Figure 4.2 Predicted 24- hourly average GLCs of SO_2 (µg/m^3)



Max Concentration SO_2 5.9µg/m^3 @ at 0.8 km in SE direction

Figure 4.3 Predicted 24- hourly average GLCs of NO_x (µg/m^3)



Max Concentration of NOx 10.3 µg/m^3 @ at 0.8 km in SE direction

4.6.4 Air pollution mitigation measures

4.6.4.1 Incinerator

Potential pollutants and respective pollution control devices are as listed below:

- The gases coming out of the incinerator stack are passed through bag filter and multi cyclone for the removal of particulates. For proper dispersion of SO_2 and NOx emissions into atmosphere, incinerator stack height meeting MoEF&CC/CPCB guidelines will be provided.
- Dry lime and activated carbon are injected for neutralization of acidic gases (HCl, HF and SO_2) and removal of organic constituents.
- Flue gases are passed through bag filters for the complete removal of particulates and further to wet alkaline scrubber for neutralization.
- To prevent the formation of dioxins, the flue gas temperature is rapidly lowered from 1100 °C to less than 240 °C by adopting rapid quench / catalyst / adsorption by activated carbon.
- If the feeding waste contains mercury and its compounds, activated carbon treatment for control of these emissions will be carried out. (Ex. activated carbon, conversion into mercuric chloride and then to mercuric sulphide etc.)
- De-mister shall be provided to eliminate mist in the stack emissions.

4.6.4.2 Boiler

- Particulate Matter: ESP with efficiency of 99.5% will be installed to collect fly ash from the flue gas of boiler. The collected fly ash and bottom ash will be sent to landfill.

- Gases: For proper dispersion of Sulphur dioxide & Oxides of Nitrogen emissions from the boiler, stack height meeting MoEF&CC/CPCB guidelines will be provided for proper dispersion into atmosphere.

- To control fly ash generation at ash handling areas, fly ash evacuation from the ESP collecting hoppers would be done in closed pipelines by pneumatic means. The following pollution control measures would be installed for ash disposal.

  - Closed trucks & containers would be used for this purpose, as far as possible.
  - It is proposed to cover the ash in the open trucks with tarpaulin to prevent flying of fine ash during transportation.

4.6.4.3 DG set

- DG set will be used only in case of power failure. The DG set will be provided with acoustic enclosures and adequate height of stack, meeting MoEF&CC/CPCB guidelines. So impact due to D.G. Set will be temporary and for short period.

4.6.4.4 Secured landfill

- During operation, part of the secured land fill will be daily covered with soil/ash and during rainy period with temporary cover (HDPE/Plastic sheets) to minimize the odor and gases generation.

4.7 Impact on water quality

The water demand of the project will be met through ground water and water pipeline/Tankers. To minimize water consumption, water saving options will be planned.

- Improve energy efficiency of operations
- Installation of flow restrictors on water supply line
- Dry sweeping of all areas before mopping/washing
- Eliminate leaks of the pipelines
- Storm water harvesting and rain water holding tanks
- Recycling of water etc.

The details of water requirement and wastewater generation are given in Table 4.7 and Table 4.8.

Table 4.7 Water requirement details (KLD)

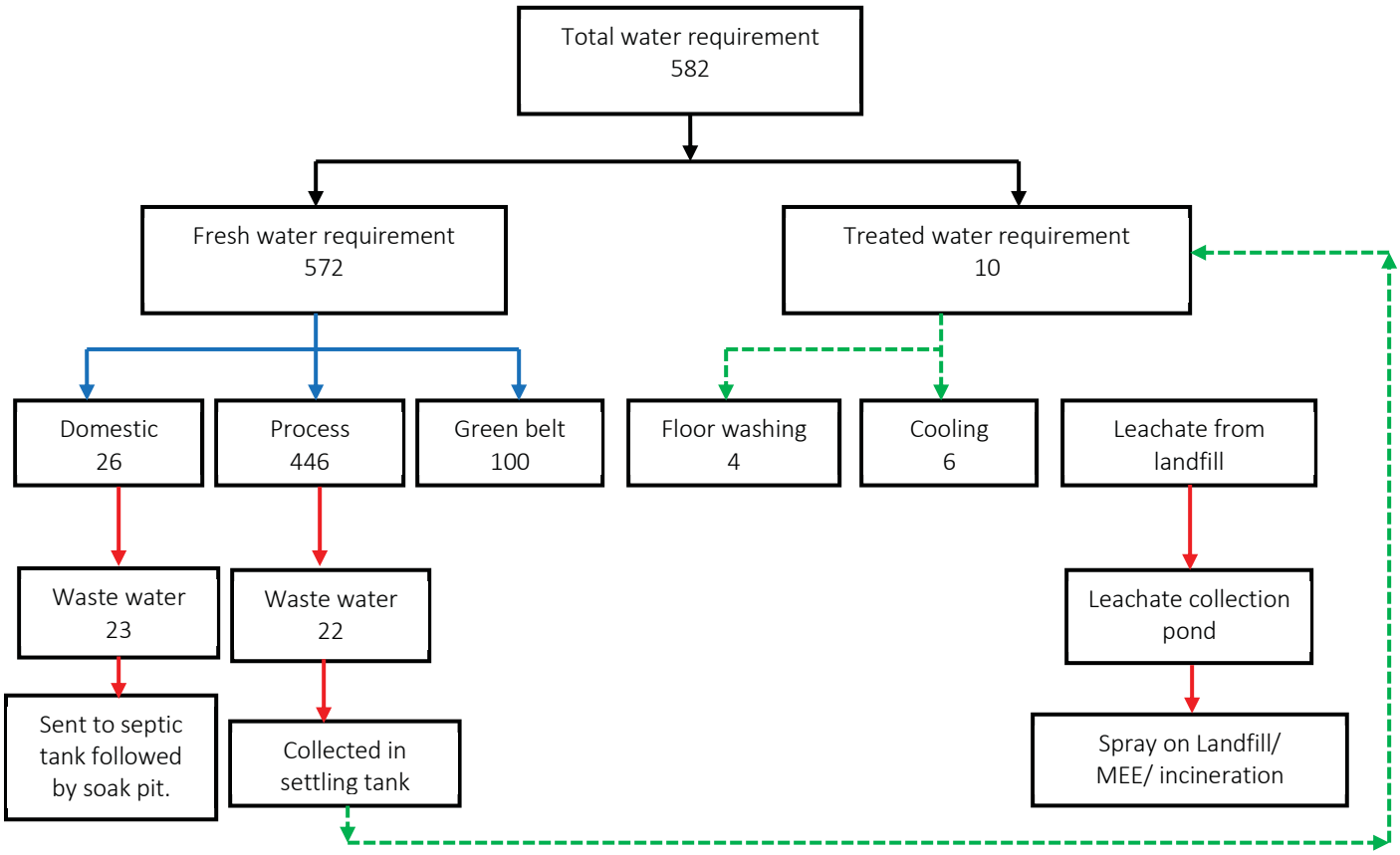
Description and Components		Domestic	Process	Floor Washing	Cooling	Gardening	Total
Existing Project		10	251	0	0	100	361
Proposed	Solvent Recovery	5	50	0	0	0	55
	Plastic Recycling	4	2	2	1	0	9
	Paper Recycling	4	0	0	0	0	4
	Drum Decontamination	2	2	2	0	0	6
	BMW	0	15	0	0	0	15
	Incinerator	1	126	0	5	0	132
Total		26	446	4	6	100	582

Table 4.8 Water and Wastewater details (KLD)

S.No	Description	Water requirement	Wastewater generation	Remarks
1	Domestic	26	23	Septic tank followed by soak pit
2	Process	446	22	Treated in SEP and reused for dust suppression, spraying on landfill / scrubbing liquid
3	Floor washing	4	0	
4	Cooling	6	0	Makeup water
5	Leachate from landfill	0	69	Incineration/forced evaporation/spraying on landfill
6	Greenbelt	100	0	
Total		582	114	

Note: Process wastewater includes
E-waste – 0.5 KLD, Solvent recovery – 8 KLD, plastic recycling – 3 KLD, drum decontamination – 2 KLD

Figure 4.4 Water balance diagram



4.7.1 Leachate collection/ treatment and disposal

Leachate is collected by a network of lateral and header pipes embedded in a drainage layer, all of which eventually drain into a leachate collection sump. The collected leachate is transferred to a leachate treatment system. Leachate, thus collected is transferred to the forced evaporation system and the residue after decanting is subjected back to the land-filling process. The leachate collection system in an engineered landfill takes the form of an under-drain beneath the waste material. It is required to ensure there is no more than a limited head of pressure above the base liner to cause leakage of liquid from the base of the landfill. The design maximum pressure head in the landfill is limited to 300 mm.

Drainage is affected by a layer of about 300 mm thick graded sand / gravel having high permeability. Within this layer a network of HDPE pipes are placed to collect leachate and conduct it quickly to the collection sump for removal from landfill. The pipes are typically perforated only over the upper half to allow the leachate to enter the pipe and thereafter to be contained within the pipe network system. The layout of the pipe network generally includes sufficient redundancy to ensure that if a blockage occurs somewhere in the network the leachate simply backs-up a little then flows into the system a little further up-gradient. Two layers of the leachate collection system are provided one over the other. Slotting area of the pipe is done only on the top 120^{o} portion of the pipe and to an extent of 100 Sq. cm per running meter of the pipe. The pipe must have sufficient strength to withstand the load imposed by the overlying waste and the earth moving activities associated with the placement and the compaction of the waste (Min 6 kg/ Sq.cm).

The main pipe (headers) feeding leachate to the sump has the capability to be cleaned out in case of clogging. However, the design must include sufficient redundancy of pipe work to ensure alternative drainage paths are available in the event of localized clogging of any part of the system.

The MWML proposes to install Multiple Effect Forced Circulation Evaporation Plant of designed capacity @ 150 KLD effluents. Zero liquid discharge system consisting of a stripper for remover of organic volatiles if present in the industrial waste water, multiple effect evaporators for achieving energy economy and a sludge dryer for converting concentrated industrial waste water into solids. MEE plant comprises of stripper, four effected forced circulation evaporate and Agitated Thin Film Dryer (ATFD). The steam stripper for removing volatile solvents, multiple effect evaporators for concentrating effluent and ATFD for drying concentrated effluent to form solid waste. The distillate of ATFD is added for to the ETP for further treatment and the solids are disposed to secured landfill within the site. The technical specifications of the MEE, ATFD are given below **Table 4.9.**

Table 4.9 Technical specifications of the MEE, ATFD

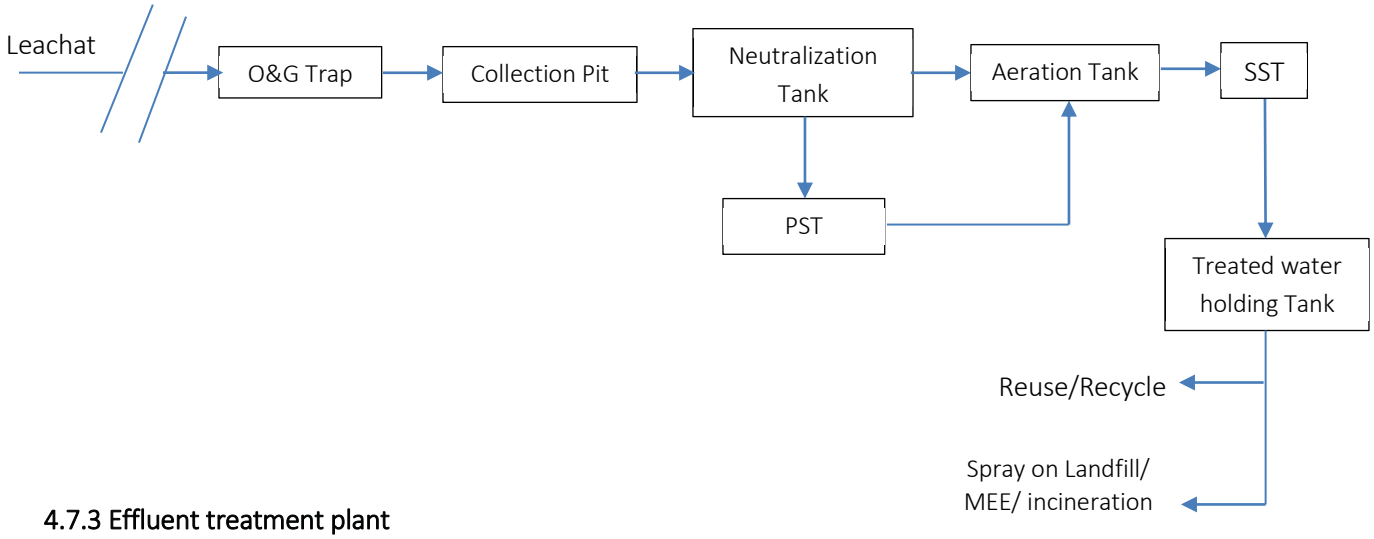
S.No	Parameters	Details	
1	Capacity of plants	150 KLPD	
2	Operating hours	20 Hrs.	
3	Sp.Gr.	1.0	
4	Mass flow Rate	7500 kg/hr	
5	Initial TDS	8% (w/w)	
6	Chloride	1.2 %	
7	PH	7-8	
8	Steam pressure	6 bars(g)	
9	C.W.Inlet Temp	32^0 C	
10	C.W.Outlet Temp	38^0 C	
11	Drive	Electrical , 415± 10%V,50 Hz,3	
12	Operation	Continuous	
Quadruple Effect Evaporation Unit			
S.No	Specification	Units	Data
1	Evaporation Rate	Kg/hr	5625
2	Feed Rate	Kg/hr	7500
3	Initial concentration	w/w%	8
4	Final concentration	w/w%	35
5	Conc.Outlet Rate	Kg/hr	1714
Agitated Thin Film Dryer(ATFD) are			
S.No	Specification	Units	Data
1	Feed Rate	Kg/hr	1714
2	Initial TDS	w/w%	35
3	Solid Recovery @ 10% moisture	Kg/hr	667
4	Evaporation Rate	Kg/hr	1048

4.7.2 Leachate treatment plant

Leachate generated in the landfill will be collected and treated in leachate treatment plant consisting of grid chamber, O&G trap followed by collection pit. After collection pit the treated leachate will be neutralized and sent for aeration tank for removal of BOD/COD, the treated leachate is settled in secondary setteling tank and final treated leachate is collected in treated water holding tank.

Treat leachate is reused for spraying on landfill, excess if any sent to MEE/Incineration. Schematic diagram is given in **Figure 4.5.**

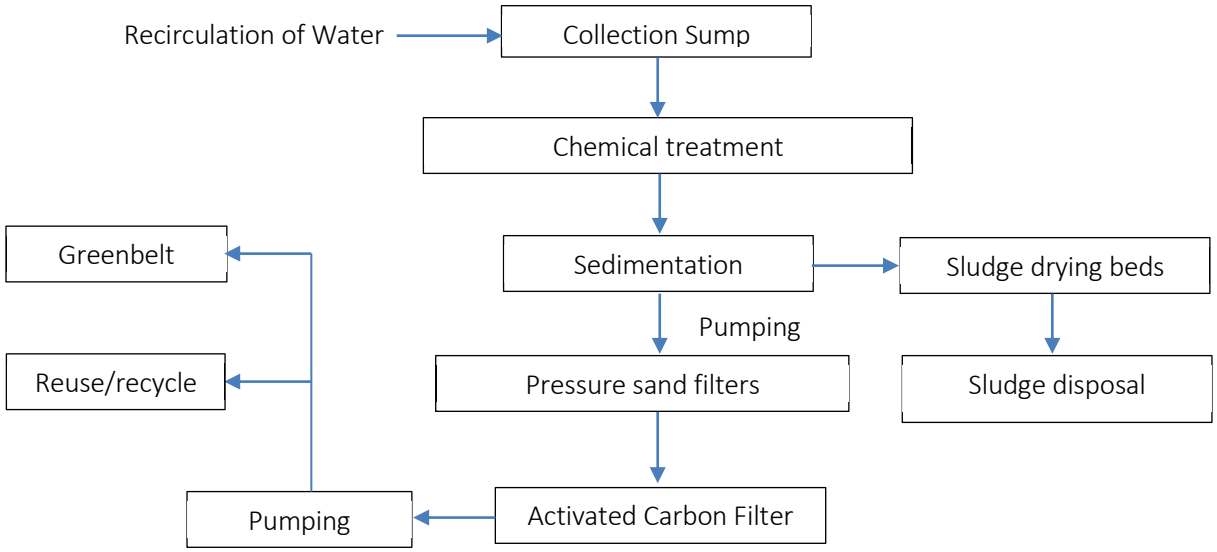
Figure 4.5 Leachate treatment plant



4.7.3 Effluent treatment plant

The wastewater generated from scrubbing, floor washings and other facilities will be treated in an ETP. The treated water shall be reused for circulation into the Incinerator scrubber/quencher, spray on landfill, floor washing and Greenbelt. However, the treatment system consists of collection sump; chemical treatment, pressure sand filter and activated carbon filter then recycled/reused for various activities including greenbelt.

Figure 4.6 Schematic flow chart of proposed ETP



4.7.4 Water impacts mitigation measures

Leachate collected from secured landfill and other wastewater generated from vehicle and container washing (excluding domestic wastewater) is sent to solar evaporation pond or sprayed on landfill. The domestic effluent generated will be treated in septic tank. The effluent generated from floor washings, recycling activity etc. will be collected in collection tank followed by settling tank and the settled water is reuse. The wastewater generated from boiler and cooling tower is used in ash quenching. There will not be any wastewater discharge to any nearby water body and adopts the zero wastewater discharge concept.

4.7.5 Storm water management

Artificial recharge measures like rain water-harvesting helps in reducing the urban run-off, decreasing the pollution of ground water and improving the ground water table which augments the yields of bore wells. Project management will make proper utilization of rainwater by rain water-harvesting. Roof water will be collected by adopting proper treatment (O&G Trap) and the collected water will be used for various uses (dust suppression, toilet flushing, greenbelt, etc.). Rainwater from surface areas will be collected by construction of check dams all along the storm water drainage network at a definite pitch. Based on the rainfall intensity of the plant area, storm water drainage system will be designed. Strom water drainage system consists of well-designed network of open surface drains with check dams at appropriate distances to improve the storm water efficiently drained off without any water logging. Necessary expert advice has been obtained in this regard.

4.8 Noise level impact and Management

In operation activities, frequent vehicular movement for loading/unloading of industrial waste and other transport are cause of adverse effect on noise environment. Adequate noise control measures such as mufflers, silencers at the air inlet/outlet, anti-vibration pad for equipment with high vibration, earmuff and earplugs to the operators, etc. shall be provided. Housing/casing shall provide for all noise generating machines. However, green belt will help to reduce noise. The adverse impact on occupationally exposed workers is not envisaged, as they will be provided with noise protection devices.

4.8.1 Noise mitigation measures

Adequate measures for noise control, at the design stage shall be taken such as keeping high noise generating equipment like pumps, motors etc., on anti-vibration pads, closed rooms and regular maintenance as suggested by the manufacturer. The mitigation measures proposed are as follows:

- Regular and proper maintenance of noise generating machinery
- Proper maintenance of the transport vehicles to maintain the low noise levels.
- Sufficient engineering control during installation of equipment
- Proper and timely maintenance of machineries
- Plant and equipment will be designed to ensure that noise generated is limited to CPCB norms
- Equipment will be provided with noise control measures such as acoustic insulation etc., to ensure noise abatement
- Noise level specification of various equipment as per the Occupational Safety and Health Association (OSHA) standards.

- Providing suitable enclosures (adequate insulation) to minimize the impact of high noise generating sources.
- Employees will be provided with PPE like ear plugs, helmets, safety shoes etc.
- Development of greenbelt all along the boundary and along the roads within the project

4.9 Predicted impacts on land environment

Environmental Impacts on land environment have been classified primarily into two broad aspects, i.e.:

- **Direct impacts on the soil and land in the study area:** Land environment in the area has potential for contamination arising out of solid waste stored in the landfill area. The leachate generated from the land fill area is collected in the leachate holding tank and used back on to the landfill for dust suppression, mixing in stabilization process, etc. If any excess leachate is left over, it will be treated in solar evaporation pond or spray dryer. As a result of this, there is no contamination of the soil due to the wastewater generated and hence the impacts due to the proposed facility on the land environment are negligible.

- The following are the impacts and the mitigation measures to be implemented during the construction and operation of proposed project.

Table 4.10 Impact quantification &mitigation on land environment

S.No	Impact	Quantification of Impact	Mitigation Measures
1	Impact on Land use	Since the proposed incinerator unit is within the premises of existing MIDC area the impact on surrounding land use would be very less,	The management should use the workers/ labours available nearby local area.
2	Impact due to emission from the proposed incinerator	There could be impact on the nearby crop land and habitation due to the emission from the proposed project site.	Appropriate mitigations measures should be provided to reduce the impact due to emissions that could generate from the proposed expansion.
3	Impact on Eco-sensitive areas, wild life and bird sanctuary	The study shows that the proposed site do not fall near to any wild life/ bird sanctuary.	Care should be taken by plant management, to reduce the emissions and also regarding discharge of effluent. Zero emission and zero discharge concepts should be adopted by unit.

4.10 Predicted impacts of the landfill

The project has proposed secured scientific landfill which comprises Govt. of India Regulations and Hazardous Wastes (Management & Handling) Rules 1989 and its subsequent amendments in 2000, 2003, 2008, 2009 and 2016 as the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules with containment measures such as:

- Composite bottom liner to prevent leachate percolation
- Landfill gas management system
- Rodent control and dust control

There shall be no loss of carbon sequestration on account of the proposed activity since the area is almost barren. Development of a thick greenbelt all long the boundary of the site will more than compensate for the loss. As there are no rare or endangered or endemic or threatened (REET) species, the proposed project will not pose any problem to the species. Hence, the impact of the project on biota is negligible.

4.11 Impacts on the community

- Public Safety: A number of activities carried out in the facility might have significant impacts on the public safety. With the implementation of a strong environmental management plan, the communities residing near the project site are unlikely to be exposed to any long-term hazards.

- Aesthetics: The project site is located away from the settlements and proposed greenbelt around the site, as a part of the environmental management plan will help in improving the aesthetics of the environment.

4.12 Impact on ecology and Biodiversity.

The impact due to proposed activity on the ecological parameters like natural vegetation, cropping pattern and aquatic life, forests and species diversity is as summarized below.

Proposed enhancement in capacity of incineration system/facility at existing common hazardous waste treatment, storage and disposal facilities (ICHWTSDF), which is located on non-agriculture land and there will not be any cutting of the plantation at the site. During construction phase, due to generation of fugitive dust emission there will be slight impact on natural vegetation of the surrounding area. Emission shall be within limit by incorporating EMP provisions. Therefore, the adverse impact over any of the ecological components of the environment is negligible.

The details of Flora/Fauna species and the wildlife habitat in the area covering 10 km radius have been collected to determine the existence of rare and/ or endangered species. There is no protected areas, national park or any sanctuary within 10 km radius of the plant. The predicted impact on surrounding ecology is not very significant.

4.12.1 Aesthetic Environment

The proposed facility is to be developed on industrial land with good landscape and plantation. Increase in fugitive emission due to very limited construction activities and increase in the vehicular movement due to the proposed activity may have minimal adverse impact on the visual quality. However, this impact can be minimized with implementation of environment management plan. Since there is no discharge of effluent to any water body, there is no adverse impact in the visual water quality. Adverse impacts are minimized with adoption of various EMP measures taken by the facility on the aesthetic environment.

There are no forests or wildlife habitats, wetlands in the core area, whereas in 10 km radius of the project. As such there are no chances of occurrence of any rare or endangered or endemic or threatened (REET) species in core zone of the project. Due to the development of green belt at the project vicinity the impact on the ecology will be minimal.

4.13 Impact on socio-economics

The proposed facility is likely to provide direct and indirect employment and likely to increase the socio-economic status of the nearby villages in the study area. Due to proposed project the facilities for public transport, water supply, telecommunications, education, public health etc., are likely to improve.

4.14 Odour management

The goal for effective odour management is to eliminate objectionable odours by reducing the frequency, intensity, duration, and offensiveness of odours that people might experience. Following are some specific odour causing conditions that can arise during solid waste handling:

i) Waste transportation

Odours from waste transportation can vary greatly depending on the type of waste and the method of transport. These odours are normally transient in nature and rarely the source of ongoing odour impacts. Typical odour causing compounds from waste transportation include volatile organic acids which can be prevented by containing the wastes as CPCB guidelines.

ii) Storage facility

The primary objective of storage is to store the waste temporarily before sending it to landfill. Some biological activity will occur in these storages, and the gases generated can be a source of odours. The potential for waste odours to be carried away by air movement will increase if the waste is left uncovered. It is important that putrescible waste be kept relatively cool in an enclosed container and be removed and disposed quickly. It is also important that the container be adequately cleaned after the waste is removed so that putrescible residues do not remain to decompose further and generate odour.

iii) Landfill facility

The most common odour-causing compounds at landfill cell are hydrogen sulphide, sulphur dioxide, ammonia etc., these odour causing compounds are produced through the decomposition of wastes. In addition, methane can be generated by waste decomposition. These problems can be addressed by control of transportation, appropriate waste storage and containment, minimization of the area, time that the active portion of the landfill remains exposed to the environment, careful operation and maintenance of the landfill facility.

4.14.1 Odour control measures

Storage facility

The proposed facility will receive and store the waste in an enclosed area. While handling odorous wastes, care shall be taken to avoid smell nuisance.

Landfill cell

For landfill cell, following methods can be used to control odour:

- Greenbelt development to form a surface capable of sorbing & forming sinks for odorous gases.
- Ensuring that the operation is carried out under the best management practices
- Storing putrescible waste in order to minimize its decomposition and control release and dispersal of its odorants
- Cleaning and removing spilled debris from storage and transport containers
- Herbal spray on hazardous waste after disposing it in the landfill cell.

4.15 Public health

During construction period, periodic check-ups of all the employees shall be done regularly. Workers will be provided with basic amenities like safe water supply, low cost sanitation facilities, first aid, required personal protective equipment, etc. Otherwise, there could be an increase in diseases related to personal hygiene.

4.16 Occupational health and risk to surrounding community

Site preparation and Secured Landfill Facility involve many occupational health hazards to the workers site. Noise generated during Setting up and the development of CHWTSDF, this including, Waste Receipt, Characterization and storage may affect the workers and staff members. Handling, transportation, storage, disposal and transportation of hazardous wastes, chemicals, fuel etc. may cause health hazard if not handled properly.

4.16.1 Mitigation Measures

- All employees will first undergo medical checks-up organized by the HR Department before hiring is done. All people who have a satisfactory health condition will be hired and the facility for free medical check-ups will be given to each and every employee every 3 months.
- First aid facilities will be available at the premises to treat basic injuries. If the case is beyond first aid, then the person will be taken to the nearest hospital for further treatment and consultation.
- All necessary pre-cautions will be taken to monitor restriction at work period. All government banned substances and products will be in the restriction list at the premises. All necessary signboards will be put up at the required places throughout the facility.
- During proposed activities, proper care would be taken. Proper PPE will be provided to site workers and staff members.
- Site preparation work will be carried out during day time only
- Acoustic enclosures will be provided to DG sets and other noise generating equipment.

4.17 Impact on soil & geology

Impact of the Project on the soil environment and its mitigation: Impact of any project on soil environment can be at different stages of project like construction phase and operational phase. Causes of impact can be air (Flue gas), Water (effluents) and solids (Waste and hazardous material). Impact can be primary, secondary or tertiary. Impact can be positive or negative. During the monsoon months the waste should be stockpiled in temporary holding area (covered with roof). During this period the landfill has to be kept capped with final cover/intermediate cover, and land filling operation should be suspended to reduce infiltration of rain water in to landfill.

Leachate drainage collection and removal:

A leachate collection system is designed at the base of the landfill. It shall comprise of drainage layer, a perforated pipe collection system, sump collection area and removal system.

Final cover system:

A final landfill cover, comprising of several layers, each with specific function shall be installed, after each landfill phase reaches the full height. The final cover system shall enhance surface drainage. Any drainage channels or drains constructed on the restored landfill surface shall be able to resist erosion and cope with localized storm condition. It is recommended that soil samples should be collected and analysed every year. For mitigation to monitor, any adverse impact on soils, around the TSDF during and after operations.

Chapter 5
Alternative Analysis (Site & Technology)

5.1 Introduction

The proposed expansion of the Common Hazardous Waste Treatment Storage and Disposal Facility to Integrated Common Hazardous Waste Treatment Storage and Disposal Facilities is being planned in the existing project site of Mumbai Waste Management Limited at MIDC Taloja, Maharashtra, no alternate sites were considered. During proposed expansion plan the treatment capacities of the hazardous waste and biomedical waste are enhanced. Some additional facilities to handle e-waste, plastic & paper recycling, solvent recovery, alternate fuel & Raw material facility and MS drum recycling are included to make it into integrated facility.

The proposed expansion is planned by following the rules provided by Hazardous & Other Waste Management Rules 1989, 2016 and its subsequent amendments thereof.

5.1.1 Site selection

Environmental sound management of hazardous wastes would require common hazardous waste management facilities for industrial clusters spread all over the country, as it is not possible to have hazardous waste management facility for each unit. Hence common facilities become more necessary in the wake of large number of small, medium industries in our country, which either have no funds or space for development of hazardous waste management facility. For establishing a common facility for treatment, storage, disposal and recycling facilities of hazardous waste CPCB has issued guidelines for site selection criteria (HAZWAMS/25/2002-2003).

5.1.2 Compliance of the site with site selection criteria

As per the Hazardous Waste (Management and Transboundary Movement) Rules, 2016 under Environment (Protection) Act, 1986, hazardous waste generated by industries have to be collected, transported, treated and disposed in a properly designed TSDF Facility. Under aforesaid rules and its amendments, CPCB guidelines have laid down a procedure for collection, storage, transportation and disposal of hazardous wastes. The location criteria of the project is given in Table 5.1

As the expansion is proposed within the existing MWML facility at MIDC Taloja, no alternate sites have been considered. The proposed expansion will be utilizing the existing infrastructure and resources. However, according to the CPCB guidelines, we have carried out complete evaluation of the site as per the site evaluation criteria given in HAZWAMS/25/2002-2003, which is presented in Table 5.2.

Table 5.1 Location Criteria

S.No	Parameter	Criteria	Observation
1.	Lake or pond (Distance from SW body)	Should not be within 200 m	Water body is located adjacent (SE) to the site boundary
2.	River	Should not be within 100 m	Bava Malang Nadi is flowing adjacent (west) to the site boundary, Taloje River – 0.7 km (S), Kasadi River – 3.4 km (S), Lendi River – 8.6 km (SE) from the site.
3.	Flood plain	Should not be within 100 year flood plain	None
4.	High way – State or National	Should not be within 500 m	National Highway (NH) -4, is located 2.8 km West
5.	Habitation – Notified habituated area	Should not be within 500 m	No notified habituated area is located within 1 km from site boundary. Karavale Village Located 0.4 km NW from site.
6.	Public Parks	Should not be within 500 m	There are no public parks within 500m
7.	Critical habitat area – area in which one or more endangered species live	Not suitable	No
8.	Reserved Forest area	Not suitable	No
9.	Wet lands	Not suitable	No, Bava Malang Nadi is flowing adjacent (west) and Water body is located adjacent (SE) to the site boundary.
10.	Air Port	Should not be within zone around the airport(s)	Chatrapati Shivaji International airport is located at 49 km (W) from site.
11.	Water supply	No Water supply well within 500 m	Few Bore wells are present within the industrial area
12.	Coastal Regulation Area	Not suitable	No
13.	Ground Water Table level	GW table should be >2m from the base of the landfill	Ground water levels in study area ranges from 2 -5 m bgl
14.	Presence of monuments / religious structures	Not suitable	No

Table 5.1 Site evaluation of the proposed site – (HAZWAMS/25/2002-2003)

Criteria			Relative values					Weightage	Overall Ranking
			5	4	3	2	1	C	
			100%	80%	60%	40%	20%		
		units	Excellent	Ideal	Good	Poor	Bad		
General Information (25% weightage)	Transportation Economy	km	0 to 5	5 to 10	10 to 20	20 to 40	>40	4	3.5
	Slope (1st Scale)	%	1.5	1.5 to 1.2	1.2 to 0.75	0.75 to 0.5	< 0.5	3	2.4
	Slope (2nd scale)	%	1.5	1.5 to 2.5	2.5 to 7.0	7.0 to 15	>15		
	Topography	Shape	Convex				Concave	4	3.2
	Flood process							5	3.5
	Optimum wind direction (D/s village)	km	>1	1 to 0.5	0.5 to 0.2	0.2 to 0.1	< 0.1	4	0.8
	Infrastructure (Accessibility)		NH	SH	Local road		No road	3	2.1
	Infrastructure (Power supply)							2	1.6
A								25	17.1
Hydrology (12.5% weightage)	Distance from surface water body / drinking water	km	> 5	5 to 3	3 to 2	2 to 1	<1	6	3.6
	Annual rainfall	cm/year	<25	25 to 80	80 to 150	150 to 250	>250	6.5	5.2
B								12.5	8.8
Hydrogeology (12.5% weightage)	GW depth Post Monsoon	m	>15	15 to 10	10 to 5	5 to 1	<1	4	2
	GW flow direction (distance to D/s village)	km	> 5	5 to 3	3 to 1	1 to 0.5	<0.5	3	0.6
	GW quality		bad				Good	3	1.8
	GW gradient	m/km	<5	5 to 10	10 to 20	20 to 50	>50	2.5	1.25
C								12.5	5.65
Geology (12.5% weightage)	Subsidence		Settled soil				Filled up soil	4.5	3.6
	Depth of bedrock	m	>15	15 to 10	10 to 5	5 to 1	<1	4	3.2
	Seismic conditions	Intensity	V	VI	VII	VIII	IX	4	3.2
D								12.5	10
Geotechnical (12.5% weightage)	Permeability	(1x10-6 cm/s)	<0.1	0.1 to 1	1 to 10	10 to 100	>100	6	4.37
	Engineering property (MA, Pl, Sheer)							6.25	5
E								12.5	9.37
Socio Economic /Ecological (25% weightage)	Demography	km	>5	5 to 2.5	2.5 to 1.0	1.0 to 0.2	<0.2	6.25	1.25
	Land use Pattern		Waste land / saline	Grazing / fallow	Single crop / non irrigated	Double crop / irrigated	Plantation	6.25	4.37
	Transportation impacts						passing populated areas	6.25	3.75
	Special ecological features							6.25	2.5
F								25	11.87
	EXCELLENT:90-100, IDEAL:80-90, GOOD:60-80, POOR:40-60, BAD:20-40								62.79
Based on the analysis of site evaluation criteria, the site got a weightage of 62.79 on a scale of 100 and it is falls under class GOOD.									

5.2 Technology aspects

The management of hazardous, bio-medical and E-waste, have become a major concern for many countries in the world in view of the environmental and public health issues which they pose. In the modern framework of hazardous waste management, a four pronged strategy has been adopted.

1. Minimizing the quantity of waste
2. Recycling
3. Treatment
4. Collection, transport and disposal of waste in an environmentally sound manner

All these four approaches are very important. When dealing with a given hazardous waste problem, often there is a need to utilize a combination of the four general approaches outlined above.

5.2.1 Waste minimization

The first priority in waste management is to reduce the quantity of waste to minimum. Three major waste reduction schemes which are often used are summarized as below:

Process modification: Often the industrial process can be altered in such a way that the use of raw materials is optimized and the amount of waste generation is reduced to barest minimum. For example, in zinc electroplating, the sulphate salt is substituted by the chloride compound with slight modification of the process; this can eliminate the cyanide problem.

Waste concentration: The waste can be concentrated using evaporation, precipitation or decantation techniques which mean that the volume of waste can be considerably reduced using these methods. Incineration, viz., oxidation of inflammable-waste is often practiced in order to reduce the volume of waste to be handled. It is an excellent method of waste disposal, but the cost of operation usually exceeds the net gains.

Waste segregation: Segregating the hazardous waste streams from non-hazardous streams decreases the volume of hazardous wastes, thus, making it easier to treat.

5.2.2 Waste recycling

Some substances in wastes also have value. They include glass, wood fiber from paper products, and metal. Scientists have developed ways of recycling many wastes so they can be used again. Almost all materials are recyclable. However, in some more energy will be required in recovery than the recovered value warrants. The two broad ways of processing hazardous waste are waste reuse and waste recycling. We shall briefly deal with them.

Reuse: In some cases waste material can be used as a raw material with very little processing. Transfer of the waste "as is" without reprocessing, to another facility is known as waste reuse or waste exchange.

Recycling: Recycling differs from reuse that, first the waste must be treated before it can be used in a manufacturing process. When a transfer of waste "as is" is not possible, reprocessing the waste for material recovery is known as recycling. For example, bag house dust from scrap steel processors, containing up to 25 per cent zinc oxide, can be combined with waste sulphuric acid to make galvaniser's pickle acid. The spent pickle liquor containing 8-10 percent zinc sulphate and some iron salts is then usable, as fertilizer in agricultural fields. Use of waste organic solvents is the best example of recycling waste.

5.2.3 Treatment of waste

After material recovery, the waste water containing hazardous waste chemicals should be detoxified and neutralized through treatment. There are many technologies available for treating hazardous wastes before they are ultimately disposed of. Their aim is to modify the physical and/or chemical properties of the wastes so that they are rendered harmless. Selection of a treatment process depends on many factors such as the nature of the waste, the desired characteristics of the output stream, and economic and energy considerations.

The treatment technologies can be divided into the following groups, namely:

- Physical treatment
- Chemical treatment
- Biological treatment
- Solidification and Incineration

Physical treatment: Physical treatment conducted using various methods such as phase separation. Phase separation includes three steps, namely: lagooning, prolonged storage in tanks and sludge drying in beds. Lagooning and tank storage are collectively used to separate particulate impurities

Chemical treatment: This treatment is used to facilitate complete breakdown of hazardous wastes and more usually to modify the chemical properties of the wastes, e.g., to reduce water solubility or to neutralize acidity or alkalinity. The techniques involve oxidation, chemical reduction, neutralization, heavy metal precipitation, oil/water separation and solvents/fuels recovery.

Biological treatment: The gross impurities obtained from treatment of sewage are collectively known as sludge, which is given biological treatment, before disposal. This is known as sludge processing which has become important since improvements in industrial waste water treatment. The typical technologies for sludge processing include conditioning, digestion, composting, thickening or dewatering and solidification.

- Conditioning: In this step the sludge is exposed to atmosphere for a stipulated period until a desired consistency is reached
- Digestion: In this process the sludge is treated with bacteria which break down the long chain compounds into simpler ones
- Composting: In this step the organic matter in the waste sludge is converted into a usable stable material

Solidification: Processes convert the liquid waste into insoluble, rock-hard material and are used as pretreatment prior to landfill disposal. This is usually done by mixing the waste with various reactants to produce a solid mass. The basic aim of solidification process is to immobilize the hazardous constituents of the waste, so that these do not leach out at the landfill disposal site.

Incineration: Thermal oxidation through incinerator is one of the proven technologies for destruction of hazardous waste in all the forms i.e. solid / semi solid / liquid and gaseous, based on the feeding system, so as to render them innocuous in the form of non-toxic and non-hazardous residues.

5.2.4 Collection, transportation and disposal

Waste disposal is a multiphase activity, the different stages of which, i.e. collection, interim storage, transport; treatment and disposal are highly interdependent, both technically and organizationally. Safe collection and transport of hazardous waste form a critical link in the chain between its point of generation and its place of treatment and disposal. In many respects, the same precautions apply to hazardous waste in transit as apply to the carriage of dangerous goods; however, additional problems arise from the hazardous nature of certain wastes because:

- Waste in general has no perceptible economic value to the generator;
- The physical & chemical properties of a waste may not be precisely known because it's frequently a complex mixture from which all economically useful components have been extracted.
- Mixing of non-compatible wastes for convenience in transit could create an acute hazard, either immediately or on treatment and disposal (for example, a mixture of ether waste containing a sodium residue with an aqueous ether waste will explode)

Therefore, for a safe and secure disposal of hazardous waste, there should be a proper collection, transport and storage system. The non-compatible wastes should be segregated and transported separately.

5.3 Disposal of hazardous waste

The final disposal of the hazardous wastes also needs to be carefully planned. There are three different ways in which hazardous wastes can be finally disposed

- Landfill disposal.
- Underground disposal
- Incineration

5.3.1 Landfill disposal

The disposal of hazardous waste by land filling is an important method of disposal in many countries. Landfilling means storing harmful substances under the ground. This involves hauling the refuse to an area allocated for this purpose. In India such areas range from unsanitary open dumps to properly operated sanitary landfills. Open dumps are a poor method of waste disposal because they cause environmental problems. For example, they can ruin the appearance of all area and provide a home for rats and other rodents who spread disease. If garbage is exposed, it rots and smells foul. Most dumps allow some burning, which fills the surroundings with smoke. In addition, rain water can drain through refuse and carry harmful substances to streams.

Properly operated sanitary landfills cause little damage to the environment. The area to be filled with waste must be lined with a nonporous substance such as clay, or high density polyethylene (HDPE)—plastic membrane to prevent the wastes from leaking to the surrounding areas. The wastes are packed and dumped at the site and covered with earth each day. The cover of earth prevents insects and rodents from getting into refuse. Operators of these sites forbid burning. In time, sanitary landfill sites become filled up; many communities then cover the site for a final time and use the area for recreational purpose.

A typical landfill site consists of an artificial double liner at the bottom and a cover at the top. The above design of landfill site does not have any provision for monitoring and repair of the site. In the recent past, a new concept has developed in which the landfill site is constructed on a structure consisting of concrete cells. The cell is a space for plant personnel to visit and observe any fault and repair the same.

5.3.2 Underground disposal

It maybe excessively expensive to dispose of certain hazardous wastes, such as radioactive nuclear wastes, in an environmentally acceptable manner at landfill still sites or incinerate them at thermal

treatment plants. These wastes are generated in all operations associated with the use of nuclear energy for national defense or peaceful purposes such as mining of radioactive ore, production of nuclear fuel, laboratory experiments and medical treatment. Underground disposal may provide an environmentally and economically viable option in case of radioactive wastes. The underground disposal of hazardous waste is acceptable only in inactive or partially active mines that meet specific geological and technical criteria. Worldwide, only one deep-mine disposal facility is currently in operation: a worked-out halite/potash salt mine at Herfa Neurode in the Federal Republic of Germany (now united Germany).

Salt mines are often used for radioactive waste disposal because the excellent properties of salt deposits prevent the interaction of wastes with other geological formations. The very existence of a salt deposit is a proof that the underground site has been unaffected by water for millions of years. Salt is impermeable to liquids and gases. Due to its hygroscopic nature, salt is capable of absorbing water entering the formation from outside and of repairing minor fractures by re-crystallization, thus maintaining the original impermeability. This feature is frequently supplemented by impermeable upper strata consisting of wastes, usually rock, from mines or other industries.

Based on the several options present for safe treatment, storage, disposal & recycling of various wastes in the proposed projects the following options are considered which meeting the national standards.

- **Hazardous wastes:** Recycling, treatment stabilization, secured landfill, incineration
- **Bio medical wastes:** Disinfection, shredding, autoclaving, incineration, secured landfill
- **E Wastes:** Dismantling, cutting, disposal to authorized dealers, incineration
- **AFRF:** Solid blending with binders

5.3.3 Incineration

Incineration burns waste products. This is another method many industries and large cities use if they do not have enough vacant areas for disposal sites nearby. Most hazardous wastes are detoxified in this process.

This is also an excellent method of waste minimization, waste detoxification and disposal, but its cost of operation is very high, if the heat content of waste is not reutilized.

Advantages

Incineration is a process for the high-temperature oxidation of gaseous, liquid or solid wastes, converting them into gases and an incombustible residue. The flue gases are released to the atmosphere with or without recovery of heat and with or without cleaning; and any slag or ash produced is deposited in a landfill. In general, incineration may be considered as an alternative method of detoxifying some non-recoverable highly toxic wastes. It is an excellent method of reducing waste volume, and in addition offers the possibility for recovering the heat content of the waste.

Waste input

Generally, the wastes having inflammable characteristics are incinerated. The following types of wastes are commonly treated in hazardous waste incinerators:

- Solvent waste and sludge
- Waste mineral oils
- Varnish and paint waste
- Plastics, rubber and latex waste
- Oils, emulsions and oil/water mixtures
- Phenolic wastes
- Mineral oil sludge
- Resin waste
- Grease and wax wastes
- Pesticide waste
- Acid tar and spent clay
- Organic waste containing halogen, sulfur or phosphorus compounds.

Waste having high chlorine, sulfur, nitrogen and phosphorus contents, polychlorinated biphenyls (PCB) and those containing heavy metals and carcinogenic substances need special incineration technologies and precautions. A large number of municipal incinerators lack adequate air pollution control devices. Burning in many of these devices may release gases and solid particles that may harm human health, damage property and kill plants. The flue gases from ordinary incinerators can be dangerous in the absence of pollution control devices.

5.4 Plant gasification

Plasma gasification technology utilizes a plasma torch powered by an electric arc to convert organic matter into synthetic gas and solid waste (slag). The technology is presently being used for the gasification of biomass and solid hydrocarbons such as coal, oil sands and shale oil. The process can concomitantly generate electricity while reducing the volume of waste. In general, the feedstock for plasma gasification is most often municipal solid waste or organic waste, or both. Feedstock may sometimes include biomedical and hazardous waste. However there are a number of parameters like content and consistency of the waste which affect the performance of a plasma facility.

5.5 Pros & cons of plasma gasification

Advantages

- Far less toxic emissions compared to landfills or other waste-to-energy facilities.
- Toxic waste can be safely processed, such as asbestos and medical wastes.
- Syngas is a byproduct of the process, hence it is as clean as or cleaner than natural gas and can be used to produce energy, such as biofuel.
- Metal is nearly 100 percent recoverable and can be used to make new steel.
- Low dioxin emissions.
- Waste is shrunk to 1% of its original size, one-tenth the size of byproducts of incineration.

Disadvantages

- Waste gasification and combustion ultimately releases carbon dioxide to the atmosphere instead of sequestering a large fraction of the carbon in a landfill.
- Large capital costs relative to current landfills.
- Requires large electrical energy input if the waste stream does not contains a large fraction of un-oxidized hydrocarbons.

- The highly corrosive plasma flame may lead to frequent maintenance and component replacement with associated facility down time.
- The filters and gas treatment systems are themselves sources of toxic waste, some of which (e.g. acidified water) are poor candidates for plasma processing.

Though plasma gasification technology is commercially proven and viable, considering its demerits, the project management has decided to adopt landfill system.

5.6 No project option

It has been made mandatory by the government to dispose solid (Hazardous, Bio-medical, e-waste, etc.,) waste in a systematic and scientific way and pollution control boards have been asked to ensure it. To achieve this, an integrated common hazardous waste treatment storage disposal facility (ICHWTSDF) becomes necessary where care has to be taken to avoid any negative effects on the environment. In the absence of this project, there are chances that industries would continue polluting the environment in all the ways possible.

The proposed integrated treatment facility would provide a 'one stop' solution for the treatment, storage and disposal of various kinds of wastes. The proposed expansion facility would facilitate a clean environment by avoiding the threat posed by indiscriminate dumping of hazardous wastes by the industries and ensures the preservation of flora and fauna of the surrounding regions.

Benefits and advantages of project

- Facilitating better management of hazardous wastes.
- Provides a one stop solution for the management of various types of wastes.
- Minimizes pollution load on environment with an additional benefit of green
- Possibility for recovery of materials thereby conserving the natural resources
- Management of wastes is relatively easier and economically viable at a common facility
- Most viable option in the absence or availability of expertise.
- Reduced environmental liability due to captive storage of hazardous waste in the premises
- Better occupational health and safety at individual industry level
- Prevention of natural resource contamination

The proposed project will not cause depletion of any natural resources or will have any significant impact on the environment. On the contrary, it will produce value added resources such as facilitating better management of the industrial wastes. Hence, "No Project Option" is considered.

Chapter 6

Environmental Monitoring Program

6.1 Environmental monitoring program

The environmental monitoring is systematic collection of samples of the environmental parameters like air, water, soil, noise in order to observe and study the environment. As per baseline surveys of the parameters, the monitoring programme will help the project on maintaining the standards of the pollution. The monitoring programme also gives action plan how to maintain the standards for each parameter.

Based on the predicted and assessed impacts as well as the baseline environmental status of the project area, an environmental monitoring program is suggested for implementation during various stages of the project cycle. All monitoring strategies and programs have reasons and justifications which are often designed to establish the current status of an environment or to establish trends in environmental parameters. In all cases, the results of monitoring will be reviewed, analyzed statistically and submitted to concerned authorities.

The project shall implement the environment monitoring program in line with the planned schedule. The proponent shall ensure that necessary requisite facilities are made available and budgetary provision is made as and when required to ensure regular efficient environmental monitoring activities. The monitoring program will have three phases:

- Construction phase
- Monitoring phase
- Post monitoring phase

6.2 Construction Phase

The proposed project envisages expansion and up gradation of existing facility in MIDC Taloja, Panvel Taluk, Raigad District, Maharashtra .Though a secured landfill cell, Bio medical Waste facility, storage sheds, incinerator, administrative buildings, canteen etc. are already present in the existing project site, the expansion would require further construction activities that include construction of buildings for new waste treatment facilities, waste recycling and recovery units, new secured landfills, sheds for waste storage, laying of roads etc.

Major mechanical components proposed to be added in facility includes: incinerators, autoclave, shredder, diesel generator and other civil, mechanical and electrical equipment. The construction activities require partial clearing of vegetation, mobilization of construction material and equipment. The construction activities are expected to last for few months.

The existing secured landfill, incinerator; bio-medical waste has been constructed complying with the standards following the guidelines set by the CPCB for hazardous wastes management and bio medical waste management. Further construction of new secured landfill cells, incinerators, bio medical facilities and other recycling facilities during expansion will also be done following the guidelines and at every stage the quality of construction will be monitored.

The generic environmental measures that need to be undertaken during project construction stage are given in the following Table 6.1.

Table 6.1 Environmental measures during construction phase

S.No	Potential Impact	Detailed action to be followed as per EMP	Parameters for Monitoring	Frequency of Monitoring
1.	Air Emissions	All equipment's are operated within specified design parameters.	Random checks of equipment logs/ manuals	Once in a quarter/as per CFE issued by SPCB
		Vehicle trips have to be minimized to the extent possible	Vehicle Logs	Once in a quarter/as per CFE issued by SPCB
		Any dry, dusty materials stored in sealed containers are prevented from blowing.	Stockpiles or open containers of dusty materials	Once in a quarter/as per CFE issued by SPCB
		Compaction of soil during various construction activities	Construction logs	
		DG set emissions have to meet stipulated standards	Gaseous emissions (SO_2, HC, CO, NO_x)	Once in a quarter/as per CFE issued by SPCB
		Ambient air quality within the premises and adjacent villages of the proposed unit to be monitored.	PM_{10}, $PM_{2.5}$, SO_2, NO_x, and CO	At 3-4 locations in every quarter/as per CFE issued by SPCB
2.	Noise	List of all noise generating machinery onsite has to be prepared.	Equipment logs, noise monitoring	Once in a month/as per CFE issued by SPCB
		Working during night has to be minimized.	Records of working hours	Daily till the construction activities are completed/ as per CFE issued by SPCB
		Generation of vehicular noise has to be minimized	Maintenance of records of vehicles	
		Implement good working practices (equipment selection and siting) to minimize noise and also reduce its impacts on human health (ear muffs, safe distances, and enclosures).	Maintaining records of noise levels	
		Machinery should not be run when not required.	Continuous checking	
		Acoustic mufflers/enclosures have to be provided for large equipment	Mufflers/enclosures shall be in place.	
		Noise levels have to be monitored in ambient air within the plant premises.	Continuous recording of noise levels	
		The noise levels shall not exceed the permissible limits both during day and night		
		All equipment's shall be operated within specified design parameters.	Random checks of equipment logs/ manuals	
		Vehicle trips to be minimized to the extent possible	Vehicle logs	
3.	Soil Erosion	Minimize the area of site clearance by complying within the defined boundaries	Site boundaries not extended/ breached as per plan	Once in six months/ as per CFE issued by SPCB

S.No	Potential Impact	Detailed action to be followed as per EMP	Parameters for Monitoring	Frequency of Monitoring
			document.	
		Protect topsoil stockpile	Effective cover in place.	
4.	Wastewater Discharge	No direct discharge of wastewater to be made into surface water, groundwater or soil.	No discharge hoses shall be in vicinity of watercourses.	Once in a quarter/ as per CFE issued by SPCB
		The discharge point would be selected properly and sampling and analysis would be undertaken prior to discharge	Discharge norms for effluents as given in Permits	
		Take care of the disposal of wastewater generated such that soil and groundwater resources are protected	Discharge norms for effluents as given in permits	
5.	Drainage and Effluent Management	Ensure drainage system and specific design measures are working effectively. They are designed to incorporate existing drainage pattern and avoid disturbing the same.	Visual inspection of drainage and records	Once in a month/ as per CFE issued by SPCB
6.	Waste Management	Implement waste management plan that identifies and characterizes every waste associated with the proposed activities Also to identify the procedures for collection, handling and disposal of each waste that arises.	Comprehensive Waste Management Plan should be in place and available for inspection onsite. Compliance with Hazardous Wastes (Management and Handling Rules), 2016	Once in a quarter/ as per CFE issued by SPCB
7.	Non-routine events and accidental releases	Plan will be drawn, considering the likely emergencies and steps required to prevent/limit consequences.	Mock drills and records of the same	Once in six months/ as per CFE issued by SPCB
8.	Health	Health check-ups for employees and migrant labour.	All relevant parameters of occupational health	Once in six months/ as per CFE issued by SPCB/as per Factories Act

6.3 Operation phase

During operational phase air emissions from incinerator, boiler, DG set, gases from landfill, Leachate, ash generation quantity, etc., would be monitored by MoEF&CC/NABL approved internal laboratory or third party laboratory. The details are given in **Table 6.2**. The following attributes which are subject to regular monitoring based on the environmental setting and nature of project activities are listed below:

- Point Source emissions and ambient air quality in nearby villages
- Ground water level and its quality
- Water and wastewater, effluent and sewage quality etc.
- Solid and hazardous waste characterization (Incinerator ash, leachate etc.)
- Soil quality

- Noise levels (machinery, occupational exposures and ambient noise)
- Ecological preservation and afforestation.
- Noise levels (equipment and machinery noise levels, occupational exposures and ambient noise levels)

Table 6.2 Environmental monitoring during operational phase

S.No	Potential Impact	Action to be Followed	Monitoring Parameters	Monitoring Frequency
1.	Air Emissions	Stack emissions from Incinerator	Operating hours, Temperature, Pressure, TOC of residues, LOI of residues, Stack temp, CO, PM, HCl, HF, SO_2, NO_x, TOC, Mercury, Heavy metals, dioxins and furans as prescribed in CFE /CFE	Once in a month as per CFE/CTO conditions given by SPCB.
		Gas quality from landfill areas	VOC, H_2S	
		Stack emissions from DG sets	As per CFE conditions PM, SO_2, NO_x	
		AAQ within the project premises. The vehicles used shall have PUC certificate.	As per CFE conditions/ NAAQ Standards Vehicle logs to be Maintained	
		Meteorological data	Wind speed, direction, temp., relative humidity and rainfall.	
2.	Noise	Noise generated from operation of boilers, cooling towers, etc. to be monitored	Continuous noise level recording	Once in a month/ as per CFE/CTO conditions given by SPCB
3.	Wastewater Discharge (leachate)	Comply with wastewater discharge standards as per CPCB/SPCB	pH, TSS, TDS, BOD, COD & Oil & grease (Heavy metals)	Daily at regular intervals/ as per CFE/CTO conditions given by SPCB
4.	Solid waste/Haz. Waste	Comply with HWM rules	Comply with HWM rules	Once in a month/as per CFE/ CTO conditions given by SPCB
5.	Ground Water Quality	Monitoring ground water quality in and around project site	Monitoring parameters as per CPCB norms	Once in a quarter/ as per CFE/CTO conditions given by SPCB
6.	Flora and Fauna	Vegetation, green cover and greenbelt development	Survival of native plant species and maintenance of planted species	Once in a season/ as per CFE/CTO conditions given by SPCB
7.	Soil quality	Checking and maintenance of soil quality in and around the project site	Physico-chemical parameters such as NPK, heavy metals etc.	Once in a quarter/ as per CFE/CTO conditions given by SPCB
8.	Health	Health check-ups for employees and migrant labour	All relevant parameters of occupational health	Once in six months/ as per CFE/CTO issued by SPCB/ as per Factories Act

6.4 Post operational phase

The post operation is the phase where the project is about to close that has completed its project lifetime and has to stop activity in the site. The MWML project is started in 2002 and till now 6 cells have been capped completed. Post-closure monitoring of the landfill will be done primarily as a compliance requirement in addition to social responsibility. The occupier/operator of all hazardous waste management facilities to store, treat and disposal of hazardous wastes shall apply in writing, at least one year in advance, seeking approval for the closure of the facility.

The closure plan should indicate all steps to perform partial and/or final closure of the facility. The minimum action shall include:

- Description of how each hazardous waste management unit at the facility will be closed.
- The closure schedule, detailed description of the steps needed to remove or decontaminate all hazardous waste residues and contaminated containment system components, equipment, structures and soils during the closure including procedures for clearing equipment and removing contaminated soils.
- Details of post-closure care including monitoring of the facility, groundwater quality, etc., Chronological list of different types of wastes disposed of in low facility site.

The post-closure program of monitoring for water quality in the ground water and surface waters down the gradient of the landfill will be similar to that established for the operational stage of the facility.

There is no need for the post-closure monitoring of air quality, noise or visual effects during the post-closure period, however, these needs to be reviewed periodically. Any aspects warrant further monitoring will be included in the program. The details of post closure monitoring are given in Table 6.3.

Table 6.3 Environmental monitoring during post operation phase

S.No	Potential impact	Action to be followed	Parameters for monitoring	Monitoring Frequency
1.	Air Emissions	Gas quality from landfill areas	VOC, H_2S	Monitoring of 3-4 locations as per CTO conditions given by SPCB
		AAQ within the project premises and surroundings. The vehicles used shall have PUC certificate.	As per CTO conditions / NAAQ standards vehicle logs will be maintained	
2.	Wastewater discharge (for leachate)	Comply with wastewater discharge standards as per CPCB/SPCB	pH, TSS, TDS, BOD, COD & Oil & grease (Heavy metals)	Daily at regular intervals/ as per CTO conditions given by SPCB
3.	Ground Water Quality and Water Levels	Monitoring ground water quality in and around project site	Monitoring parameters as per CPCB norms	Once in a quarter/ as per CTO conditions given by SPCB
4.	Flora and Fauna	Vegetation, green cover and greenbelt development	Survival of native plant species and maintenance of planted species	Once in a season/ as per CTO conditions given by SPCB
5.	Soil quality	Checking and maintenance of soil quality in and around the project site	Physico-chemical parameters such as NPK, heavy metals etc.	Once in a quarter/ as per CTO conditions given by SPCB
6.	Health	Health check-ups for employees and migrant labour	All relevant parameters of occupational health	Once in six months/ as per CTO issued by SPCB/ as per Factories Act

6.5 Environmental laboratory equipment

The project has a well-established in-house environmental laboratory in its existing facility for the analysis of samples. The facility is equipped with required equipment's for enabling comprehensive analysis of solid waste, air, water and waste water. The laboratory monitors periodically the ground water, surface water, air, noise, soil and stack emissions within its premises. MWML is certified for a Quality management system as per ISO 9001:2008, Environment Management System as per ISO 14001:2004 and Occupational Health and Safety Management System as per OHSAS 18001:2007 standard.

The procedures given in IS standards or CPCB approved methods will be followed of analysis and sampling of various environmental parameters. Stacks of incinerator and DG set will have provision of platform and port hold to stack sampling meeting MOEF standards with necessary power point. Environmental laboratory shall have below equipment/instruments to analyze air and wastewater parameters. The list of laboratory equipment required for environmental monitoring is given in Table 6.4.

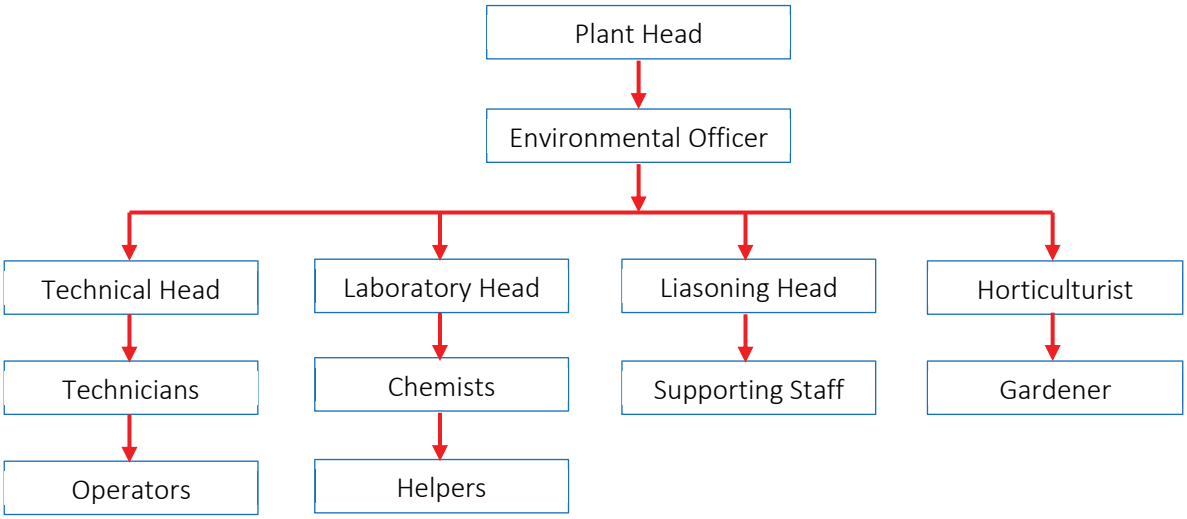
Table 6.4 Existing equipment used for environmental monitoring

Name of the Equipment	No of Instruments for laboratory
Online monitoring for incinerator stack	1
Weather Station, which can record wind speed, wind direction Temperature, Relative Humidity (Automatic or manual),	1
Respirable Dust samplers	4
Fine Dust samplers	4
Portable Flue Gas Combustion Analyzer	2
Portable Noise level meter (Dosimeter)	2
Portable Wastewater Analysis Kit	2
BOD Incubator	1
COD Digester with colorimeter	2
Electronic Balance	1
Spectrophotometer	1
Hot Air Oven	1
Laboratory Water Distillation and demineralization unit	2

6.5.1 Environmental management cell

For implementation of Environmental Management Plan facility should have a team of experts/EMP cell at the project site. The existing site has an EMP cell which is headed by a Project In-charge/head having a minimum of 5 to 10 years of experience. The project In-charge/head is supported by a team of members (managers, operators, chemists, technicians, etc.) having minimum of 2 to 3 years of experience in their respective fields of work. The same team would also take care of the proposed expansion with more added manpower as required during construction and operation stage of the new facilities. The general organizational setup of the environmental management cell is given below in Figure 6.1.

Figure 6.1 Organization setup of environmental management



6.6 Pollution monitoring facilities

6.6.1 Reporting schedules of the monitoring Data

It is proposed that voluntary reporting of environmental performance with reference to EMP should be undertaken. The environmental monitoring cell shall co-ordinate all monitoring program at site and data thus generated shall be regularly furnished to the State regulatory agencies. The frequency of reporting shall be twice a year (on a six monthly basis) submitted to the local state PCB officials and to Regional office of MoEF&CC. The Environmental Audit reports shall be prepared for the entire year of operations and shall be submitted to the regulatory authorities.

6.6.2 Public health monitoring

The value of public health monitoring is of immense importance to establish whether or not a site or facility has caused adverse health effects. In this situation, the results from a public health study may not fulfill the primary objectives of such a program. The objective has to be to detect health changes before the manifestation of adverse health effects. Therefore, a three-stage health monitoring program is proposed.

- Monitoring the health of workers within the project site to identify adverse health effects.
- Periodically obtain feedback from local doctors regarding any potential indicators of adverse health effects due to the proposed project in the surrounding communities, particularly down-stream of the landfill.
- By organizing health camps on a regular basis.

6.6.3 Budgetary provision for EMP

In order to comply with the environmental protection measures as suggested in the above sections, the project management has made budgetary provision for environmental protection and safety measures. Cost towards environmental mitigation measures are given in **Table 6.5.**

Table 6.5 Budget for implementation of environmental management plan

S. No	Control measures	Existing (Lakhs)		Proposed(Lakhs)	
		Capital Cost	Recurring cost/year	Capital Cost	Recurring cost/year
1	Air Pollution Control	557	40	159	15.9
2	Water Pollution Control	203	36	75	7.5
3	Noise Pollution Control	43	4.3	18	1.8
4	Solid waste management	34	3.4	13	1.3
5	Greenbelt & Miscellaneous development	184	18.4	30	3
6	Environmental Monitoring	537	53.7	55	5.5
	Grand Total	**1558**	**155.8**	**350**	**35**

Chapter 7

Additional Studies

7.1 Risk assessment

The principal objective of risk assessment is to identify and quantify the major hazards and risk associated with various operations of the proposed project, which may lead to emergency consequences (disasters) affecting the public health and safety. The unpredictable nature of natural hazards occurring in the area also leads to the vulnerability of people at the site.

7.1.1 Risk analysis

Risk analysis includes an estimate of the probability or likelihood that an event will occur. Estimation of random incidents totally uncorrected with plant activities may also be taken in to account. Based on this information, the emergency preparedness plan needs to be updated to mitigate the consequences. The approach involves hazards identification, hazards assessment, evaluation and developing a Disaster Management Plan (DMP).

7.2 Hazard identification

Identification of hazards is the primary task for planning for risk assessment in the analysis, quantification and cost-effective control of accidents involving chemicals and processes. A classical definition of hazard states that it is the characteristic of system/process that presents a potential for an accident. Hence, all the components of a system/process need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident. The methods employed for hazard identification in this study are:

- Identification of major hazards based on Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) amendment rules, 2000
- Identification of potential hazard areas and representative failure cases
- Visualization of the mode of chemical releases and the resulting accident scenarios
- Occupational health and safety of workers

The nature of possible hazards is listed in **Table 7.1.**

Table 7.1 Nature of possible hazards

Hazard	Area	Probable cause of the accident
Physical/ Falls	Construction activities/ erection of plant	Untrained workers/no safety gears/wearing loose clothes/ working equipment
Electrical	Entire site	Loose connections/ cables running across site
Explosion	Boilers/transformers/receivers for the air compressors.	Malfunctioning of the safety valve
	Flammable petroleum product storage tank/drum storage area	External fire causing pressure built up in the tanks/barrels
Fire	HSD/fuel storage area	Flammable vapor-air mixture and source of ignition.
	Flammable petroleum product	Formation of the pool in the dyke wall and source of

Hazard	Area	Probable cause of the accident
Physical/ Falls	Construction activities/ erection of plant	Untrained workers/no safety gears/wearing loose clothes/ working equipment
Electrical	Entire site	Loose connections/ cables running across site
	storage tank/drum storage shed/ production area	ignition.
		External fire Built up of internal pressure Failure of the top cover Tank on fire
	Coal storage area Coal handling plant	Fire, spontaneous combustion Fire or dust explosions
Spillage	Acid/alkali storage area	Spillage of acid/alkali due to rupture of the pipeline, the collapse of the storage tank

7.2.1 Identification of toxic, flammable chemicals

Toxic chemicals: Chemicals having acute toxicity values, owing to their physical and chemical properties are capable of producing major accidents. The details are given in **Table 7.2.**

Table 7.2 Toxicity values of chemicals

S. No	Toxicity	Oral toxicity LD_{50} (mg/kg)	Dermal toxicity LD_{50} (mg/kg)	Inhalation toxicity LC_{50} (mg/l)
1.	Extremely toxic	>5	<40	<0.5
2.	Highly toxic	>5-50	>40-200	<0.5-2.0
3.	Toxic	>50-200	>200-1000	>2-10

Flammable chemicals:

Flammable gases: Gases which at 20°C and at a standard pressure of 101.3 kPa are:-

- Ignitable when in a mixture of 13 % or less by volume with air, or
- Have a flammable range with air of at least 12 % points regardless of the lower flammable limits.
- **Extremely flammable liquids:** chemicals which have flash point lower than or equal to 23°C and a boiling point of less than 35°C
- **Very highly flammable liquids:** chemicals which have a flash point lower than or equal to 23°C and initial boiling point higher than 35°C.
- **Highly flammable liquids:** chemicals which have a flash point lower than or equal to 60°C but higher than 23°C.

7.2.2 Storage of hazardous chemicals and nature of possible hazards

The details of storage facilities and capacities of hazardous chemicals proposed to be used in the project particularly with reference to the solvent recovery/ waste oil recovery unit are given in **Table 7.3**.

Table 7.3 Details of chemicals and applicability of GoI rules

Solvent	Storage type	Listed in scheduled	Threshold quantity (Tons) for application of rules	
			4,5,7-9,13-15	10-12
High speed diesel (HSD)	Tank	Schedule 1 (part I)	5000	50000
Isopropyl alcohol		Schedule 1 (part III)	7000	7000
Butanol		Schedule 1 (part IV)	10000	10000
Toluene		Schedule 1 (part III)	7000	7000
N,N-dimethyl formamide		Schedule 1 (part V)	5000	50000
O-dichlorobenzene		Schedule 1 (part V)	5000	50000
Acetylene	Cylinder	Schedule 1 (part II)	1000	5000

From the above table, it can be inferred that there would be no major hazardous chemicals stored at the proposed plant which would attract the GoI rules 4, 5, 7-9 and 13-15. Further, as the quantities likely to be stored at site lie below the stipulated threshold quantities major hazards are not anticipated.

7.2.3 Maximum credible accident (MCA) analysis for diesel storage area

Identification of causes and types of hazards is the primary task for assessing risk. Hazards can happen because of the nature of chemicals handled and also the nature of processes involved which is done in accordance with **MSIHC Amendment Rules, 2000.** Schedule 1, of the Rule, provides a list of toxic and hazardous chemicals and the flammable chemicals. It defines flammable chemicals based on flash point and boiling point.

"**Major accident hazards (MAH) installations**" is defined as the isolated storage and industrial activity at a site handling (including transport through carrier or pipeline) of hazardous chemicals equal to or, in excess of the threshold quantities specified in Column 3 of Schedule 2 and 3 respectively. Schedule 3 has classified hazardous substances in an operating plant into 5 groups and has provided the threshold quantities for application of the above rules.

- Group 1 and 2 – Toxic substances
- Group 3 – Highly reactive substances
- Group 4 – Explosive substance
- Group – 5 Flammable substances

Table 7.4 shows the list of major chemicals which have been identified as hazardous, as per the MSIHC amendment rules 2000 and which are to be considered as MAH installations.

Table 7.4 Hazardous chemicals at the project site

Chemical	Use	Nature of chemical	Type of storage & No's	Storage quantity
Acetylene	Welding purpose	Flammable	Vertical & 4 No.	30 kg
HSD	Fuel for D.G sets & incinerator start-up	Flammable	Vertical & 1No.	30 kL
Isopropyl alcohol	Solvents recovered will be stored and sold to the end user	Very highly flammable		5 KL
Butanol		Highly flammable		

Chemical	Use	Nature of chemical	Type of storage & No's	Storage quantity
Toluene		Very highly flammable		
N,N-dimethylformamide		Flammable		
O-dichlorobenzene		Flammable		

The summary of physical properties of chemicals at the site is given in **Table 7.5**.

HSD is mainly used for D.G sets fuel and incinerator start-up activity and 20kL storage currently exist at site. Around 1.6 kLD of HSD is expected to be consumed during the operation, hence inventory of HSD of 10 kL tank is considered. The solvents are recovered through a solvent recovery unit of 5 kL capacity and 1 kL of each solvent is considered for storage. Acetylene is used for welding purpose and 4 cylinders of 7.5 kg capacity are taken. For risk assessment, the complete tank is considered for any accidental release of fuel due to leakage.

Table 7.5 Physical properties of chemicals at the site

Chemical	Codes/ Label	TLV (mg/m^3)	BP	FP	LEL	UEL
			(°C)		%	
HSD	Flammable/ Toxic	800 ppm	215-376	32	0.6	6.0
Isopropyl alcohol		400	83	12	2	12.7
Butanol		100	118	35	1.45	11.25
Toluene		100	111	6	1.1	7.1
N,N-Dimethylformamide		10-30	153	67	-	-
O-dichlorobenzene		50	180	66	2.2	9.2
Acetylene		-	-84	-17	2.5	100

TLV: Threshold limit value; BP : Boiling point; MP : Melting point; FP : Flash point;
UEL: Upper explosive limit; LEL: Lower explosive limit

Fire Explosive Toxicity Index (FETI)

The computations of FETI (Fire and Explosion, Toxicity Index) for HSD and other chemicals at proposed TSDF is shown in **Table 7.6** and the subsequent F&EI categories are given in **Table 7.7**. The Health (Nh), Flammability (Nf), Reactivity (Nr), and MF (Material Factor) under consideration was derived from the NFPA (National Fire Protection Association) codes. The GPH (General Process Hazard Factor) and SPH (Specific Process Hazard Factor) was calculated accordingly. Based on F&EI (Fire and Explosion Index), HSD and other solvents comes under "Low" category and ranges from nil to moderate toxicity.

Table 7.6 F&EI of fuel and solvents for the proposed project

Chemical/Fuel	NFPA Classification				GPH	SPH	*F&EI	Toxicity Category	F&E Category
	Nh	Nf	Nr	MF					
HSD	1	2	0	10	1.8	2.8	50.4	Nil	Low
Isopropyl alcohol	1	3	0	16	1.9	1.3	39.5	Nil	Low
Butanol	1	3	0	16	1.9	1.3	39.5	Nil	Low
Toluene	2	3	0	16	1.3	1.2	25.1	Moderate	Low
N,N-dimethylformamide	2	2	0	10	1.2	1	12	Moderate	Low
O-dichlorobenzene	2	2	0	14	1.3	1.2	22.1	Moderate	Low
*FEI = MF *(GPH) * (SPH)									

The F&EI values are ranked into the following categories

Table 7.7 F&EI category

S.No	F&EI	Category
1	1-60	Low
2	60-90	Medium
3	90 and above	Severe

7.2.4 Nature of hazard from oil storage

Diesel is a flammable liquid having a flash point of 32°C. However, its auto-ignition temperature is 225°C. Its boiling point ranges between 215-376°C. Major hazards from oil storage can be fire and maximum credible accidents from oil storage tank can be

a) Tank fire and
b) Pool/dyke fire.

Similarly, for the solvents, it can be seen as a fire hazard to be a major cause and none of them is toxic to cause another accidental scenario.

a. Tank fire

A series of incidents could lead to tank fire. Any leak in rim seal that leads to accumulation of vapour could be a source of the fire. Further, this lighting can be a source of ignition and can cause tank fire. At times, overflow from tank leading to spillage may also cause vapour cloud formation which in turn catches fire. These can again flashback to the tank to cause tank fire.

b. Pool/dyke fire

If there is outflow from the tank due to any leakage from the tank or any failure of connecting pipes or valves, oil will flow outside and form a pool. When the tank is surrounded by a dyke, the pool of oil will be restricted within that dyke. After some time, the vapour from the pool can catch fire and can cause pool or dyke fire.

7.2.5 Heat radiation and thermal damage criteria

The level of damage caused by heat radiation due to fire is a function of the duration of exposure as well as heat flux (i.e. radiation energy onto the object of concern). This is true for both the effect on building and plant equipment and also for the effect on personnel. However, the variation of likely exposure time is more marked with personnel, due to the possibility of finding shelter coupled with protection of the skin (clothed or naked body). Further, it is assumed that everyone inside the area by

the pool fire will be burned to death (100% lethality) or will asphyxiate. The effect of heat radiation on percentage fatality with variation in exposure time is given in Table 7.8.

Table 7.8 Effect of heat radiation

Exposure Time in seconds for % Fatality			
Radiation Level (KW/m^2)	1%	50%	99%
1.6	500	1300	3200
4.0	150	370	930
12.5	30	80	200
37.5	8	20	50

The damage and fatality due to the exposure time are very important in determining the degree of fatality and corresponding effect distance. It is observed that the exposed persons normally find shelter or protection from the heat radiation (e.g. against a wall) within 10 seconds. However, exposure time of 30 seconds is normally assumed for pessimistic calculation which applies when people do not run away immediately or when no protection is available. The effects on humans due to variations in heat flux and duration of exposure have been developed in the form of a Probit model which gives the following values for human fatality levels as shown in Table 7.9.

Table 7.9 Heat radiation and fatality

Incident radiation intensity (kW/m^2)	Type of damage
37.5	Sufficient to cause damage to process equipment
25	Minimum energy required to ignite nearby wood at infinitely long exposure (non-piloted)
12.5	Minimum energy required for piloted ignition of wood, melting plastic tubing etc. 1st degree burns for 10 seconds exposure.
4.5	Sufficient to cause pain to personnel if unable to reach cover within 20 seconds; however blistering of skin (1st degree burns) is likely.
1.6	Will cause no discomfort to long exposure

Tank rupture is considered as one of the major accidental scenarios in which a large quantity of HSD will be leaked into the surrounding areas of the storage. If an ignition source is available near the accident site, the leaked fuel will easily catch fire. It is assumed that the complete liquid leaks due to tank rupture and develops into a pool and gets ignited. Hazard distances have been arrived due to the effect of pool fires. For computing the damage distances, Areal Locations of Hazardous Atmospheres (ALOHA) software is used. Full tank storage capacity has been considered for the calculations. The effect of heat radiation and subsequent damage distances for HSD – 20kL and 10 KL are given in Table 7.10 and 7.11. The risk contour for HSD - 20kL and 10kL are given in Figure 7.1. The ALOHA source point for HSD leakage on the site layout is given in Figure 7.2 and 7.3.The effects of heat radiation due to solvent leakage are given in Table 7.12 and risk contour are given in Figure 7.4.

Table 7.10 Effect of heat radiation due to HSD storage tank – 20kL (Pool fire)

Input Data		Results of computation	
Spilled quantity	20 kL	Max. flame length	11 m
Circular opening diameter	4 cm	Max burn rate	54.7 kg/min
Wind speed	2.0 m/s	Total amount burned	3,255 kg
Heat Radiation at ground level kW/m^2		Damage distances (m)	
8.0		<10	

4.5	14
1.6	24

Table 7.11 Effect of heat radiation due to HSD storage tank – 10kL (Pool fire)

Input Data		Results of computation	
Spilled quantity	10 kL	Max. flame length	10 m
Circular opening diameter	3.5 cm	Max burn rate	41.9 kg/min
Wind speed	2.0 m/s	Total amount burned	2,492 kg
Heat Radiation at ground level kW/m^2		Damage distances (m)	
8.0		<10	
4.5		13	
1.6		21	

Table 7.12 Effect of heat radiation due to solvent leakage (Pool fire)

	N-butyl alcohol	Isopropanol	N,N-dimethyl formamide	O-dichloro benzene	Toluene
Spilled quantity (kL)	1				
Opening diameter (cm)	3				
Wind speed (m/s)	2.0				
Max flame length (m)	7	6	6	7	9
Max burn rate (kg/min)	32.9	32.5	35.7	41.9	34.1
Total amount burned (kg)	1,929	1,897	2,058	2,417	2,024
Thermal radiation damage distances					
Red (12.5 kW/ m^2)	<10 m	<10 m	<10 m	<10 m	<10 m
Orange (4.5 kW/ m^2)	11 m	10 m	10 m	<10 m	11 m
Yellow (1.6 kW/ m^2)	17 m	23 m	15 m	15 m	19 m

From the above table, it is observed that for heat radiation of 12.5kW/m^2 the damage distances are found to be less than 10 m from the accidental site. Whereas, for heat radiation of 4.5kW/m^2, the impact distances varies from 10 - 11 m. For a heat radiation intensity of 1.6 kW/m^2, the damage distances are in the range of 15 - 23 m.

Figure 7.1 Thermal radiation threat zones for HSD

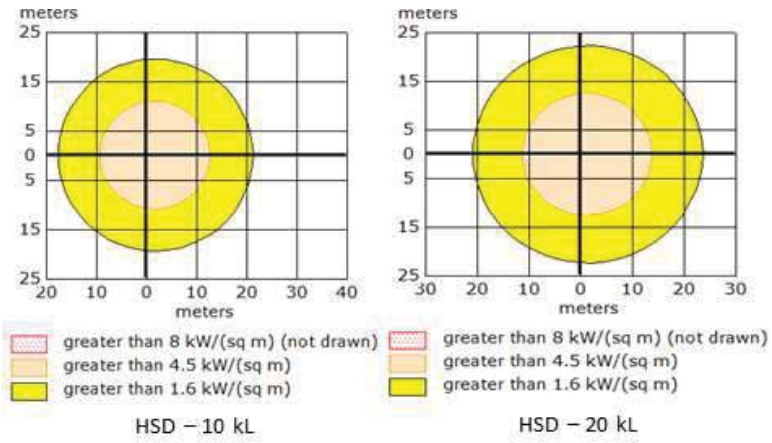


Figure 7.2 ALOHA source point on the layout – 20 kL

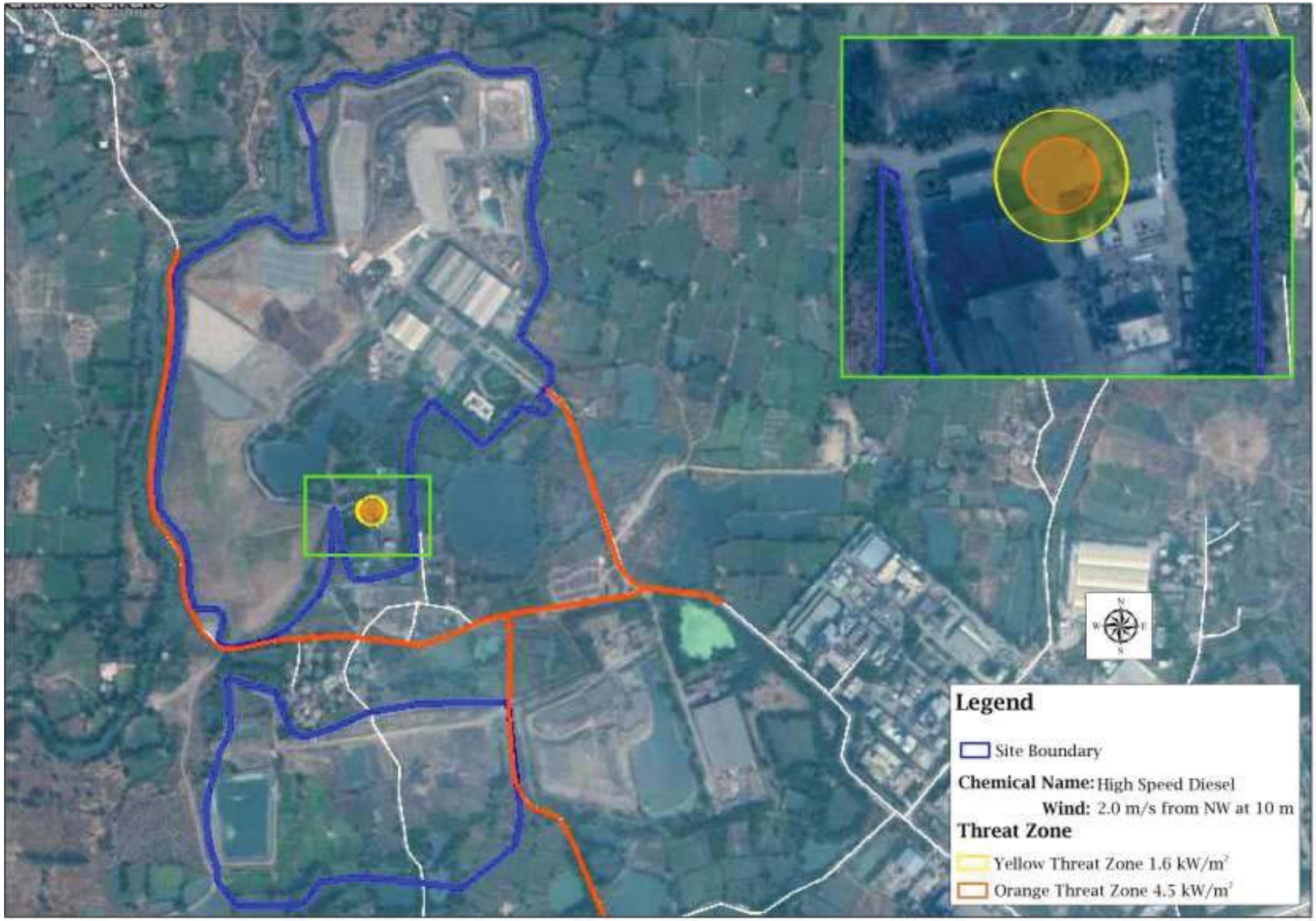
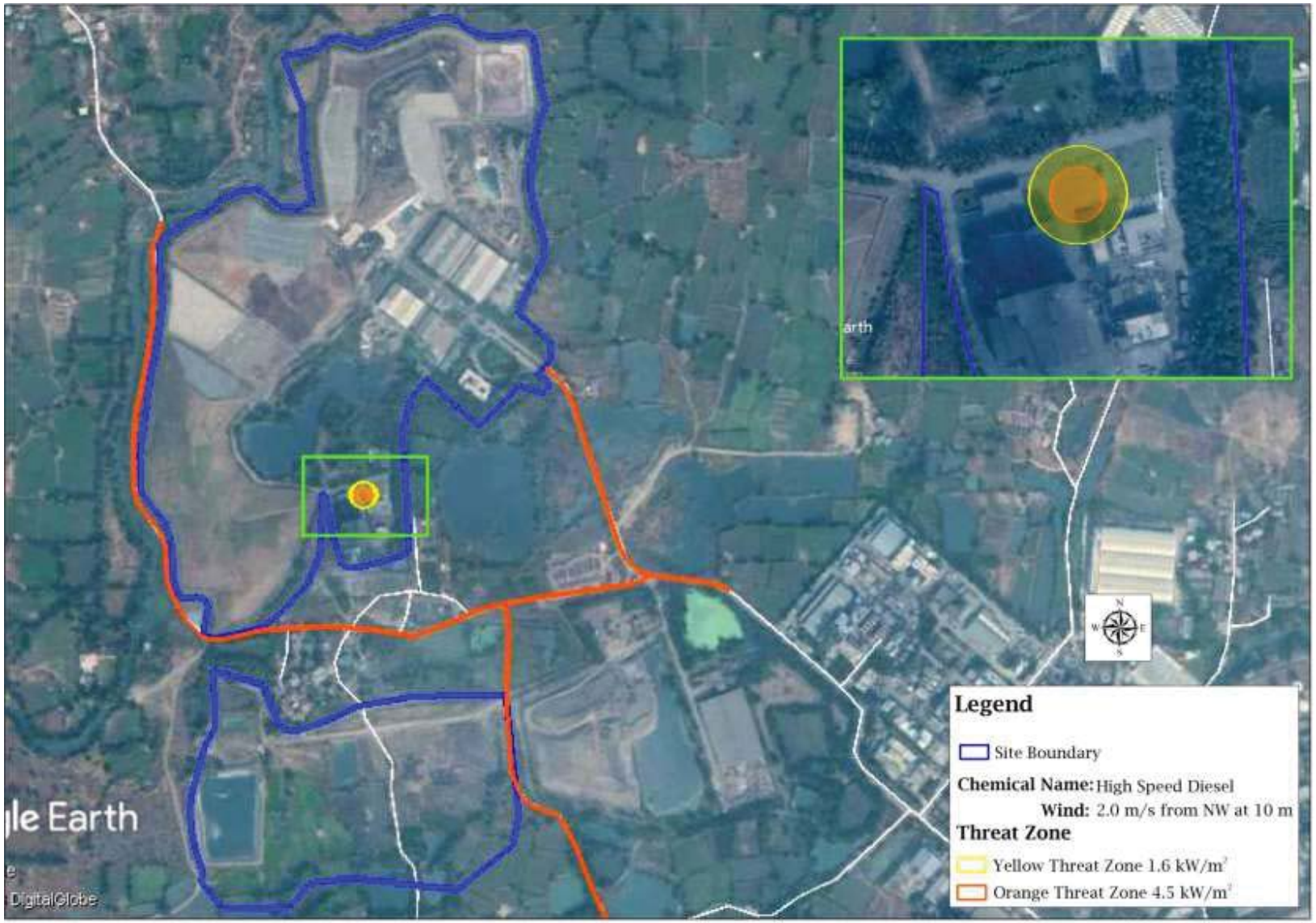
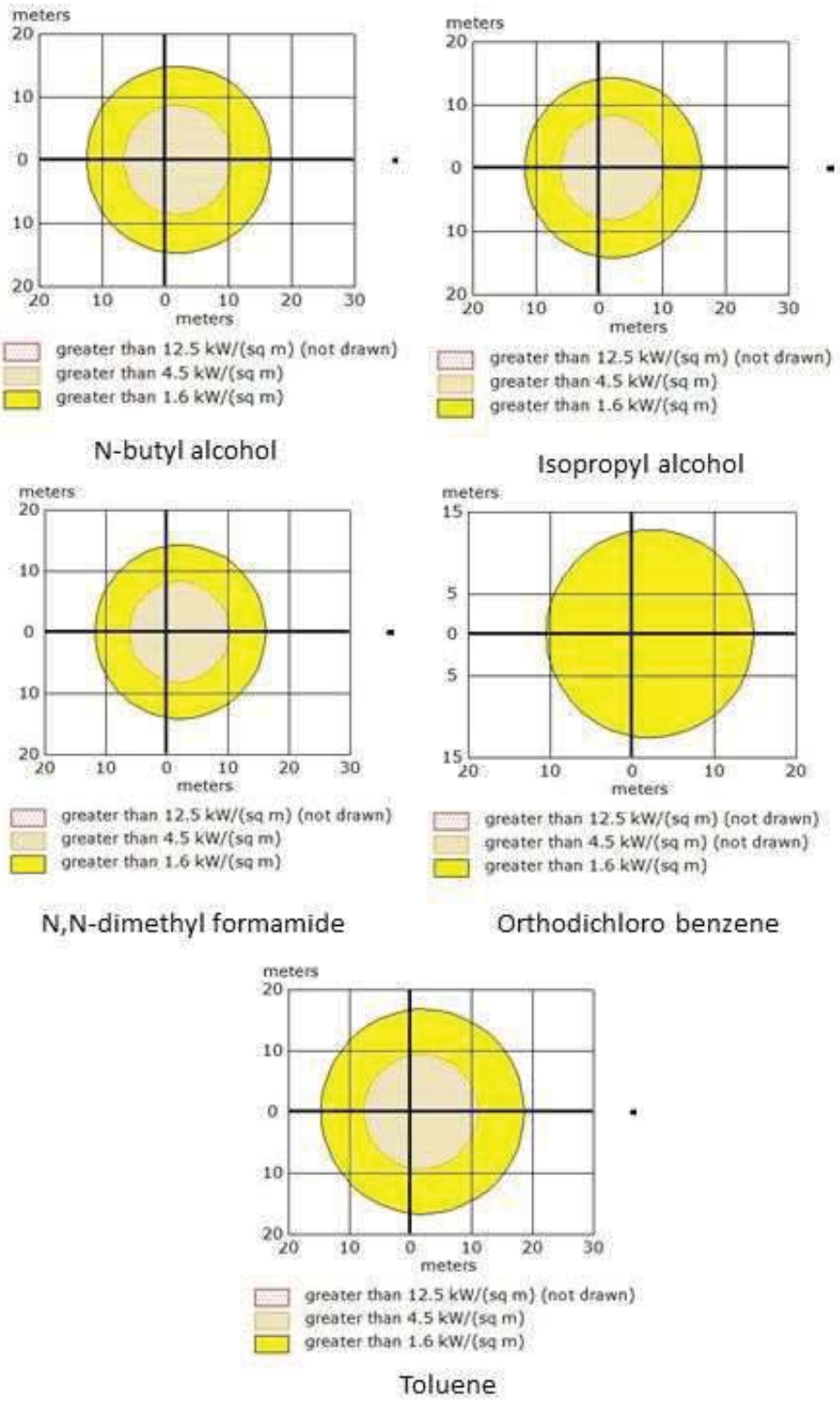


Figure 7.3 ALOHA source point on the layout – 10 kL



097

Figure 7.4 Thermal radiation threat zones for solvents



Acetylene

Cylinder with a damaged hole as a cause, with two accidental scenarios has been considered.

- Flammable Area Vapor Cloud and
- BLEVE (Boiling Liquid Expanding Vapor Explosion).

Acetylene, when leaked into the atmosphere, forms a mixture of air-acetylene because of its high reactivity resulting in a violent explosion. A cylinder of 7.5 kg is considered with a diameter of 0.2m and length of 1.4m. Aperture of 0.5 cm is considered and following results are obtained using ALOHA. The thermal radiation threat zone is given in **Figure 7.5.**

Flammable Area Vapor Cloud

Threat Zone:

Red: 21 meters --- (25000 ppm = LEL)

Orange: 29 meters --- (15000 ppm = 60% LEL = Flame Pockets)

Yellow: 84 meters --- (2500 ppm = 10% LEL)

BLEVE

Percentage of Tank Mass in Fireball: 100%

Fireball Diameter: 11 meters Burn Duration: 1 second

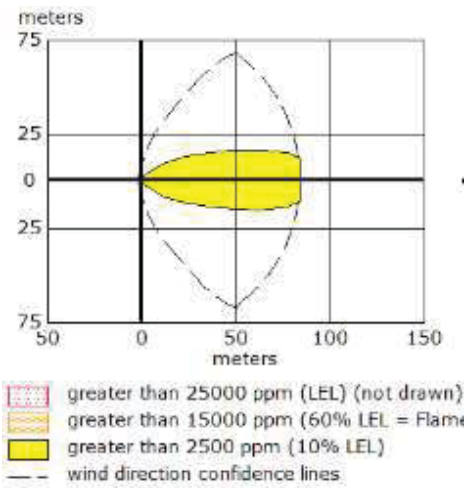
Threat Zone:

Red: 14 meters --- (37 kW/(sq m))

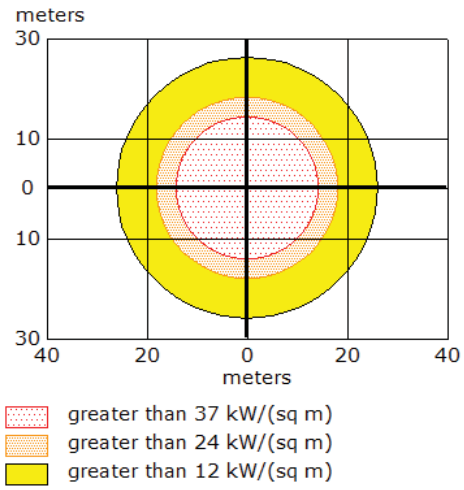
Orange: 18 meters --- (24 kW/(sq m))

Yellow: 26 meters --- (12 kW/(sq m))

Figure 7.5 Thermal radiation threat zones for acetylene



Flammable Area Vapor Cloud



BLEVE

7.3 Hazards occurring at site

The project authorities have to prepare detailed emergency control measures and give information such as the quantity of hazardous material stored, the location of storage, the approximate population living in the vicinity and the detail of the hazardous characteristic of the material to the employees, concerned government departments and the public living in the vicinity regularly to enable the government to prepare the off-site disaster management plan. Educate employees and the public living in the vicinity the safety measures required to be taken in the event of an accident taking place.

7.3.1 Safety during construction

A construction site forms a potentially accidental environment. To ensure the workers safety at site, it shall be properly secured by fencing or by construction of a boundary wall. First aid facility is to be created for immediate assistance in case of emergency and accidents. Important information about nearby hospitals, fire stations, police station etc. should be kept available in the first aid centres for speedy action at the time of emergency.

The objective is to ensure health and safety of the workers during construction, with effective provisions for the basic facilities of sanitation, drinking water, safety of equipment or machinery etc. Comply with the safety procedures, norms and guidelines (as applicable) as outlines in the Constructional Practices and Safety, 2005, National Building Code of India, Bureau of Indian Standards. Protective equipment, helmets etc. shall be provided to the construction workers.

Hazard identification	Risks	Possible causes	Safety measures required
Physical Hazards • Fall from height • Motor vehicle crash • Excavation accidents • Electrocution • Struck by falling objects	• Accidental/ personnel injury	• Untrained workers • Wearing loose clothes • No safety gear • Untrained reckless drivers • Unidentified cables and temporary connections • walking below loading or working equipment	Fall protection • Guardrails/Safety net/PPEs • Warning ribbons/Signboards Vehicles with • Service, emergency and parking brake • Hooter system • Lights, rear window mirrors, reflectors

7.3.2 Fire

To increase the level of safety in the proposed project, installation of smoke alarms or automatic fire detection/alarm systems will be proposed at strategic locations as an early warning of fire to the occupants. To prevent fire mishaps and to manage the emergency situation during a fire in the proposed project the following activities and precautions are proposed.

- Emergency evacuation plan
- Regular mock drills to create awareness on procedures to be followed in times of emergency situation/evacuation

- It will be advised to keep oxygen cylinders, medical kits and masks to prevent smoke inhalation especially for those with respiratory disorders for who smoke inhalation can be very dangerous.
- Plant manager will be advised to ensure that the fire-fighting equipment are in good working conditions in sufficient numbers

7.3.3 Electrical accidents

Electrical hazards can cause burns, shocks, and electrocution which can lead to serious injury and even death.

Prevention of electrical accidents

- Flexible cords connected to appliance should be wired to conform to the international colour code.
- The appliance should preferably be tested and certified by a national or reputed standards testing authority
- All electrical wiring, rewiring or extension work must be carried out by licensed electrical contractors. On completion, the contractors should test before electricity supply is connected.
- To ensure electrical safety in the facility, a current-operated Earth Leakage Circuit Breaker (ELCB) or Residual Current Circuit Breaker (RCCB) set to operate at a very small leakage current is recommended. In case of dangerous electrical leakage to earth, it should automatically cut off the supply of electricity.

7.3.4 Major explosion of chemicals/fire and toxic gas release in landfill or stores

a. Control measures during planning:

- Ensuring that the material collected is analyzed before taking the material inside the premises and explosive materials should not be accepted without treatment
- Well-covered storage space is available for incinerable waste material and the storage area is well ventilated to prevent accumulation and concentration of gases below the explosive and flammable limit. Install gas detectors and explosive level meters with early warning alarm. Avoid electric fittings inflammable material storages and use flameproof materials if felt essential.
- Compartmentalize storage to limit the stock quantity and risk of fire spread. Locate incinerable waste storages away from heat source and hot furnace areas. Provide communication facility and an adequate number of security personnel for 24 hours of manual watching.
- Installation of smoke detection and warning and automatic fire hydrant with foam monitors, automatic sprinklers, mist sprays and CO_2 flooding system in incinerable waste storage will help a lot in early detection and automatic fire fighting. Provide spark proof equipment to handle solvent waste containers.
- Sufficient gap to be maintained between storage sheds are maintained as per national building code to prevent fire spread and easy movement of fire vehicles around the storage during an emergency. Windsocks with wind speed indicators are installed on the site to see the wind direction from any location. Lightning arrestors are installed to cover the whole site.
- Employ only qualified and trained employees to supervise the storage activities.

b. Control measures during operation:

- Ensure public liability insurance cover is in force for the site. Plan for the disposal of low flash point materials immediately on arrival and minimize inventory of these materials and flammable materials. Reactive materials shall be separated and stored away from the flammable materials store. Display No Smoking warning boards around the waste material storages.
- Provide first aid to burn injuries by pouring cool water before shifting the victim to hospital: Phone Number of Hospitals: Shift the gas affected victims to a well-ventilated area and provide breathing oxygen.
- Ensure static electricity is discharged from material containers by bonding the containers. Maintain sufficient gap between stack for inspection and also for better ventilation. Do not use mechanical handling equipment which produce sparks or static electricity.
- Use spark-proof equipment while handling low flash point and waste containing solvents. Ensure good housekeeping is maintained in and around storage. Maintain a record of the quantity of material stock and the MSDS of material in each shed for giving the required information to disaster management team on arrival at the site. Install and maintain a sufficient number of appropriate first aid fire appliances and ensure the approach way is not blocked.
- Train all the employees in first aid, fire-fighting and the procedures to be followed in case of an emergency. Replace leaky containers and clean spillage immediately. Remember inhaling gas generated due to a fire or explosion is dangerous. Use of Self-Contained Breathing Apparatus (SCBA) is mandatory for all rescue and fire-fighting work in case of an explosion or fire. Check the wind direction and inform everyone to stand on the upwind direction through the public address system or through phones. Advice evacuation of people at site and surrounding if found necessary.
- Try and put off the fire with the help of available hand appliances, fire hydrant water using internal trained employees. Bring all available fire-fighting appliances and also get help from nearby industries in control and rescue operations only if they are trained and have the required PPE to carry out the work safely. Phone numbers of nearby industries: If the fire is found very major leave it to professionals to deal with it.
- Inform state fire, police department about the disaster and nearby hospitals of the possible gas that can release from the incident for quick treatment.
- Call an additional ambulance if felt necessary the site controller will direct concerned department to arrange without delay. Provide first aid to the affected victim before moving them to hospitals. Send the victims to the hospital with their personal data and their medical history while sending for treatment. Measure the contamination level of air and soil and report to authorities. Initiate remedial measures such as the supply of drinking water and measure air contamination level regularly till the condition normalizes.
- Inform fire service and police personnel about the potential of the gas emanated due to the reaction promptly. Block the road traffic at least 5 km distance depending on the toxicity of the gas and the wind speed to prevent exposure of more number of public.
- If felt necessary, inform public living near the affected area to evacuate through a public announcement and by using media like radio and TV the direction of an escape route and advise

them to use a wet cloth to cover the nose while moving. Put off the fire using the fire hydrant water and foam compound or with the help of fire extinguisher.

- Check the extent of damage to the liners if any and arrange for immediate repair based on the need. Prepare a report of the incident and investigate and find out the root cause of the accident.

7.3.5 Contamination of soil and water sources due to leakage of contaminants

a. Control measures:

- Before commencing the operations, a collection of soil and water samples from the site have to be carried out to establish the baseline data. Ensure public liability insurance cover is taken for the site.
- Make sure that the preparation of landfill pits is done as per the laid out standard. Special care should be taken while laying the liners such as visual check for damage of liner material and proper welding of joints to ensure that the leakage of leachate from the liner is absolutely nil also by conducting leak proof tests ultrasonic or X-ray tests.
- Avoid damage of liners during landfill operation by the use of sharp-edged objects such as cutting knives, dropping of crowbars and by moving the heavy vehicle on the liners. Contamination of water and soil due to leakage of leachate from the liners / due to overflowing from leachate ponds especially during rainy season spillage while pumping or spillage during handling operation to be avoided.
- The flooring of material stores should not have cracks and should not allow seepage of material. The floor should be provided with the bund wall and collection pit.
- Periodic checking of soil and water samples and compare data with baseline data at least once a month. If any adverse increase in parameters noticed an increase in the frequency of tests. Prepare comparative analysis data if found more, than the baseline data inform the pollution board authorities.

b. After the incident:

If the operation is continued, the condition is going to be disastrous after some time. Hence it is necessary to initiate corrective measures as per the advice of the pollution control board. Follow the corrective measures mentioned after an earthquake and flood.

7.3.6 Release of toxic gases from the incinerator

a. Control measures:

- Ensure public liability insurance cover is taken for the site. Analyze the combination of waste material that is proposed to be burned and check the possibility of toxic gas generation and get the written report from the lab before starting to feed the waste material into the incinerator.
- Install windsocks and wind speed monitor at site visible from all points. Employ qualified and well-trained operators to operate the incinerator. Maintain the temperatures of gases at locations as per the incinerator operation instruction. Install instruments to detect and warn operators before the toxicity level reaches higher than the statutory limit.

- Monitor the toxic content levels at the chimney exhaust continuously during the operation. If any changes in parameters of gases noticed during the operation stop feeding the material and inform the lab manager immediately and take corrective measures. Re-analyse the sample and decide the combination of materials before the restart.
- Maintain the record of changes made for future reference. Inform the employees and the public living in the vicinity of the safety measures required to be taken in case of an accidental release.

b. After the incident:

Evacuate everyone from the site and the vicinity to a safe place. Additional care has to be taken while evacuating, sick, old, infants and physically challenged persons. Detect the gas that is generated by analyzing the gas and its toxicity level. Provide first aid to victims by removing them to the safe and well-ventilated area. If necessary send the victim for treatment with information of the type of gas victim is exposed to.

7.3.7 Hazards due to combustibles

Hazards during storage and handling of combustible materials like plastics, paper and wood are very common. In the current expansion project, facilities for recycling of waste paper and plastic are proposed. Hence there are chances of hazards due to these combustible materials.

When the inflammable material is crushed, conveyed and stored, the risk of fire increases as these materials are usually dry and need only low ignition energy to ignite. The extent of damage due to fire in a waste recycling facility can occur due to several reasons like the oxygen content of the material, particle size and shape, moisture content, turbulence etc. A fire in these units can spread very quickly. Therefore, a fast-acting fire protection system or safety measures to mitigate the conditions is required.

Control measures

- A well-defined process for managing plastics and paper shall be in place not to let the waste build up and the waste shall be compacted to reduce its volume.
- The combustible materials shall be stored in containers made of non-combustible material. Generally, metal bins shall be used as they don't burn and won't add to the fire. A rubber lid shall be provided on the top of the containers to prevent fire.
- Where possible, access is restricted to the areas where waste is stored.
- Rubbish containers shall never be overfilled and always kept securely shut.
- Paper bales shall be arranged in an interlacing pattern rather than arranging directly on top of each other. This will reduce air-flow and fire intensity.
- Separating ignition sources from areas where explosive atmospheres may form will reduce the risk of explosion considerably. Regular inspection, testing, and maintenance of equipment are vital to their proper operation and the prevention of fires.
- Oxidant reduction can be accomplished by adding inert gas to enclosed processes in order to reduce the oxygen concentration to a level below that required for ignition to occur.
- Portable fire extinguishers capable of extinguishing combustible dust fires to be provided throughout the process area.

- Automatic sprinkler protection should be provided in all buildings or rooms in which the storage, handling, or processing of combustible dust is conducted.
- Spray or fog nozzles should be provided for hose stations and extinguishers to reduce the potential of dust being thrown in suspension.
- Employees should be informed of the hazards in their work area and trained to protect themselves from the hazards. The training should include instruction on what they are to do in an emergency.

7.3.8 First aid and emergency procedures

Burns can cause due to acid spillage and leakage of electricity. Curative measures for any issues of burns and first aid procedures are given in Table 7.13.

Table 7.13 First aid for burns

Burns covering small area	Burns covering extensive area
i. Allow cold tap water to run gently over the area or immerse in cold water. ii. It may be necessary to cover with gauze or a clean handkerchief, and bandage.	i. Allow the person to lie down. ii. Cover burned areas with a sterile dressing or clean cloth and lightly bandage. iii. If clothing is adhering, do not disturb; leave the clothing alone. iv. Keep the person warm. If a person is not nauseated, he may have sips of water. v. Arrange for immediate medical care.

7.4 On-site emergency plan

In view of the hazardous nature of products/process handled at the project site, the plan is prepared to deal with probable scenarios like fire, explosion and others etc. etc. The EPP consists of organizational setup, roles and responsibilities operational systems, actions on site, and mitigation measures after commissioning of work at the site. Onsite emergency plan will be shared with district administration for enabling them to update the "District Offsite Emergency Plan".

7.4.1 Roles and responsibilities of emergency personnel

The general roles and responsibilities of the emergency personnel involved are tabulated in Table 7.14.

Table 7.14 Roles and responsibilities of the emergency personnel

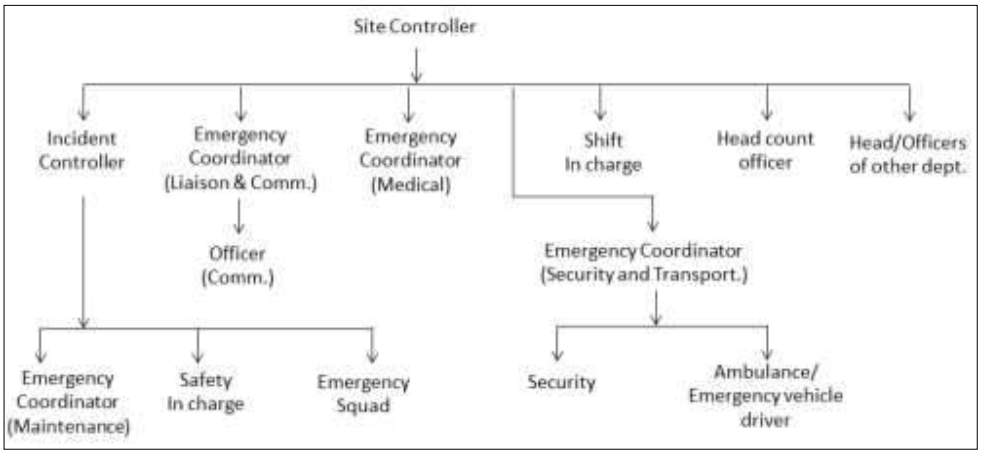
Person in-charge	Roles and responsibilities
Operational In charge	Informs about the emergency to works incident controller
Security Personnel	The control room I/C informs key persons as per list and keeps the telephone lines clear for communication. Team I - Controls the main gate, allows only persons connected with emergency operations, ambulance or other emergency vehicle inside the gate.
Works Main Controller	
Site In charge	Director communicates to Govt. Authorities / Press and News Media in consultation with works main controller.

Person in-charge	Roles and responsibilities
Dept. Head	• Immediately on knowing about the emergency, he proceeds to the Emergency Control Centre (ECC). • Relieves Incident Controller of responsibility for overall main control. • Depending on the seriousness of emergency, he ensures outside help and arranges to inform nearby factories. • Ensures key personnel are in their places. • Exercises control of the unaffected areas. • Continuously review possible developments. • Makes arrangement for the shutdown of plant and evacuation in consultation with and works incident controller other key personnel. • Ensure that casualties are receiving adequate attention and relatives are advised to extend necessary co-operation by Hospital. • Ensure that statutory authorities are informed. • Ensure accounting of personnel by. • Regulate vehicular movements in the Unit. • Arrange for recording of chronological sequence of activities of an emergency. • In consultation with Director, preparation of incident statement to be submitted to news media. • In case of likely aggravation of the incident, arrange to warn the nearby population through Police.
Works Incident Controller	• Activate emergency procedure as required • Direct all operations within affected area priority • Looking after firefighting/ emergency control operations • Ensuring the affected area is cordoned off, supervising rescue and search for casualties • Directing the shutdown of operations and evacuation • Reporting the situation development to Site In charge
Safety In charge	• Assist by WMC providing necessary information damage due to chemical

7.4.2 Organizational setup and infrastructure for emergency operations

The organizational set up for emergency operations for on-site emergency control is given in

Figure 7.6 Organogram for emergency operation



7.4.3 Existing safety facilities

The existing incinerator, landfill area, electrical, administrative and other control rooms are well equipped with necessary safety equipment such as fire hydrant system, water mist fire tender, foam monitor with foam, fire extinguishers, sand buckets, fire blankets, SCBA, PPE's, Spill control kits etc.

Details of the fire protection equipments are given in **Table. 7.15**. Light arresters are installed at locations given in **Table 7.16** and first-aid box locations in **Table 7.17.** Layout with existing fire control infrastructure (fire hydrant system) is given in **Figure 7.6**.

Table 7.15 Details of fire protection equipments

S.No	Description	Qty.
1	Hydrant Points	35
2	Hose Pipe Box(Each box contain 02 pipes, 15meter length)	35
3	Foam Monitors	06
4	Mobile Foam Trolley	02
5	Fire Water Tank Capacity (KL)	350
6	Main Pump (capacity 75 HP-171M3/hr) Electrical Operated	01
7	Diesel Engine Pump(Capacity 85 HP-171M3/hr)	01
8	Jockey Pump 10 HP (10.8M3/hr)	02
9	Beam Detector System –IWS 02	03
10	Beam Detector System –IWS 03	05
11	Water Sprinkler System-IWS-02	1
12	Water Sprinkler System-IWS-01	1
13	Fire Extinguisher	86
14	Sand Bucket	34
15	Fire Blanket	04
16	Fire Alarm call point	10

Table 7.16 Location of lightening arrester

S.No	Location	Height (m)	Qty.
1	Administration building: Cooper rod – 1 m. length	15	1
2	Incinerator plant , Chimney: Cooper rod – 1 m. length	40	1
3	Shed No – 1: Cooper rod – 1 m. length	15	1
4	Shed No – 2: Cooper rod – 1 m. length	15	1
5	Shed No – 3: Cooper rod – 1 m. length	15	1
6	Weigh bridge: Cooper rod – 1 m. length	10	1

Table 7.17 Location of first-aid boxes

S.No	Location	Area
1	Main gate	Security control room
2	Store	Near store officers cabin
3	Laboratory	Wet Chem lab
4	Operation	Operation office
5	HZW incineration plant	PLC room
6	Bio-medical plant	Plant entrance
7	Ambulance	Back side of driver seat

Emergency control center - ECC is set up and marked on the site plan. It is located at administrative building/ security control cabin and serves as the focal point in case of an emergency. The existing ECC have all the necessary documents, equipments and communication facilities. It will be upgraded as per the needs for the proposed expansion project.

Assembly point – They are located at

1. In front of administrative building
2. In between HZW and BMW incineration plant

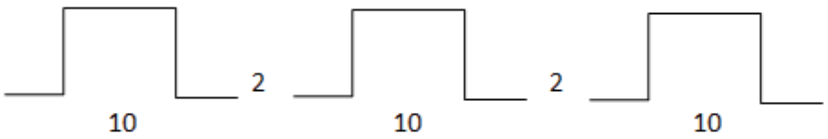
Depending upon the location of emergency, the assembly point may vary. Accordingly, for each hazardous zone an assembly point is identified.

Siren details:

Emergency code

Interrupted shot blast (wailing sound) for 10 seconds duration and gap for 2 seconds and repeat it 3 times. Emergency squad will sound the emergency siren with the instructions received from incident controller. Intermittent hooting will be made continuously for 3 minutes to declare emergency. The purpose is to alert all personnel that the emergency has occurred in the Plant.

Long and short blast:



On hearing the emergency siren, all the people will immediately reach the assembly point. Once the emergency site is located and informs the same to the Emergency Administrator and Incident Controller.

All clear signal:

After the situation is brought under control, site controller through assistant-communication will call off the emergency. The 1-minute continuous blast will devote all clear and restoration of normalcy.

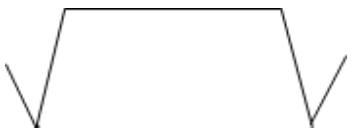


Figure 7.7 Fire hydrant system layout



7.1.1 Local actions taken up during an emergency

Work site(s):

- Evacuate the area immediately
- Inform to all nearby colleagues
- Try to control locally, in case not possible inform to responsible people at administrative building
- Stay at the site until Sr. Manager- Operation/EHS In charge reaches there

Waste storage shed(s):

- In case of fire in or adjacent to Waste Storage sheds area try to prevent spreading of fire and try to control locally using the fire extinguisher provided there
- Shout and inform all to get assistance and support

Landfill:

- People as well as earth moving machinery to be shifted/diverted in the up wind direction
- Use the soil readily available to spread on the fire/smoke/fumes to suppress/control
- Use the DCP/foam fighting equipment in case of requirement to control locally
- Use abundant water to control the fire

General:

- Emergency handling team should immediately proceed to the designated job
- Visitors and outside people should be retained/sent at the main gate
- All other employees should suspend their work(s) temporarily and proceed to the assembly point and act as per the directions given
- Panic people should be retained and directed to the main gate.

7.2 Operational systems during emergency

7.2.1 Communication system

There are different types of alarms to differentiate one type of an emergency from other such as - fire or gas, normal fire siren, emergency/evacuation and high-pitched wailing Siren. Apart from these alarms, an adequate number of external and internal telephone connections should be installed for passing the information effectively.

7.2.2 Warning system and control

Control centres - The control centres should be located at an area of minimum risk or vulnerability in the premises concerned, taking into account the wind direction, areas which might be affected by fire/explosion, toxic releases, etc.

Emergency services - Under this, each site should describe the facilities of fire-fighting, first-aid and rescue. Alternate sources of power supply for operating fire pumps, communication with local bodies, fire brigade, etc. should also be clearly indicated.

7.2.3 Mutual aid

It is essential to have mutual aid arrangements as it is useful in cases of major fire and other emergencies. Mutual aid arrangements are to be worked out in the plan to facilitate additional help, such as fire-fighting or medical attention which might be beyond the capacity of an individual unit.

7.3 Off-site emergency plan

The existing off-site emergency of the facility is given in Table 7.18. The same plan shall be augmented taking into consideration the proposed expansion.

Table 7.18 Off-site emergency plan

S.No	Type of emergency	Preventive and control measures
1	Spillage of waste during transport.	• Check and repair containers before sending to the generator's site. • Train the driver and cleaner to seal the container doors properly before lifting the container on the truck and on spill clean-up procedure. • Fill the container up to about 80% and cover with tarpaulin to prevent flying dust. • Ensure the spill kit and PPE is available in the truck for use in case of emergency.
2	Collision with other vehicle, pedestrians, trees or objects at the side of the road and injury to persons/damage to the vehicle due to the accident.	• Hire drivers who have a valid license and well trained in hazardous waste transport. • Ensure vehicle is well maintained and certified before it is sent out of the gate. • Ensure valid insurance is available for the vehicle. • Maintain first aid box with content in the vehicle. • Maintain Phone No's of authorized hospitals, specialist doctors, police station, and the fire station in the vehicle also paint the paint the phone No of the unit on the vehicle. • Inform authorized hospital over the phone. • Ensure first aid is given to the injured quickly and is taken to the nearby hospital for necessary treatment. • Report the matter to the nearby police station and project authorities. • Immediately inform the site in-charge or his deputy in the absence of site in-charge. • Based on the seriousness the site in-charge will send the unit Personnel manager and the site transport in-charge to the accident site without delay. • Take care of the injured without any delay and the unit personnel manager will follow up the requirement of further

S.No	Type of emergency	Preventive and control measures
		treatment. • The transport in-charge and the personnel manager will deal with the police department for the release of the driver and the vehicle.
3	Toppling of truck and spillage of waste.	• Hire only qualified drivers. • Keep the vehicle insurance updated. • Carry the MSDS issued by the waste generator • Barricade the area till the resumption of normalcy. • Contain and lean the spillage using the spill kit. • Report to project official and inform pollution control board officials. • Complete rescue work of the truck.
4	Fire on waste material during transport.	• Ensure fire extinguishers are available in the truck • Ensure that the driver and cleaner are trained in the use of fire extinguishers. • Inform the driver and cleaner, MSDS detail of the waste from the comprehensive analysis and the easy identification method before sending them for collection. • Park the vehicle at the side away from the busy area. • Avoid inhaling the smoke or gases emanated due to the fire. • Stand on upwind direction. • Use the fire appliance and fight the fire. • Barricade the area and stop another vehicle movement if the fire is uncontrolled. • Inform the nearest fire station and police the exact location where the vehicle is parked and the details of the MSDS of the material on fire. • Maintain the phone numbers including mobile numbers of the fire station, police station, waste generator and company emergency team members in the vehicle. • Give cool water bath as first aid to persons if at all there are burns and send for further treatment to the nearest hospital. • Inform project officials and the waste generator. • One who receives the information has to inform the site in-charge immediately. • Site in-charge has to send the lab in-charge, site safety officer and lab technician immediately to collect waste samples for further analysis and as well as to gather and record on hand information from the site. Photographs of

S.No	Type of emergency	Preventive and control measures
		the scene will also help to analyse and to educate others and increase awareness thus reducing accidents • Collect relevant information from the accident spot for analysis of accident and the safety officer will complete the investigation report and the root cause of the accident. • Inform the pollution control board if required. • Inform insurers if there is damage. • Preserve the manifest copy issued by the waste generator for further investigation purposes. • Share the details of the accident with the site in-charge and the team of drivers. • Implement preventive measures as per the recommendations are given by the enquiry team to prevent such accident in future.

7.4 Disaster management plan

No records of flood, earthquake, cloudbursts etc. have been observed. However, certain measures should be taken to be able to deal in case of any emergency.

7.4.1 Earthquake

The site falls under seismically less stable zone and situated in seismic Zone-III (moderate risk zone) as per IS: 1893-1970 and is susceptible to earthquake. The design and construction of the unit to done as per the codes laid down in above standard. In case of any emergency in the factory, if that would affect the general population (community around the factory) then control measures given are:

Precautionary measures

- Overhead light and fixtures to be braced securely, heavy/large objects to be stored on lower shelves
- Repair defective electrical wiring and leaky gas connections. These are potential fire hazards
- Safe places to be identified, indoors and outdoors, during tremors
- Emergency centres like hospitals, fire station, police station etc. with telephone/cell numbers to be displayed

During an earthquake	After an earthquake
• Remain calm and try to reassure others • Stay away from glass windows, mirrors, chimneys and other projecting parts of the building • Try to get under a table, desk or stand in the inner corner away from the windows • If possible, move to an open area way from the falling hazards	• Check for injuries, do not attempt to move seriously injured persons unless they are in immediate danger of further injury • Inform and request for help from civil defence, fire services, police, home guards and other public safety officials • Do not crowd the damage areas unless help has been requested • Re-enter the building premises once it is deemed safe by the fire department/a designated representative

7.4.2 Flood

There is no history of last 30 years of any drastic floods happen in the area. Hence, heavy rainfall in the region may create the flood situation. In such situation the facility may flooding water can take access to the area. In such condition the safe shutdown of complete activities/site is recommended.

Precautionary measures

- Sewerage and storm water systems to be checked at regular intervals for their proper functioning
- Provision will be made to harvest most of the rain water from the proposed site. This will reduce the water shortage as well as runoff water on the site
- Move to higher floor of the building when the ground/site is flooded
- Turn off electricity to reduce the risk of electrocution
- Alert necessary government agencies/departments to make evacuation plan

7.4.3 Mock drill monitoring

Mock drills have to be conducted at regular intervals. For conducting mock drills, a committee has to be organized. The committee may invite any other official/expert if considered necessary. Mock drills should be carried out step by step as stated below.

First step	Test the effectiveness of the communication system
Second step	Test the speed of mobilization of the emergency teams
Third step	Test the effectiveness of rescue teams and treatment of casualties
Fourth step	Test emergency isolation, and shut down
Fifth step	Conduct a full rehearsal of the actions to be taken during an emergency

Chapter 8

Project Benefits

8.1 Introduction

The Hazardous Waste (Management & Handling) Rules, 1989 and its subsequent amendments (2008, 2016) prevent the industries from dumping their solid wastes indiscriminately. At the same time, provisions have been made for the industries to dispose off their wastes in a systematic and scientific manner and the pollution control boards been asked to ensure it. In view of this, the proposed project would minimize the risk involved in hazardous waste management by way of transportation and waste movement through manifest and regular monitoring of such facility would be better and feasible as compared to individual captive facilities adopted by industries.

8.2 Benefits of the project

The main benefits of the existing as well as proposed expansion project are:

- Provides services to minimize & scientific management of hazardous wastes
- Provides a one stop integrated solution for the management of various types of wastes at one place.
- Minimizes pollution load on environment with an additional benefit of green and clean surroundings;
- Management of wastes is relatively easier and economically viable at a common facility
- Most viable options in the absence or availability of expertise
- Reduced environmental liability due to captive storage of hazardous waste in the premises of industries
- Better occupational health and safety at individual industry level
- Prevention of natural resource contamination

8.3 Benefits of processing and resource recovery from e-waste

All the materials used for the manufacturing of the electronic equipment's can be recovered to make new products. Metals, plastics, glass etc., can be turned into new materials and products. For example, electronic equipment's contain a number of metals such as gold, silver, platinum, palladium, copper, tin, and zinc that could be recovered. These metals are used by various industries for making jewelry, plating, electronics, automotive and art foundries. Plastics recovered from the electronic equipment are recycled into plastic components for new electronic devices or other plastic products such as garden furniture, license plate frames, nonfood containers and replacing automotive parts.

Recycling E-waste helps protect the environment in a number of ways. Recovering these materials avoids the need to mine and process new materials, which in turn, conserves our natural resources thereby avoiding air and water pollution as well as greenhouse gas emissions that are caused by manufacturing virgin materials.

8.4 Benefits of bio-medical waste treatment

Inappropriate treatment and disposal of bio-medical waste contributes to environmental pollution. Indiscriminate dumping of these wastes, uncontrolled burning/incineration causes air, water and soil pollution.

Thus, proper bio-medical waste management will help control nosocomial diseases (hospital acquired infections), reduce HIV/AIDS, sepsis, and hepatitis transmission from dirty needles and other improperly cleaned / disposed medical items, control zones (diseases passed to humans through insects, birds, rats and other animals), prevent illegal repacking and resale of contaminated needles, cut cycles of infection and avoid negative long-term health effects like cancer, from the environmental release of toxic substances such as dioxins, mercury and others.

8.5 Benefits of secured landfill

Following are the benefits offered from landfills:

The land fill is the most effective way to dispose of waste without causing environmental pollution, when the landfill is properly designed and operated.

- Landfills minimize the impact of solid waste disposal on land
- Up on completion, the landfill site can be reclaimed and used as parks and recreation facilities.
- Controls odors emanating from indiscriminate dumping of hazardous wastes in open areas.

8.6 Benefits from recycling facilities

Recycling is the process of making or manufacturing new products from a product that has originally served its purpose. If these used products are disposed off in an appropriate and environmental friendly way, the process of recycling has been set in motion. The recycling facilities proposed in the expansion project and the benefits from these facilities are discussed below:

- Spent Solvents
- Waste paper
- Waste plastic
- AFRF
- MS Drum recycling.

8.6.1 Spent solvent recycling

Waste solvent recycling means reducing the amount of local, state and central toxic release inventory. Recycling waste solvents keeps excess contaminants from entering water systems and damaging the environment. Recovering solvents reduces emissions and cuts down raw material costs. Some of the benefits due to spent solvents recycling are as follows:

- Reduces environmental impact by reducing the volume of solvents destined for disposal at incineration facilities.
- Reduces the amount of hazardous waste generation
- Reduces the amount of virgin solvents for manufacturing
- Where waste is suitable for fuel blending a more cost effective solution will be provided

8.6.2 Waste paper recycling

- Reduces pressure on trees
- Conserves energy
- Conserves water
- Reduces air and water pollution
- Reduces Greenhouse Gas Emissions

8.6.3 Waste plastic recycling

Plastics are becoming increasingly easy to recycle. Besides the invention of new plastic recycling technology, governments all over the world have plastic collection schemes in place.

- Recycling plastic conserves natural resources & energy that would be required to produce plastic from scratch.
- When plastic is recycled, less plastic is sent to landfill and thus less of this material takes up room in our environment for hundreds of years. In fact, recycling one ton of plastic can save 7.4 cubic yard of landfill space.
- Reduces air and water pollution
- Reduces toxic Gas Emissions, produced while burning of plastic.

8.6.4 Benefits of alternate fuel raw material recovery facility

- Prevents resource depletion of valuable non-renewable fossil fuels;
- Produces overall environmental benefits by reducing releases to air, water and land;
- Maximizes the recovery of energy from waste, while ensuring their safe management.
- Obviates the need to build dedicated incineration facilities.

8.6.5 Benefits of Mild Steel (MS) drums recycling

- Steel is an alloy of iron and carbon, it requires a lot of energy to produce heat during the production process.
- Most beneficial feature of steel is that it is 100% recyclable and is long lasting, thereby making it an ideal environmental performer to remain in use for many years
- Reduces the amount of waste sent to landfills and incinerators.
- Conserves natural resources such as timber, water and minerals.
- Increases economic security by tapping a domestic source of materials.
- Prevents pollution by reducing the need to collect new raw materials.
- Saves energy.

8.7 Improvements in the physical infrastructure

As the project is located in the notified industrial area where all the physical infrastructures are being provided by the Taloja industrial estate, and as the project has developed its own physical infrastructure as roads, solar electric streetlights , water supply, and sanitation within the project. As the project is going for expansion there will be a scope of increase of the infrastructure to the project. The following physical infrastructure facilities will be improved due to the proposed expansion project.

- Roads & transportation facilities
- Educational facilities
- Banking facilities
- Post office
- Communication facilities
- Recreational facilities
- Water supply and sanitation facilities
- Electricity
- Housing facilities
- Water supply and sanitation

8.8 Improvements in the social infrastructure

At the Ramky Group, Corporate Social Responsibility (CSR) is an integral, self-regulating mechanism through which the business monitors and safeguards its active compliance with global norms and ethical standards. The goal of Ramky Group is to embrace responsibility for its actions and do all that

it takes to make a positive impact on the environment, communities, employees, consumers, stakeholders and the public at large.

Since its inception in 2006, Ramky Foundation has been proactively promoting the public interest by encouraging community growth and development and voluntarily eliminating practices that are not in harmony with the environment and the public sphere. With the emphasis on four thrust areas - Natural Resource Management, Women Empowerment, Education and Health, the Foundation is growing rapidly with clear-cut strategies including successful collaborations with various government and non-government agencies and mobilization of additional resources to widen the scope of the engagement.

Ramky Foundation is present in 16 States and its impact has been felt far and wide and appreciated in different form throughout the Indian subcontinent. It has moved beyond the 'gap-filling' initiatives into capacity building activities.

8.9 CER and CSR activities and budget

8.9.1 Corporate Environmental Responsibility (CER)

In the past different Expert Appraisal Committees (EAC) / State Expert Appraisal Committees (SEAC) have been prescribing different formulation for the CER and no common principles are followed. Hence MOEFCC has issued Office Memorandum on 1st May 2018 in order to have transparency and uniformity while recommending CER by EAC/ SEAC and issued the guidelines for both green field project and brownfield projects based on capital investment proposed.

The cost of the CER is an addition to the cost envisaged for the implementation of the EIA/EMP which includes the measures for the pollution control, environmental protection and conservation, R&R, wildlife and forest conservation / protection measures including the NPV and compensatory afforestation, required if any, and any other activities, to be derived as part of the EIA process.

The activities proposed under CER shall be worked based on the issues raised in public of nearby villages, social need assessment, EMP, etc. Some of the activities which can be carried out in CER, are infrastructure creation for drinking water supply, sanitation, health, education, skill development, roads, cross drains, electrification including solar power, solid waste management facilities, scientific support and awareness to local farmers to increase yield of crop and fodder, rain water harvesting, soil moisture conservation works, avenue planation, plantation in community areas, etc.

The proposed activities shall be restricted to the affected area around the project. The entire activities proposed under CER shall be treated as project and shall be monitored. The monitoring report shall be submitted to the regional office as a part of half-yearly compliance report, and to the District Collector (DC), and displayed in the website of the project proponent. The DC may add or delete the activities as per the requirement of the district.

8.9.2 Monitoring of CSR activities

Monitoring of the CSR activities is very crucial and needs to be a periodic activity of monitoring by project officials. These activities will be strengthened focusing on Education, Health and Improvement of basic amenities. The Board of directors would discuss the implementation of CSR activities in their board meetings.

A separate paragraph/Chapter will be included in the annual report on the implementation of CSR activities/projects including the facts relating to physical and financial progress. Project management will appoint a CSR committee or a Social Audit Committee or a suitable credible external agency for proper and periodic monitoring of CSR activities. Project management will promote to evaluate the CSR projects by an independent internal or external agency. Most of the CSR activities are carried out by Ramky Foundation.

Ramky Foundation is the Corporate Social Responsibility (CSR) arm of the Ramky Group of companies that strives to realize the dream of a green and clean earth, since its inception in 2006. The Foundation's three thrust areas include - natural resource management, women empowerment, health and education.

8.9.3 CER and CSR Funding

CER fund shall be allotted as per the MoEF&CC office memorandum F.No.22-65/2017-IA.III dated 1st May 2018. "The fund allocation for CER shall be deliberated in the EAC or SEAC or DEAC as the many case may be with a due diligence subject to maximum percentage as prescribed below for the different cases"

Capital Investment /Additional Capital Investment (in Rs.)	Greenfield Project - % of Capital Investment	Brownfield Project – % of Additional Capital Investment
≤ 100 Crores	2.0%	1.0%
> 100 Crores ≤ 500 Crores	1.5%	0.75%
> 500 Crores ≤ 1000 Crores	1.0%	0.50%
> From 1000 Crores to ≤ 10000 Crores	0.5%	0.25%
> 10000 Crores	0.25%	0.125%

The CER budget allotted based on the capital cost of the proposed expansion and details break up and activities considered under the CER are given in Table 8.1.

Table 8.1 Budgetary proposed for CER - Brownfield project

S. No	Item	Rs (in Lakhs)	Remarks
1	Drinking water supply	5	The budget breakup is tentative, allotment will be based on the requirement of villagers and district collector advise
2	Health camps and facilities	5	
3	Skill development	4	
4	Roads & Cross drains	4	
5	Electrification, Solar power	4	
6	Sanitation, Solid waste management	4	
7	Scientific support to farmers	4	
8	Rainwater harvesting, soil conservation	3	
9	Plantation (Avenue, community, schools, etc.)	3	
10	Others as per the requirement	4	
	Total	40	
Cost of the proposed expansion is Rs 40.05 Crores, CER fund is 1.0 % (Rs 40 Lakhs) maximum based on EAC recommendation			

The CSR budget will be mandatorily as per the guidelines created through a Board Resolution as a percentage of net profit as per the rule prescribed by the government of India/Companies Act 2013.

Criteria for Applicability of CSR Under Section 135 (I) of Companies Act 2013		
Either of the Following 3 Criteria		
Turnover Criteria Turnover during financial Year is INR 1000 Crores or More	Net Profit Criteria Net profit during financial year is INR 5 Crores or more	Net worth Criteria Net worth is INR 500 Crores or More
As per the act the management board shall ensure that at least 2% of average net profits of the company made during three immediately preceding financial years shall be spent on CSR activities in every financial year.		

The CSR Budget will be fixed for each financial year. This funding will not lapse. However, if project have different Profit Centres like factories/plant locations, they will be allocated separate CSR budgets to be spent by them under the Annual CSR Budget allocations.

Under CSR activities of the existing project, several activities were carried out for the surrounding villages and for local people. The details of the various CSR activities include - infrastructure development, conducting awareness camps, training camps medical camps etc. The CSR activities carried out by existing project and expenditure incurred details are given in Table 8.2 and activities proposed for taking up are given in Table 8.3.

Table 8.2 List of CSR measures undertaken by existing project (Period Dec-2016 to Dec' 2017)

S No	Project Name	Funding Source	Activity	Partnering Organisation	Location	Date	Purpose	Targeted Beneficiaries	No. of beneficiaries	Amount (Rs.)
1	Shaksham Shiksha	MWML, Taloja	Donate ABL Tool Kit	Zilla School - Siddi Karavle Village, Gram panchayat	ZP School Siddhi Karavle	30.12.16	Facilitate students to build on their learning skills	ZP School underprivileged students	150	50000
2	Observe Special Days	MWML, Taloja	Republic Day – Felicitate Security personnel, drawing, quiz & competition	Zilla Parishad Education Dpt.	MWML site, ZP schools	26th Jan to 30th Jan'17	Celebrate Republic day and promote Art culture	MWML employees, ZP school students	250	0
3	Shaksham Shiksha	MWML, Taloja	Bags & Uniform Distribution	Zilla School - Siddi Karavle Village and School Management Committee	ZP School, Siddhi Karavle	Feb'17	Support tribal children's	Tribal children	60	37600
4	School Infrastructure development	Ramky Foundation	Bhumipuja ceremony of School Classroom construction	Zilla Parishad Education Dpt., Gram Panchayat, SMC	ZP School, Dharna Camp	11.3.17	ZP School Classroom construction	ZP School underprivileged students	80	1000000
5	Prerna – Women's Empowerment	MWML, Taloja	Women's Group Meeting	Shanti Kuti Women's Group & Integrated Child Dpt. Services and Anganwadi's	Taloja Majkur Anganwadi	18.2.17	Motivate SHG members to start IGP/Livelihood program	Members of Shanti Kuti SHG	32	2175
6	Observe Special Days	MWML, Taloja	General Health Check-up Camp	Panvel Municipal Corporation, Senior Citizen Group, Panvel & Rural Hospital, Panvel	Senior Citizen Hall, Old Panvel	8.3.17	Observe International Women's Day'2017	Community Women and Senior Citizens	283	250000
7	Observe Special Days	MWML, Taloja	TB Awareness Rally & Seminar	Panvel Municipal Corporation, Senior Citizen Group, Panvel & Rural Hospital, Panvel	Senior Citizen Hall, Old Panvel	24.3.17	Observe World TB day	Nursing Students, Health Staff and Government officials	125	45000
8	Employee Engagement	MWML & it's Employees contribution	Donation Drive – Donate Coats and Mattress	CRPF's Rapid Action Force	RAF Campus, Kharghar	20th Mar to 3rd April	Support soldiers suffering with cancer	CRPF-RAF soldiers	----	260000
9	Prerna – Women's Empowerment	MWML, Taloja	Capacity Building Training on IG	ZP School Taloja Majkur, Shanti Kuti Women's group, ICDS dpt. and	ZP School, Taloja Majkur	21.4.17	Encourage local women's to actively participate in IGP/Livelihood	SHG members	54	9800

S No	Project Name	Funding Source	Activity	Partnering Organisation	Location	Date	Purpose	Targeted Beneficiaries	No. of beneficiaries	Amount (Rs.)
				Anganwadi's			programs			
10	Observe Special Days	MWML, Taloja	Environment Campaign	Orion Mall, Bharat Petroleum CSR, NaviMumbai, block development Office-Gram Sevak	MWML plant area, Panvel city, Navi Mumbai	4th June to 22nd June'17	Observe World Environment Day'2017	General Public, Industrial workers, petrol pump workers, Govt. officials, Youths	1500	49600
11	Ante Natal Care	MWML, Taloja	ANC Clinic	ICDS Dpt. ZP Education dpt.	Taloja Pachnand School	13.6.17	Monitor status of pregnant women health progress during pregnancy provide nutrition supplement	Community Pregnant women's	22	16600
12	Observe Special Days	MWML, Taloja	Yoga Session	MWML internal activity	MWML Training Centre	21.6.17	Observe International Yoga Day	MWML staff	50	3800
13	Campaign and Awareness	MWML, Taloja	Tree Plantation drive – Donate 230 Trees	Panvel Police Dpt., ZP Education dpt.	Kharghar Police station, Dharna Camp, Siddhi Karavle	5th to 7th July'17	Create Mass awareness in schools and local vicinity on "Save Environment"	ZP Schools, Police Stations	-	38500
14	Campaign and Awareness	MWML, Taloja	Education Fare – Shikshanachi Wari	ZP Education dpt., CIPLA company	Rasrang Hall, Rasayani	11.7.17	Domestic Waste Management Awareness	ZP School Teachers and Students	800	6400
15	Prerna - Women's Empowerment	Breast Feeding seminar and Health check-up camp	MWML, Taloja	ICDS Dpt. Urban Health Mission, Taloja Manufacturing Association	3.8.17	TMA Hall, Taloja	Breast Feeding Mothers and Pregnant Women's	Observe Breast Feeding week	120 women's participated in the health checkup	20700
16	Observe Special Days	Flag Hoisting and Certificate distribution	MWML, Taloja	MWML internal activity	15.8.17	MWML Campus	MWML employees	Celebrate Independence day		10500
17	Shasham Shiksha	Handicapped children welfare awareness program & Rally	MWML, Taloja	Inclusive India, ZP School Rasayani, CIPLA	18.8.17	ZP School, Rasayani	Handicapped children and their parents	Handicapped children education in mainstream system		5000
18	Employee Engagement	Team Outing	MWML, Taloja	MWML internal activity	20.8.17	IMAGICA Water park	MWML employees	Team Building		0
19	Shasham Shiksha	Note Books Distribution	Ramky Foundation	ZP Education Dpt.	21.8.17	ZP school Taloja Majkur, Dharna	School Children's	Education Support to underprivileged children	Total 832 books received:	2000

S No	Project Name	Funding Source	Activity	Partnering Organisation	Location	Date	Purpose	Targeted Beneficiaries	No. of beneficiaries	Amount (Rs.)
						Camp, contract labor children's of MWML		studying in Zilla Parishad schools	distributed 600 books	
20	Employee Engagement	Cultural Programs and Indoor/outdoor games	MWML, Taloja	MWML internal activity	28th Aug to 5th Sept'17	MWML Campus	MWML employees	Celebrate Ganesh Utsava		4800
21	Community Health and Hygiene	Blood Donation Camp by Tata Memorial Cancer Centre	MWML, Taloja	Tata Memorial Cancer Research Centre, Kharghar	13.09.17	MWML - Training Centre	Cancer Patients	Transfusion of blood for Cancer Patients for their treatment.	Gift Vouchers: 30 @ 250 = 7500 Food Refreshment: 15 @ 150 = 2250 Vehicle charges: 1000 Volunteer Charges: 2 @ 500 = 1000 Total = 11750	11750
22	Campaign and Awareness	Pulse Polio Campaign	MWML, Taloja	Rural Hospital Panvel & Urban Health Mission dpt.	18th to 22nd Sept'17	Panvel City	Small children's age group 0 to 5yrs.	Feed Polio drops - Prevent/control and eradicate polio	Vehicle for 5 days @ 3000 = 15000/- Food/Refreshment of volunteers 1000 @ 5 days = 5000/- **Total = 20000/-**	20000
23	Shaksham Shiksha	Donate Ceiling Fans	Employees Contribution	ZP School Siddhi Karavle	22.09.17	ZP School, Siddhi Karavle	Under privileged children's (boys and girls)	Ceiling fans in classroom for students comfortable study	4 ceiling fans @ 1500 = 6000	6000
24	Employee Engagement	Distribution of Sarees	MWML, Taloja		28.09.17	Training Centre, MWMWL	MWML Female staff and workers	Appreciation for their good work and strong bonding with the company, share best practices, success stories and challenges	45 sarees of devi from MWML Temple	0
25	Shaksham Shiksha	Note Books Distribution	Ramky Foundation		29.09.17	Manav Vikas Sanstha, Panvel	Special children's with disability	Support special children's for their education	**200 short books and 200 long books**	0
26	Campaign and Awareness	Daan Utsav - Diwali stall, Donation Drive	NA	Bhartiya Manav Vikas Sanstha - Panvel, Orion Mall Panvel, BPCL	12th to 30th Oct'17	MWML site, Orion Mall, BPCL Tetrol Pump	Mentally challenged and disabled children	Education support & upliftment of disabled children studying in special school		20000
									Total Expenditure	**1870225**

PERIOD: Aug'17							
S.No	Project Name	Particular	Partnering Organization	Date	Location	Target Group	Purpose
1	Prerna - Women's Empowerment	Breast Feeding seminar and Health checkup camp	ICDS Dpt. Urban Health Mission, Taloja Manufacturing Association	3.8.17	TMA Hall, Taloja	Breast Feeding Mothers and Pregnant Women's	Observe Breast Feeding week
2	Observe Special Days	Flag Hoisting and Certificate distribution	MWML internal activity	15.8.17	MWML Campus	MWML employees	Celebrate Independence day
3	Shasham Shiksha	Handicapped children welfare awareness program and Rally	Inclusive India, ZP School Rasayani, CIPLA	18.8.17	ZP School, Rasayani	Handicapped children and their parents	Handicapped children education in mainstream system
4	Employee Engagement	Team Outing	MWML internal activity	20.8.17	IMAGICA Water park	MWML employees	Team Building
5	Shasham Shiksha	Note Books Distribution	ZP Education Dpt.	21.8.17	ZP school Taloja Majkur, Dharna Camp, contract labor children's of MWML	School Children's	Education Support to underprivileged children studying in Zilla Parishad schools
6	Employee Engagement	Cultural Programs and Indoor/outdoor games	MWML internal activity	28th Aug to 5th Sept'17	MWML Campus	MWML employees	Celebrate Ganesh Utsava

PERIOD: Sept'17						
S.No	Project Name	Particular	Date	Location	Target Group	Purpose
1	Community Health and Hygiene	Blood Donation Camp by Tata Memorial Cancer Centre	13.09.17	MWML - Training Centre	Cancer Patients	Transfusion of blood for Cancer Patients for their treatment.
2	Campaign and Awareness	Pulse Polio Campaign	18-22.09.17	Panvel City	Small children's age group 0 to 5yrs.	Feed Polio drops - Prevent/control and eradicate polio
3	Shaksham Shiksha	Donate Ceiling Fans	22.09.17	ZP School, Siddhi Karavle	Underprivileged children's (boys and girls)	Ceiling fans in classroom for students comfortable study
4	Employee Engagement	Distribution of Sarees	28.09.17	Training Centre, MWMWL	MWML Female staff and workers	Appreciation for their good work and strong bonding with the company, share best practices, success stories and challenges
5	Shaksham Shiksha	Note Books Distribution	29.09.17	Manav Vikas Sanstha, Panvel	Special children's with disability	Support special children's for their education

PERIOD: Oct & Nov'2017							
S.No	Project Name	Particulars	Partnering Organization	Date	Location	Target Group	Purpose
1	Campaign and Awareness	Daan Utsav - Diwali stall, Donation Drive	Bhartiya Manav Vikas Sanstha - Panvel, Orion Mall Panvel, BPCL	12-30.10.2017	MWML site, Orion Mall, BPCL Tetrol Pump	Mentally chalanged and disabled children	Education support and upliftment of diabled children studying in special school
2	Observe Special Days	Children's Day Cultural and School Competition programs	Block Education Dpt.	14 & 18.11.2017	ZP School Taloja Majkur & Dharna Camp	Underprivileged students of ZP school	Encourage talents and creativity of students on occasion of children's day
3	Shaksham Shiksha	Industrial Visit of School Students	Kamlu Maha Vidyalaya	15.11.2017	MWML project site	Underprivileged students from local villages	Awareness amongst school students on Environment Control Safety and Management.
4	Shaksham Shiksha	Donate Gym equipments to School students	Kamlu Maha Vidyalaya	21.11.2017	Kamlu Maha Vidyalaya	Underprivileged students from local villages	For physical and mental wellbeing of underprivileged students
5	Shaksham Shiksha	Career Guidance Session	Kamlu Maha Vidyalaya	21.11.2017	Kamlu Maha Vidyalaya	10th and 12th Std. Students	Facilitation to choose career after 10th and 12th std.
6	Campaign and Awareness	Visit of Ramky Foundation Head (operations) and Team	Ramky Foundation	21-23.11.2017	NA	NA	Frame CSR strategy, field Visits, meeting with government officials, Facilitate CSR activity
7	Campaign and Awareness	Corporate Exhibition	Envirotech		Exhibition Centre Goregaon	-	-

PERIOD: December'2017							
S.No	Project Name	Activity	Partnering Organization	Date	Location	Target Group	Purpose
1	Observe Special Day	HIV/AIDS Awareness Rally	ICTC Panvel/RH	01.12.17	Panvel City	Local Community people	Oberve World AIDS Day
2	Campaign & Awareness	Industrial Awareness Campaign on HIV/AIDS	ICTC Panvel/RH, Aadhar org. & Lokparishad	05.12.17	TMA Hall, Taloja MIDC, Deepak Fertilizer	Industrial workers & Truckers	Sensitize Industrial workers on HIV/AIDS and conduct free HIV testing
3	Campaign & Awareness	HIV Testing Camp	Aadhar Org.Panvel	06.12.17	MWML Project Site, Taloja	MWML Employees	Provide free HIV testing services
4	Campaign & Awareness	Sponsorship in Cricket Tournament	Cricket Club Siddhi Karavle, Taloja	16th to 20th Dec'17	Siddhi Karavle Ground	Local Youth Groups	Motivate local youths
5	Official Tour	Participate in workshop on FPO's	NABARD	29.12.17	Kudal	NGO, CSR Foundation	Develop linkages to apply for grant proposals
6	Official Tour	Visit to Livelihood Unit of MAVIM	MAVIM, LUPIN	30.12.17	Sawantwadi, Malgaon	Women's SHG	Exposure visit
7	Official Tour	Visit to Vengurel Municipal Corporation waste management project	Vengurle Nagarparishad	30.12.17	Ansur - Vengurle	Venurle MC staff	Exposure visit

Table 8.3 Budget allotted for proposed expansion project: Jan to Mar'18

S No	Project Name	Activity	Partnering Organisation	Purpose	Targeted Beneficiaries	No. of beneficiaries	Proposed Budget
1	Paryavaran Suraksha - Environment Safety and Awareness Campaign	Trainings Session on Industrial Hazardous Waste, Bio Medical Waste, Domestic Waste Management	Environment colleges	Create mass awareness on "Save the Environment" concept and sensitize local community people on global environment issues.	Housing Society, Environment colleges, High Schools, Medical and Nursing colleges	300	25000
2	Shaksham Shiksha	Donate Sport Materials and Laboratory Equipment's	Kamlu Vidyalay - Taloja Majkur	For children's physical and mental growth	Underprivileged students	335	120000
3	School Infra Structure Development	Completion of Dharna Camp School Construction Building	Sarva Shiksha Abhiyan - Block Education Dpt.	Create safe and hygenic study environment for village underprivileged students	Underprivileged students	150	1400000
4	Observe Special Days	Republic Day – Sports Competitions, Youth Development sessions	TMA, MIDC, HINDALCO	Celbrate Republic day and facilitate youth development activities	Underprivileged school students and community youths	200	20000
5	Shaksham Shiksha	Career Guidance Sessions	Kamlu Vidyalay - Taloja Majkur	Facilitation to choose career after 10th and 12th std.	10th and 12th Std. Students	150	15000
6	Prerna – Women's Empowerment	Support Women's Group Income Generation Program	Shanti Kuti Women's Group & Integrated Child Dept. Services and Anganwadi	Motivate SHG members to start IGP/Livelihood program	Members of Shanti Kuti SHG	80	40000
7	Community Health and Hygiene	Donate Surgical Kit and Conduct General Health Camp in Schools and nearby villages	Block Education Dpt. and Rural Hospital, Panvel	Health check-up of underprivileged children's studying in ZP schools	ZP School students and Villagers	250	70000
8	Observe Special Days	Women's Day Program - Health Check-up, Seminar and Awards/Recognition: 8th Mar'17	Panvel Municipal Corporation, Senior Citizen Group, Panvel & Rural Hospital, Panvel, SIES College, kamlu Vidyalay	Observe and Celebrate women's day with some motivational activities for community women's	Self Help Groups, Mahila Mandal, Pregnant Women's, Community Women's	200	25000
9	Observe Special Days	TB Awareness Rally and Seminar: 24th Mar'17	Panvel Municipal Corporation, Senior Citizen Group, Panvel & Rural Hospital, Panvel	Observe World TB day	TB Patients, Truckers, Slum dwellers	500	20000
10	Employee Welfare	Scholarships, Awareness Sessions for Factory workers and employs, Awards and Recognition	NA	Welfare activities for workers and employees children's, training employees on Safety, Health and Environment issues	MWML employees and workers	350	100000
11	Paryavaran Suraksha - Environment Safety and Awareness Campaign	Campus Beautification and Tree Plantation	Rajya Rakhiv Police Bal, Navi Mumbai	Clean and Green Environment Management drive	Police stations and Anganwadi	1000	**100000**
						Total budget allotment	**1935000**

CSR ACTIVITY WISE ANNUAL BUDGET: YEAR: 2018-2019															
Budget for Y18-19: INR 12,55,000/-															
Ref. No	Project Head	Activity/ Description	Yearly Budget	April'18	May'18	June'18	July'18	Aug'18	Sept'18	Oct'18	Nov'18	Dec'18	Jan'19	Feb'19	Mar'19	Cumulative
1.0.0	Education Support	Scholarships, Capacity buildings, Cultural programs, Competitions, Exposure visits, Support in Kind (uniform /note books/school kit	175000	0	0	20000	20000	20000	20000	20000	20000	20000	15000	10000	10000	175000
2.0.0	School Infra Structure Development.	School building/Toilet construction work, school repairing, donate fans, benches etc.	170000	30000	30000	10000	10000	10000	10000	10000	10000	10000	10000	15000	15000	170000
3.0.0	Community Development	Livelihood/Income generation program for women's, skill development for youths, water and sanitation program, Agriculture, Road repairing, Trainings and capacity building programs	290000	30000	30000	20000	20000	20000	20000	20000	20000	20000	30000	30000	30000	290000
4.0.0	Community Health	General Health Camp, Eye camp, ANC Clinic, Health education programs	110000	5000	5000	5000	5000	5000	5000	20000	5000	5000	10000	20000	20000	110000
5.0.0	Observe Special Days	Independence day, Republic day, Environment day, Women's day, TB day, Health day, Teachers day, children's day	140000	5000	0	5000	30000	20000	5000	5000	10000	30000	20000	5000	5000	140000
6.0.0	Employees Welfare		190000	20000	20000	15000	15000	15000	20000	15000	10000	10000	10000	20000	20000	190000
7.0.0	Employee Engagement	Cleanliness/Hygiene, donation drive, school visits, coaching to students	50000	5000	0	0	5000	5000	5000	5000	5000	5000	5000	5000	5000	50000
8.0.0	Campaign & Awareness/ Miscellaneous	street play, rally, petrol pump campaigns, awareness programs, community meetings	70000	0	0	0	5000	5000	5000	5000	10000	10000	10000	10000	10000	70000
9.0.0	Miscellaneous	stationary, printing and designing	60000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	60000
			1255000	100000	90000	80000	115000	105000	95000	105000	95000	115000	115000	120000	120000	1255000

For Proposed Expansion Project			
Proposed Activities/Projects & Budget			
S.No	Project Head	Activities/Projects	Proposed Budget
1	Community Development	Installation of Biogas plant in villages in Mahad area	50000
2	Waste Management	Develop Domestic waste management model for villagers in Mahad and Taloja MIDC area	150000
3	Education Support	Student friendly E-learning for underprivileged students	200000
4	Cleanliness and Sanitation	construction of toilet blocks in Zilla Parishad schools	100000
5	Youth Development	Skill training for community youths	200000
6	Waste Management	Waste management awareness campaigns in schools/colleges/housing colonies	40000
			740000

8.10 Employment potential

The major advantages of the existing and proposed projects are employment generation. Around 70 skilled and 200 unskilled manpower are employed in the existing project. For proposed expansion another 61 skilled manpower and 245 unskilled manpower requirement were estimated. Around 576 skilled and unskilled local surrounding villagers will be get employment. In addition to this there will be indirect employment of around 100 people. Project provides opportunity for participation of women workers both during construction and operation phase. Additionally it is estimated that good number of jobs will be created as an indirect employment opportunities at local/regional level due to contractual, marketing and associated jobs directly with the project. The other related employment due to transportation requirement, supply of essential items and services to the project site and other community services will be plenty.

8.11 Other tangible benefits

- The multiplier effect as the TSDF has a flow of people regularly, it effect's the other sectors as a hotels, restaurants will come up, tea stalls, tiffin center, lodges, etc.
- Housing, transportation, recreation facilities will also improve.
- Improvement in communication, transport, education, community development and medical facilities comes along as the development happens.
- Overall change in employment and income opportunity.
- The State Government will also benefit directly from the proposed project, through increased revenue from royalties, excise duty, etc.

8.12 SWOT Analysis

SWOT analysis is identifying Strengths, weakness, threats, and opportunity of the project,

Strengths	Weakness
• Located in an industrial area • Providing service – scientific disposal of hazardous waste, Bio-medical waste, e-waste, recycling of paper/plastic. • Best alternative technologies. • Conserves resources & reduces environmental pollution • More than 500 people work at different capacities in the project. • Closed landfill site has no effect on the environment that can be used as a public facility • The waste that dumped openly on various sites in un-scientific method will reduce. • Available resource that can be used to improve its performance.	• Chances of industrial accidents due to unforeseen situations. • Insufficient treatment of leachate in the landfill area • Chances of accidental leakage of leachate onto ground or water aquifer • Flaws/shortcomings of any system that may cause to lose a competitive advantage, efficiency or financial resources.

Opportunity	Threats
• Growing industrial sector has good scope of work in hazardous waste management. • Some part of the waste will be re - usable; recyclables can be used for other activities. • Some technologies can be implemented in the waste treatment, for generation of power (waste to energy), complicated waste can be sent to incinerator/landfill.	• Involves high risk in project, but can be properly managed with proper planning. • Leachate pollution to the environment • Influence of dumping in the site area can be resulted in the odor diffusion. • The land cannot be used for any other activity except for developing playground, parks, etc.

8.12.1 Strategies derived from the SWOT profile of the landfill

- Proposing the technology to recover reusable, recyclable material from wastes.
- Authority of project can coordinate with local persons to educate them for employment opportunities.
- Maintain the project site more properly to prevent the effect to the surrounding area and environment with using the sufficient equipment and facilities, and the technology such as daily cover and insect prevention.
- Constructing the suitable leachate treatment facility to prevent the negative impact on the environment.

8.13 Conclusion

The strategies for the environmental consideration were also focused in managing the landfill site more properly. The strategies were concern to prevent the bad effects of the proposed project to the environment and surrounding area. They included encouraging proper and liberal development of green belt that acts as a remedy to all kinds of pollution problems.

As the proposed project itself is an environmental friendly project which strives to minimize various risks and hazards associated with non-scientific ways of industrial, biomedical and other hazardous waste disposal and also equips itself with the most advanced and scientifically reliable ways of handling all types of wastes with proper preparedness to tackle accidents and unexpected incidents, the projects has been found more beneficial to society for present and future needs of waste management.

Chapter 9

Environmental Management Plan

9.1 Introduction

The environmental management plan is the key mile stone of a project implementation, where first the environmental parameters are surveyed. After collection of data they are analyzed based on the given guidelines and the impact of the project on the environment is measured using modeling techniques and based on the frequency of impact, the mitigation measures are given. After identification of the mitigation measures, a monitoring plan is mandatory for all the environmental parameters. A Management Plan is required to implement all these mitigation measures and monitoring plan which is a whole set called as Environmental management plan. The management plan comprises as four major elements as:

- Management plan during construction phase
- Management plan during operation phase
- Management plan post operation phase
- Costing of environmental management plan

9.2 Environmental Management during Construction

The impact of the construction activities on the environment is short term and gradually decreases as the construction activities get completed.

9.2.1 Air quality management plan

As the current project is of expansion of the existing project where the new facilities are also proposed, thereby construction activities as site leveling and grading will be carried out. Leveling activity will be carried out only for providing roads, sewage network, storm water system, construction of sheds and administrative buildings. During construction activity most of the excavated land will be reused within the project site as bunds for leachate ponds, landfill, covering of landfills etc. During construction period most of the dust generated will be from the movement of construction vehicles on unpaved roads. Unloading and removal of soil material shall also act as a potential source for dust generation.

Following are the control measures proposed to mitigate the impacts of air pollution caused by fugitive and gaseous emissions:

- Water sprinkling on main haul roads in the project area will be done, this activity will be carried out at least twice a day, if need arises frequency will be increased on windy days, in this way around 50% reduction on the dust contribution from the exposed surface will be achieved.
- The duration of stockpiling of excavated mud will be as short as possible as most of the material will be used as backfill material for the open cut trenches for road development.
- Temporary tin sheets of sufficient height (3m) will be erected around the site of dust generation or all around the project site as barrier for dust control.
- Tree plantations around the project boundary will be initiated at the early stages by

plantation of 2 to 3 years old saplings using drip irrigation or by regular watering so that the area will be moist for most part of the day.

- All vehicles carrying raw materials will be instructed to cover with tarpaulin / plastic sheet, unloading and loading activity will be stopped during windy period.
- Regular maintenance of machinery and equipment will be carried out; all the vehicles used for construction activity shall have valid "Pollution under control" Certification.

The impact and mitigation measures above mentioned are during the construction of the project where the site engineer who is responsible to implement all the measure to ensure that the dust generated will be controlled.

9.2.2 Water quality mitigation measure

During construction of the site there will be domestic wastewater and the runoff water from the construction activities at site, which does not contain any major chemical impurities. The domestic wastewater will be diverted to septic tanks followed by soak pit or portable STP of existing unit and runoff water from construction activities, water from the cleaning of vehicles are diverted to working pits, so that the suspended solids will be settled and the water will be reused for the sprinkling on road for dust suppression. Therefore, impact on water quality due to proposed unit would be insignificant. It is the site engineer responsibility to see that the working pit should get constructed and thereby used properly.

9.2.3 Noise mitigation measures

The use of noise generating equipment will be confined during day time. Proper enclosures will be used for reduction in noise levels and wherever possible the noise generating equipment will be kept away from the human habitation. Temporary tin sheets of sufficient height (3 m) will be erected around the noise generating activity or all around the project site as barrier for minimizing the noise travel to surrounding areas. Therefore, impact on noise environment due to the proposed project would be insignificant. Furthermore, all vehicles entering into the project will be instructed to maintain speed limits, and not to blow horns unless it is required. Personal protective equipment like earmuffs, helmets covering ears would be provided to the workers working near noise generating equipment and would see that workers use the protective gadgets regularly.

9.2.4 Solid waste mitigation measures

The solid waste generated during construction activity is of construction waste, and domestic waste, however the waste will be segregated sent for reuse and recycling facilities or handed over to the authorities to dispose of safely. All attempts would be made to stick to the following measures.

- All construction waste shall be stored within the site itself. A proper cover will be provided so that the waste does not get scattered.
- Attempts will be made to keep the waste segregated into different heaps as far as possible so that their further gradation and reuse is facilitated.
- Materials, which can be reused for purpose of construction, leveling, making roads/ pavement will also be kept in separate heaps from those which are to be sold or land filled.
- Construction waste generated will be deposited at collection center made by local body or handed over it to the authorized processing facilities of construction and demolition waste.

9.2.5 Ecological Aspects

The expansion of the project is within the site boundary where no major clearing of vegetation is observed, where ever the top soil is suggested to be cleared, will be collected separately so that it can be utilized it for the green belt development. A comprehensive green belt program will be planned to improve the ecological condition of the region.

9.2.6 Site Security

The site is having compound wall / wire fence along the boundary to provide adequate security thereby to ensure that the local inhabitants and stray cattle are not exposed to the potential hazards of construction activities. The site will be under vigilance by the security personnel appointed, to restrict their entry. All the mitigation measures mentioned above are tabulated and presented in Table 9.1.

Table 9.1 Mitigation measures during construction period

Air Quality Mitigation Measures	Water sprinkling on haulage roads in the project area. This activity will be carried out at least twice a day, if need arises frequency will be increased on windy days, in this way around 50% reduction on the dust contribution from the exposed surface will be achieved.
	The duration of stockpiling of excavated mud will be kept as short as possible, as most of the material will be used as backfill material for the open cut trenches and for road development, bunds along landfill
	Temporary tin sheets of sufficient height (3 m) will be erected around the site or construction activity as barrier for dust control.
	Tree plantations around the project boundary will be initiated (wherever there are gaps) by planting 2 to 3 years old saplings using drip irrigation or by regular watering so that the area will be moist for most part of the day.
	All vehicles carrying raw materials will be instructed to cover with tarpaulin / plastic sheet, unloading and loading activity will be stopped during windy period.
	To reduce the dust movement from civil construction site to the neighborhood, the external part of the construction activity will be covered by plastic sheets.
Water Quality Mitigation Measures	The runoff water from the site is collected in working pit and the settled water is reused for construction activities. Over flow if any, will be diverted to nearby greenbelt / plantation area.
	The washed water from all the equipment's will be diverted to the working pit to arrest the suspended solids and the settled water will be reused for construction purposes and for sprinkling on roads to control the dust emission, etc.
	The domestic wastewater generated from washrooms used by the work force will be diverted to septic tank followed by soak pit.
Noise Mitigation Measures	Noise generating equipment will be limited to day time.
	Proper enclosures will be used for reduction in noise levels. Wherever possible, the noise generating equipment will be kept away from human habitation.
	Temporary tin sheets of sufficient height (3 m) will be erected around the noise generating activity or all around the project site as barrier for minimizing the noise travel to surrounding areas.
	All vehicles entering into the project will be informed to maintain speed limits, and not blow horns unless it is required.
	Personal protective equipment like earmuffs, helmets covering ears would be provided to the workers working near noise generating equipment and would see that workers use the protective gadgets regularly.
Solid Waste Mitigation Measures	All construction waste shall be stored within the site itself. A proper screen will be provided so that the waste does not get scattered.
	Attempts will be made to keep the waste segregated into different heaps as far as possible so that their further gradation and reuse is facilitated.

	Materials, which can be reused for purpose of construction, levelling, making roads/ pavement will also be kept in separate heaps from those which are to be sold or land filled or given authorized solid waste processing facilities
Site Security	Adequate security would be arranged to ensure that the local inhabitants and stray cattle are not exposed to the potential hazards of construction activities. Fencing / compound wall will be provided all along the boundary.
	Round the clock, the site will be under vigilance by the security personnel to restrict entry of unwanted people to the site.

9.3 Environmental Management Plan during operation stage

The necessary mitigation measures are suggested to reduce the impact of the continuous emission of the pollution. Necessary control measures will be undertaken at the design stage to meet the statutory requirements and towards minimizing environmental impacts. During project implementation period, special emphasis will be made on minimizing leachate/effluent generation and noise control at source. The specific control measures related to air emissions, liquid effluent discharges, noise generation, solid waste disposal etc. are discussed below:

9.3.1 Air quality management

The main activities from the proposed project which cause air pollution are as follows:

- Stack emissions from incinerator, Boiler and DG sets
- Particulates due to movement of vehicles and sweeping of roads
- Dust, odour and gas generation from secured landfill

The following methods of abatement will be employed for the air pollution control.

- Incinerator will be provided with a stack height meeting MoEF&CC guidelines. Spray dryer, cyclone separator, Bag house, and Wet scrubber shall be used to control other pollutants.
- Boiler will be provided with a stack height meeting MoEF&CC guidelines.
- DG set will be provided with a stack height meeting MoEF&CC guidelines for proper dispersion of sulfur dioxide and oxides of nitrogen.
- Internal roads will be paved to reduce dust emissions. Speed restriction will be followed within the project and speed breakers will be provided at entry and exit points
- Gas management system in secured landfill will be provided
- Green belt will be provided along the internal roads and plant boundary

9.3.2 Odor control

The odor management is one of the issues in TSDF. The main aim is to minimize the number of sources of odor generation which exist in site. To undertake direct management of odor generating sources that give rise to odor problems.

The mitigation measures proposed to minimize and control odor are as follows.

- Dilution of odorant by odor counteraction or neutralized by spraying herbal spray around odor generation areas at regular intervals.
- Covering the landfill area under operation, daily with layer of earth, clay or a similar material.
- Covering of trucks carrying waste while transportation.
- The waste after combustion in primary and secondary stages the off gas/flue gases shall be passed through spray dryer, cyclone separator, activated carbon dry lime and wet scrubber.

- The odour will be removed during the above gas cleaning operations especially the activated carbon shall adsorb any organics if so present in the flue gases. The odour free gases shall be released into the atmosphere from 40 m stack.

9.3.3 Gas management

Hazardous Landfill mainly comprises of material which are stabilized and made inert. Hence the generations of gases are feeble. However to monitor the same gas vents are provided.

9.3.4 Water quality mitigation measures

The main sources of water pollution are

- Leachate from landfill
- Domestic water

The main sources of wastewater generation in the proposed project are wastewater from domestic use, leachate generation from secured land fill area, effluent from various facilities including that used in processes and floor washing, maintenance etc. Leachate is treated by incineration/ forced evaporation/spraying on landfill. The domestic effluent generated will be sent to septic tank. The effluent generated from floor washings, recycling activity, etc., will be collected in collection tank followed by settling tank and the settled water is reused. The waste water generated from boiler and cooling tower used in ash quenching. There will not be any wastewater discharge to any nearby water body and adopts the zero wastewater discharge concept.

9.3.5 Noise mitigation measures

The main source of noise generation is due to the movement of vehicles carrying waste. All vehicles (drivers) entering into the project site will be informed to maintain speed limits, and not blow horns unless it is required. Necessary speed controlling bumps will be placed near weighbridge and entrance of the site.

Other areas where noise generation is anticipated are- Incinerator section, power plant area, DG set room etc. Necessary PPE like earmuffs, helmets would be provided to the workers working near noise generating equipment and would see that workers use the protective gadgets regularly. Regular maintenance of the equipment will be carried out as per the schedule given by suppliers. The following mitigation measures are proposed for controlling noise pollution:

- Acoustic enclosures shall be provided for all high noise level equipment's.
- Ensure that all the design/installation precautions as specified by the manufacturers with respect to noise control are strictly adhered to
- Major noise generating sources are insulated by providing suitable enclosures
- Other than the regular maintenance of various equipment, PPE are provided to the personnel working in noise generating units.
- All the opening like covers, partitions are designed properly

9.3.6 Solid waste mitigation measures

The ash coming from the incinerator will be used as a daily cover for landfill along with soil and mud. The mitigation measures proposed during operation period are given in Table 9.2.

Table 9.2 Mitigation measures proposed during operation period

Air Quality Management	Boiler and Incinerator will be provided with a stack height meeting MOEF Guidelines and necessary air pollution control devices
	DG set will be provided with a stack height meeting MOEF Guidelines proper dispersion of sulfur dioxide and oxides of nitrogen.
	Internal roads will be concreted / asphalted to reduce dust emissions
	Speed restriction will be followed within the project and speed breakers will be provided at entry and exit points
	Gas management system in secured landfill will be provided
	Green belt will be provided along the internal roads and plant boundary
Odour Control	Dilution of odorant by odour counteraction or neutralizing by spraying herbal spray around odour generation areas at regular intervals.
	Covering the landfill area under operation daily with layer of earth, clay or a similar material
Gas Management	To minimize the gas generation in the landfill, the organic based waste will be diverted to incineration to the maximum extent possible
	To manage the gas generated a venting system with flaring arrangement will be provided, if the gas generation is more it will be directed to canteen
Water Quality Mitigation Measures	The leachate generated from landfill will be collected into leachate collection pond.
	The leachate collected will be sprayed back into landfill for dust suppression, stabilization of hazardous waste, etc. the excess if any will be disposed into spray drier of the incinerator or treated and sent to solar pond (during phase I)
	The domestic wastewater will be collected and treated in septic tank/soak pit or portable STP and reused for greenbelt
	The effluent from floor washings, workshop etc., will be collected, treated in O&G trap, settling tank and recycle back for dust suppression, etc.,
	The waste water from bio-medical sections will collected, disinfected and after necessary treatment reused for dust suppression on landfill area
Noise Mitigation Measures	Acoustic enclosures will be provided for all the high noise generating equipment's Major noise generating sources shall be insulated adequately by providing suitable enclosures Other than the regular maintenance of the various equipment, ear plugs are provided to the personnel close to the noise generating units; All the openings like covers, partitions are designed properly.
Solid Waste Mitigation Measures	The ash coming from incineration plant will be used as daily cover in secured landfill
	The sludge generated in the leachate pond/ solar evaporation pond will be sent to secured land fill.
Occupational Health & Safety	Periodic health checkups for workers would be facilitated for early detection and control of communicable Diseases
	Will provide preventive measures for potential fire hazards with requisite fire detection, firefighting facilities and adequate water storage, etc.
	Provide regular training for workers in their respective fields

9.4 Post operation of landfill

A final landfill cover is usually composed of several layers, each with a specific function. The surface cover system must enhance surface drainage, minimize infiltration, support vegetation and control the release of landfill gases. The landfill cover to be adopted will depend on the gas

management system. As recommended by the MoEF&CC, the final cover system must consist of a vegetative layer supported by a drainage layer over barrier layer and gas vent layer. The details of the landfill cover are given below:

- A 60cm thick compacted clay
- A HDPE geo-membrane liner of thickness 1.5 mm
- Top soil 45 cm and vegetative soil 15 cm followed by vegetation.

The mitigation measures proposed during post operation period are given in **Table 9.3.**

Table 9.3 Mitigation measures proposed during post operation period

Post operation phase	
Landfill maintenance	➢ After closure of the landfill, the integrity of the final cover will be maintained. If any repairs are required it will be rectified as necessary.
	➢ After closure of the landfill, management as well as environmental monitoring shall be continued for leachate, landfill gas and surface water for a period of 30 years or until harmful leachate is not produced for 5 continuous years.
	➢ After few years of closure, the leachate is observed to meet all discharge standards, the same shall be discharged directly to lined drains.
	➢ The landfill shall be abandoned after 30 years of closure if concentrations of contaminants in all liquid and gaseous emissions from the landfill are observed to be below prescribed limits.

9.5 Socio economic development activities under CSR

Corporate Social Responsibility (CSR) has become an integral, self-regulating mechanism through which business monitors and safeguards its active compliance with the Law and ethical standards. CSR aims to embrace responsibility for the company's actions and encourage a positive impact through its activities on the environment, employees, consumers, stakeholders, communities and the larger public. The proposed project would proactively promote the public interest through provision of basic amenities such as roads, transportation, electricity, education and sanitation and healthcare facilities. This would also encourage community growth and development and improved socio-economic conditions, and quality of life of the people living in the project area. The company shall also continue to have among its objectives the promotion and growth of the national economy through increased productivity, effective utilization of material, manpower resources and continued application of modern scientific and managerial techniques, in keeping with the national aspiration; and the company shall continue to be mindful of its social and moral responsibilities to consumers, employees, shareholders, society and the local community.

9.5.1 Planning

The planning for CSR starts with the identification of activities/projects to be undertaken. CSR projects/activities may be undertaken in the periphery of project boundaries or anywhere in the country. Selection of activities under CSR would be made to ensure that the benefits reach the smallest units in the area of district depending upon the operations and resource capability of the project. The monitoring skills available with the project authorities could be shared as far as possible, with the local administration by training and setting up required structures and systems. The long-term CSR Plan shall match with the long term business plan. This shall be broken down into medium term and short term plans. Each of these plans shall be clearly specified the following.

- Requirements relating to baseline survey
- Activities to be undertaken
- Budgets allocated
- Time-lines prescribed
- Responsibilities and authorities defined
- Major results expected

However, these plans shall also clearly specify the implementation guidelines and the involvement of the implementing agency

9.5.2 Implementation

CSR initiatives shall consider the following parameters for identifications/selection of schemes/projects as per the stipulated guidelines:

- Investment in CSR should be project based. Mere donations to philanthropic/charity or other organizations would not come under the category of CSR.
- CSR activities should generate community goodwill, create social impact and visibility.
- For every project, the time-frame and periodic milestones should be finalized at the outset.
- CSR activities should also involve the suppliers in order to ensure that the supply-chain also follows the CSR principles.
- CSR activities should help in building a positive image of the company in the public perception.
- CSR projects may be closely linked with the principles of sustainable Development. Based on the immediate and long term social and environmental consequences of their activities.
- Management should take the shoulder responsibility for restoring/Compensating for any ecological damage that is taking place as a result of its operations.

Project activities identified under CSR shall be implemented by Specialized Agencies and generally not by staff of the project management. Specialized agencies would be made to work singly or in tandem with other agencies. Specialized agencies would include:

- Community based organizations whether formal or informal
- Elected local bodies such as Panchayat
- Voluntary Agencies (NGOs)
- Institutes/Academic Organizations
- Trusts, Missions, etc.,
- Self-help Groups (SHG's)
- Government, Semi-Government and autonomous Organizations
- Standing Conference of Public Enterprises (SCOPE)
- Mahila Mandals/Samitis and the like
- Contracted agencies for civil works
- Professional Consultancy Organizations, etc.,

Most of the CSR activities of Ramky group companies are carried out by Ramky Foundation, which is the Corporate Social Responsibility (CSR) arm of the Ramky Group of companies that strives to realize the dream of a green and clean earth, since its inception in 2006. The Foundation's three

thrust areas include - natural resource management, women empowerment, health and education.

Project Management will take responsibility to develop awareness among all levels of their staff about CSR activities and the integration of social processes with business processes. Initiatives of State Governments, District Administration, local administration as well as Central government departments/agencies, self-Help Groups, etc., would be synergized with the initiatives taken by the management.

Every care will be taken to ensure that there is no duplication of CSR activities undertaken by the project with that of programs run by Central State and Local Governments. While assigning CSR projects to specialized agencies, every possible effort will be made to verify the reliability and clean track record of such agencies or they may select from panels maintained by Government, semi-government, autonomous organization or the national CSR hub, etc.

Activities related to sustainable Development will form a significant element of the total initiatives of CSR. However, these activities will be carried out under the 3 UN Global compact principles, pertaining to the Environment. Nevertheless, business related with project activities will be asked to:

- Support a precautionary approach to environmental challenges
- Undertake initiatives to promote greater environmental responsibility
- Encourage the development and diffusion of environmental friendly technologies.

9.5.3 Possible areas of activities under CSR

Some of the possible areas of activities under CSR are given below; they will be undertaken depending on the local requirement and its immediate need.

- Drinking Water Facilities
- Education
- Electricity
- Solar lighting system
- Health and family welfare
- Plantation/Irrigation facilities
- Sanitation and public health
- Pollution control
- Animal care
- Promotion of sports and games
- Promotion of art and culture
- Promotion of livelihood for economically weaker sections through forward and backward linkages.
- Disaster management activities and relief to victims of natural calamities like earth-quake, cyclone, drought and floods in any part of the country
- Supplementing development program of the government
- Promote the use of Non-conventional energy sources
- Construction of community centres/night shelters/old age homes
- Imparting vocational training

- Setting up of skill development centers
- Adoption of villages
- Scholarships to meritorious students belonging to SC, ST, OBC and disabled categories
- Adoption/construction of hostels (especially those for SC/ST and girls)
- Skill training, entrepreneurship development and placement assistance program for youth
- Building of roads, pathways and bridges
- Entrepreneurship development program (EDP)
- Activities related to the preservation of the ecology and sustainable development.

9.5.4 Occupational health management

Health of the employees would be regularly monitored as the workers are exposed to various operations. All the employees shall be required to undergo a medical checkup before joining the facility. Medical checkup will be conducted on regular basis and the health conditions will be monitored. First aid facilities required to attend immediately for meeting emergency situations shall be made available at the facility.

9.6 fire protection system

The fire protection system will protect the entire site area from accidental fire hazards. The fire protection system comprises of a ground level water storage tank to store the necessary required water for emergency. One electric motor driven pump and one diesel high pressure pump will be provided to pump the water to a high pressure header from where the water is distributed to various high pressure hydrants provided at selected locations. Necessary fire hoses with spouts will be kept ready at each hydrant location to facilitate firefighting. The header also caters to a multi fire system to automatically sprinkle water through sprinklers provided.

9.7 Greenbelt development

An area of 144121 sq. m (14.4Ha) (33 %) of the total site area (43.66 Ha) is earmarked for green belt development. As it is an existing facility and about 10.4 Ha of land is covered under greenbelt and remaining 4.0 Ha of land to developed under greenbelt cover. But it is not alike a typical industrial greenbelt of 1500 to 2000 trees per Ha.

There are big gaps. A typical industrial greenbelt of 5 to 10 m width on all sides cannot be developed unless the existing trees are removed and the entire area is denuded. It is not advisable to uproot the existing trees and hence it is planned to reinforce and strengthen the existing greenbelt by pruning the branches of the trees to the desired level so that it becomes possible to grow new saplings close to the trees. It is proposed to have 2 to 5 rows of trees on all sides with a spacing of 2m x 3m (1500 / Ha).

9.7.1 Action plan for greenbelt development in 33% of area

Environmental protection has been considered as an important domain for industrial and other developmental activities in India. Ministry of Environment & Forests and Climate Change (MoEF&CC) has taken several policy initiatives and promoted integration of environmental concerns in developmental projects. One such initiative is the notification on Environmental Impact Assessment (EIA) of developmental projects issued in 1994 and further revised notification in year 2006 under the provisions of Environment (Protection) Act, 1986 EIA Guidance Manual for

building, construction, townships, and area development projects proactively talks about the importance of greenbelts in such projects.

Greenbelt in India refers to a buffer zone created beyond which industrial activity may not be carried on. This concept has developed through a long line of cases and today, greenbelts are present not only for the purpose of protecting sensitive areas to maintain ecological balance but are also be found in urban areas so as to act as a sink for the harmful gases released by vehicles and industries operating in the city area. In this regard, comprehensive guidelines for developing greenbelts have been compiled by the Central Pollution Control Board [Refer Probes/75/1999-2000]. As per the stipulations of MoEF, greenbelt is to be provided all along the boundary by planting tall, evergreen trees and the total green area including landscaping area will be 1/3rd (about 33%) of the plant area.

This will include lay down area which will be later on converted into green area. depending on the size, activity and environmental impacts of the industry; extent of land available, agro- climatic conditions, at least 5 m wide greenbelt of two rows of tall and evergreen plants shall be grown at the rate of 600 per Ac (1500 per Ha). About 1.96 Ha (4.98%) of the total land is going to be used for road network.

The estimated road length is about 3.6km. At a distance of about 10m from tree to tree, about 100 avenue trees can be grown per km on each side. Thus, a total of around 700 avenue trees can be grown along the 3.6 km long road network theoretically or mathematically. However, it is possible to use not more than 80% of the total as there will be road junctions, pipelines, electrical lines, entrances and exits etc. Thus, it is feasible to grow about 550 avenue trees at a distance of 10 m from plant to plant in one row on either of the roads. Profusely branching trees with canopy, such as Peepal, Banyan, Kadamb, Neem, Conocarpus lancefolius etc will be grown as avenue trees.

As stated earlier, it envisaged to develop greenbelt of 5 to 10m width on all sides of the industry in an area of 4.0 Ha out of 14.4Ha. At present around 4500 plants are existing in the facility. Saplings grown in polythene bags will be planted at distance of 2 m x 3 m @ 1500/Ha). Work on greenbelt shall be undertaken along with the proposed construction.

An amount of Rs.80,00,000 is allocated for development of greenbelt at the rate of Rs.6,00,000 per Ha and the amount will be spent in five years after construction, erection and fabrication of the TSDF at the rate of Rs.30,00,000 during the first year and Rs.20,00,000 during the second year.
A total of 14,000 trees will be grown in the 14.4 Ha in 2 to 5 rows of 3mx2m all along the boundary besides one row of avenue plantations on either side of the internal roads at a distance of 10m from plant to plant. Saplings grown in poly bags are transplanted in pits of 30 Cm depth. Treated effluent water and rain water harvested shall be used for plantations. A list of plants suitable for greenbelt and to the local agro climatic conditions is given in Table 9.4.

Table 9.4: List of plants suggested for greenbelt and avenue plantations

S.No	Botanical Name	Family	English /Common	S/T	Habitat	Height(m)
1	*Acacia auriculiformis A.cunn*	Mimoseae	Australian Wattle	T	Tree	16
2	*Acacia nilotica (Linn) Wild*	Mimoseae	Indian gum	T	Tree	8
3	*Albizia lebbeck Benth*	Mimoseae	Sirisha			15
4	*Anthocephalus chinensis (Lamk.)*	Rubiaceae	Kadambama	T	Tree	20
5	*Azadirachta indica*	Meliaceae	Neem	T	Tree	20
6	*Bambusa arundinacia (Retz)Roxb*	Poaceae	Thorny Bamboo	T	Shrub	20
7	*Bambusa vulgaris Schrad*	Poaceae	The Golden Bamboo	T	Shrub/Tree	15
8	*Bauhinia purpurea Linn*	Caesalpinaceae	Butterfly tree	T	Tree	7
9	*Bauhinia varigata Linn*	Caesalpinaceae	Budhist bauhinia	T	Tree	5
10	*Cassia fistula Linn*	Caesalpinaceae	Golden showers	T	Tree	12
11	*Citrus aurantium Linn*	Rutaceae	Citrus tree	T	Tree	5
12	*Cocos nucifera Linn*	Arecaceae	Coconut tree	T	Tree	15
13	*Delonix regia (Boijer) Rafin.*	Caesalpinaceae	Flame tree	T	Tree	15
14	*Emblica officinalis Gaertn.*	Euphorbiaceae	Gooseberry	T	Tree	5
15	*Eucalyptus citriodora Hook*	Myrtaceae	Lemon scented gum	T	Tree	20
16	*Ficus benghalensis Linn*	Moraceae	Banyan tree	T	Tree	20
17	*Ixora undulata*	Rubiaceae	Ixora	T	Tree	6
18	*Madhuca longifolia (Koen)*	Sapotaceae	The butter tree	T	Tree	15
19	*Mangifera indica Linn*	Anacardiaceae	Mango tree	S	Tree	15
20	*Nerium indicum*	Apocynaceae	Pink oleander	T	Shrub	5
21	*Peltophorum pterocarpum*	Caesalpinaceae	Copper pod tree	T	Tree	20
22	*Polythia longifolia*	Anonaceae	Ashoka tree	S	Tree	20
23	*Terminalia catappa*	Combretaceae	The Indian almond	T	Tree`	10

An amount of around Rs. 80 lakhs has been allocated as capital cost for greenbelt development in the EMP budget as shown in Table 9.5.

Table 9.5 .Action Plan for Greenbelt Development

Activity	Area (Ha)	No. saplings	Amount (Rs)
Ist year			
Preparation of land: Leveling, clearing, alignment, preparation of pits	4	NIL	10,00,000
Transplantation	5	4500	10,00,000
Maintenance: Gap Filling	5	1500	10,00,000
IInd Year			
New plantation	4	4000	10,00,000
Maintenance: Gap Filling	10	2000	10,00,000
IIIrd year			
Avenue plantations	1.4Ha or 3.5 km	550	2,00,000
Maintenance & Gap Filling	14.4 Ha	1450	10,00,000
IVth Year Maintenance	14.4 Ha	-	8,00,000
Vth Year Maintenance	14.4 Ha	-	5,00,000
Overheads & Miscellaneous	-	-	5,00,000
Grand Total (survival)	**-**	**14,000**	**80,00,000**

9.8 Environmental Management Cell

The Environmental Cell will be headed by the project managers followed by other officers and technicians. The departments are the nodal agency to co-ordinate and provide necessary services on environmental issues during operation of the project. This environmental group is responsible for implementation of environmental management plan, interaction with the environmental regulatory agencies, reviewing draft policy and planning. This department interacts with State Pollution Control Board and other environment regulatory agencies. The department also interacts with local people to understand their problems and to formulate appropriate community development plan. The major duties and responsibilities of Environmental Management Cell shall be as given below:

- To implement the environmental management plan.
- To assure regulatory compliance with all relevant rules and regulations.
- To ensure regular operation and maintenance of pollution control devices.
- To minimize environmental impacts of operations as by strict adherence to the EMP.
- To initiate environmental monitoring as per approved schedule.
- To review and interpret monitored results and corrective measures in case monitored results are above the specified limit.
- To maintain documentation of good environmental practices and applicable environmental laws as ready reference and ensure that they are followed and maintain environmental records.
- Coordination with regulatory agencies, external consultants

9.8.1 Record keeping and reporting

Record keeping and reporting of performance is an important management tool for ensuring sustainable operation. Records should be maintained for regulatory, monitoring and operational issues. Typical record keeping requirements for the TSDF is summarized in Table 9.6 below.

Table 9.6 Record keeping particulars

Parameter	Particulars
Solid Waste Handling and Disposal	• Daily quantity of waste received • Daily quantity of waste sent to landfill
Waste water	• Daily quantities of waste water & treated effluent • Point of generation & usage of treated wastewater • Treated wastewater quality
Regulatory Licenses (Environmental)	• Environmental Permits / consents from SPCB
Monitoring and Survey	• Records of all monitoring carried out as per the finalized monitoring protocol
Accident reporting	• Date and time of the accident • Sequence of events leading to accident & history of accidents • Investigation reports of previous accidents • Chemical datasheet assessing effect of accident on health and environment • Emergency measures taken • Corrective measures and steps taken to prevent recurrence of such events
Other	• Log book of compliance • Employee environmental, health and safety records • Equipment inspection and calibration records • Vehicle maintenance and inspection records

9.9 Budgetary provision for EMP

In order to comply with the environmental protection measures, the project management has made budgetary provisions for environmental protection and safety measures. Cost towards environmental mitigation measures summarized in Table 9.7 and detailed EMP cost for existing and proposed furnished in Table 9.8.

Table 9.7 EMP budget summary

S. No	Control measures	Existing (Lakhs)		Proposed(Lakhs)	
		Capital Cost	Recurring cost/year	Capital Cost	Recurring cost/year
1	Air Pollution Control	557	40	159	15.9
2	Water Pollution Control	203	36	75	7.5
3	Noise Pollution Control	43	4.3	18	1.8
4	Solid waste management	34	3.4	13	1.3
5	Greenbelt development	184	18.4	30	3
6	Environmental Monitoring	537	53.7	55	5.5
	Grand Total	**1558**	**155.8**	**350**	**35**

Table 9.8 Budget for implementation of environmental management plan

S. No	Control measures	Description	Existing (Lakhs)		Proposed(Lakhs)	
			Capital Cost	Recurring cost/year	Capital Cost	Recurring cost/year
1	Air Pollution Control	Bag Filters, wet scrubbers, Cyclone separators & Bag House	253	9.6	65	6.5
		Installation of VOC online monitoring system	200	20	80	8
		Fume Hood with scrubber	100	10	10	1
		Sprinkling of Water	4	0.4	4	0.4
		Sub Total	**557**	**40**	**159**	**15.9**
2	Water Pollution Control	Soak pit & septic tank	8	0.8	5	0.5
		Solar evaporation pond, guard pond, etc.	60	6	40	4
		Analysis and treatment of leachate	50	5	10	1
		Storm water drains	85	24.2	20	2
		Sub Total	**203**	**36**	**75**	**7.5**
3	Noise Pollution Control	Personal Protective Equipment	23	2.3	15	1.5
		Acoustic enclosures	20	2	3	0.3
		Sub Total	**43**	**4.3**	**18**	**1.8**
4	Solid waste management	Waste storage shed	19	1.9	8	0.8
		Waste storage platform	15	1.5	5	0.5
		Sub Total	**34**	**3.4**	**13**	**1.3**
5	Greenbelt development	Greenbelt & open area Horticulture	120	12	15	1.5
6	Miscellaneous	Solar street Lighting (80 no's @ 20 m, 1 bulb of 40W)	64	6.4	15	1.5
		Sub Total	**184**	**18.4**	**30**	**3**
7	Environmental Monitoring	Ambient air quality studies-Once in quarter	127	12.7	35	3.5
		Water quality monitoring-once in quarter	105	10.5	15	1.5
		Noise levels - Once in a month	135	13.5	3	0.3
		soil quality -once in quarter	80	8	2	0.2
		Sub Total	**537**	**53.7**	**55**	**5.5**
		Grand Total	**1558**	**155.8**	**350**	**35**

9.10 E-Waste Management and Handling Rules 2016

The proposed E-waste management facility would comply with the EWM Rules, 2016. The responsibilities of E-waste collection centers and dismantlers/recyclers to comply with EWM Rules, 2016 are summarized in **Table 9.9.**

Table 9.9 Compliance as per E-Waste Management and Handling Rules, 2016

Section	Applicable Rule	Compliance
Chapter II	Responsibilities of Collection Centers	
6.1	collect E-waste on behalf of producer or dismantler or recycler or refurbished including those arising from orphaned products; Provided the collection centers established by producer can also collect e-waste on behalf of dismantler, refurbished and recycler including those arising from orphaned products	Shall comply with the rules
6.3	Ensure that the E-waste collected by them is stored in a secured manner till it is sent to registered dismantler(s) or recycler(s) as the case may be	Shall comply with the rules
6.4	Ensure that no damage is caused to the environment during storage and transportation of E-waste	After receiving the request from the client the project management will arrange a suitable and secured transport to collect the material from client's premises and the collected material will be stored in secured place till it is processed further.
6.5	Maintain records of E-waste handled, in Form-2 and make such records available for scrutiny by the concerned SPCB	Shall comply with the rules
Chapter II	Responsibilities of Dismantler	
10.1	Ensure that the facility and dismantling process are in accordance with the standards or guidelines published by the CPCB from time to time	Shall be ensured
10.2	Obtain authorization from the concerned State Pollution Control Board in accordance with the procedure under sub-rule (3) of rule 13	Authorization and registration will be obtained after obtaining EC
10.3	Ensure that no damage is caused to the environment during storage and transportation of E-waste	It will be ensured that storage and transportation of E-waste does not damage the environment
10.4	Ensure that dismantling process do not have any adverse effect on the health and the environment	Necessary pollution control measures shall be taken care of to preserve health and environment.
10.5	Ensure that dismantled E-waste are segregated and sent to the registered recycling facilities for recovery of materials	Shall comply with the rules
10.6	Ensure that non-recyclable/non–recoverable components are sent to authorized treatment storage and disposal facilities	Non-recyclable/non–recoverable components are separated and sent to incineration or secured land fill for further disposal
10.7	maintain record of e-waste collected, dismantled and sent to authorized recycler in Form-2 and make such record available for scrutiny by the Central Pollution Control Board or the concerned State Pollution Control Board	Shall comply with the rules
10.8	File a return in Form- 3 to the SPCB on or before 30th June following the financial year to which that return relates	Annual returns in Form-3 shall be filed
10.9	Not process any E-waste for recovery or refining of materials, unless he is authorized with the concerned SPCB as recycler for refining and recovery of metals	Shall comply with the rules

9.11 Action plan for complying performance evaluation and monitoring TSDF

The detailed action plans for complying performance evaluation and monitoring of TSDF facility as per HAZWAMS/..../2010-2011 are given in Table 9.10.

Table 9.10 Action plan for monitoring TSDF

Section	Condition	Compliance
4.1	Basic Information to be provided by the operator of the facility	The basic information as per the format given CPCB manual in HAZWAMS/..../2010-2011 dated May 24, 2010, Annexure-II will be provided to SPCB/CPCB before the commencement of operation of the facility. This would be done as one time exercise. In case there is any change in the activity of the proposed facility, information will be updated to SPCB/CPCB
4.2	Periodic information to be prepared and submitted on quarterly basis by the operator of the facility	Periodic information as per the format given CPCB manual in HAZWAMS/..../2010-2011 dated May 24, 2010, Annexure-III will be provided to SPCB/CPCB on quarterly basis within 15 days before the end of the quarter
5.2	Uniformity in monitoring of soil, ground and surface water, ambient air quality, gaseous emissions from vents provided to the already capped landfills, a monitoring protocol is to be followed	A monitoring protocol suggested in CPCB manual HAZWAMS/..../2010-2011 dated May 24, 2010, Annexure-IV will be followed and will be provided to SPCB/CPCB as per Consent conditions
5.4	Storage of Incompatible wastes in the TSDF	While storing and mixing incompatible wastes general criteria suggested as guideline in CPCB manual HAZWAMS/..../2010-2011 dated May 24, 2010 is followed
5.6	Online tracking system for movement of hazardous waste	Measures will be taken to put in place online tracking system for movement of the hazardous waste from generators to the TSDF
5.7	Strengthening and upgrading laboratories, Accreditation as per EPA, 1986, obtaining ISO 17025 through NABL system	A full-fledged laboratory having sufficient equipment for monitoring and analysis of all required parameters is in place.

9.12 Compliance of Hazardous Waste Rules, 2016

Point wise compliance of the Hazardous Waste (Management and Transboundary Movement) Rules 2016 pertaining to authorization, collection, storage, transportation etc., are given in Table 9.11.

Table 9.11 Compliance of hazardous waste rules 2016

Chapter II PROCEDURE FOR MANAGEMENT OF HAZARDOUS AND OTHER WASTES		
II - 4	Responsibilities of the occupier for handling hazardous wastes	Compliance
4.2	The occupier shall be responsible for safe and environmentally sound handling of hazardous wastes generated in his establishment.	No hazardous waste will be generated as the proposed project is Treatment, Storage and Disposable Facility (TSDF)
4.3	The hazardous wastes generated in the establishment of an occupier shall be sent or sold to a recycler or re-processor or re-user registered or authorized under these rules or shall be disposed of in an authorized disposal facility.	No hazardous waste will be generated as the proposed project is Treatment, Storage and Disposable Facility (TSDF)
4.4	The hazardous wastes transported from an occupier's establishment to a recycler for recycling	Transportation of hazardous waste shall be done in accordance with the provisions of

	or reuse or reprocessing or to an authorized facility for disposal shall be transported in accordance with the provisions of these rules.	these rules
4.5	The occupier or any other person acting on his behalf who intends to get his hazardous wastes treated and disposed of by the operator of a TSDF shall give to the operator of a facility, such information as may be needed for safe storage and disposal	Management shall collect information required as per State Pollution Control Board from the respective industries which send the hazardous waste for treatment and disposal
4.6	The occupier shall take all adequate steps while handling hazardous wastes to: I. contain contaminants and prevent accidents and limit their consequences on human beings and the environment; and II. Provide persons working on the site with the training, equipment and the information necessary to ensure their safety.	All necessary preventive measures will be taken while handling the hazardous wastes. Personal protective gadgets will be provided to workers and it will be seen that they use while working In case of accidents, necessary cleaning of the site will be taken up
II - 6	Grant of authorization for handling hazardous wastes.	
6.1	Every person engaged in generation, processing, treatment, package, storage, transportation, use, collection, destruction, conversion, offering for sale, transfer or the like of the hazardous waste or occupier of the facility shall make an application in Form 1 to the SPCB for authorization within a period of sixty days from the date of commencement of these rules: Provided that any person authorized under the provisions of the Hazardous Waste(Management, Handling and Transboundary Movement) Rules, 2008, prior to the date of coming into force of these rules, shall not require to make an application for authorization till the period of expiry of such authorization.	Application in Form 1 will be submitted to the concerned State Pollution Control Board for authorization of proposed TSDF
6.2	On receipt of the application complete in all respects for the authorization, the State Pollution Control Board may, after such inquiry as it considers necessary and on being satisfied that the applicant possesses appropriate facilities, technical capabilities and equipment to handle hazardous waste safely, grant within a period of one hundred and twenty days an authorization in Form 2 to the applicant, which shall be valid for a period of five years subject to such conditions as may be laid down therein.	Accepting the condition
6.2	An application for the renewal of an authorization shall be made, before its expiry and the State Pollution Control Board may renew the authorization after examining each case on merit subject to the condition that there has been no report of violation of the provisions of the Act or the rules made there under or conditions specified in the authorization.	Application for the renewal of authorization shall be made before the expiry to State Pollution Control Board
6.4	The State Pollution Control Board may after giving reasonable opportunity of being heard to the applicant refuse to grant any authorization.	Condition acceptable
6.5	Every person authorized under these rules shall maintain the record of hazardous wastes handled by him in Form 3 and prepare and submit to the	Shall maintain the record of hazardous wastes handled at the facility in Form 3 and prepare and submit to the State Pollution

	State Pollution Control Board, an annual return containing the details specified in **Form 4** on or before the 30th day of June following to the financial year to which that return relates.	Control Board, an annual return containing the details specified in **Form 4** on or before the 30th day of June following to the financial year.
6.6	The State Pollution Control Board shall maintain a register containing particulars of the conditions imposed under these rules for management of hazardous waste, and it shall be open for inspection during office hours to any person interested or affected or a person authorized by him on his behalf.	condition acceptable
II - 7	**Power to suspend or cancel an authorization**	
7.1	The State Pollution Control Board, may, if in its opinion the holder of the authorization has failed to comply with any of the conditions of the authorization or with any provisions of the Act or these rules and after giving him a reasonable opportunity of being heard and after recording reasons thereof in writing cancel or suspend the authorization issued under rule-6 for such period as it considers necessary in the public interest.	Condition acceptable
7.2	Upon suspension or cancellation of the authorization the State Pollution Control Board may give directions to the person whose authorization has been suspended or cancelled for the safe storage of the hazardous wastes, and such person shall comply with such directions.	Directions given by State Pollution Control Board shall be followed
II-8	**Storage of Hazardous Waste**	
8.1	The occupiers, recyclers, re-processors, re-users, and operators of facilities may store the hazardous wastes for a period not exceeding ninety days and shall maintain a record of sale, transfer, storage, recycling and reprocessing of such wastes and these records available for inspection: Provided that the State Pollution Control Board may extend the said period in following cases, namely:- I. small generators (up to ten tonnes per annum) up to one hundred and eighty days of their annual capacity; II. actual users and disposal facility operators up to one hundred and eighty days of their annual capacity, III. occupiers who do not have access to any treatment, storage, disposal facility in the concerned State; or IV. The waste which needs to be specifically stored for development of a process for its recycling, recovery, pre-processing, co-processing or utilization; V. In any other case, on justifiable grounds up to one hundred and eighty days.	condition acceptable

Chapter IV TREATMENT, STORAGE AND DISPOSAL FACILITY FOR HAZARDOUS AND OTHER WASTES		
IV 16	Treatment, Storage and Disposal-Facility for hazardous wastes	
16.1	The State Government, occupier, operator of a facility or any association of occupiers shall individually or jointly or severally be responsible for, and identify sites for establishing the facility for treatment, storage and disposal of the hazardous wastes in the State.	Site meeting MoEF&CC guidelines has been proposed for the expansion project
16.2	The operator of common facility or occupier of a captive facility shall design and set up the treatment, storage and disposal facility as per technical guidelines issued by the Central Pollution Control Board in this regard from time to time and shall obtain approval from the State Pollution Control Board for design and layout in this regard.	The proposed facility shall be designed as per CPCB technical guidelines and necessary approval will be obtained from State Pollution Control Board for design and Layout
16.3	The State Pollution Control Board shall monitor the setting up and operation of the common or captive treatment, storage and disposal facility, regularly	Condition acceptable
16.4	The operator of common facility or occupier of a captive facility shall be responsible for safe and environmentally sound operation of the facility and its closure and post closure phase, as per guidelines or standard operating procedures issued by the Central Pollution Control Board from time to time.	Management shall be responsible for safe and environmentally sound operation of TSDF, closure and post closure phase.
16.5	The operator of common facility or occupier of a captive facility shall maintain records of hazardous and other wastes handled by him in **Form 3.**	We shall maintain records of the hazardous wastes handled as per **Form 3**
16.6	The operator of common facility or occupier of a captive facility shall file an annual return in **Form 4** to the State Pollution Control Board on or before the 30th day of June following the financial year to which that return relates.	Annual return will be filed in **Form 4** to the State Pollution Control Board on or before the 30th day of June following the financial year to which that return relates.
Chapter V PACKAGING, LABELLING AND TRANSPORT OF HAZARDOUS AND OTHER WASTE		
V - 17	Packaging and labeling	
17.1	The occupier handling hazardous or other wastes and operator of TSDF shall ensure that the hazardous and other wastes are packaged in a manner suitable for safe handling, storage and transport as per the guidelines issued by the Central Pollution Control Board from time to time. The labelling shall be done as per **Form 8.**	Packaging and Labeling shall be done as per **Form 8**.
17.2	The label shall be of non-washable material and packaging shall be easily visible and be able to withstand physical conditions and climatic factors.	Packaging and labeling shall be done in such a way that it is easily visible and withstands physical conditions and climatic factors
V - 18	Transportation of Hazardous waste	
18.1	The transport of the hazardous wastes shall be in accordance with the provisions of these rules and the rules made by the Central Government under the Motor Vehicles Act. 1988 and other guidelines issued from time to time in this	Transportation of the hazardous wastes shall be in accordance with the provisions of these rules and the rules made by the Central Government under the Motor Vehicles Act.1988 and other guidelines issued from

	regard.	time to time.
18.2	The occupier shall provide the transporter with the relevant information in **Form 9**, regarding the hazardous nature of the wastes and measures to be taken in case of an emergency and shall label the hazardous wastes containers as per **Form 8**.	Condition acceptable
18.3	In case of transportation of hazardous wastes for final disposal to a facility for treatment, storage and disposal existing in a State other than the State where the hazardous waste is generated, the occupier shall obtain 'No Objection Certificate' from the State Pollution Control Board of both the States.	Condition acceptable
18.6	In case of transportation of hazardous and other wastes for recycling, utilization including co-processing or disposal through a State other than the State of origin or destination, the occupier shall intimate the concerned State Pollution Control Boards before he hands over the hazardous wastes to the transporter.	Condition acceptable
V -19	Manifest system (Movement Document to be used within the country only)	
19.1	The sender of waste shall prepare seven copies of the manifest in **Form 10** comprising of color code indicated below and all 7 copies shall be signed by the transporter.	Condition acceptable and 7 copies manifest system shall be followed
19.2	The sender shall forward copy 1 (white) to the State Pollution Control Board, and in case the hazardous wastes is likely to be transported through any transit State, the occupier shall prepare an additional copy each for intimation to such State and, forward the same to the concerned State Pollution Control Board before he hands over the hazardous wastes to the transporter.	Condition acceptable
19.3	No transporter shall accept hazardous wastes from an occupier for transport unless it is accompanied by copies3 to 7 of the manifest.	Condition acceptable
19.4	The transporter shall submit copies 3 to 7 of the manifest duly signed with date to the operator of the facility along with the waste consignment.	Condition acceptable
19.5	The operator after acceptance of the waste shall hand over copy 4 (orange) to the transporter and send copy 5 (green) to his State Pollution Control Board and send copy 6 (blue) to the sender and the copy 3 (pink) shall be retained by the receiver.	Condition acceptable
19.6	The copy 7 (grey) shall only be sent to the State Pollution Control Board of the sender, if the sender is in another State.	Condition acceptable
	Chapter VI Miscellaneous	
VI -20	Records and returns	
20.1	The occupier handling hazardous wastes and operator of the facility for disposal of hazardous waste shall maintain records of such operations in **Form 3**.	Disposal of hazardous waste records shall be maintained in Form 3

20.2	The occupier and operator of a facility shall send annual returns to the State Pollution Control Board in **Form 4**.	Annual returns shall be sent to the State Pollution Control Board in Form 4.
20.3	The State Pollution Control Board based on the annual returns received from the occupiers and the operators of the facilities for disposal of hazardous and other wastes shall prepare an annual inventory of the waste generated; waste recycled, recovered, utilized including co-processed; waste re-exported and waste disposed and submit to the Central Pollution Control Board by the 30th day of September every year.	Not the responsibility of the facility
VI -21	**Responsibility of Authorities** The Authority specified in column 2 of the Schedule VI shall perform the duties as specified in column 3 of the Schedule subject to the provisions of these rules.	Not the responsibility of the facility
VI -22	**Accident reporting and follow-up** Where an accident occurs at the facility or on a hazardous or other waste site or during transportation of the hazardous waste, the occupier or operator of the facility or the transporter, as the case may be, shall report immediately to the State Pollution Control Board about the accident in **Form11.**	In case of accident report shall be sent to the State Pollution Control Board in Form 11
VI- 23	**Liability of occupier, importer or exporter and operator of a disposal facility**	
23.1	The occupier, importer, transporter and operator of the facility shall be liable for all damages caused to the environment or third party due to improper handling of the hazardous wastes or disposal of the hazardous wastes.	Condition acceptable
23.2	The occupier and the operator of the facility shall be liable to pay financial penalties as levied for any violation of the provisions under these rules by the State Pollution Control Board with the prior approval of the Central Pollution Control Board.	Condition acceptable
VI -24	**Appeal**	
24.1	Any person aggrieved by an order of suspension or cancellation or refusal of authorization or its renewal passed by the State Pollution Control Board, may, within a period of thirty days from the date on which the order is communicated to him, prefer an appeal in **Form12** to the Appellate Authority comprising of the Environment Secretary of the State.	Condition acceptable
24.2	The Appellate Authority may entertain the appeal after the expiry of the period of thirty days if it is satisfied that the appellant was prevented by sufficient cause from filing the appeal in time.	Condition acceptable
24.3	Every appeal filed under this rule shall be disposed of within a period of sixty days from the date of its filing.	Condition acceptable

Chapter 10

Summary & Conclusion

10.1 Project name and location

Mumbai Waste Management Project located at Industrial P-32 & P-32 (part), MIDC Taloja, Panvel Taluk, Raigad District, Maharashtra is the site where existing Integrated Common Hazardous Waste Treatment, Storage and Disposal Facility (ICHWTSDF) is established and is operational since 2002. Land area of the existing ICHWTSDF is 97.35 acres. The proposed expansion will be within the existing area.

10.2. Products and capacities. If expansion proposal then existing products with capacities

The project is established and operational since 14.11.2002, now the project is going for expansion where the details of the proposed and existing are given in Table 10.1

Table 10.1 Details of Proposed and Existing Project Capacities

S.No	Name of the Facility	Existing	After Proposed Expansion
1	Secured Landfill *	1,20,000 MTPA	3,50,000 MTPA
2	Incinerator 1	15,000 MTPA	15,000 MTPA
	Incinerator 2	15,000 MTPA	15,000 MTPA
	Incinerator 3	-	15,000 MTPA
3	Bio medical waste	150 TPM	250 TPM
	Incinerator	1X250 kg/hr	2X250 kg/hr
	Autoclave	2X600 lit/batch	2X3000 lit/batch
	Shredder	2X100 kg/hr	2X200 kg/hr
4	E-waste	-	5400 MTPA
5	Plastic Recycling	-	5000 MTPA
6	Paper Recycling	-	30000 MTPA
7	Solvent Recovery	-	9000 KLPA
8	Alternate Fuel & Raw Material Facility	-	70 MTPD
9	MS Drum Recycling	-	15 MTPD

*Stabilization & land fillable hazardous waste & incinerated ash at the rate of 20% of hazardous waste incinerated.

- Existing incinerator capacity is 30,000 MTPA with two operating incinerators. One new incinerator is proposed with a capacity of 15,000 MTPA. With this the total capacity of the incinerator will become 45,000 MTPA.
- Autoclave from 1200 lit/batch to 6000 lit/batch. Shredder from 200 kg/hr to 400 kg/hr.

10.3. Requirement of land, raw material, water, power, fuel, with source of supply (Quantitative)

The proposed expansion is within the existing project site, no additional land is required for proposed expansion, expansion is within existing land area of 97.35 acres, there is no major raw material required for the project, the hazardous waste generated in the member industries is transported to the project site for treatment and disposal. The water required for the project after expansion is 582 KLD, Power required after expansion is 2220 kVA. For emergency power requirement there is one existing DG set of 875 kVA and one additional DG set of 500 kVA is proposed. The water and power are supplied from the MIDC Taloja, as the project is located within the industrial estate.

10.4 Process description in brief, specifically indicating the gaseous emission, liquid effluent solid and hazardous wastes.

Depending on the nature and characteristics of hazardous waste sent by the member industries based on the preliminary analysis results the method of treatment is proposed and the following disposal methods are followed:

- ETP sludge's is sent directly to landfill or after stabilization.
- Depending on the characteristics of the impurities, bottom residues, process residues and other organic wastes including spent carbon can be sent for incineration.
- Incineration ash, slags, asbestos and glass fibers are essentially inorganic in nature and can go to landfill directly or with simple stabilization techniques.
- Spent catalysts and resins would have to be characterized on a case-by-case basis to assess their nature and characteristics. However, the percentage of wastes generated through these sources is likely to be very small as most of it is taken back by the manufacturers.
- Salts will have to be bagged and land filled.

The leachate generated from the secured landfill is been sent to solar evaporation pond, rest is been sent to the incinerator. The ash generated from incineration is sent to secured landfill. The gases generated during incineration are treated in air pollution control devices (Spray drier, multi cyclones, bag filters, scrubbers, chimney).

On receipt of the bio medical waste at the facility, waste containers shall be unloaded. A mechanical shredder shreds the bio-medical waste. All incinerable wastes shall be directly loaded into the incinerator, while autoclave required wastes shall be loaded into the autoclave for disinfection. Ash, residues from high temperature incineration and other materials from the process shall be collected into containers and disposed into a secured landfill.

The E-waste collected will sent to destruction followed by dismantling it will be segregated into various types of waste and sent to suitable recycling process. Recycling facilities for plastic waste, paper waste, mild steel drums and solvent recovery facilities are also proposed.

10.5 Capital cost of the project, estimated time of completion.

The capital cost of the proposed expansion is Rs.40.05 Crores (Existing project cost is Rs.155.82 Crores). The capital cost allocated for EMP is around Rs. 3.5 Crores with a recurring cost of Rs. 35 lakhs/annum. The CER budget proposed is Rs 40 Lakhs as per MoEF&CC OM dated 1st May 2018. The CSR budget will be as per companies' act 2013.

As per initial estimate around 6 months is required for implementation of the project considering the starting date i.e. from the date of receiving all the statutory clearances from concerned departments of state and central government.

10.6 Site selected for the project

To improve the infrastructure facilities like power connection, water supply, roads equipments of MWML with expansion due to following advantages:

1. The project site is located within the notified industrial area of MIDC, Taloja, Maharashtra.
2. Existing facility is under operation. Infrastructure facilities such as land, water, roads etc., are available.
3. Required land is available for expansion. No additional land acquisition is involved.
4. There is no forest land involved for the project
5. Since existing facilities are being used, such facilities were used in common.

10.7 Baseline environmental data - air quality, surface and ground water quality, soil characteristic, flora and fauna, socio-economic condition of the nearby population

Baseline monitoring studies were carried out during the Post-monsoon period (September to November) of 2018. Following are the observations made for quality of Air, water, Soil, Noise, Biological, Social studies and traffic study etc.

Air environment

- The predominant wind direction during study period was W to SW. Ambient Air Quality Monitoring stations were installed at 10 different locations. The maximum and minimum (98^{th} Percentile) values recorded for all the pollutants- PM_{10}, $PM_{2.5}$, SO_2, NO_x, O_3, CO, C_6H_6, NH_3 were found to be within the permissible limits. The AQI is calculated for the all the location and found to be falling in Satisfactory Category (51-100) Minor breathing discomfort to sensitive people.

Surface water & Ground water

- A total of 10 ground water samples and 2 surface water samples were collected from the study area in order to assess the water quality.

- pH of the ground water samples varied between 6.9 to 8.1. Total dissolved solids varied from 194 mg/l to 812 mg/l. Chloride levels ranged from 25 mg/l to a maximum of 214 mg/l. Hardness values varied from 120 mg/l to 503 mg/l. Fluoride values were in the range of <0.5 mg/l.

- pH of the surface water was in the range of 7.9 to 8.2. The total dissolved solids were in the range of 194 to 335 mg/l. Chlorides were in the range of 30 to 55 mg/l. Hardness as $CaCO_3$ varied between 155 to 259 mg/l. Fluorides in the samples were found to be in the range of 0.65to 0.85 mg/l. BOD values ranged from 12 to 24 mg/l.

- In conclusion all the parameters are above acceptable limits and below permissible limits for ground water samples, however surface water samples are found to be not suitable for drinking.

Noise:

- Baseline noise levels have been monitored at ten locations within the study zone, using a continuous noise measurement device. The day equivalents during the study period ranged between 50.6 to 55.2 dB (A) whereas the night equivalents were in the range of 40.7 to 44.1 dB (A). It was observed that the day equivalents and the night equivalents were within the

AAQ standards in respect of Noise SO 123 (E) date. 14th Feb 2000 for Residential and Commercial area.

Traffic

- The MIDC Taloja is well planned industrial area with well-developed roads and well planned wide internal roads. The traffic survey was carried out near the project site (in both the cases two and fro). From the study, it was observed that the highest peak on approach road near project site was observed 618 PCU/hr during peak period of 9AM to 10AM. As per the IRC the existing level of service is good. This implies that traffic will not have a major impact due to the proposed expansion.

Soil Quality

- Baseline soil samples have been monitored at eight locations within the study area. The pH values of the soil varied from 7.4 to 8.3 indicating that soils fall under normal to saline category. Electrical conductivity in varied from 132 to 245 µS/cm indicating that the soils fall under normal category. The organic carbon in the study area varied from 0.28 to 0.65% indicating medium levels of total organic carbon. Nitrogen in the study area varied from 72 to 150 kg/Ha. Available phosphorus varied from 6.3 to 9.4 kg/Ha. Potassium in the study area ranged between 47 to 123 kg/Ha indicating that all samples are falling under medium category, whereas nitrogen is falling under low category.

Flora & fauna

- There are no National Parks, Wildlife Sanctuaries, Biosphere Reserves and Important Bird Areas (IBA) within the study area. Except 2 scrub jungle reserve forest patches namely; RF near Malangadh village-4.3 km (East) &RF near Rohinjan village- 5.1 km (West) have been found within the 10 km of study area. There are no reports of occurrence of any rare or endangered or endemic or threatened (REET) fauna is listed in the study area as per Indian Wildlife (Protection) Act 1972.

Socio-economic condition

- As it is an existing TSDF facility and the land use is under industrial category, there is no need for conversion of agricultural or forest area for the project.

- The proposed project will additionally lead to direct and indirect employment opportunities. In addition, the company shall also earmark fund of Rs. 40 Lakhs towards CER and other developmental activities which will benefit the villagers in and around the project site.

- Around 70 skilled and 200 unskilled manpower are employed in the existing project. For proposed expansion another 61 skilled manpower and 245 unskilled manpower requirement

were estimated. Around 576 skilled and unskilled local surrounding villagers will be get employment.

10.8 Identification of hazards in handling, processing and storage of hazardous material and safety system provided to mitigate the risk.

During operation of the proposed expansion of site, following activities can pose hazards and risk to human and surrounding environment:

- Loading and unloading hazardous waste - mechanical movements;
- Storage of HSD (High Speed Diesel), incinerable & hazardous waste
- Handling of hazardous chemicals;
- Landfill gas leakage
- Toxic gas release from incinerator

Worst case a scenario such as pool fire by tank rupture resulting in complete leakage of fuel, was used for simulation in ALOHA software. It predicted that for HSD storage, with 4 cm will have high radiation level of 8 kW/m^2 which is less than 10 m.

Some of the risk mitigation measures to be taken:

During construction

- Safety PPE will be provided and usage will be supervised
- Safety practices, guidelines and norms will be followed
- Hygiene and sanitary facilities will be provided

During transportation

- Transportation of waste by covered vehicles;
- Regular training to drivers to handle emergency situation during transportation of waste;
- Implementation of TREM card.

10.9 Likely impact and mitigation measures for the project on air, water, land, flora-fauna and nearby population

The mitigation measures for various environmental attributes are collectively presented below:

During construction phase

- Regular water sprinkling on haulage roads to deliver continuous moisture to suppress dust in dust prone areas.

- Temporary tin sheets of sufficient height will be erected around the site of dust generation or all around the project site as barrier for dust control.

- During site development, necessary precautions will be taken, so that the runoff water from the site gets collected to working pit and if any, over flow will be diverted to nearby greenbelt/ plantation area.

- All noise generating equipment will be used during day time for brief period of its requirement. Equipment will be provided with noise control measures such as acoustic insulation etc., to ensure noise abatement. Personnel Protective Equipment's (PPE) like ear plugs/muffs shall be provided to all the workers at site and their usage is ensured during their work.

- Dense Greenbelt development around the noise source area and along the boundary of premises will be done.

- The project will result in employment opportunities for labourers, semi/unskilled workers.

- The impact of the proposed project on the local as well as regional ecology is not very significant.

During operation phase

- The gases coming out of the incinerator stack are passed through multi cyclone separator for the removal of particulates. For proper dispersion of SO2 and NOx emissions into atmosphere, incinerator stack height meeting MoEF&CC/CPCB guidelines will be provided.

- Flue gases are passed through bag filters for the complete removal of particulates and further to wet alkaline scrubber for neutralization. To prevent the formation of dioxins, the flue gas temperature is rapidly lowered from 500 °C to less than 200 °C by adopting rapid quench/catalyst/adsorption by activated carbon.

- ETP is proposed to treat wastewater generated from scrubbing, floor washings and wastewater generated from various facilities. The treated water shall be reused for circulation into the scrubber.

- Currently, the leachate generated is transferred to a leachate collection pond/ solar evaporation pond/Incinerator. The decanted liquid is directly reused as sprayer on the landfill or pumped to the incinerator and the residue is disposed in landfill. However, after the integrated facility is established, the leachate would be directed to the MEE along with wastewater generated from other units a portion of which will be recycled back for use in waste stabilization.

- During operation, part of the secured land fill will be daily covered with soil/ash and during rainy period with temporary cover (HDPE/Plastic sheets) to minimize the odor and gases generation.

- 33% of total land will be utilized to develop greenbelt and open spaces.

10.10 Emergency preparedness plan in case of natural or in plant emergencies

On-site and off-site emergency plans are prepared to respond in various emergency situations. In case of emergency necessary roles and responsibilities, assembly points, organizational setup etc. are formed. Safety equipments like extinguishers, hydrant system, alarm and siren of adequate number are kept at required locations. Mock drills are organized to be prepared for emergencies.

10.11 Issues raised during public hearing (if applicable) and response given:

Public hearing is exempted for the project as per para 7(i) III Stage (3)(i)(b) of EIA Notification, 2006 for preparation of EIA/EMP Report, being site is located in the Notified industrial area.

10.12 CSR plan with proposed expenditure:

Activities planned for proposed expansion project:

The activities carried under CSR during last few years are as follows: Organized trainings programs on industrial hazardous waste, bio medical waste, domestic waste management. Donated sport materials

and laboratory equipment's to need organizations, Financial support for construction of building of Dharna camp school, Organized Republic day – sports competitions, youth development sessions, career guidance sessions, support women's group income generation program, donatee Surgical Kit and conducted general health camp in schools and nearby villages. On women's day conducted - health checkup, seminar and awards/recognition, TB awareness rally and seminar. Conducted awareness sessions for Factory workers and employees, distributed awards for recognition, carried out campus beautification and tree plantation.

The following Table 10.2 is the activities proposed under CER for proposed expansion:

Table 10.2 Budgetary proposed for CER - Brownfield project

S. No	Item	Rs (in Lakhs)	Remarks
1	Drinking water supply	5	The budget breakup is tentative, allotment will be based on the requirement of villagers and district collector advise.
2	Health camps and facilities	5	
3	Skill development	4	
4	Roads & Cross drains	4	
5	Electrification, Solar power	4	
6	Sanitation, Solid waste management	4	
7	Scientific support to farmers	4	
8	Rainwater harvesting, soil conservation	3	
9	Plantation (Avenue, community, schools, etc.)	3	
10	Others as per the requirement	4	
	Total	40	
Cost of the proposed expansion is Rs 40.05 Crores, CER fund is 1.0 % (Rs 40 Lakhs) maximum based on EAC recommendation			

10.13 Occupational health measures

Health of the employees would be regularly monitored as the workers are exposed to various operations. All employees are sent to medical checkup before joining the facility. Medical checkups will be conducted on regular basis and the health conditions will be monitored. First aid facilities are provided for immediate needs in emergency situations, personal protective equipment's for required workers as per there day to day activities.

10.14 Post project monitoring plan

2Post project monitoring shall conduct as per the environmental monitoring programme suggested for construction and operation phases as discussed in chapter-6. Specific requirement of post project monitoring will be carried in accordance with compliance to EC/CTE/CTO, emissions/discharges and soil and hazardous waste generation. The ambient as well as stack monitoring data will be sent online with the help of concerned web portal from time to time. Industry specific critical pollutants will be monitored at industry level. Specific requirement of monitoring will be carried out as a part of compliance to CTE/CTO.

10.15 Solid and hazardous waste generation and disposal system

As this is a Hazardous solid waste disposal facility, there is no hazardous waste generation from land filling facility. Hazardous waste generation from various industries all over the state due to the

industrial process and hazardous waste are received from the member industries for secure landfill disposal.

Incineration ash, discarded containers and used oil are generated from common incineration facility, which are handling as per the Maharashtra Pollution Control Board (MPCB).

10.16 Recommendations

The following recommendations are made based on the environmental impact assessment, which are to be implemented.

- Most of the impacts activities envisaged are due to construction activities. Systems of periodic auditing and reporting shall be adopted during the construction period to ensure that the contractors adhere to the EMP.
- The project proponent and contractors are urged to develop a strategy for effective communication with local people.
- The project proponent must keep themselves updated with respect to applicable laws and take appropriate actions in case the provisions in some regulations undergo change.
- The construction team/developer should effectively follow the suggestions made in the EMP and/or/any other environmental measures so as not to damage the environment of the project area.
- Regular monitoring of liquid as well as gaseous emissions from the process and same should be submitting state authority time to time.
- Project proponent should develop proper and effective greenbelt as per the norms and around the site boundary.
- Proper maintenance and periodical checkups of vehicles, equipments, plant machinery and other components to avoid any risk.

10.17 Conclusion

Appropriate air pollution control equipment, treatment of waste water generation & reuse and solid / hazardous waste management lead to very negligible environmental impact which will be mitigated by taking preventive measures. Implementation of well-defined and practiced Onsite-Offsite management plan by experienced and trained staff will developed.

There is employment potential for skilled, semi- skilled and unskilled labors both during construction and operational phases of the project. Setting up of CHWTSDF facility is mandatory requirement for highly waste generating state like Maharashtra. In absence of CHWTSDF facility industries have to send their incinerable hazardous waste to open dumping & store landfillable waste within their premises. Both of the above are dangerous since it involves transportation of HW over long distance, storage in each industry where it is difficult to have strict supervision & control & results in creation of pollution hotspots. Thus, this project will immensely help in safe & scientific disposal of Hazardous waste.

The EIA study has concluded that the project would be environmentally acceptable, in compliance with environmental legislation and standards. Hence the proposed project may be considered for granting Environmental Clearance.

Chapter 11
Disclosure of Consultant Engaged

11.1 About the Group

Ramky, founded in the year 1994, today spans into a specialist multi-disciplinary organization focused in areas of Civil, Environment & Waste Management Infrastructure with specific emphasis on 'Public Private Partnership' Projects. The corporate office of the group is located at Hyderabad and the regional offices are located at Delhi, Mumbai, Ahmedabad, Bangalore, Chennai, Bhopal and Kolkata. The major companies of the group are:

1) Ramky Infrastructure Ltd (RIL).
2) Ramky Enviro Engineers Ltd (REEL)
3) Ramky Enviro Services Pvt. Ltd. (RESPL)
4) Ramky Estates & Farms Pvt. Ltd. (REFL)
5) Ramky Life Sciences Ltd (RLSL)
6) Ramky Foundation (RF)

11.2 About the Accredited Consultant Organization

Ramky Enviro Services Pvt. Ltd. (RESPL) is the consulting arm of the group provides vital function of effectively providing the backward linkage to the project implementation function in the form of concepts, strategies, structuring, planning and designing infrastructure projects. A multi and cross disciplinary team of professionals, offering solution at each stage of the life cycle of the project. It is one of the well-established and leading Environmental Engineering concern in this country having under taken Ten Industrial Estate projects which involves the duties of project scheduling and budgeting, Topographical surveying and soil investigation, Environmental and social impact assessment, market viability, Master Planning, land use Planning, design of Roads, Water supply system, CETP, Storm Water Drainage, Electrical System, Cost Planning, Financial Feasibility, Project Structuring and Draft Concession Agreement, Bid Process Management etc. Our Company also designs, manufactures and supplies almost the entire range of equipments required for ETPs, STPs and WTPs. Consultancy Division is one of the departments of REEL. The services offered by the consultancy division are given below.

11.2.1 Consultancy Services

- Facilitating Environmental Clearances from MOEF, New Delhi
- Obtaining Consent for Establishment and consent for Operation from state pollution Control Boards Preparing of Environmental Impact Assessment Reports.
- Environmental Audits to help industries to recycle and reuse resources and plan for low polluting technologies.
- Risk Assessment Studies for hazardous chemical storage & Process in order to devise viable onsite and offsite emergency plans.
- Identification and evaluation of hazardous Waste disposal sites.
- Environmental management systems, training, documentation and implementation as per ISO 14001:1996 Standards.

- Characterization and quantification of biomedical waste, municipal solid waste and design of disposal facilities.
- Environmental management strategies to mitigate adverse impacts arising out of developmental activities.
- Effluent treatment plant design after thorough review of process, reaction mass balance and treatability studies of effluents
- Post project Monitoring network design
- Consultancy Services for setting up environmental laboratories
- Design of Sewage treatment plants
- Design of Waste treatment plants
- Health and socio- economic surveys
- Resettlement and rehabilitation plans
- Systems development for ISO9000, Oshas 18000, NABL, ISO 17025 Standards

11.2.2 Laboratory services

- Analysis of air samples for ambient air quality and those collected from industrial sources for both routine and industry specific pollutants
- Water and waste water analysis for all parameters as for standard methods, including pesticides and poly hydro carbons
- Solid and hazardous waste analysis including TCPL tests
- Monitoring of noise levels at source and in ambient air
- Development of new methods and quality assurances of results obtained
- Design and settings of laboratories

11.2.3 Training services

- Monitoring of environmental parameters –air, water, noise, soil etc…
- Environmental impact assessments
- Effluent treatment plant operations and maintenance
- Sewage treatment plant operations and maintenance
- ISO 9000 & 14000, OHSAS 18000 Awareness, documentations, internal auditors
- Establishment environmental laboratories
- Pollution control in industries
- Biomedical waste management

11.2.4 Field Services

- Site selection and suitability studies for settling up of Industries
- Ambient Air Quality monitoring for all pollutants
- Noise Level Monitoring
- Meteorological data collection as per CPCB norms
- Stack Emission monitoring for all pollutants and assessment of efficiency of control equipment
- Water, Wastewater and Soil Sample Collection

- Assessment of efficiency of ETP and analyzing critical parameters of field.
- Flora and Fauna assessment through sectorial studies and damage assessment due to
- development projects
- Damage Assessment studies in case of oil well blowouts, major industrial accidents, etc.

11.2.5 Treatment Plant Services

- Water Treatment Plants-design, construction, operation and maintenance
- Efficiency studies of Effluent Treatment plants
- Design, construction, operation and maintenance of ETP
- Up-gradation/modification of ETP
- Sewage Treatment Plants-design, construction, operation and maintenance along with mechanical equipment erection
- Supply of mechanical equipment

11.2.6 Solid Waste Management Services

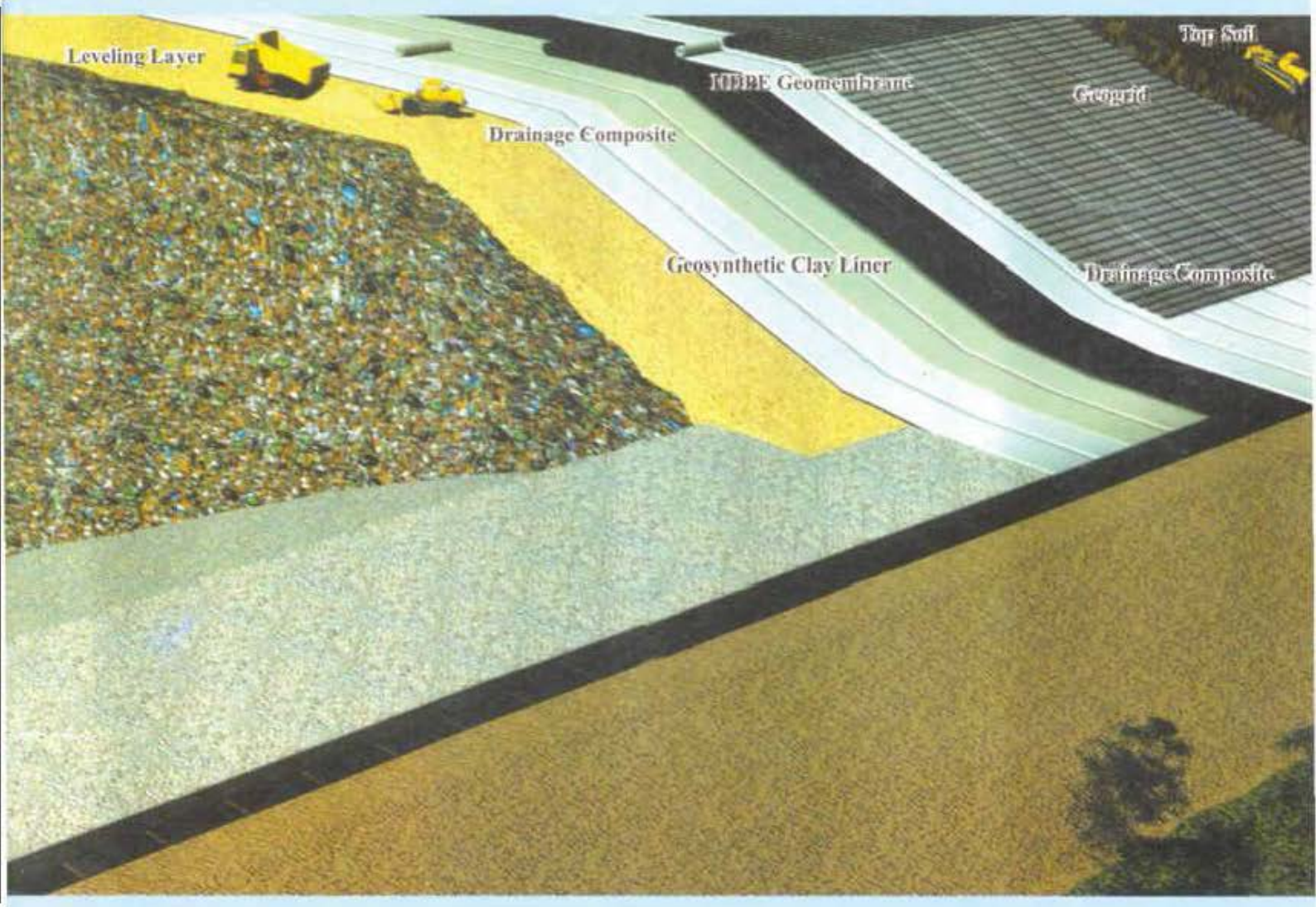
- Industrial Waste Management
- Hazardous Waste Management
- Municipal Solid Waste Management
- Biomedical Solid Waste Management
- E-waste Management

11.3 Declaration by Accredited Consultant Organization

The Company has over 2000 employees in various sectors of which over 600 employees are post graduates and about 15 employees are having Ph.D's. The Analysis was carried out in the Laboratory of Hyderabad Waste Management Project, a subsidiary company under Ramky Enviro Engineers Ltd., which is NABL accredited and recognized as Environmental Laboratory by Ministry of Environment and Forests under the Environment (Protection) Act 1986.

Hazardous Waste Management
Series : HAZWAMS/17/2000-01

CRITERIA FOR HAZARDOUS WASTE LANDFILLS



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February, 2001

Hazardous Waste Management
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CRITERIA FOR HAZARDOUS WASTE LANDFILLS

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केन्द्रीय प्रदूषण नियंत्रण बोर्ड
(भारत सरकार का संगठन)
पर्यावरण और वन मंत्रालय
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(A Govt. of India Organisation)
Ministry of Environment & Forests
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FOREWORD

The Ministry of Environment & Forests, Government of India, has notified the Hazardous Waste (Management & Handling) Rules, in July 1989 under the Environment (Protection) Act, 1986. On 6th of January, 2000, major amendments to these rules with re-defined categories of hazardous wastes and harmonising them with the international laws, were notified. In order to facilitate implementation it is felt necessary to provide a set of guidelines on the Criteria for Hazardous Waste Landfills for the use of industries, implementing agencies and the general public.

The task of preparation of the guidelines was entrusted to a group comprising Prof. Manoj Datta, Indian Institute of Technology, New Delhi, Dr. D.B. Boralkar, Assistant Secretary, Central Pollution Control Board, Delhi and Ms. Sanchita Jindal, Joint Director (HSMD), Ministry of Environment & Forests, New Delhi. Useful criticism and suggestions were provided by National Productivity Council, New Delhi. The draft document was discussed and finalised by an Expert Committee under the Chairmanship of the Chairman, CPCB. The Expert Committee opined that secured disposal facilities need to be properly designed, constructed, commissioned and operated and that such facilities may not serve for the disposal of high-volume low-toxic waste. The present document provides guidance in respect of criteria for location, site selection and investigation, planning and design, waste acceptance, landfill liner system and cover, construction and operation, inspection, monitoring & record keeping, post-closure, financial assurance and contingency plan for emergencies.

This document on criteria for hazardous waste landfills has been brought out for use by implementing agencies, operators of landfills and others concerned.

(Dilip Biswas)

February, 2001

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CRITERIA FOR HAZARDOUS WASTE LANDFILLS

CONTENTS

S.No.	Particular	Page No.
1.0	Applicability	1
2.0	Locational Criteria	1
3.0	Site Selection	2
4.0	Site Investigation Criteria	5
5.0	Planning and Design Criteria	6
	5.1 Essential Components	6
	5.2 Design Life	7
	5.3 Waste Volume, Waste Compatibility & Landfill Capacity	7
	5.4 Landfill Layout	8
	5.5 Landfill Section	8
	5.6 Phased Operation	9
	5.7 Estimation of Leachate Quantity	9
	5.8 Liner System	10
	5.9 Leachate Drainage, Collection and Removal	10
	5.10 Leachate Management	11
	5.11 Gaseous Emissions Management	12
	5.12 Final Cover System	12
	5.13 Surface Water Drainage System	12
	5.14 Base Stability, Slope Stability and Seismic Aspects	13
	5.15 Materials Balance	14
	5.16 Site Infrastructure	14
	5.17 Environmental Monitoring System	15
	5.18 Closure and Post-Closure Maintenance System	16
6.0	Waste Acceptance Criteria	16
7.0	Landfill Liner Criteria and Cover Criteria	17
	7.1 Liner Criteria	17
	7.1.1 Minimum Specifications	18
	7.1.2 Design Requirements	19
	7.1.3 Construction Requirements	20

S.No.	Particular		Page No.
		7.1.4 Quality Control	20
	7.2	Cover Criteria	21
		7.2.1 Minimum Specifications	21
		7.2.2 Design Requirements	22
		7.2.3 Construction Requirements	23
		7.2.4 Quality Control	24
8.0	Construction and operation Criteria		24
	8.1	Site Development	24
	8.2	Site Procedures : Record Keeping and Waste Inspection	25
	8.3	Phase Development	26
	8.4	Phase Operation	26
	8.5	Pollution Prevention and Safety During Operation	28
	8.6	Phase Closure	29
	8.7	Landfill Closure	30
	8.8	Post-closure Vegetative Stabilisation (Long-term)	30
9.0	Inspection, Monitoring and Record Keeping Criteria		31
	9.1	During Construction of Liners and Covers	31
	9.2	During Operation	32
	9.3	During Closure and Post-Closure Period	32
	9.4	Environmental Monitoring Systems	33
10.0	Post-closure Criteria		34
11.0	Financial Assurance Criteria		34
12.0	Contingency Plan for Emergencies		35

CRITERIA FOR HAZARDOUS WASTE LANDFILLS

1.0. APPLICABILITY

The criteria stated hereafter apply to owners and operators of facilities that dispose hazardous waste in landfills. The term 'hazardous waste landfill' (HW Landfill) is used to designate a waste disposal unit designed and constructed with the objective of minimum impact to the environment. This term encompasses other terms such as "secured landfill", "engineered landfill", "waste mounds", "waste piles" etc.

2.0. LOCATIONAL CRITERIA

HW Landfills shall not be located within a certain distance of the following : lakes, ponds, rivers, wetlands, flood plains, highways, habitation, critical habitat area, water supply wells, Airports, coastal zone. If it is absolutely essential to site a landfill within the restricted zone, then appropriate design measures are to be taken and prior permission from the SPCB/PCC should be obtained :

(a) Lake or Pond : No landfill shall normally be constructed within 200 m of any lake or pond. Because of concerns regarding runoff of waste contaminated water, a surface water monitoring network with approval of SPCB/PCC shall be established.

(b) River : No landfill shall be constructed within 100 m of a navigable river or stream.

(c) Flood Plain : No landfill shall be constructed within a 100 year flood plain. A landfill may be built within the flood plains of secondary streams if an embankment is built along the stream side to avoid flooding of the area. However, landfills must not be built within the flood plains of major rivers unless properly designed protection embankments are constructed around the landfills.

(d) Highway : No landfill shall be constructed within 500 m of the right of way of any state or national highway.

(e) Habitation : A landfill site shall be atleast 500 m from a notified habitated area. A zone of 500 m around a landfill boundary should be declared a no-development buffer zone after the landfill location is finalised.

(f) Public parks : No landfill shall be constructed within 500 m of a public park.

(g) Critical Habitat Area : No landfill shall be constructed within critical habitat areas including reserved forest areas. A critical habitat area is defined as the area in which one or more endangered species live. It is sometimes difficult to identify a critical habitat area. If there is any doubt then the SPCB/PCC shall be consulted for clarification.

(h) Wetlands : No landfill shall be constructed within wetlands. It is often difficult to identify a wetland area. Maps may be available for some wetlands, but in many cases such maps are absent or are incorrect. If there is any doubt, then the SPCB/PCC shall be consulted for clarification.

(i) Airports : No landfill shall be constructed within a zone around Airports as notified by the regulatory authority or the aviation authority.

(j) Water Supply Well : No landfill shall be constructed within 500 m of any water supply well.

(k) Coastal Regulation Zone : No landfill shall be sited in a coastal regulation zone.

(l) Ground water table level : No landfill shall be located in areas where the ground water table will be less than 2 m below the base of the landfill.

(m) Other criteria may be decided by the planners in consultation with SPCB/PCC commensurate with specific local requirements such as presence of monuments, religious structures etc.

3.0. SITE SELECTION

Hazardous waste landfills should preferably be located in areas of low population density, low alternative land use value, low ground water contamination potential and at sites having high clay content in the subsoil.

A HW landfill will be selected following the guidelines published by MoEF The step by step procedure will be as follows :

(i) Earmarking a 'search area' taking into account the location of the waste generation units and a 'search radius' (typically 5 to 250 km). The search area will be so chosen that it minimises the number of HW landfills in any region or state.

(ii) Identification of a list of potential sites on the basis of:
(a) availability of land
(b) collection of preliminary data
(c) restrictions listed in the locational criteria (section 2.0).

(iii) Collection of preliminary data as follows :

(a) Topographic Maps : A topographic map will help find sites that are not on natural surface water drains or flood plains. Topographical maps may be procured from Survey of India.

(b) Soil Maps : These maps, primarily meant for agricultural use, will show the types of soil near the surface. They are of limited use as they do not show types of soil a few metre below the surface. They may be procured from Indian Agricultural Research Institute.

(c) Land Use Plans : These plans are useful in delineating areas with definite zoning restrictions. There may be restrictions on the use of agricultural land or on the use of forest land for landfill purposes. Such maps are available with the Town Planning Authority or the Municipality.

(d) Transportation Maps : These maps, which indicate roads and railways and locations of airports, are used to determine the transportation needs in developing a site.

(e) Water Use Plans : Such maps are usually not readily available. A plan indicating the following items should be developed : private and public tubewells indicating the capacity of each well, major and minor drinking water supply line(s), water intake wells located on surface water bodies, and open wells.

(f) Flood Plain Maps : These maps are used to delineate areas that are within a 100 year flood plain. Landfill siting must be avoided within the flood plains of major rivers.

(g) Geologic Maps : These maps will indicate geologic features and bedrock levels. A general idea about soil type can be developed from a geological map. Such maps can be procured from Geological Survey of India.

(h) Aerial Photographs / Satellite Imagery : Aerial photographs or satellite imageries may not exist for the entire search area. However such information may prove to be extremely helpful. Surface features such as small lakes, intermittent stream beds and current land use, which may not have been identified in earlier map searches, can be easily identified using aerial photographs.

(i) Ground Water Maps : Ground water contour maps are available in various regions which indicate the depth to ground water below the land surface as well as regional

ground water flow patterns. Such maps should be collected from Ground water Boards or Minor Irrigation Tubewell Corporations.

(j) Rainfall Data : The monthly rainfall data for the region should be collected from the Indian Meteorological Department.

(k) Wind Map : The predominant wind direction and velocities should be collected from the Indian Meteorological Department.

(l) Seismic Data : The seismic activity of a region is an important input in the design of landfills. Seismic coefficients are earmarked for various seismic zones and these can be obtained from the relevant BIS code or from the Indian Meteorological Department.

(m) Site Walk Over and Establishment of Ground Truths : A site reconnaissance will be conducted by a site walk-over as a part of the preliminary data collection. All features observed in various maps will be confirmed. Additional information pertaining to the following will be ascertained from nearby inhabitants : (a) flooding during monsoons; (b) soil type; (c) depth to G.W. table (as observed in open wells or tube wells); (d) quality of groundwater and (e) depth to bedrock.

(n) Preliminary Boreholes and Geophysical Investigation : At each site, as a part of preliminary data collection, one to two boreholes will be drilled and samples collected at every 1.5m interval to a depth of 20m below the ground surface. The following information will be obtained : (i) soil type and stratification; (ii) permeability of each strata; (iii) strength and compressibility parameters (optional); (iv) ground water level and quality and (v) depth to bedrock. In addition to preliminary boreholes, geophysical investigations (electrical resistivity/seismic refraction/others) may be undertaken to assess the quality of bedrock at different sites.

(iv) Selection of two best ranked sites from amongst the list of potential sites on the basis of the ranking system stipulated by MoEF (1991).

(v) Environmental Impact Assessment for the two sites for the following parameters :

(a) ground water quality; (b) surface water quality; (c) air quality - gases, dust, litter, odour; (d) land use alteration; (e) drainage alteration; (f) soil erosion; (g) ecological

impacts (h) noise; (i) aesthetics - visual, vermin, flies; (j) traffic alteration; and (k) others.

(vi) Assessment of public perception for the two sites.

(vii) Selection of final site.

(viii) The above site selection procedure shall not be applicable for location of facility within industrial areas of State Industrial Development Agencies. However EIA requirement will apply.

4.0. SITE INVESTIGATION CRITERIA

The data collected during site selection is not sufficient for landfill design. To be able to undertake detailed design of a landfill at a selected site, it is essential to characterise the landfill site and evaluate the parameters required for design. It is necessary that all data listed in Section 3.0 (iii) on "preliminary data" be collected for site characterisation. If some data has not be collected, the same should be obtained before site investigations are undertaken for site characterisation. The following additional data will be collected through a detailed site investigation programme at the chosen site.

A detailed site investigation programme will comprise of subsoil investigation, ground water/hydrogeological investigation, hydrological investigation, topographical investigation and geological investigation. The output expected from each investigation is listed below :

(a) Subsoil Investigation : A detailed investigation plan may be drawn up in consultation with a geotechnical engineer. The output from such an investigation should yield the following :

(i) Stratification of subsoil - type of soil and depth

(ii) Depth to ground water table and bedrock (if located within 15m of base of landfill)

(iii) Permeability of various strata beneath the landfill.

(iv) Strength and compressibility properties of subsoil

(v) Extent of availability of liner material, drainage material, top soil and protective soil in adjacent borrow areas.

(vi) Subsoil properties along approach road.

A minimum of 3 boreholes per hectare of landfill area upto 15m beneath the base of the landfill shall be drilled and insitu tests as well as laboratory tests shall be performed for permeability, strength, compressibility and classification of soils. In addition, test pits and boreholes should be drilled at borrow area for liner and cover materials as well as along approach road.

(b) Ground Water / Hydrogeological Investigation : A detailed investigation plan may be drawn up in consultation with a ground water specialist or a hydrogeologist. The output from such an investigation should yield the following :

(i) Depth to groundwater table and its seasonal variations.

(ii) Ground water flow direction

(iii) Baseline ground water quality parameters - all drinking water quality parameters.

(c) Topographical Investigation : Construction of a landfill involves a large quantity of earthwork. It is essential to have an accurate topographical map of the landfill site to compute earthwork qauntities precisely. A map of 0.3m contour interval is considered desirable.

(d) Hydrological Investigation : The objective of a hydrological investigation is to estimate the quantity of surface runoff that may be generated within the landfill to enable appropriate design of drainage facilities. If additional run off from areas external to the landfill is likely to enter the landfill, this quantity should also be estimated to design interception ditches and diversion channels. Such an investigation shall yield estimates of peak flows. If seasonal rivers or streams run close to the site, hydrological investigation should indicate the possibility of flooding of the site under one in 100 year flood flows. Surface water samples for water quality analysis may be collected from during hydrological studies.

(e) Geological Investigation and Seismic Investigation : Geological investigations shall delineate the bedrock profile beneath the landfill base, if not confirmed by subsoil investigations. Geophysical surveys may be designed in consultation with a geologist. In hilly areas or in quarried rocks, geological investigations should indicate the quality of surficial rock, depth to sound rock and the possibility of interconnected aquifers beneath the landfill base in the rock mass. Detailed seismic data may be obtained as a part of geological investigations (if required) in seismically active areas.

5.0. PLANNING AND DESIGN CRITERIA

5.1. Essential Components :

A HW landfill shall have the following seven essential components :

(a) A liner system at the base and sides of the landfill which prevents migration of leachate or gas to the surrounding soil.

(b) A leachate collection and treatment facility, which collects and extracts leachate from within and from the base of the landfill and then treats the leachate to meet standards, notified under E(P)Act 1986.

(c) A gas collection and treatment facility (optional) which collects and extracts gas from within and from the top of the landfill and then treats it or uses it for energy recovery.

(d) A final cover system at the top of the landfill, which enhances surface drainage, prevents infiltration of water and supports surface vegetation.

(e) A surface water drainage system, which collects and removes all surface runoff from the landfill site.

(f) An environmental monitoring system which periodically collects and analyses air, surface water, soil-gas (optional) and ground water samples around the landfill site.

(g) A closure and post-closure plan which lists the steps that must be taken to close and secure a landfill site once the filling operation has been completed and the activities for long-term monitoring, operation and maintenance of the completed landfill.

5.2. Design life

A landfill design life will comprise of an 'active' period and an 'closure and post-closure' period. The 'active' period shall comprise of the period for which waste filing is in progress at the landfill and typically range from 10 to 25 years depending on the availability of land area. The 'closure and post-closure' period for which a landfill will be monitored and maintained shall be 30 years after the 'active period' is completed.

5.3. Waste Volume, Waste Compatibility and Landfill Capacity

The volume of waste to be placed in a landfill will be computed for the 'active' period of the landfill taking into account (a) the current generation of waste per annum and (b) the anticipated increase in rate of waste generation on the basis of past records.

A landfill will comprise of separate 'units'. In each unit, only compatible wastes will be disposed. Table 1 gives guidelines regarding compatibility of wastes. Incompatible wastes will be stored in separate units.

The actual capacity of each landfill unit will be computed taking into account the volume occupied by the liner system and the cover material [daily/weekily (optional) intermediate and final cover] as well as the compacted density of the waste. In addition, the amount of settlement a

waste will undergo due to overburden stress and due to bio-degradation (if any) shall also be taken into account.

The total landfill area should be computed on the basis of the designed height of the landfill (usually between 5 to 20m). Approximately 15 to 20% area more than the area required for landfilling should be adopted to accommodate all infrastructure and support facilities as well as to allow the formation of a green belt around the landfill. This additional area shall be computed separately and may be as high as 30% of the total area in case of small to medium landfills. The total landfill area is computed on trial and error basis.

There is no standard method for classifying landfills by their capacity. However the following nomenclature is often observed in literature :

Small size landfill	:	less than 5 hectare area
Medium size landfill	:	5 to 20 hectare areas
Large size landfill	:	greater than 20 hectare area.

5.4. Landfill Layout

A landfill site will comprise of the area in which the waste will be filled as well as additional area for support facilities. The area in which waste is to be filled may comprise of separate landfill units with each unit accommodating a group of compatible wastes. Within each unit work may proceed in phases with only a part of the area under active operation. A typical site layout is shown in Fig.1. Such a layout must be prepared for all landfills. The following facilities must be located in the layout: (a) access roads; (b) equipment shelters, (c) weighing scales; (d) office space; (e) location of waste inspection facility (if used); (f) temporary waste storage and/or disposal sites for special wastes; (g) demarcation of the landfill areas and areas for stockpiling cover material and liner material; (h) location of surface water drainage facilities; (i) location of landfill leachate management facilities; (j) location of gas management facilities (optional); (k) location of monitoring wells/environmental monitoring facilities, (l) fencing and green belt along the peripheral boundary and (m) emergency exit.

It is essential that for each landfill site, a layout be designed incorporating the above mentioned facilities.

5.5. Landfill Section

Landfills may have different types of sections depending on the topography of the area. The landfills may take the following forms: (a) above ground landfills; (b) below ground landfill; (c) slope landfills; (d) valley landfills (canyon landfills); and (e) a combination of the above. Fig.2 shows some typical landfill sections.

It is recommended that the landfill section be arrived at keeping in view the topography, depth to water table and availability of liner and cover material. Above ground landfills shall be preferred to below ground landfills, as leachate collection in the former is by gravity flow and does not require the use of pumps.

Slope landfills and valley landfills are normally adopted in hilly areas, above-ground landfills in flat undulating ground and below-ground landfills in low-lying areas, depressions or pits.

5.6. Phased Operation

Before the main design of a landfill can be undertaken it is important to develop the operating methodology. A landfill is operated in phases because it allows the progressive use of the landfill area, such that at any given time a part of the site may have a final cover, a part being actively filled, a part being prepared to receive waste, and a part undisturbed.

For each landfill unit, a phased operation plan will be drawn up.

The term 'phase' describes a sub-area of the landfill. A 'phase' consists of cells, lifts, daily/weekly (optional) or intermediate cover, liner and leachate collection facility, gas control facility (optional) and final cover over the sub-area (Fig.3).

Each phase is typically designed for a period of 12 months. Phases are generally filled from the base to the final/intermediate cover and capped within this period leaving a temporary unrestored sloping face. Fig.4 shows a simplified sequence of phased operation.

A 'phase plan' shall be drawn up for the active life of the landfill as soon as the landfill layout and section are finalised. It must be ensured that each phase reaches the final cover/intermediate cover level at the end of its construction period and that it is capped before the onset of monsoons.

During the monsoon months the waste may stockpiled in a temporary holding areas (covered with roof). During this period and the landfill may be kept capped with the final cover/intermediate cover and landfilling operations suspended to reduce infiltration of rain water into the landfill. However, if the incoming waste quantity is too large for temporary stockpiling or the monsoon period lasts for a long period, special phases may have to be designed with high leachate handling capacity and special operating procedures adopted.

5.7. Estimation of Leachate Quantity

Leachate is generated on account of the infiltration of water into landfills and its percolation through waste as well as by the squeezing of the waste due to self weight. The quantity of leachate generated in a landfill

is strongly dependent on the quantity of infiltrating water. This, in turn, is dependent on weather and operational practices. The amount of rain falling on a landfill, to a large extent, controls the leachate quantity generated. Precipitation depends on geographical location.

Significant quantity of leachate is produced from the 'active' phases of a landfill under operation. The leachate quantity from those portions of a landfill which have received a final cover is minimal. Fig. 5 shows the components of a water balance approach for estimating leachate quantity.

For design, computer simulated models (e.g. HELP) have to be used for estimation of leachate quantity generation. It is recommended that such studies be conducted to estimate the quantity of leachate and design the leachate drainage, collection and removal facility.

5.8. Liner System

Leachate control within a landfill involves the following steps : (a) prevention of migration of leachate from landfill sides and landfill base to the subsoil by a suitable liner system; and (b) drainage of leachate collected at the base of a landfill to the side of the landfill and removal of the leachate from within the landfill.

On a basis of review of liner systems adopted in different countries and in consideration with Indian conditions, it is recommended that for all HW landfills the liner system criteria listed in Section 7.0 be adopted in consultation with SPCB/PCC and commensurate with local area specified needs.

5.9. Leachate Drainage, Collection and Removal

A leachate collection system shall be designed at the base of all landfills. It shall comprise of a drainage layer, a perforated pipe collection system, sump collection area, and a removal system.

The leachate collection layer (drainage layer) will usually be a 30 cm thick sand-gravel layer with a slope of 2% or higher and a permeability of greater than 10^{-2} cm/sec (10^{-4} m/sec). A system of perforated pipes and sumps is provided within the drainage layer. The pipe spacing will be governed by the requirement that the leachate head shall not be greater than the drainage layer thickness. Fig. 6 shows a typical layout of pipes and sumps.

Leachate will be removed from the landfill (Fig. 7) by (a) pumping in vertical wells or chimneys (b) pumping in side slope risers, or (c) by gravity drains through the base of a landfill in above-ground and sloped landfills. Side slope risers may be preferred to vertical wells to avoid any down drag problems. Submersible pumps have been used for pumping for several years; educator pumps are also being increasingly used. The

leachate may be stored in a holding tank (for a few days) before being sent for treatment.

The design of following components should be undertaken :

(a) leachate pipe and leachate trench network

(b) leachate sumps and pumps

(c) leachate wells/side slope riser

(d) leachate holding tank

(e) backwashing/backflushing arrangement to prevent clogging/ choking/headloss.

The material used for pipes etc., should be such that it is not affected by the leachate quality.

5.10. Leachate Management

The following alternatives shall be considered for leachate management :

(a) Offsite treatment of leachate : This involves storage, pretreatment and transportation of leachate to off-site facilities not associated with the landfill e.g. industrial effluent treatment facility etc. This will be feasible where offsite facilities are available at a reasonable distance and where pretreatment requirements for the leachate (such as adjustment of pH, reduction in concentration etc.) are not very stringent. Transportation of leachate to offsite facility will be undertaken through a manifest system in accordance with HWM rules of MoEF.

(b) Onsite treatment of leachate : This involves complete treatment of the leachate at the landfill site to meet discharge standards for lined drains. Treatment processes may be biological, chemical or physical processes. Processes, which have been judged as having been "demonstrated", should be adopted.

(c) Recirculation : One of the methods for treatment of leachate is to recirculate it through the landfill. This has two beneficial effects : (i) the process of landfill stabilisation is accelerated and (ii) the constituents of the leachate are attenuated by the biological, chemical and physical changes occurring with the landfill. Recirculation of a leachate requires the design of a distribution system to ensure that the leachate passes uniformly throughout the entire waste. Leachate recirculation has been used in some municipal waste landfills. Information on its efficacy in HW landfills is scanty.

5.11. Gaseous Emissions Management

Landfill gas is generated as a product of waste biodegration or on account of presence of VOCs in the waste. Gas generation can be reduced or eliminated by avoiding disposal of biodegradable/organic wastes. For HW landfills where gaseous emissions are anticipated (as in the case of mixed waste having biodegradable components), the gas management strategy shall be (a) controlled passive venting or (b) controlled collection and treatment/reuse.

5.12. Final Cover System

A final landfill cover, comprising of several layers, each with a specific function shall be installed after each landfill phase reaches the full height. The final cover system shall enhance surface drainage, minimise infiltration, support vegetation to prevent erosion and control the release of landfill gases. On the basis of a review of HW landfill covers adopted in different countries [#] and in consideration with Indian Conditions the cover system criteria listed in Section 7.0 be adopted in consultation with SPCB/PCC and commensurate with local area specified needs.

5.13. Surface Water Drainage System

Surface water management is required to ensure that rainwater run-off does not drain into the waste from surrounding areas and that there is no waterlogging/ponding on covers of landfills. A surface water drainage system comprising of channels, drains, culverts and basins (Fig.8) shall be designed to ensure the following :

(a) Rainwater running off slopes above and outside the landfill area shall be intercepted and channelled to water courses without entering the operational area of the site. This diversion channel may require a low permeability lining to prevent leakage into the landfill.

(b) Rain falling on active tipping areas shall be collected separately and managed as leachate, via the leachate collection drain and leachate collection sumps to the leachate treatment and disposal system.

(c) Rainfall on areas within the landfill site, but on final covers of phases which have been completed and are not actively being used for waste disposal shall be diverted in drainage channels away from active tipping areas, and directed through a settling pond to remove suspended silt, prior to discharge.

(d) Any drainage channels or drains constructed on the restored landfill surface shall be able to accommodate settlement, resist erosion and cope with localised storm conditions.

(e) The horizontal surface of the final cover shall be provided a slope of 3 to 5% for proper surface water drainage. The slope of the cover on the sides will be higher and governed by slope stability considerations.

(f) All interceptor channels, drainage channels and settling ponds (storm water basins) shall be designed by a hydrologist using hydrometerological data.

(g) It shall be ensured that water collected by surface water drainage system and leachate collected by the leachate collection system do not get intermixed at any stage of collection or storage. This shall apply to the 'active' and 'post closure' periods of the landfill.

The design of following components shall be undertaken :

(a) stormwater drains, diversion channel
(b) stormwater basin
(c) culverts

5.14. Base stability, Slope stability and Seismic Aspects

For landfills constructed on loose/soft soil, the base will be checked for stability against bearing failure or excessive settlements.

The stability of side slopes of a landfill shall be checked for the following cases (Fig. 9).

(a) stability of excavated slopes
(b) stability of liner system along excavated slopes
(c) stability of temporary waste slopes constructed to their full height (usually at the end of a phase)
(d) stability of slopes of above-ground portion of completed landfills
(e) stability of cover systems in above ground landfills.

The stability analysis shall be conducted using the following soil mechanics methods depending upon the shape of the failure surface : (a) failure surface parallel to slope; (b) wedge method of analysis; (c) method of slices for circular failure surface and (d) special methods for stability of anchored geomembranes along slopes.

In preliminary design of a landfill section, the following slopes may be adopted.

(a) Excavated soil slopes	(2.5 horizontal : 1 vertical)
(b) Temporary waste slopes	(3.0 horizontal : 1 vertical)
(c) Final cover slopes	(4.0 horizontal : 1 vertical)

Slopes can be made steeper, if found stable by stability analysis results. Acceptable factors of safety may be taken as 1.3 for temporary slopes and 1.5 for permanent slopes. In earthquake prone areas, the stability of all landfill slopes shall be conducted taking into account seismic coefficients as recommended by BIS codes.

5.15. Materials Balance

A materials balance shall be prepared for each material required for construction of a landfill, phase-by-phase, indicating materials required materials available and deficient material to be imprоted or surplus material to be exported. If a borrow area is located within the landfill site it shall not become a part of an early phase to avoid stockpiling and double handling.

5.16. Site Infranstructure

The following site infrastructure shall be provided at each HW landfill :

(a) Site Entrance and Fencing
(b) Administrative and Site Control Offices
(c) Access Roads
(d) Waste Inspection and Sampling Facility
(e) Equipment Workshops and Garages
(f) Signs and Directions
(g) Water Supply
(h) Lighting
(i) Vehicle Cleaning Facility
(j) Fire Fighting Equipment.

Site entrance infrastructure should include :

(a) A permanent, wide, entrance road with separate entry and exit lanes and gates
(b) Sufficient length/parking space inside the entrance gate till the weighbridge to prevent queuing of vehicles outside the entrance gate and on to the highway.
(c) A properly landscaped entrance area with a green belt of 20m containing tree plantation for good visual impact.
(d) Proper direction signs and lighting at the entrance gate
(e) A perimeter fencing of atleast 2m height all around the landfill site with lockable gates to prevent unauthorised access.
(f) Full time security guard at the site.

An accurate record of waste inputs is essential, hence good quality weighbridges shall be used. For sites receiving more than 400 tons per day of waste, twin weighbridges to weigh both entry and exit weights may be located on either side of an island on which a weighbridge office room

is located. The weighbridge office should be elevated and the weighbridge operator should be able to see entering vehicles as well as speak to drivers.

Administrative and site control offices should include : administrative office building (permanent); site control office (portable) near the active landfill area; stores (permanent) within or near administrative office; welfare facilities - toilets, shower room, first aid room, mess room; small temporary accommodation; infrastructural services - electricity, drinking water supply, telephone, sewerage and drainage system and communication services (telephone etc.) between site control office and administrative office and weighbridge office.

5.17. Environmental Monitoring System

Monitoring at a landfill site (Fig. 10) shall be carried out in four zones (a) on and within the landfill; (b) in the unsaturated subsurface zone (vadose zone) beneath and around the landfill; (c) in the groundwater (saturated) zone beneath and around the landfill and (d) in the atmosphere/local air above and around the landfill.

The parameters to be monitored regularly are :

(a) long-term movements of the landfill cover;
(b) leachate head within the landfill;
(c) leachate quality within the landfill;
(d) gas quality (optional) within the landfill;
(e) quality of pore fluid in the vadose zone;
(f) quality of pore gas (optional) in the vadose zone;
(g) quality of groundwater in the saturated zones and
(h) air quality above the landfill, at the gas control facilities, at buildings on or near the landfill and along any preferential migration paths.

The indicators of leachate quality and landfill gas quality must be decided after conducting a study relating to the type of the waste, the probable composition of leachate and gas likely to be generated and the geotechnical as well as hydro-geological features of the area.

A monitoring programme must specify (i) a properly selected offsite testing laboratory capable of measuring the constituents at current detection levels (ii) a methodology for acquiring and storing data; and (iii) a statistical procedure for analyses of the data.

The following instruments/equipment shall be used for monitoring :

(a) Groundwater samplers for groundwater monitoring wells.
(b) Leachate samplers for leachate monitoring within the landfill and at the leachate tank.

(c) Vacuum lysimeters, filter tip samplers, free drainage samplers for leakage detection beneath landfill liners.
(d) Surface water samplers for collection of sample from sedimentation basin.
(e) Downhole water quality sensors for measuring conductivity, pH, DO, temperature in leachate wells, groundwater wells and sedimentation basins.
(f) Landfill gas monitors (portable) for onsite monitoring of landfill gases.
(g) Active and passive air samplers for monitoring ambient air quality.

It is recomemended that the location of each type of instrument/equipment be finaised in conjunction with an expert on the basis of the topography of the area and the layout of the landfill. A minimum of 4 sets of ground water monitoring wells (one up-gradient and three down gradient) for sampling in each acquifer are considered desirable at each landfill site (Fig.11).

5.18. Closure and Post-Closure Maintenance Plan

A statement on the end-use of landfill site is an essential part of the plan for landfill closure and post-closure maintenance. Some possible uses of closed landfill sites near urban centres include parking area, recreational area etc. A closed landfill should be aesthetically landscaped.

A closure and post-closure plan for HW landfills must be evolved and should indicate the following components :

- Plan for vegetative stabilization of the final landfill cover and side slopes
- Plan for management of surface water run-off with an effective drainage system.
- Plan for periodical inspection and maintenance of landfill cover and facilities.
- Plan for post-closure management of leachate and gas
- Plan for post-closure environment monitoring.

6.0. WASTE ACCEPTANCE CRITERIA

A waste acceptance criterion shall be formulated for each landfill site. The following guidelines for waste acceptance are suggested :

(a) All waste shall be routinely accepted if the truck/tipper carries authorised documents indicating the source and type of waste. Such waste shall be routinely inspected visually at the tipping area in the landfill site.

(b) Bulk or non-containerised liquid hazardous waste or slurry-type hazardous waste containing free liquid or waste sludge, which has not been dewatered, shall not be placed in landfills. Such waste, (usually transported in pipelines) shall be placed in Hazardous Waste Impoundments designed specifically for liquid hazardous waste.

(c) Incinerable/compostable waste or any other type of waste from which energy/material recovery is feasible, shall not be placed in HW landfills.

(d) Incompatible wastes shall not be placed in the same landfill unit. Compatible wastes will be grouped together and placed in the same landfill unit (each such unit shall have its own phase, cells etc). Incompatible waste group shall be accommodated in separate landfill units (each such unit shall have its own phases, cells etc).

(e) Wastes which are incompatible with the liner material shall either be containerised and placed in the landfill (ensuring adequate container safety, or placed in a separate landfill unit made of alternate compatible liner material).

(f) Extremely hazardous waste (e.g. radioactive waste) shall not be disposed off in HW landfills but in specially designed waste disposal units.

(g) Non-hazardous waste (e.g. municipal solid waste) shall not be deposited in HW landfills. However such waste can be deposited in a MSW landfill units in the vicinity of HW landfills.

(h) Residue of treated biomedical waste (e.g. incinerator ash etc) can be deposited in HW landfills.

7.0. LANDFILL LINER AND COVER CRITERIA

7.1 Liner Criteria

The liner system shall be designed, constructed and installed to satisfy the following:

(a) Prevent migration of waste, leachate or gas to the adjacent subsurface soil or ground water or surface water.
(b) Constructed of materials that have adequate chemical properties, physical properties and engineering properties to prevent failure on account of loads, climatic conditions, and contact with waste or leachate.
(c) Placed in a stable manner on the base and side slopes.
(d) Installed to cover all surrounding soils likely to come in contact with the waste or leachate.

The base of the liner system (at the lowest point in a landfill) shall be atleast 2.0 meter above the highest anticipated ground water table level.

7.1.1. Minimum Specifications

The liner system shall be designed specifically for each site to meet the criteria stated in Section 7.1.

The liner system must include the following components. However, depending on the design requirements, the number of components as well as the specifications of the components can exceed the minimum specifications listed below. The components listed below are waste downwards (Fig. 12).

(a) A leachate collection layer of thickness 30 cm or more and coefficient of permeability in excess of 10^{-2} cm/sec (10^{-4} m/sec.)

(b) A single composite liner comprising of

  (i) A HDPE geomembrane of thickness 1.5 mm or more (see specification* below) and
  (ii) A compacted clay (or compacted amended soil) layer of thickness 150 cm or more having a coefficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less. At locations where availability of clay is limited, amended soil will be constituted by mixing bentonite or any other suitable clay to locally available soil to achieve the desired permability.

In regions where rainfall is high and/or subsoil is highly permeable (e.g. gravel, sand, silty sand) and/or the water table is within 2.0 m to 6.0 m beneath the base of the landfill, the liner system shall be a double composite liner and shall include the following components, waste downwards (Fig. 13):

(a) A primary leachate collection layer of thickness 30 cm or more and coefficient of permeability in excess of 10^{-2} cm/sec (10^{-4} m/sec).

(b) A primary composite liner comprising of

  (i) A HDPE geomembrane of thickness 1.5 mm or more (see specification* below) and
  (ii) A compacted clay (or compacted amended soil) layer of thickness 45 cm or more having a coefficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less.

(c) A secondary leachate collection layer (also called leak detection layer) of thickness 30 cm or more and coefficient of permeability in excess of 10^{-3} cm/sec (10^{-5} m/sec).

(d) A secondary composite liner comprising of

(i) A HDPE geomembrane of thickness 1.5 mm or more (see specification* below) and
(ii) A compacted clay (or compacted amended soil) layer of thickness 45 cm or more having a coefficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less.

**Specification* : *[The geomembrane must have (a) Tensile Strength at yield > 18 kN/m, (b) Tensile Strength at break > 30 kN/m, (c) Tear Resistance > 150 N and (d) Puncture Resistance > 250 N].*

The liner materials listed above can be substituted by equivalent materials only if the following is satisfied :

(a) the liner system components continue to function as 'composite' liners; and
(b) the use of such components has been demonstrated over a 10 year period in different HW landfill and approved by a regulatory agency
(c) the design, construction and quality control specifications of such materials have been approved by a regulatory agency and are available for implementation.

For extremely hazardous waste, the number of composite liner layers shall, if necessary, exceed two and these will be finalised by the design engineer in consultation with SPCB/PCC as per site specific conditions.

7.1.2. Design Requirements

The liner system shall meet the following design requirements :

(a) Requirement of adequate stability at the base of the landfill (in soft soil)
(b) Requirement of adequate stability along the sides of the landfill
(c) Requirement of adequate strength to withstand construction loads/vehicle loads
(d) Requirement of permeability and material properties as specified in Section 7.1.1.
(e) Requirement of compatibility with leachate and waste
(f) Requirement of transition filters between waste and leachate collection layer to prevent clogging of the leachate collection layer.

(g) Requirement of protection layer/transition layer between each component of the liner system (A protection layer between a leachate collection layer and the HDPE geomembrane may sometimes be required if coarse/angular sand or gravel is used in the leachate collection layer. The protection layer may comprise of silt/local earth (15cm thick or a geotextile).

(h) Requirement of adequacy of clay additive in amended soils.

Guidelines for design are indicated in "Manual for Design, Construction & Quality Control of Liners & Covers" (to be prepared).

7.1.3. Construction Requirements

The liner system shall be constructed to ensure that :

(a) the compacted clay (or compacted amended soil) layer has a co-efficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less, is devoid of clods and shrinkage cracks; and achieves the desired strength.

(b) the geomembranes is laid in intimate contact with the compacted clay/compacted amended soil layer; is properly joined/welded at the seams; and is not punctured by construction vehicles/tools

(c) the leachate collection layer has a coefficient of permeability of 10^{-2} cm/sec (10^{-4} m/sec) or more and does not become clogged by intermixing or migration of fine particles.

On side slopes, the horizontal width of the 150 cm thick clay liner will normally exceed 300 cm and the clay can be compacted in horizontal layers using standard compaction equipment or in inclined layers using slope compactors.

Guidelines for construction are indicated in "Manual for Design, Construction & Quality Control of Liners & Covers" (to be prepared).

7.1.4. Quality Control

A quality assurance programme shall be drawn up by the owner/operator during construction of the liner system. Such a programme will include :

(a) Regular performance of quality assurance test in the field for each component of the liner system – one set of field and laboratory tests for each soil component per 500 to 1000 cubic meters of earthwork and one set of field and laboratory tests for the geomembrane per 200 sq.m. of installed area.

(b) Approval by the regulatory authority of the lists of tests, their frequency and the acceptance criteria.

(c) Periodical visits by representatives of the regulatory authority (or their nominee) during construction of the liner.

(d) Complete documentation of all quality control records and their submission to the SPCB/PCC alongwith statistical analysis showing satisfactory achievement of acceptance criteria.

The quality control tests for compacted clay layer (or amended soils) as well as the leachate collection/drainage layer shall include (i) in-situ density tests, (ii) in-situ moisture content tests, (iii) compaction tests, (iv) permeability tests, (iv) grain size distribution tests and (v) Atterberg's limits tests (vi) others.

The quality control tests for geomembrane liners shall include (i) thickness tests, (ii) density tests, (iii) strength tests, (iv) toughness tests, (v) durability tests, (vi) chemical resistance tests, (vii) field seam strength tests, (viii) overlap check tests, (ix) others.

Guidelines for quality control are indicated in "Manual for Design, Construction & Quality Control of Liners & Covers" (to be prepared).

7.2. Cover Criteria

The cover system shall be designed, constructed and installed to satisfy the following :

(a) Prevent infiltration of precipitation into the closed landfill
(b) Promote drainage of surface water accumulated on the cover
(c) Minimise erosion of the cover.
(d) Withstand or accommodate settlement of the cover to maintain its integrity
(e) Have a permeability less than or equal to the liner system
(f) Function with minimum maintenance for the post-closure period of 30 years.

7.2.1. Minimum Specifications

The cover system shall be designed specifically for each site to meet the criteria stated in Section 7.2.

The cover system must include the following components. However, depending on design requirements, the number of components as well as the specification of the components shall exceed the minimum specifications listed below. The components listed below are from top surface downwards to the waste (Fig. 14).

(a) A surface soil layer of local top soil which supports self-sustaining vegetation and which has a thickness not less than 60 cm.

(b) A drainage layer of thickness 30 cm or more having a coefficient of permeability in excess of 10^{-2} cm/sec (10^{-4} m/sec).

(c) A single composite barrier comprising of

(i) A HDPE geomembrane of thickness 1.5 mm or more and
(ii) A compacted clay (or compacted amended soil) layer of thickness 60 cm or more having a coefficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less. At locations where availability of clay is limited, amended soil will be constituted by mixing bentonite or any other suitable clay to locally available soil to achieve the desired permeability.

(d) A regulatory layer (optional) of thickness 30 cm having coefficient of permeability greater than 10^{-2} cm/sec (10^{-4} m/sec). Such a layer shall be provided whenever there is requirement of (i) gas collection or (ii) transition filter between waste and soil.

The drainage layer shall be replaced by the local top soil, if the coefficient of permeability of the local top soil is greater than 10^{-4} cm/sec. In such a case the total thickness of the surface soil layer (of top soil) will be 90 cm.

In dry arid regions, where self sustaining vegetation is not possible, special erosion control measures shall be adopted for the stability for the cover soil layer.

The cover materials listed above can be substituted by equivalent materials if the following is satisfied :

(a) the use of such components has been demonstrated over a 10 year period in different HW landfills and approved by aregulatory agency or SPCB/PCC.
(b) the design, construction and quality control specifications of such materials have been approved by a regulatory agency or SPCB/PCC and are available for implementation.

7.2.2. Design Requirements

The cover system shall meet the following design requirements:

(a) Requirement of stability/integrity of cover under settlement through design/maintenance/repair.
(b) Requirement of stability of steep side slopes of cover
(c) Requirement of establishment of self-sustaining vegetative cover for long-term stabilisation/or special measures in dry arid regions.
(d) Requirement of adequate strength to withstand construction loads/vehicle loads.
(e) Requirement of permeability and material properties as specified in Section 7.2.1.

(f) Requirement of surface water drainage as specified in Section 5.13.
(g) Requirement of transition filter between waste and the layer immediately above it.
(h) Requirement of protection layer/transition layer between each component of the liner system.

Guidelines for design are indicated in "Manual for Design, Construction & Quality Control of Liners & Covers" (to be prepared).

7.2.3. Construction Requirements

The cover system shall be constructed to ensure that

(a) the surface soil layer is adequately compacted and prepared to allow vegetative growth.
(b) the compacted clay/compacted amended soil layer has a coefficient of permeability of 10^{-7} cm/sec (10^{-9} m/sec) or less; is devoid of clods and shrinkage cracks; and achieves the desired strength.
(c) the geomembranes is laid in intimate contact with the compacted clay/compacted amended soil layer; is properly joined/welded at the seams; and is not punctured by construction vehicles/tools.
(d) the drainage layer has a coefficient of permeability of 10^{-2} cm/sec (10^{-4} m/sec) or more and does not become clogged by intermixing or migration of fine particles.
(e) the final cover slopes are as specified in section 5.13.

Guidelines for construction are indicated in "Manual for Design, Construction & Quality Control of Liners & Covers" (to be prepared).

7.2.4. Quality Control

A quality assurance programme shall be drawn up by the owner/operator during construction of the cover system. Such a programme shall include :

(a) Regular performance of quality assurance tests in the field for each component of the cover system – one set of field and laboratory tests for each soil component per 500 to 1000 cubic meters of earthwork and one set of field and laboratory tests for the geomembrane per 200 sq.m. of installed area.
(b) Approval by the regulatory authority of the lists of tests, their frequency and the acceptance criteria.
(c) Periodical visits by representative of SPCB/PCC (or their nominee) during construction of the cover
(d) Complete documentation of all quality control records and their submission to the SPCB/PCC alongwith statistical analysis showing satisfactory achievement of acceptance criteria.

The type of quality control tests for the drainage layers, compacted clay layer and geomembrane shall be the same as those indicated in Section 7.1.4. for the liner system.

Guidelines for quality control are indicated in "Manual for Design, Construction & Quality of Liners & Covers" (to be prepared).

8.0. Construction and operational criteria

The construction and operation of a landfill shall consist of the following steps :

(a) Site Development
(b) Phase Development
(c) Phase Operation
(d) Phase Closure
(e) Landfill Closure
(f) Post-closure vegetative stabilisation

8.1. Site Development

The following construction activities shall be undertaken during site development :

(a) Construction of perimeter fence, entrance gate, and green belt
(b) Construction of main access road near the entrance gate with parking area
(c) Construction of road along the perimeter of the site and well as construction of arterial load to tipping area of the first phase.
(d) Acquisition and installation of weighbridges
(e) Construction of weighbridge room/office, administrative office and site control office
(f) Construction of waste inspection facility, equipment workshop and garage, vehicle cleaning area
(g) Installation of direction signs, site lighting, fire fighting facilities, communication facilities
(h) Construction of water supply and waste water/sewage disposal system
(i) Construction of surface water drainage system
(j) Construction of main leachate pipe, tank and treatment facility
(k) Installation of environmental monitoring facilities
(l) Construction of gas collection pipe and treatment facility (if needed)
(m) Construction of waste recovery/incineration/waste processing facility (if so planned)
(n) Construction of emergency exit gate.

8.2. Site Procedures : Record Keeping & Waste Inspection

Record keeping procedures as well as waste acceptance procedures to be followed at the landfill site shall be formulated.

Records shall be kept on a daily, weekly and monthly basis. In addition a site Manual shall be kept at the site office giving all site investigation, design and construction details – these are necessary as landfill design may get modified during the operational phase.

(i) Site Manual : The site manual shall contain the following information :

(a) Data collected during site selection
(b) Environmental impact assessment report
(c) Site investigation and characterisation data
(d) Detailed topographical map
(e) Design of all landfill components
(f) Landfill layout and its phases
(g) Construction plans
(h) Details of leachate management plan
(i) Details of gas management plan (optional)
(j) Environmental monitoring program
(k) Closure and post-closure plan
(l) All permissions/licences from concerned authorities.

(ii) **Site Reports** : The daily, weekly and monthly reports shall comprise of the following :

(a) Weighbridge data (daily inflow and outflow for each vehicle)
(b) Waste inspection data (daily)
(c) Materials, stores etc. (daily)
(d) Bills/accounts (daily)
(e) Visitor record (daily)
(f) Complaints record from nearby areas (daily)
(g) Topographic survey at operating phase (daily/weekly)
(h) Photographic record at operating phase (daily/weekly)
(i) Environmental monitoring data (weekly/monthly)
(j) Wastefilling plan and actual progress i.e. cell construction (daily/weekly) and review (monthly)
(k) Leachate generation and gas generation (weekly/ monthly/extreme events).
(l) Weather/climatic data (extreme events)
(m) Accidents etc. (adhoc)
(n) Others.

(iii) Vehicle Inspection :

Each vehicle carrying the waste shall be checked for :

(a) Incoming weight (full)
(b) Outgoing weight (empty)
(c) Availability of relevant docuemnts
(d) Visual check at weigh-in (if feasible)
(e) Visual inspection after discharge at tipping area (inspection report to be filed for each vehicle). A visual inspection checklist must be framed which should list visual features for identification of unacceptable material. This checklist shall be filled for every unloading by a vehicle in tipping area at the working phase in the landfill.

If there is reason to doubt the presence of unacceptable waste, the vehicle shall be taken to the waste inspection facility, the waste down-loaded, inspected visually and sampled (if necessary). Vehicles having non-conforming waste shall be held-up and matter reported to engineer or manger at site.

8.3. Phase Development

Development of each phase shall be done in stages. These stages are:

(a) Clearing the area of all shrubs and vegetation
(b) Excavation (if required),
(c) Stockpiling of excavated material and material imported from borrow area,
(d) Levelling of base and side slopes of landfill and achieving desirable grades at the base of the landfill,
(e) Construction of embankment and temporary berms along the perimeter of the phase,
(f) Construction of temporary surface water drains,
(g) Installation of monitoring instruments,
(h) Liner Construction
(i) Leachate collection and removal system

8.4. Phase operation

At the design stage, the phases of a landfill are clearly demarcated. Operation of a phase requires planning and execution of daily activities – daily waste filling plan and demarcation, waste discharge and inspection, waste placement, waste compaction, daily covering of waste, prevention of pollution and fires.

(a) **Daily waste filling plan and demarcation at site :** On the completion of a phase and before the start of a new phase, a waste filling plan for daily cells shall be evolved. A study of the landfill base contour maps

and the final cover levels of the phase allows such a plan to be devloped. If a phase is to be operational for 365 days, all 365 cells must be marked in plan and in sectional drawings. These may require revision as a landfill is constructed because waste quantities may vary in an unforeseen manner. The area and height proposed to be filled every day should be demarcated at the site on a daily or weekly basis using temporary markers or bunds.

(b) **Waste discharge and inspection** : Waste shall be discharged by tipping at the working area of a landfill, within the area demarcated for the cell. Every discharged load shall be visually inspected by a designated operator. Working area personnel shall be trained and competent at waste identification in order that they can recognise waste which may be non-conforming. In the event of reasonable doubt as to the waste acceptability, the operator shall inform the waste reception facility and/or the site manager immediately and the consignment shall be isolated pending further inspection.

(c) **Waste placement (spreading) and compaction** : Once waste has been discharged it shall be spread in layers and compacted in a well defined manner to ensure that the completed slopes of a daily cell are at the designed gradients. Waste placement (spreading) can be done by the following methods :

(i) Face tipping method : Waste is deposited on top of existing surface and spread horizontally by tipping over an advancing face.

(ii) Inclined layering method (onion skin tipping). Similar to (a) but inclined layering (gentle slope) done instead of advancing of face.

(iii) Working upwards : Waste is deposited on the lower surface and pushed upwards.

It is necessary to level and compact the waste as soon as it is discharged at the working area. Steel wheeled mobile landfill compactors (smooth / cleated / spiked / special wheels) are generally accepted as the best equipment for this purpose. They have largely replaced the small crawler-tracked machines which were previously in general use.

(d) **Daily / Weekly Cover** : Daily / Weekly cover (optional) is primarily used for prevention windblown dust, litter and odours, deterrence to scavengers, birds, reduction of infiltration (during unseasonal rian) and in improving the site's visual appearance. Soil used as daily / weekly cover shall give a pleasing uniform appearance from the site boundary. To achieve this a thickness of about 150 mm is usually adequate and shall be adopted.

(e) **Operation in Monsoons** : During the monsoon month, high rainfall results in excessive generation of leachate. Hence, before the onset of monsoons, the phase must be capped with a cover. Waste received

during monsoon months shall be stockpiled in temporary holding area (covered). Alternatively special "monsoon phases" may be designed with high leachate holding capacity and operated using daily covers / temporary covers.

8.5. Pollution Prevention and Safety During Operation

The following measures are needed to ensure that the landfill operation shall not adversely affect local environment within and outside the landfill.

(i) **Traffic :** Heavy lorry traffic shall give rise to nuisance, damage to road surface and verges and routing problems. The following measures are helpful :

(a) routing to avoid residential area
(b) using one-way routes to avoid traffic conflict in narrow roads
(c) carrying out road improvements, for example strengthening or widening roads, improved provision of footpaths, improvement of sight lines, provision of passing places, provision of new roads,
(d) Limiting the number of vehicle movements
(e) Restrictions on traffic movement hours which are staggered with respect to peak traffic hours.

(ii) **Noise :** Adverse impacts on the local community from noise may arise from a number of sources including : throughput of vehicles and fixed and mobile plant, for example compactors, generators at the site. Peripheral noise abatement site measures shall be adopted.

(iii) **Odour :** Offensive odours at landfill sites may emanate from a number of sources, including waste material, which have decomposed significantly prior to landfilling, leachates and leachate treatment systems, and landfill gas. Good landfill practices shall greatly reduce general site smell and reduce impact from odours which could lead to complaints from the local community, site users and site staff. Good practice includes : (a) adequate compaction; (b) speedy disposal and burial of malodorous wastes; (c) effective use of appropriate types of daily cover; (d) progressive capping and restoration; (e) effective landfill gas management; (f) effective leachate management and (g) consideration of prevailing wind direction when planning leachate treatment plants, gas flares, and direction of tipping.

(iv) **Litter :** Poor litter control both on and off site is particularly offensive to neighbours. Good operational practice shall be adhered to in terms of temporary fencing, waste discharge, placement, compaction and covering to minimise the occurrence of windblown litter.

(v) **Bird Control :** Birds are attracted to landfill sites in large numbers where sites receive appreciable amounts of bio wastes. Measures which can be used to mitigate birds nuisance include the employment

of good landfill practice, working in small active areas and progressive prompt covering of waste, together with the use of bird scaring techniques.

(vi) **Vermin and Other Pests :** Landfills have potential to harbour flies, rodents and vermin, particularly where the waste contains bio materials. Modern landfilling techniques including prompt emplacement, compaction and covering of wastes in well defined cells are effective in the prevention of infestation by rodents and insects.

(vii) **Dust :** Dust from landfill operations is mainly a problem during periods of dry weather but can also arise from dusty waste as it is tipped. Dust is generally associated with (a) site preparation and restoration activities; (b) the disposal of waste comprising of fine particles, for example powders; and (c) traffic dust. Dust suppression can be effected by (a) limiting vehicle speed; (b) spraying roads with water; and (c) spraying site and powder type waste with water; (d) covering powder type waste with daily soil cover.

(viii) **Mud on the Road :** Mud on the public highway is one of the most common causes of public complaint. It is therefore, in the interest of the landfill operator to provide adequate wheel cleaning facilities to ensure that mud is not carried off site by vehicles.

(ix) **Landfill Fire Management :** Fires in waste on landfill sites are not uncommon and it is important for site operators to be aware of the dangers, how to treat fires and to address the problems associated with them. All fires on-site shall be treated as a potential emergency and dealt with accordingly.

(x) **Landfill Safety Aspects :** Training of employees shall include site safety, first aid and the handling of dangerous materials where appropriate. Since landfill sites can pose dangers to both site operator and users, emergency plans shall be laid down. Landfill sites shall be regarded as potentially hazardous locations and the operator shall have a written safety plan for the site. Safety hazards present at landfill sites may include : (a) moving plant and vehicle; (b) steep slopes; (c) bodies of standing water; (d) contaminated, putrescible, toxic, flammable or infective material and (e) noxious, flammable, toxic or hazardous gas. All employees and visitors to the site shall be made aware of the potential hazards and the safety procedures to be implemented including fire safety.

8.6. Phase Closure

After the last set of cells of a phase are placed (on the highest lift), an intermediate or final cover shall be constructed. If another phase is to be placed over the just completed phase, an intermediate cover is provided. However if the just completed phase has reached the final

height of the landfill, the final cover system and surface water drainage system is provided.

An intermediate cover shall be made of locally available soil (preferably low permeability) and is 45 to 60 cm thick. It is compacted with smooth steel drum rollers and provided a suitable gradient (3 to 5%) to encourage surface water to run-off from the cover and thus minimise infiltration. The side slopes of the intermediate cover are compacted by the crawler tracked dozer moving up and down the slope.

Final cover construction and quality control all criteria are discussed in Section 7.0.

8.7. Landfill Closure

As each phase is completed and as the final cover level is reached in successive phases, the following interconnectivities are established :

(a) the leachate collection system of each phase is sequentially connected (if so designed)
(b) the surface water drainage system at the cover of each phase is sequentially connected (if so designed)
(c) the temporary surface water drainage system constructed at the base of each completed phase is dismantled
(d) the gas collection system (if provided) of each phase is sequentially connected.

Upon completion of all phases a final check is made of the proper functioning of all inter connected systems.

An access road is provided on the landfill cover to enable easy approach for routine inspection of the landfill cover.

8.8. Post Closure Vegetative Stabilisation (Long Term)

If a landfill cover is intended to be used for a specific purpose e.g. park or vehicle parking area, then the cover shall be stabilised in such a manner that the end-use is achieved. However, if no specific end-use is envisaged, then long-term vegetative stabilisation will be undertaken to return the land to its original and natural vegetative landform.

Vegetation is by far the most common and usually the preferred stabilisation option after closure of landfills. If a self-perpetuating vegetative cover can be established, not only can wind and water erosion be minimized, but also the landfill can be returned to some semblance of its original appearance and land use. In favourable climates, revegetation may require only modest effort or may occur by natural process during a reasonably short period of time. However, in arid climates or a harsh environment, establishment of vegetation may

be a difficult and costly process and alternative techniques may be examined for vegetative stabilisation.

While the specific procedures are unique to each landfill and climatic regime, the following representative elements of the process shall be adopted in all procedures.

(a) Seedbed Preparation : Seedbed preparation is necessary to set the stage for establishment of the short-term community. Initial operations shall include grading, furrowing, or grouping to enhance microclimate and addition of nutrients and soil amendments, if required.

(b) Short-Term Vegetation : It is common practice, in both humid and dry environments, to rely largely on grasses for the primary initial source of short-term land cover. Usually several species are included in the initial seeding mixture to increase diversity and reduce the chance of total community failure. Short term vegetation is usually assisted by irrigation.

(c) Long Term Vegetation : To achieve the ultimate goal of attaining a self sustaining and stable community, a transition between short term and long term vegetation must occur. In some cases, this may be left to invasion by native species after short term vegetation is assured and soil development is well under way. In other cases – for example, when irrigation has been used temporarily to establish the short term community – it may be necessary or desirable to enhance the natural succession process by replanting with a more diverse mix of species suited to the next stage of community succession, such as shrubs. The need for artificial enhancement of the successional process shall depend on the success of previous short term efforts and on the ultimate intended land use of the reclaimed area. All vegetation efforts, however, shall work toward self generation and minimum management in the long term. Fig. 15. illustrates the sequential steps in vegetation growth after landfill closure.

9.0. INSPECTION, MONITORING & RECORD KEEPING CRITERIA

9.1. During Construction of Liners and Covers

(a) During the construction of liners and covers, inspection shall be carried by the SPCB/PCC (or its nominee) atleast twice during each phase to ensure that construction procedures and quality control procedures isted in section 7.0 are being followed.

(b) Immediately upon the completion of construction of a liner in each phase, the complete set of construction records and quality control test results as listed in Section 7.0 will be provided by the

owner/operator to the SPCB/PCC for verification and record keeping. The same will also be done upon the completion of cover system in each phase.

9.2. During Operation

(a) The owner/operator shall monitor and keep a record of the following in the operation period :

(i) Functioning of the leachate management system (including levels in leachate holding tank) (weekly)

(ii) Functioning of the surface water run-off system (weekly)

(iii) Functioning of the gas management system (if any) (weekly)

(iv) Waste filling records shall be kept on daily basis as specified in Section 8.2 on site procedure

(v) Environmental monitoring shall be done, 1 to 2 times a month, and all parameters listed in Section 5.17 shall be recorded and compared with the permissible limits provided by the SPCB/PCC

(vi) After a major storm, the occurence of the storm and functioning of various systems shall be recorded.

(b) The SPCB/PCC (or its nominee) shall inspect all facilities atleast twice a year. The owner/operator shall provide a copy of the environmental monitoring record to the SPCB/PCC on a yearly basis.

9.3. During Closure and Post Closure Period

Period inspection and routine maintenance at a closed landfill site shall be carried out for a period of 30 years after closure. The SPCB/PCC shall inspect all facilities during the closure and post closure period atleast once a year. The owner/operator shall provide a copy of the environmental monitoring record to the SPCB/PCC once a year. The following components of a closed landfill shall be inspected visually after landfill closure to confirm that all functional elements are working satisfactorily and inspection report will be recorded. A maintenance schedule with specified reporting formats is drawn up after each inspection.

(a) Cover System : The final cover is inspected 2 to 4 times a year (a) to check that vegetation growth is occurring satisfactorily and that plants are not showing stunted growth, (b) to detect if any erosion gullies have been formed thereby exposing the barrier

layers, (c) to earmark depressions that may have developed with time and (d) to identify ponding of water on the landfill cover. Atleast one inspection shall be carried out during or immediately after the peak of the monsoon season.

Closed landfills show significant settlement. Rectification measures shall not only re-establish the initial slope of the cover (for proper surface water run-off) but shall also ensure that all the components of the landfill cover system continue to perform as originally envisaged. Site managers shall have sufficient equipment and funds to periodically carry out maintenance work in the form of soil filling, re-grading the cover and revegetating the landfill cap.

In areas where extensive erosion gully formation is observed, filling of cover material, regrading of cover slopes and re-vegetation must be routinely undertaken.

(b) Surface Water Drainage System : The surface water drainage system is also inspected 2 to 4 times a year (a) to identify cracks in drains due to settlements, (b) to delineate clogged drains requiring immediate clean-up and (c) to study the level of deposited soil in the storm water basin and initiate excavation measures. Broken pipes and extensively cracked drains may require replacement after filling soil beneath them to establish slopes for gravity flow. In extreme cases where long-term settlement shall be excessive, it shall become necessary to make sumps and operate storm water pumps for removal of accumulated water in the drainage system.

(c) Gas and Leachate Management Systems : A weekly operating record of leachate and gas management systems shall be kept in the post-closure period. Periodic inspection of the leachate and gas collection systems (2 to 4 times a year) is undertaken to identify broken pipes, leaking gas (if any) and damaged or clogged wells/sumps. Repair work requires skilled manpower and shall be carried out by the agencies operating the gas treatment and leachate treatment facilities. One may often have to install new gas extraction wells and leachate collection wells if the damaged/clogged facilities are inaccessible and irrepairable.

9.4. Environmental Monitoring Systems

Ground water monitoring wells, air quality monitoring systems and vadose zone monitoring instruments shall be periodically inspected 2-4 times a year to check that all systems are functioning satisfactorily and that well caps and sampling ports are not subjected to damage due to excessive settlement or vandalism.

Environmental monitoring systems have to be maintained during the entire post-closure period. Wherever possible, monitoring instruments must be periodically re-calibrated. Sampling devices shall be routinely detoxified and also regularly checked for proper functioning of the opening and closing of valves or spring loaded mechanisms.

10.0. Post-Closure Criteria

(a) After closure of the landfill, the owner/operator of the landfill shall maintain the integrity of the final cover systems incldung making repair, as necessary, to rectify the settlement, subsidence or erosion of the cover.

(b) After closure of the landfill, the owner/operator shall continue to operate all leachate, gas and surface water management systems as well as continue environmental monitoring of the landfill for a period of 30 years or until such time that harmful leachate is not produced for 5 continuous years.

(c) If after a few years of closure, the leachate is observed to meet all discharge standards, the same shall be discharged directly to lined drains.

(d) The landfill shall be abandoned after 30 years of closure, if concentrations of contaminants in all liquid and gaseous emissions from the landfill are observed to be below prescribed limits. However, if the emissions continue to be hazardous, the landfill management strategy shall have to be evolved for future years.

11.0. FINANCIAL ASSURANCE CRITERIA

The owner/operator shall prepare detailed financial estimates for the following :

(a) the fixed initial cost for setting up the landfill facility

(b) the recurring annual costs for operating the facilities

(c) the cost of hiring a third party to close the landfill

(d) the cost of hiring a third party to conduct post-closure care for 30 years after closure of the landfill

(e) the cost of hiring a third party to undertake corrective action in case of an emergency resulting in loss of ecology due to the failure of the system during the active, closure and post-closure periods.

The owner/operator shall demonstrate the funds needed for (c), (d) and (e) above will be available whenever they are needed in the form of options such as trust funds, surety bonds, letter of credit, insurance etc.

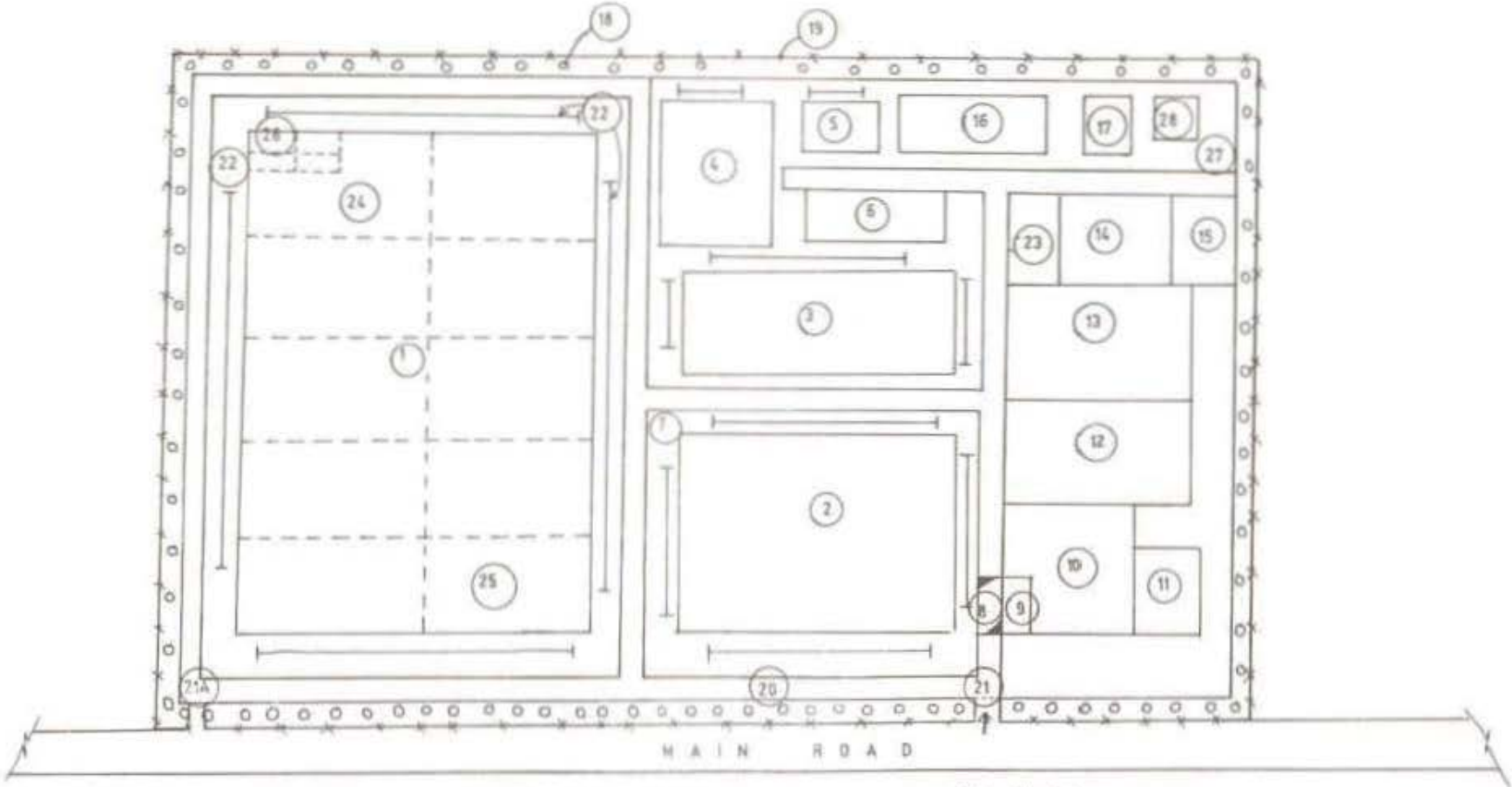
12.0. CONTINGENCY PLAN FOR EMERGENCIES

The owner/operator of a HW landfill shall prepare a contingency plan listing procedures to be executed immediately whenever there is fire, explosion or unexpected release of hazardous waste at the landfill site during the active period as well as during the closure and post-closure periods. Such a contingency plan shall be approved by the SPCB/PCC.

1	Oxidising Mineral Acids	1										
2	Caustics	H	2									
3	Aromatic Hydro-carbons	H_F		3								
4	Halogenated Organics	$H_{F\ GT}$	H_{GF}		4							
5	Metals	$GF_{H\ F}$			H_F	5						
6	Toxic Metals	S	S				6					
7	Sat Aliphatic Hydro-carbons	H_F						7				
8	Phenols and Cresols	H_F							8			
9	Strong Oxidising Agents		H	H_F		H_F		H		9		
10	Strong Reducing Agents	$H_{F\ GT}$			H_{GT}				GF_H	$H_{F\ E}$	10	
11	Water and Mixtures containing water	H			H_E		S				GF_{GT}	11
12	Water Reactive Substances ←			Extremely reactive, do not mix with any chemical or waste material →								12

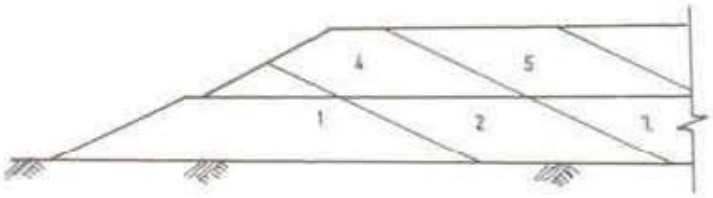
E	Explosive
F	Fire
GF	Flammable Gas
GT	Toxic Gas
H	Heat Generation
S	Solubilisation of Toxins

Table 1 : Compatibility of Selected Hazardous Wastes

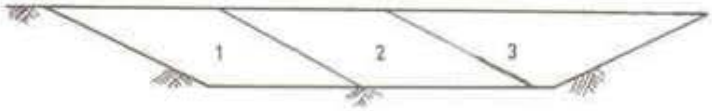


(1) Landfill Unit 1
(2) Landfill Unit 2
(3) Landfill Unit 3
(4) Landfill Unit 4
(5) Landfill for Special Hazardous Waste
(6) Area for Stockpiling Cover and Liner Material
(7) Mobile Site Office
(8) Weigh Bridge
(9) Reception/Security
(10) Administrative Office
(11) Environmental Laboratory
(12) Open Lorry/Tanker Parking Area
(13) Temporary Waste Storage Shed
(14) Equipment Shelter
(15) Workshop
(16) Landfill Leachate Management Facilities
(17) Storm-water Collection/Sedimentation Tank
(18) Green belt
(19) Fencing
(20) Approach Road/Arterial Roads
(21) Site Entrance
(21A) Emergency Exit
(22) Environmental Monitoring Facilities
(23) Vehicle Washing
(24) Phase (1) of Landfill Unit 1
(25) Phase (10) of Landfill Unit 1
(26) Cell (1) of Phase (1) of Landfill Unit 1
(27) Air Quality monitoring Station to be located at 120° from each other
(28) Space for Waste Recovery/Incineration/Waste Processing Facilities

FIG. 1: TYPICAL LAYOUT OF HAZARDOUS WASTES LANDFILL

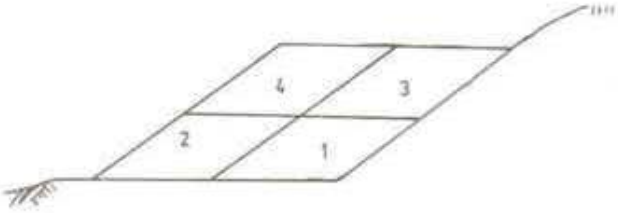


(a) Above ground landfill

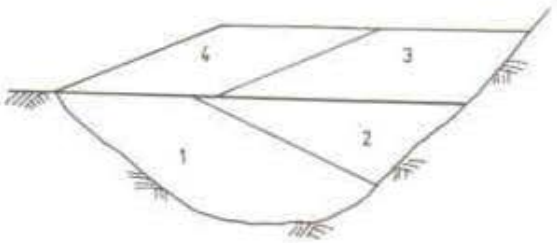




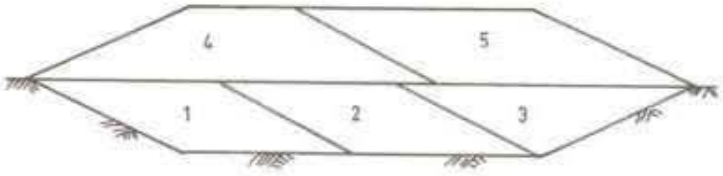
(b) Below ground and trench landfill



(c) Slope landfill



(d) Valley landfill



(e) Above and below ground landfill

FIG. 2: TYPICAL SECTION OF HW LANDFILLS

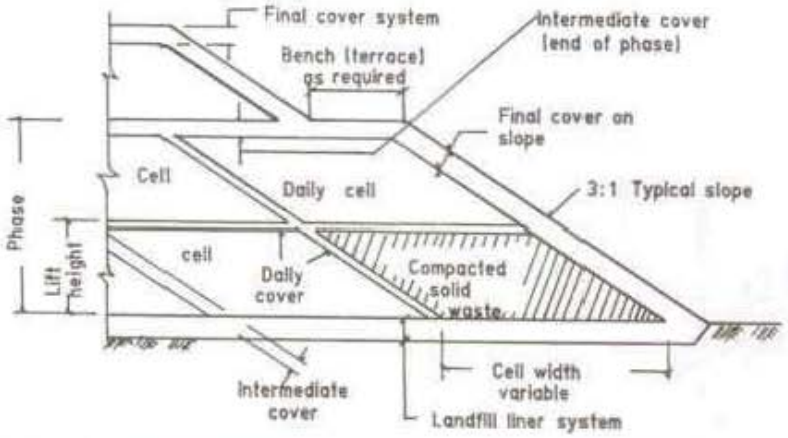


FIG. 3: COMPONENTS OF A LANDFILL PHASE

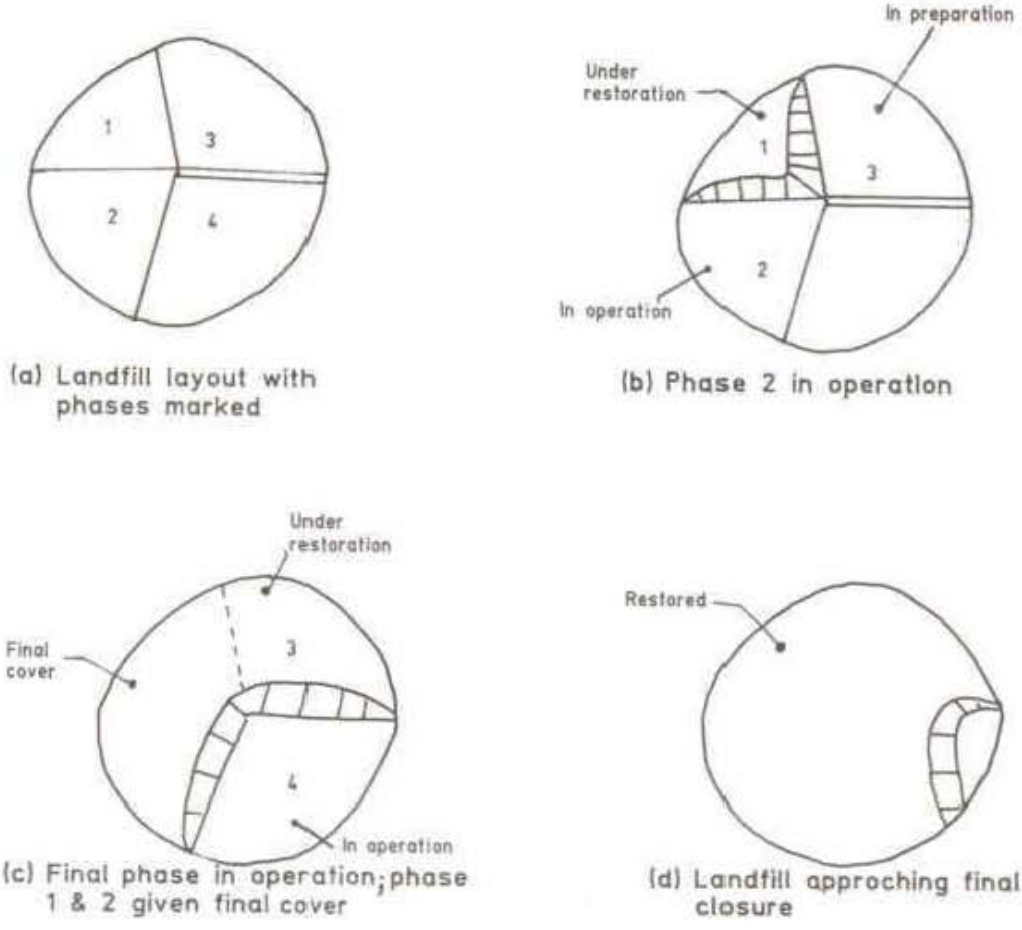


FIG. 4: OPERATION OF A LANDFILL IN PHASES

- Precipitation conditions (P)
- Evaporation transpiration (E_T)
- Surface water runoff (R)
- Infiltration and precipitation over the landfill site (P_1)
- Changes in the water storage in the sealing layer (ΔU_S)
- Overland water flow from surrounding terrain (R_1)
- Ground water flow from surrounding land (I_G)
- Decomposition of waste generating small volumes of water (b)
- The moisture content of the waste when it is deposited(S)
- Leakage of leachate volume (L_1)
- Collected leachate volume (L_R)
- Changes in the moisture content of the waste (ΔU_W)

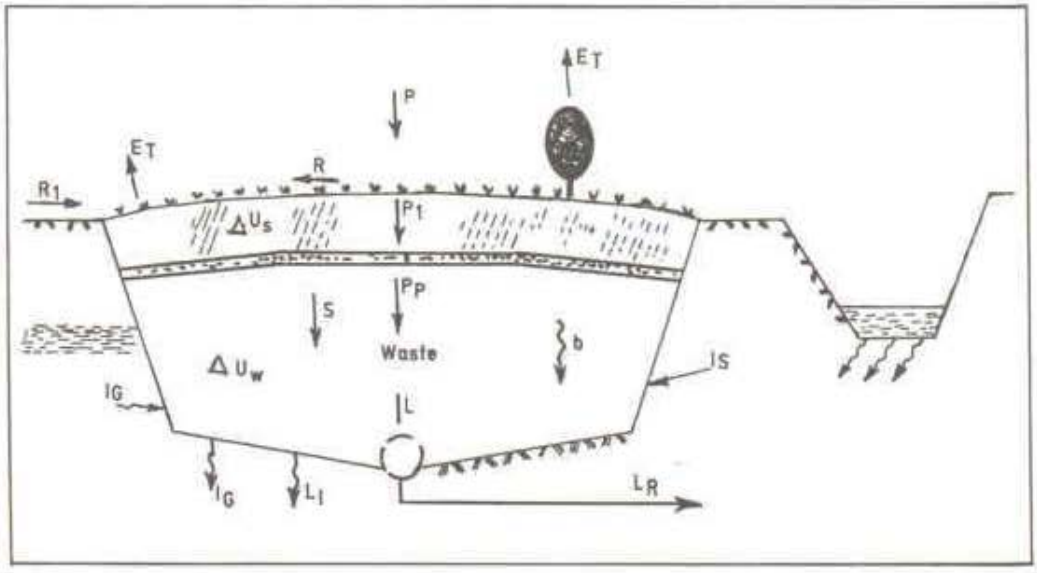
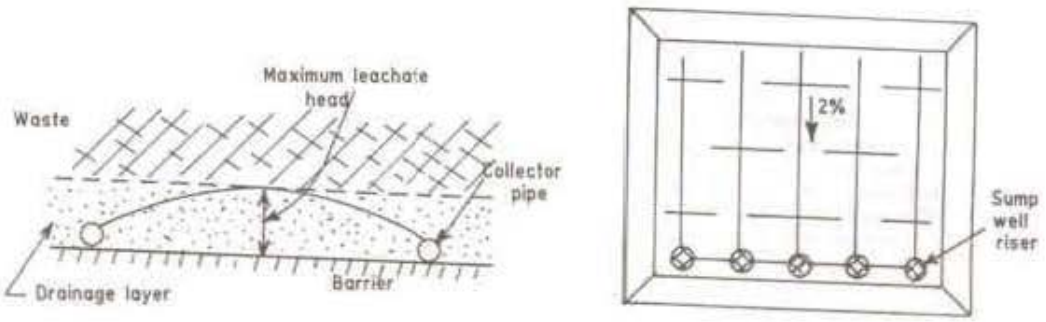


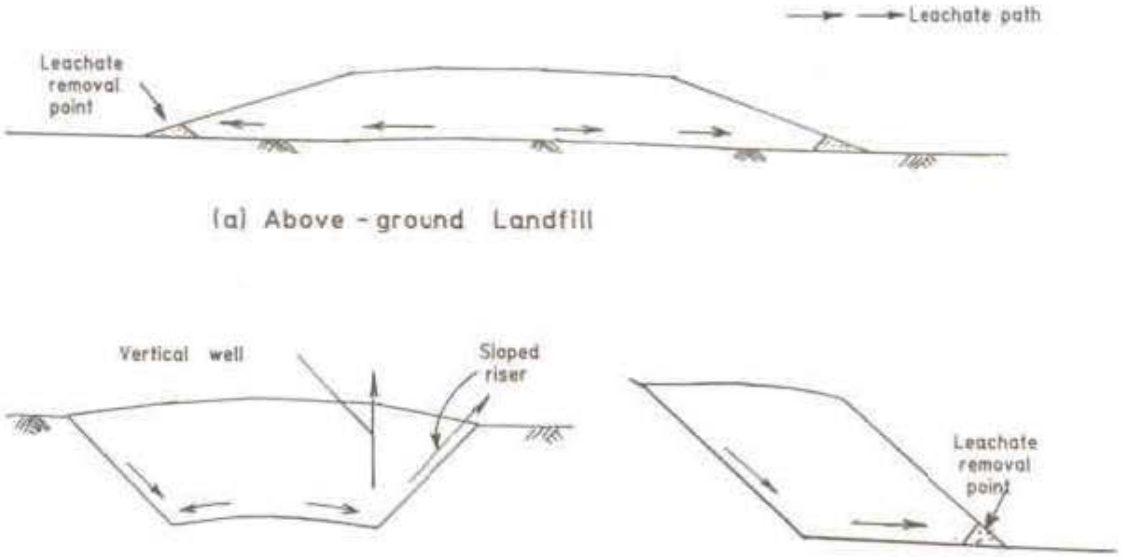
FIG. 5: WATER-BALANCE FOR ESTIMATION OF LEACHATE QUANTITY



(a) Leachate mound

(b) Pipe network (plan) at base of Landfill

FIG. 6: LEACHATE COLLECTION PIPE NETWORK



(a) Above - ground Landfill

(b) Below ground landfill

(c) Sloped landfill

FIG. 7: LEACHATE PATH AND LEACHATE REMOVAL

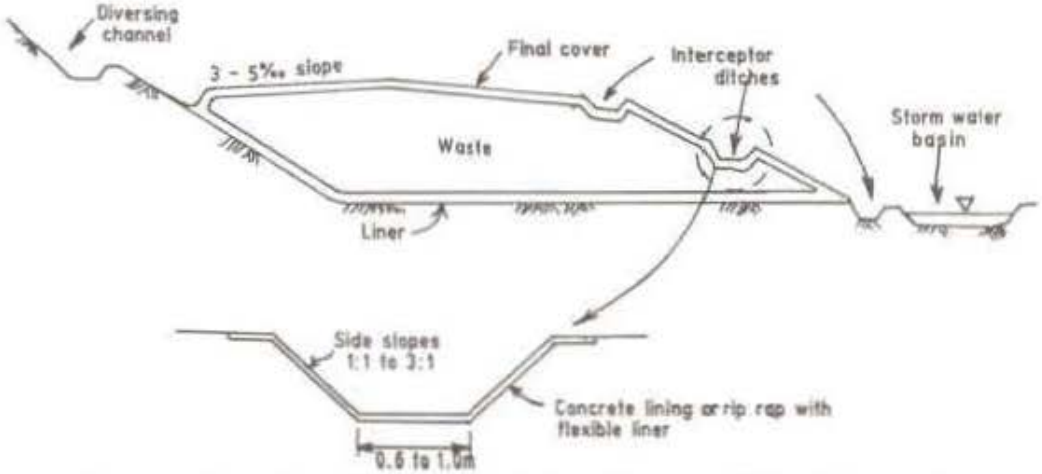


FIG. 8: SURFACE WATER DRAINAGE SYSTEM FOR A COMPLETED LANDFILL

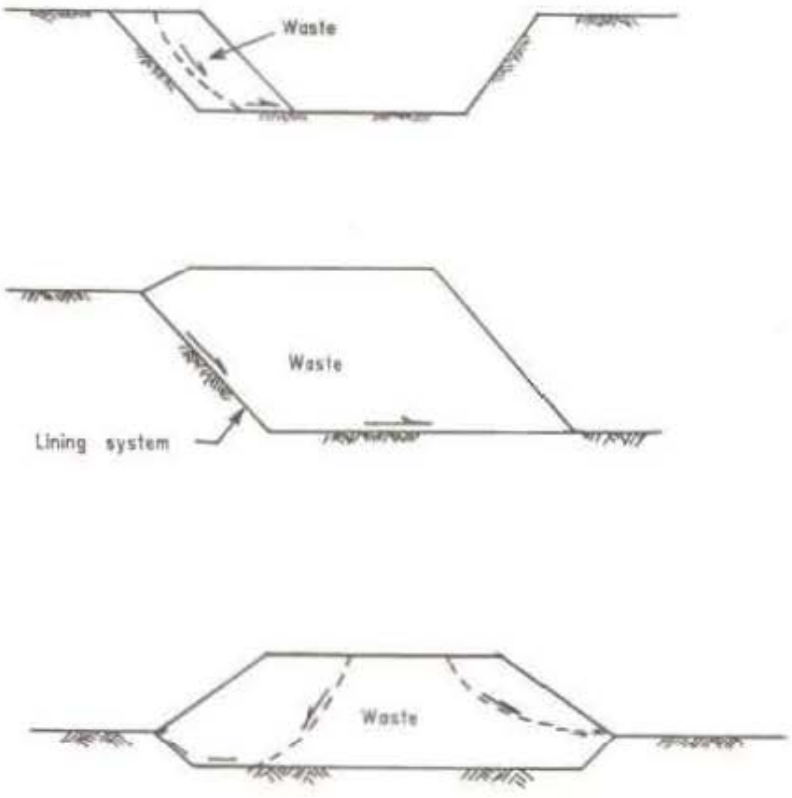


FIG. 9: SOME TYPICAL FAILURE MECHANISMS FOR SLOPES IN LANDFILLS

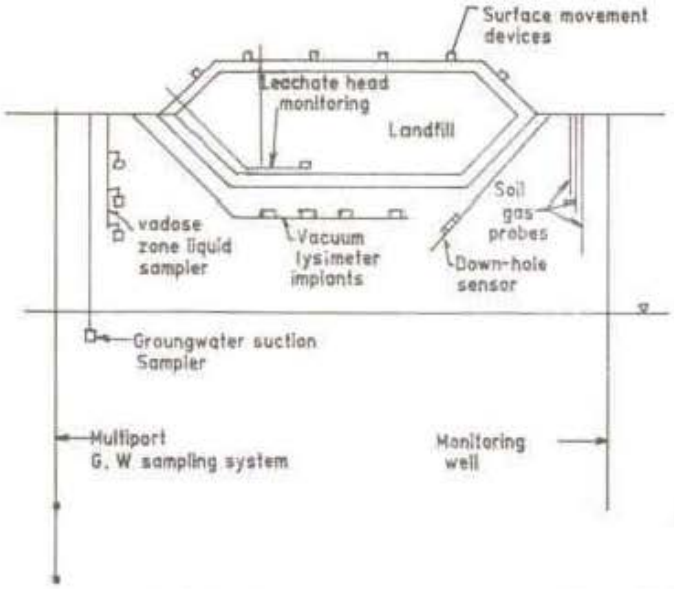


FIG. 10: TYPICAL LANDFILL INSTRUMENTATION

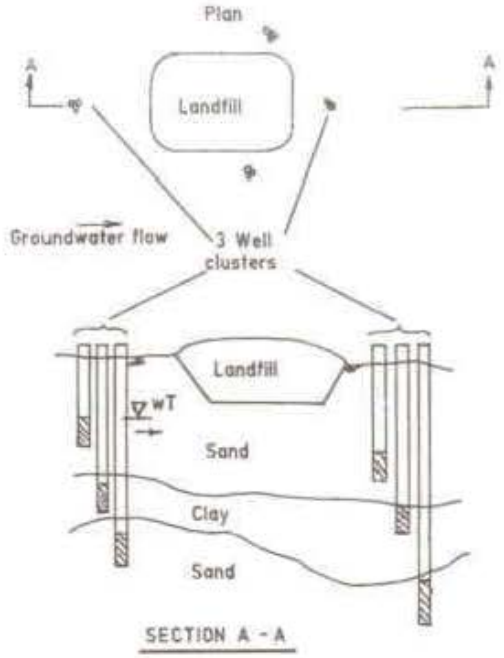


FIG. 11: GROUND WATER MONITORING WELLS AROUND A LANDFILL.

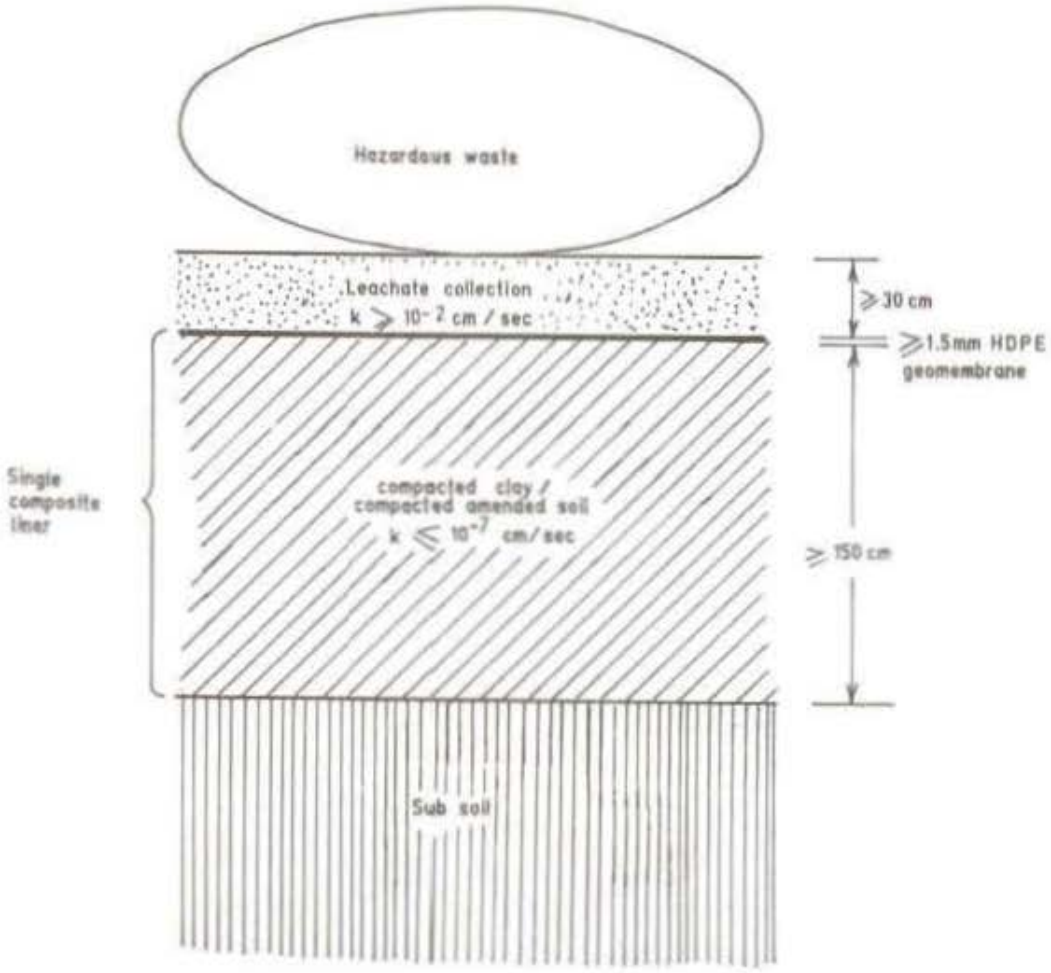


FIG. 12 : SINGLE COMPOSITE LINER SYSTEM

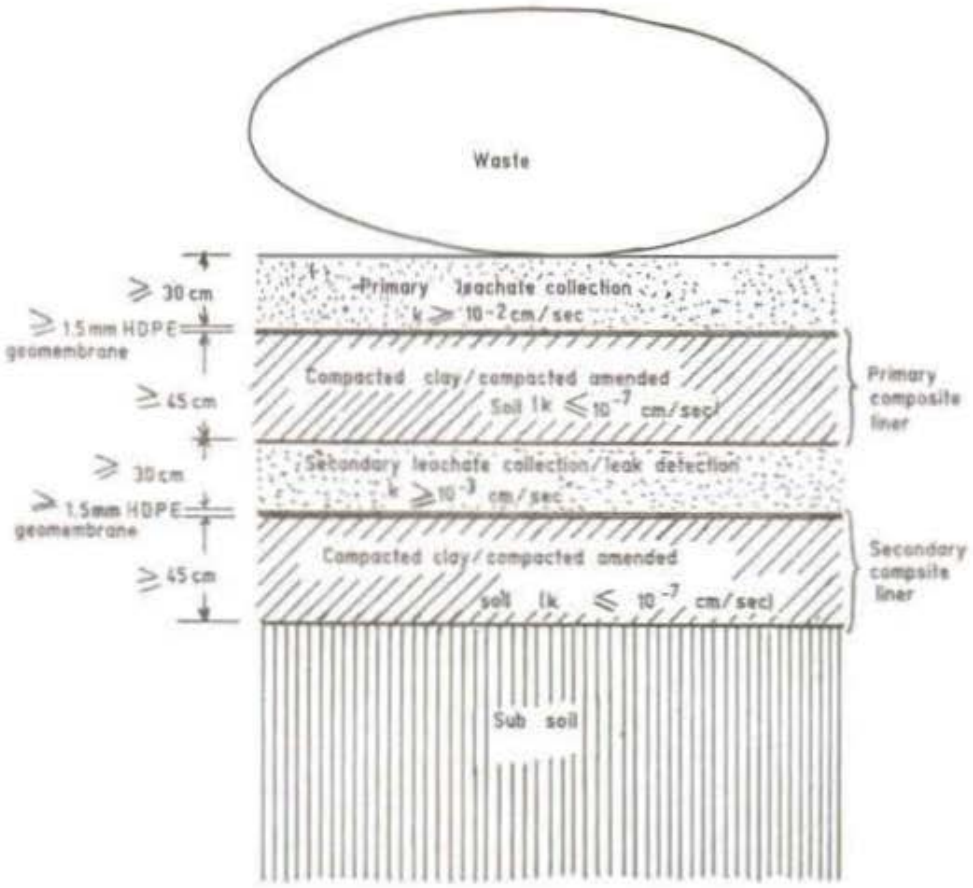


FIG. 13 : DOUBLE COMPOSITE LINER SYSTEM

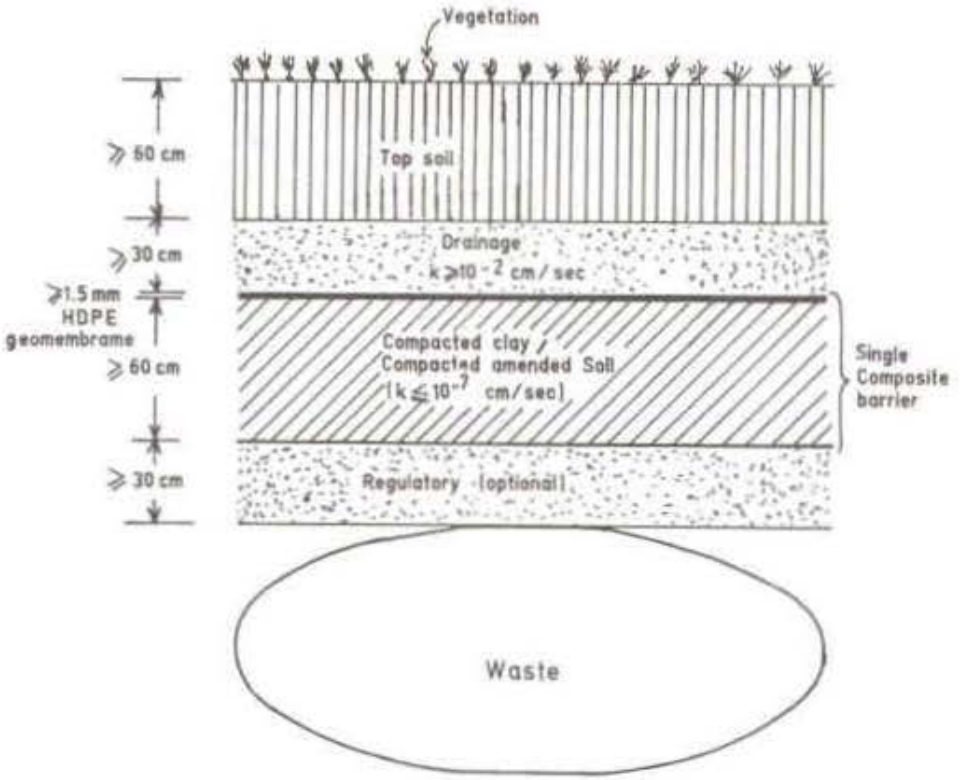
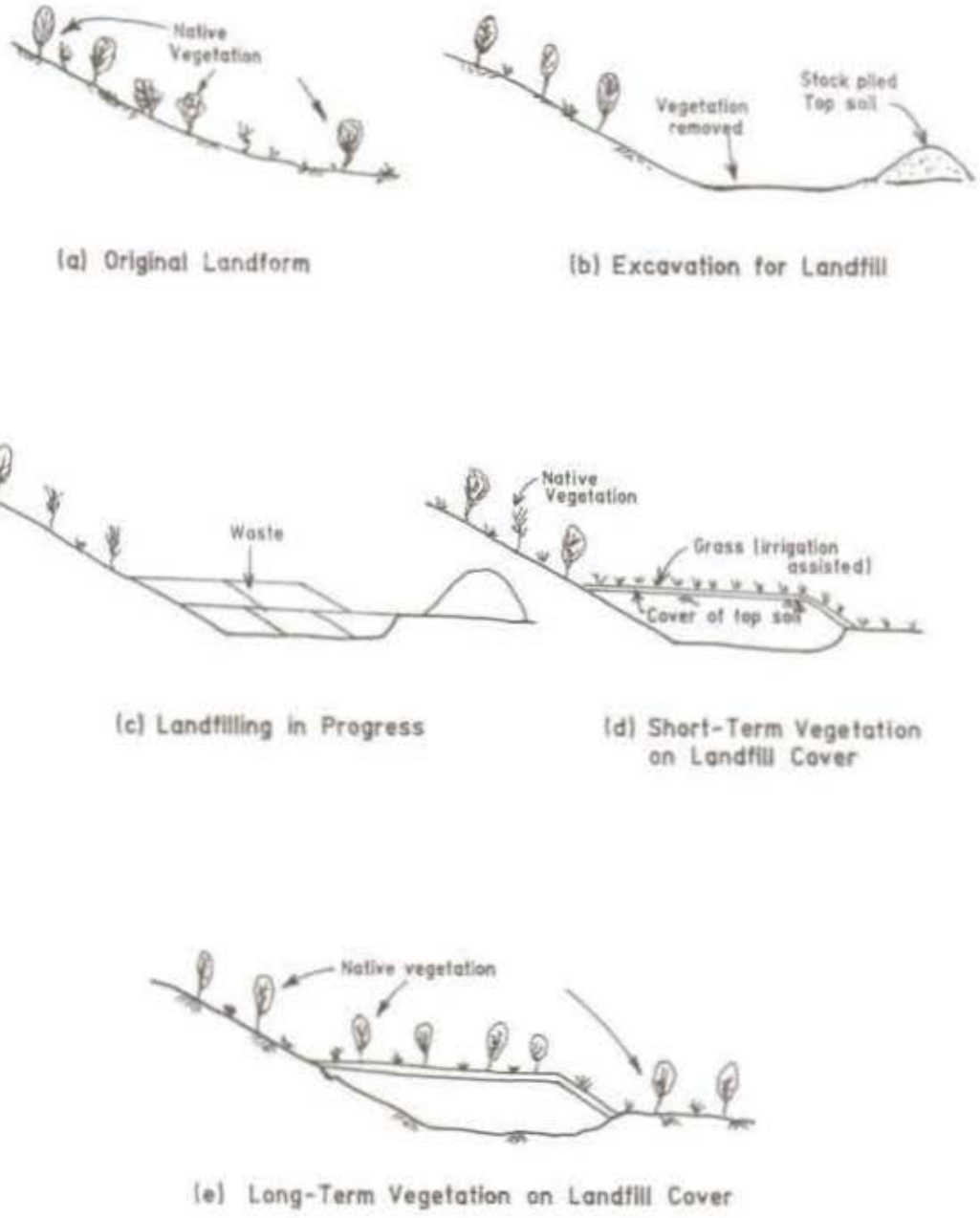


FIG. 14 : COVER SYSTEM



(a) Original Landform

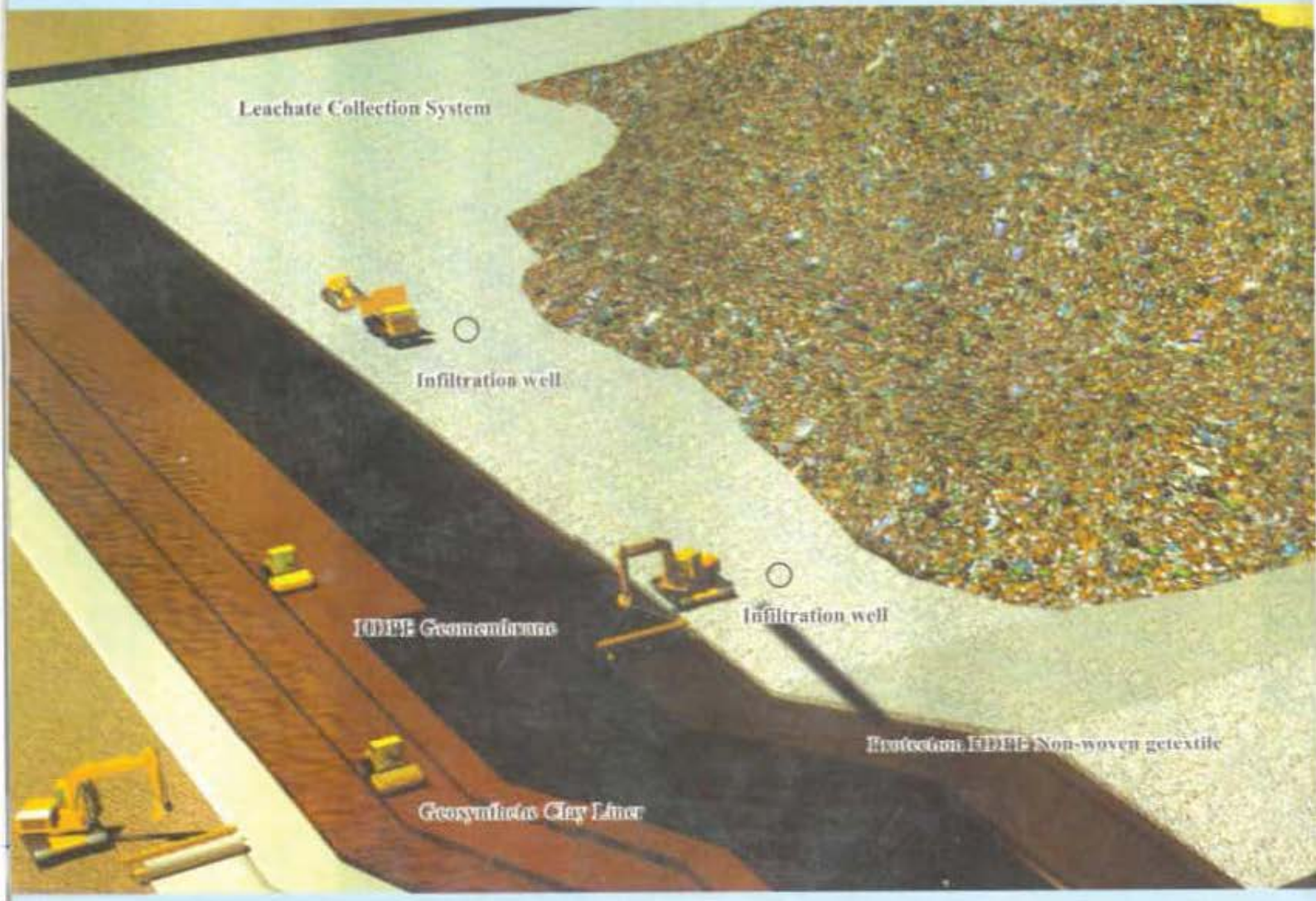
(b) Excavation for Landfill

(c) Landfilling in Progress

(d) Short-Term Vegetation on Landfill Cover

(e) Long-Term Vegetation on Landfill Cover

FIG. 15 : LONG-TERM VEGETATIVE STABILISATION OF CLOSED LANDFILL


Leachate Collection System
Infiltration well
Infiltration well
Protection HDPE Non-woven getextile
Georynthetic Clay Liner

BASEL CONVENTION TECHNICAL GUIDELINES ON SPECIALLY ENGINEERED LANDFILL



Basel Convention on the Control of Transboundary Movements on Hazardous Wastes and Their Disposal

No. 3

UNEP

BASEL CONVENTION
ON THE CONTROL OF TRANSBOUNDARY MOVEMENTS OF
HAZARDOUS WASTES AND THEIR DISPOSAL

UNEP

SECRETARIAT

TECHNICAL GUIDELINES ON SPECIALLY ENGINEERED LANDFILL (D5)

Revised Version
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Foreword

These technical guidelines are principally meant to provide guidance to countries who are building their capacity to manage waste in an environmentally sound and efficient way and in their development of detailed procedures or waste management plan or strategy. They should not be used in isolation by the competent authorities for consenting to or rejecting a transboundary movement of hazardous waste, as they are not sufficiently comprehensive for environmentally sound management of hazardous waste and other waste as defined by the Basel Convention. These technical guidelines concern waste generated nationally and disposed of at the national level as well as waste imported as a result of a transboundary movement, or arising from the treatment of imported wastes.

It is necessary to consider this document in conjunction with the Document on Guidance in developing national and/or regional strategies for the environmentally sound management of hazardous wastes (SBC Publication - Basel Convention Highlights No. 96/001 - December 1995) adopted by the second meeting of the Conference of the Parties. In particular, special attention should be given to the national/domestic legal framework and the responsibilities of the competent authorities.

These guidelines are meant to assist countries in their efforts to ensure, as far as practicable, the environmentally sound management of the wastes subject to the Basel Convention within the national territory and are not intended to promote transboundary movements of such wastes.

CONTENTS

Introduction…….. 1
Types of Landfill…….. 2
Specific Operational Types of Landfill……. 2
Specially Engineered Landfill……... ……... 3
Operational Methods……...…….. 3
Environmental and Human Health Aspects…….. 6
Safe Landfill Management Practices……...…….. 8
Elements to be considered for Environmentally Sound Management……..…… 21
Technical Cooperation……..…… 22
Conclusion…….…… 23
Glossary……. 24
References…….…… 26
General Information Sources on Hazardous Waste…….. 27

Annexes……. 29

INTRODUCTION

1. These technical guidelines provide general guidance on specially engineered landfills used for the wastes which exhibit one or more hazardous characteristics. The technical guidelines also discuss the landfilling of other wastes, as defined in the Basel Convention, e.g. collected from households, to provide a more comprehensive picture on environmental and health problems arising from landfills. In addition to the requirements for establishing new landfills, the technical guidelines also consider the critical issue of existing or abandoned landfill sites which require strict control, monitoring and often remedial measures. They provide general guidance as to which hazardous wastes would be suitable for landfilling.

2. Landfill is by far the most commonly practised waste disposal method in the majority of countries. It is the descriptor used for the placement of wastes into or onto the ground and, in many cases because of the nature of the materials involved, equates to long-term storage.

3. As a result of serious environmental and health problems experienced with historic and abandoned dump sites and the very high costs associated with clean-up measures at contaminated sites, many countries have introduced the "specially engineered landfill concept", the wastes for which are only consigned to sites selected for their containment properties, these being natural, augmented by or provided directly by liners, the overall engineering being such as to ensure as far as possible the isolation of wastes from the environment. Such landfills are considered a final resort option only to be used after every effort has been made to reduce, mitigate or eliminate the hazards posed by such wastes.

4. Reducing dependence on land disposal through waste prevention, minimization and other technical possibilities represents the first choice in the hierarchy of hazardous waste management options. Chapter 20 of UNCED Agenda 21 stipulates that prevention of the generation of hazardous wastes and the rehabilitation of contaminated sites are the key elements for environmentally sound management, and both require knowledge, experienced people, facilities, financial resources and technical scientific capacities. In this regard a precautionary approach should be applied to landfill disposal. Such approach could be summarized as follows:

> Environmental protection should be undertaken whereby preventive measures are taken when there is reason to believe that substances, waste or energy introduced into the environment are likely to cause harm even when there is no conclusive evidence to prove a causal relation between inputs and their effects.

5. While waste avoidance is clearly the preferred management option, current patterns of waste generation mean that landfill, as a disposal method will continue to be used. Many countries are faced with starting a hazardous waste management programme with the existence of unregulated dumping sites. They need in this case to focus on immediate remedial measures and improvements where these sites are continuing to operate as well as considering waste management strategies which should be based on the concept of providing long-term security rather than short-term expediency which is inappropriate in respect of the landfilling of wastes.

6. Short-term actions must commence with a thorough site investigation and assessment of environmental impacts, the monitoring and reporting of wastes received and any problems caused by unregulated disposal. Some control must be exercised at dumping sites while simultaneously attempts are to be made to upgrade the site.

7. Existing and ongoing landfills, where a significant proportion of biodegradable or bioconvertible materials is contained in the wastes deposited, will benefit from improved controls over the moisture content, pH, compaction/density. These will allow for improvement in the chemical and biochemical degradation of the wastes leading to a more rapid stabilization of the mass. The tendency is to increase pre-treatment processes prior to landfilling. Useful technologies which are increasingly used are solidification and chemical fixation. Very soon after (or even better, simultaneously) there should be an attempt to go back to the source of the wastes to see if some reductions cannot be made there. For many wastes where there is no satisfactory disposal option, source reduction provides the most viable management action, this being especially the case in small countries. In a number of countries, landfill disposal is likely to be the only method available for the disposal of significant quantities of hazardous wastes.

Types of Landfill

8. Generally three situations are experienced in practice:

- *Historic, closed sites*: The management of any problems associated with these will be influenced by the level of knowledge regarding inputs, past experience, when the site was closed, those post the early 1960's having greater problem potential, and what restoration and aftercare measures, if any, were installed.

- *Historic, still operating*: Here how problems can be most effectively managed will be influenced by such factors as the level of knowledge in respect of previous inputs, when licensing/authorization systems providing for improved controls and improved management regimes were put in place, pre or post the early 1960s, changes in the nature of inputs, etc.

- *Green Field sites*: These are set up according to waste being handled and will be the subject of appropriate license/authorization conditions, which produce where appropriate for phased restoration, and operated under quality assured management regimes should present minimal operational, restoration and aftercare problems.

Specific Operational Types of Landfill

9. *Containment sites*. These include those affording material containment are frequently found in naturally occurring clay deposits, involving the filling of the void spaces created by the extraction of clay for brick making or cement manufacturing and those with engineered liners augmenting or substituting for natural containment. In both these cases it is also common to install liquid collection systems below and above the liners so that any leachate which leaks through or is retained on them can be recovered.

10. *Those providing for attenuated release*. Here the underlying natural or artificially engineered strata provides an unsaturated zone which allows for physical, chemical and biochemical attenuated release processes to occur, the result of these minimizing the pollution potential of any leachate and allowing the capacity of the recipient environment to accommodate any released species not to be exceeded. There are parallels here with the recipient-environments ability to accommodate the fluxes of material arising for the weathering and exposure to water flow of naturally occurring minerals.

11. In the context of this paper a specially engineered landfill is seen as one customary providing for containment; having such features as installed drainage to recover any leakage, providing for leachate management including recirculation and gas control systems where appropriate, Also almost certainly operating on a cell system employing progressive restoration. Successful containment is achieved through (a) the selection of a suitable site, (b) high standards of operation and (c) a strict selection and/or pre-treatment of the wastes to guarantee (by way of their chemical properties) a long term minimization of releases into the environment.

Specially Engineered Landfill

12. This form of landfill however, which provides the means for the controlled deposit of wastes on land is sometimes the only practicable disposal option for wastes, in particular for hazardous wastes. In principle, and for a defined time period, a landfill site can be engineered to be environmentally safe subject to appropriate siting, proper precautions and efficient management. Preparation, management and control of the landfill must be of the highest standard to minimize the risks to human health and the environment. Such preparation, management and control procedures should apply equally to the process of site selection, design and construction, operation and monitoring, closure and post closure care.

Operational Methods

13. There are a number of different ways of depositing hazardous waste in a landfill. Each has advantages and disadvantages.

14. Any landfilling of hazardous waste poses a potential threat to human health and the environment, and must therefore be undertaken with great care. A high level of technical competence is required in designing, operating and monitoring the site.

15. Wherever possible, hazardous wastes should be pre-treated to render them less hazardous or inert before landfilling. Many pre-treatment possibilities are available, but a discussion of them is beyond the scope of this paper. Widely used pre-treatment operations are, in particular, incineration and physico-chemical processes.

16. Two specific ways of landfilling hazardous waste are mono-disposal and co-disposal:

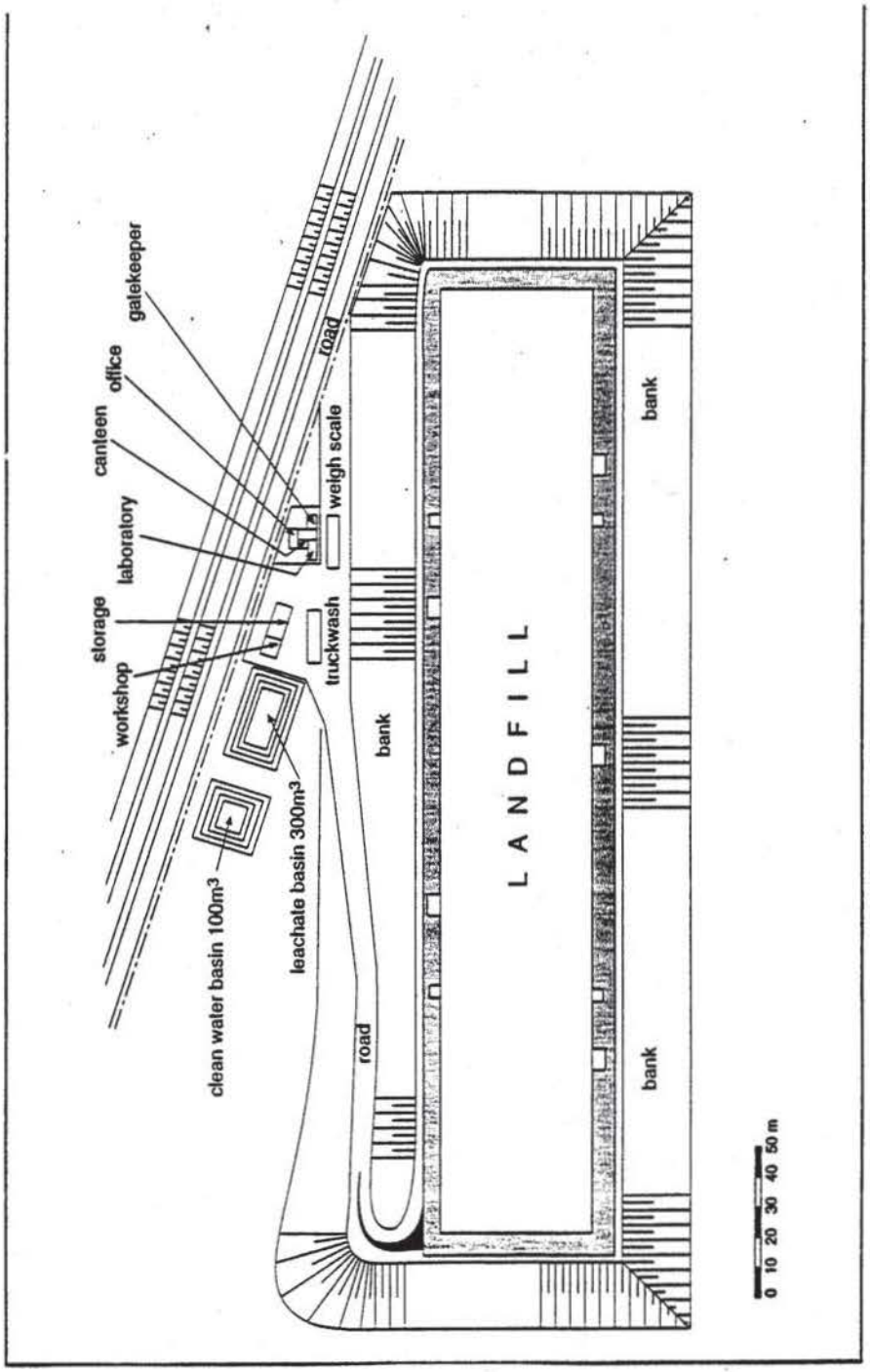
- *Mono disposal* means placing a single waste stream (or closely-related streams) either in a landfill or in an individual cell in a landfill. For non-degradable wastes this is, in effect, permanent storage. For this reason, close attention must be paid to the long-term engineering stability of the site, and to precautions to be taken against the site being

accidentally breached. The consequences of any release must be evaluated.

- *Co-disposal* uses the processes of degradation of municipal waste to destroy or stabilize hazardous waste. Eventually, after many decades, such a site can become stable and operate as permanent storage. However, the reactions involved are complex and not well understood. For this reason only wastes which are amenable to destruction in this way should be co-disposed, and comprehensive monitoring of emissions from the site should be undertaken during its active period.

17. It is strongly recommended that different wastes should not be mixed in a landfill site unless some significant reduction in hazard is expected to result from their mutual interaction. Even then, any such mixing should be carried out in a controlled and monitored way.

Figure 1 LANDFILL SITE LAY-OUT (Taken from UNEP Industry and Environment Technical Report 17)



Environmental and Human Health Aspects

18. In assessing the risks associated with landfill activities the landfill needs to be characterized in terms of the factors which will affect the degree to which human exposure may occur. In this regard, an immediate and long-term environmental impact assessment has to be carried out as required under national legislations or procedures. The environmental impact assessment which is applied to "specially engineered landfill" should cover scoping, objectives and policy making, assessment of baseline status, identification, prediction and evaluation of impacts on major and sensitive components of the environment. Issues like long-term impacts, after-care management and long-term land use policies should be considered. In characterizing the landfill, three important areas can be identified:

- Wastes involved; what type of wastes have been or are being deposited and in what quantities and forms? What are the disposal methods employed? Also, any new waste coming into the landfill should be sampled and analysed.

- Chemicals involved; what chemicals are present in the wastes and in what form and concentration do they occur? Subsurface conditions; what type of materials are present below the landfill?

- Control systems; for instance what type of cover exists over the landfill, and what types of leachate and surface run off controls are present.

Chemicals

19. Typically, a large number of chemicals will be present within a landfill. Unless specific sampling has been carried out on the contaminated materials, it will be very difficult to determine exactly which chemicals are present and in what concentrations they occur. In order to provide analysis for sites where no sampling has been done, it is necessary to outline groups of indicator chemicals associated with different waste streams. A procedure can be used with estimation of the annual amounts of different types of wastes deposited at the landfill and the landfill volume utilized to provide approximations of selected indicator chemicals in the waste. This procedure must be modified to account for the disposal of drummed and liquid wastes which may or may not be restricted to portions of the landfill area. In the case of landfills that are still operating, a sampling and analytical programme should be carried out for any incoming wastes.

Subsurface and surface conditions

20. At many landfills no leachate controls were implemented during landfill construction. In these cases therefore the subsurface conditions have to be generally defined by the local geology and soil characteristics. Where liners and leachate control systems were in place, they can be effective in preventing ground water contamination. Most landfills are covered with a temporary cover during operation, and final soil or clay cover prior to closure or abandonment. The presence of a clean cover over the waste can reduce exposures via wind-born dusts, erosion of the contaminated deposit by surface run off, and by direct contact to persons using the site. The cover may or may not be vegetated and maintained, factors which will have an effect on the overall efficacy of the cover.

On-site and Off-site Exposure

21. In order for contaminants residing in a landfill to have an impact on human health, there must exist the potential for the chemical to come into contact with individuals. This contact can occur either as on-site exposures as a result of the receptor entering the landfill itself, or as off-site exposures as a result of chemicals migrating from the landfill to off site exposure points.

Potential Exposure Pathways

22. The link between chemicals in the landfill and the potential receptors constitutes an exposure pathway. There are three essential components of a pathway which must be present for the pathway to complete:

- A chemical release mechanism;
- A transport route for chemicals to migrate to an exposure point;
- An exposure point, where human or environmental exposures may occur.

23. The nature of a chemical release depends heavily on the form and conditions in which the chemicals exist in the landfill. Release mechanisms are different for liquids in containers losing their integrity than for chemicals bound to soil particles by adsorption, dissolved with residual soil moisture, or present in perched ground water within the landfill. Many waste sites are characterized as having contaminated soil areas where chemicals previously released in liquid form are adsorbed onto the soils and are released slowly by leaching. A surface impoundment containing contaminated liquids might release chemicals through volatilization into the atmosphere and by infiltration of the contaminated liquids through the unsaturated soil zone.

24. Often, on-site exposures are not the most significant hazards associated with a site, since site access is usually restricted to a point where exposures are rather infrequent. Once the release of chemicals has been evaluated, the next step is to examine their transport to points where more substantial evaluating chemical movement through several media including transport routes if dependent on both release mechanisms and exposure points of concern. Exposure points may be identified as points where individuals would indicate the likelihood for future contact. Common exposure points evaluated at waste disposal sites include nearby water supply wells, points of discharge of ground water to surface water, local surface water used recreationally or as drinking water supplies or as a source of fish, and property boundaries or nearest residences where the population may be exposed to air borne contaminants.

25. There are many pathways by which exposure to wastes in landfill can occur. Experience with site-specific risk assessments based on exhaustive site investigations in the USA has shown that it is common to find upwards of 95% of the exposure associated with a particular site attributable to one exposure pathway. Identification of applicable exposure pathways begins with the identification of possible release mechanisms for wastes contained in the landfill. These include:

- Leachate production; chemicals may leach from soils and wastes contained in the landfill and be carried out of the contaminated area via percolating water;

- Contaminated surface runoff; chemicals may leach from soils and wastes and be carried by surface runoff. Surface runoff may also carry contaminated soils as suspended particulates;

- Gas production; gases produced within the landfill may migrate due to pressure gradients carrying volatile chemicals outside the contaminated area;

- Volatilization; volatile chemicals may be given off directly into the atmosphere;

- Dust emissions; wind-borne particulates may carry absorbed chemicals.

Persons who come into direct contact with the landfill may carry away contaminated material on their skin and clothes.

26. At most landfills it is also best to avoid the deposition of significant quantities of soluble materials that are not, or are only slowly bioconvertible. Similarly, the deposition of chelating agents that can solubilize heavy metals should be avoided. It is also important to minimize the amount of organo-chemical wastes entering into the landfill.

SAFE LANDFILL MANAGEMENT PRACTICES

1. *General considerations*

27. Landfill operations should be part of an integrated overall system of waste management which include the steps involved in a "cradle to grave" and "after disposal care" approach. Residuals from treatment process or disposal operations that are not discharged as treated effluent or emissions to the environmental media and which are still hazardous are deposited in a specially engineered landfill. All landfill operations require careful planning in advance of the first deposit of waste. How a landfill is operated determines to a large extent the environmental effects. One basic factor influencing the planning of site operations is the nature and quantity of incoming waste. Figure 1 provides for a typical operational plan for landfill site (from U.K. Dept. of the Environment, Waste Management Paper No. 26).

28. The major disadvantages of landfill disposal include:

- The potential risks for polluting water resources;
- The potential risks of contaminating the soil;
- The generation of landfill gas i.e. methane and carbon dioxide;
- Potential human exposure to volatile chemicals;
- Smell, vermin and fire;
- Destruction of natural/virgin sites;
- Long term and cost intensive clean-ups remediation and monitoring (aftercare, close-up).

Landfill has several advantages:

- Landfill can represent a long-term storage method;

- It is not an unduly capital-intensive disposal method over time although setting up costs could be high;
- It is widely available;
- It is comparatively insensitive to day-to-day variations in the quantity and nature of the wastes deposited;
- It is appropriate in a wide range of circumstances (i.e: equipment, technology and skills are available virtually worldwide at local levels).

29. Proper site selection, design of the landfill, control and management of operations, control of input waste, installation of appropriate means for avoiding leachate outside the fill and reducing escape of landfill gas would be necessary to minimize the potential harmful effects of a land filling on public health and the environment and minimization of free[1] liquids placed in the landfill as well as minimization of precipitation and run-on into the fills is achieved.

30. As stated earlier, specially engineered landfills could be used as a disposal option for selected hazardous wastes provided adequate safety measures including pre-treatment of the waste in question are being taken to protect human health and the environment, and minimization of free liquids placed in the landfill as well as minimization of precipitation and run-on into the fills is achieved. There are, however, a number of hazardous wastes for which landfill disposal is not appropriate and cannot be recommended;

- hazardous liquid wastes and hazardous materials containing free liquids[2];
- highly volatile and flammable liquid wastes;
- wastes containing appreciable quantities of mineral oils;
- spontaneously flammable or pyrophoric solids;
- clinical wastes (such as infectious wastes; sharps; etc);
- strong oxidizing/reducing wastes;
- shock sensitive explosives;
- compressed gases;
- highly reactive wastes;
- water soluble non-convertible materials;
- persistent organo-halogen compounds;
- volatile materials of significant toxicity;
- substances that react with water, air or dilute acids and alkalies to produce hazardous gases or hazardous reactions;
- concentrated acids, alkalis;
- empty containers unless they are crushed, shredded or similarly reduced in volume.

31. Liquids placed in a landfill can contribute significantly to leachate generation. To minimize this generation, it is recommended that liquids and materials containing free liquids be excluded from landfills. This prohibition should be extended to include liquids absorbed in materials. At the pressures that could exist in the depths of a landfill, liquids could be "squeezed

[1] Free liquid means uncombined or interstitial liquids.

[2] Views on allowing non-hazardous liquid wastes into a landfill are varied. It is however essential to contain any free liquids in the landfill and to control the water content of the landfill.

out" of the absorbent material to become uncombined and unabsorbed liquids (free liquid) once again. Dilution or blending of a hazardous waste with a non-hazardous material should not be permitted for the sole purpose of diluting it to meet any specified concentration limit.

32. Empty containers such as drums and canisters should not be placed in landfills unless crushed, shredded, or processed by some other means to reduce their volume. This will eliminate the chance of subsidence occurring in the completed landfill due to collapse of the containers under the pressures experienced after burial. If subsidence were to occur, it could threaten the integrity of the landfill cover which would then require on-going maintenance to ensure the security of the landfill.

33. Consideration should be given to the establishment of trace levels of organic hazardous wastes, level of contaminants, particularly halogenated organic compounds which can be landfilled.

34. In principle, hazardous wastes to be deposited in a landfill should receive treatment and/or processing consistent with the best demonstrated available technique appropriate to the type of waste. The objective in applying such a technique should be to minimize the potential release of contaminants to the environment if the security of the landfill system is breached. The appropriate management methods and treatment/processing technology that could be applied to hazardous wastes prior to landfilling could include:

- reduction in waste volumes produced at the source by installing modifications to the industrial process producing the waste or reduction in volume on the landfill site;
- recycling, recovery and/or re-use of various components of the waste;
- physical/chemical treatment for liquids solid separation and detoxification;
- biological treatment for removal of biodegradable/bioconvertible organic components;
- solidification/stabilization/fixation for converting liquid wastes to solid form and for encapsulating hazardous components;
- thermal treatment for destruction of organic wastes.

35. A number of technical measures which are interdependent should be taken to mitigate the impacts of landfill operations on the environment and human health, they concern:

a. **Site selection**. Landfills should be sited, where possible to avoid the possibility of ground water pollution. Where this is not possible, landfills should be designed and constructed to prevent the migration of leachate from the fill to ground water.

b. **Design of operations**. Landfills can be designed and operated in ways that minimize the generation of leachate, by for example tipping vertically rather than horizontally, and by the prompt application of appropriate intermediate cover over the deposited waste, graded to encourage run-off rather than infiltration. Effective compaction of the deposited waste is also important.

c. **Design of landfill** and its proper engineering

d. **Control on incoming waste**. The amounts of waste that directly increase leachate volumes (e.g. wet wastes) should be reduced to a practical minimum.

e. **Landfill closure**. The final closure cover for the landfill can be designed and laid in such a way that infiltration of rainfall into the fill will be greatly reduced.

f. **Careful construction** and operation are essential.

g. Monitoring. A comprehensive programme of monitoring will be required for all landfill sites. It should cover inputs to, contents of and emissions from the site and the surrounding environment. It should be designed to provide advanced warning of any unexpected problems and guidance on remediation possibilities. It should also indicate the point at which the landfill has become stable.

2. *Site selection*

36. In selecting a site for the construction of, for instance, a hazardous waste landfill, several geographical and hydrogeological factors of the location must be considered as well as several potential sites. These factors will have a significant bearing on the level of environmental protection provided by the landfill. Consideration on the future use of the landfill area should be made. Geographical and hydrogeological factors of a site will also influence the design of the landfill including the type of liner system drainage work, and ground water monitors installed.

37. In addition, the degree of urbanization and its proximity to a landfill site should be considered. When an urban centre is near, extra effort must be taken to reduce any social disturbances the landfill may impose. Such disturbances include impacts on the landscape and sewage systems (contaminated by leachate, noise levels, odour levels, vermin, scavengers), and traffic patterns. Also, great care must be taken in developing an emergency preparedness plan in the event of a gas leak or other accident.

38. The site selection process for establishing a hazardous waste landfill must address geotechnical, land-use, biological, socio-economic (it is a widely-held assumption that public opposition to waste management facilities has become one of the critical problems faced in site selection), human and environmental factors. In addition, the process must be carried out in accordance with the environmental assessment requirements specified by regulation or legislation or any relevant jurisdictions. Programme planning, for hazardous landfill sites should be conducted in such a way as to involve local communities and get their input into the process.

39. With the general land area needs and locations identified, approximate costs can be estimated. These costs should include the costs of design, operation, closure, aftercare, financial guarantees for potential damages to third parties, and remediation. Such costs and pertinent factors such as ownership and social acceptability can be used to make an informed decision whether a site represents an economically viable hazardous waste disposal option. If a positive conclusion is reached, detailed technical, biological, social, economical and political analysis of the feasible site could be undertaken.

40. No site should be used for the landfill disposal of hazardous wastes unless the geological and hydrogeological properties of the site have been carefully investigated and found to offer maximal safety for public health and the environment. For instance, a hazardous waste landfill should not be located in a floodplain or be in contact with groundwater. The seasonal height and flow of the groundwater should be established so that the potential for water contamination can be assessed and the location of monitoring wells be established. The site should not be in an area of seismic activity or an area that includes cavities, faults or sinkholes. The integrity of the landfill may be compromised in such areas. The soils at the bottom of the hazardous waste landfill site should be clays and should be several feet thick and relatively impermeable. Thickness of a clay liner of the above dimension delays the problem of losing the protective capacity of the landfill but will not be sufficient to ensure full and complete protection. If such clay soils are not available, appropriate clays or materials may have to be brought to the site to serve as liner material and/or a synthetic flexible membrane liner will have to be installed. Suitable soils should be available as landfill cover material otherwise appropriate soils will have to be brought to the site. There is a concern over the long-term integrity, reliability and operability of liner systems, leachate control systems, and other engineered components of a landfill facility. Both clay and synthetic liners can be damaged during placement of the wastes. In addition, the properties of clay and synthetic liners can be altered by contact with certain wastes such as solvents. Thus, it is essential that landfill design and waste materials be compatible. The site should not be located where normal runoff will inundate the site. Drainage from the surrounding land should be diverted around the site.

41. Annexes I A and I B to these guidelines provide a description of the factors required to select a site and the criteria for landfill site selection. Annex I B is extracted from the World Bank Technical Paper No.93 (see Reference No. 1).

3. *Design considerations*

42. Conceptually, there are two basic approaches to the safe landfilling of problem waste: natural attenuation and containment. In the first approach, landfills designed to receive hazardous wastes are located only in areas where containment attenuation in the environment can be achieved naturally. This approach allows for the possibility of achieving a condition where maintenance is not required over the long term. The major disadvantage in the natural attenuation approach is that it is based largely upon the accuracy of predictions of the level of protection provided by the natural environment. Natural attenuation also requires the presence of suitable hydrological and geological conditions.

43. In the second approach, reliance is placed on engineered facilities rather than on natural attenuation to protect the environment. Typically, landfills designed using this approach combine engineered liners, covers, leachate and/or gas collection and treatment systems to control the release of contaminants into the environment. While engineered containment reduces the potential risk associated with contaminant migration into the environment, questions remain concerning the integrity and functionality of such systems over the long term. The additional cost and responsibility associated with the maintenance and operation of such systems have to be accounted for.

Specially Engineered landfill

44. For specially engineered landfill, receiving wastes, in particular hazardous wastes, a complete site assessment, including development of a contaminant transport model, should be conducted to estimate the potential environmental impact of contaminant migrating from the site at specific locations of concern such as site boundaries and monitoring installation. The landfill site would then be designed in such a manner as to mitigate any impacts identified in the environmental impact assessment.

45. Safe landfill management requires the design of a number of systems, the main purposes of which are to control and minimize leachate, runoff and landfill gas evaporation. The main features of a specially engineered landfill include:

a. Liner systems

46. After a landfill site has been selected, a system to line the landfill must be chosen. The liner system is key to achieving the goal of landfill management to insulate and prevent toxic and other hazardous compounds from being released beyond the confines of the landfill into the environment. Increasingly, double and sometimes even triple liner systems are being selected with liquid collection systems above, below and between liners. Choosing the liner materials compatible with the wastes to be put in the landfill is important. The estimated service life of a liner in a particular exposure condition is also an important factor in selecting a liner material. A variety of complete systems for landfill liners and leachate removal have been designed to protect the environment surrounding the landfill site. The topic of landfill liner systems and leachate control concepts has been the subject of considerable debate and as yet, no consensus has emerged on what the preferred approach should be in general and/or in specific circumstances. One example is represented by a combined liner system (see Figures 2 and 3 with explanatory text).

Engineered containment systems

The bottom and sides of the landfill should be lined with a low permeability containment system. Care must be taken not to penetrate the system during laying or use.

Figure 2 LINER SYSTEM

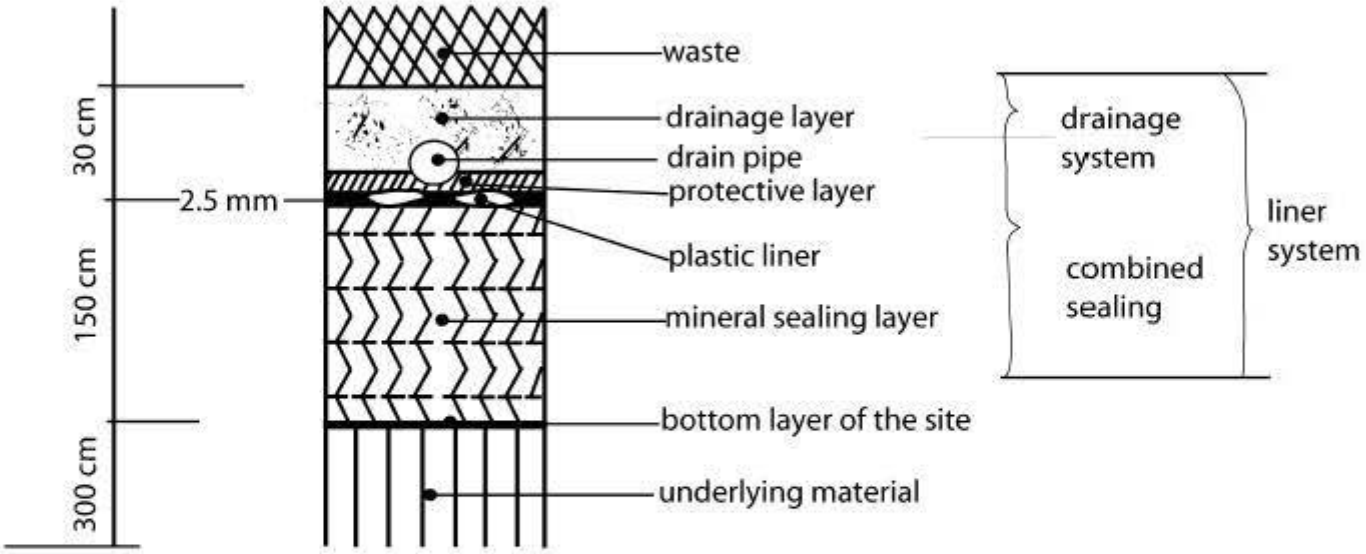


Figure 2 shows one possible system. It consists of the following components which will lie directly above each other:

- A mineral sealing layer (for example, compacted clay) typically 2m thick with a permeability of about 10 m/sec.

- A plastic liner typically 2.5mm thick. Care will need to be taken to avoid leaks and distortions during laying the plastic liner.

- A drainage layer of about 0.3m thickness will be needed. It should be constructed of coarse material, so that over time its permeability will be reduced by clogging.

Drain pipes, collection points and catch pits will be needed to collect and transport leachate.

Figure 3 LANDFILL CAP

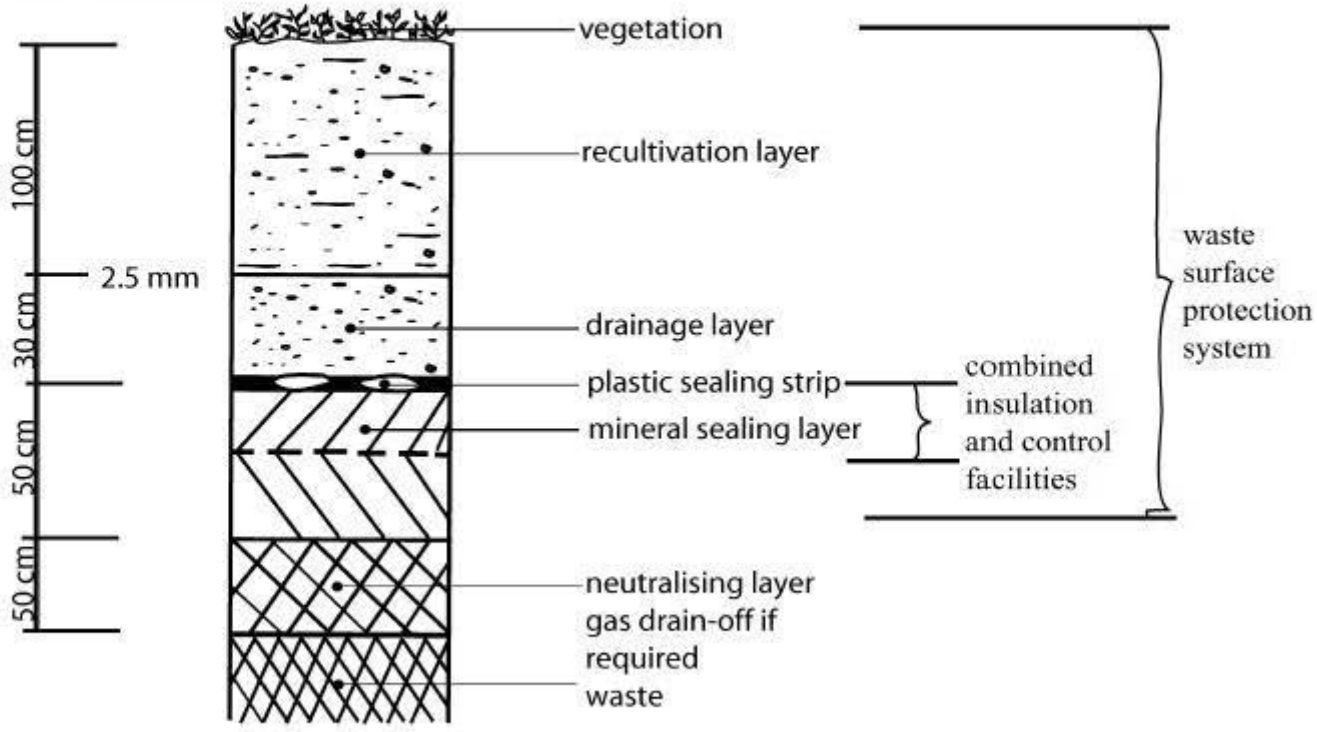


Figure 3 shows one possible construction of a capping system. When each cell is filled, it is covered with a gas collection and neutralisation layer, a combined mineral and plastic sealing layer, surface drainage and soil for cultivation.

b. Leachate control

47. As far as possible, leachate should be avoided. In general, the composition of leachate will be a function of the types and age of wastes deposited, the prevailing physico-chemical conditions, the microbiology and the water balance of the landfill. The main components in the leachate from landfill sites may be grouped into four classes, as follows:

- major elements and ions such as calcium, magnesium, iron, manganese sodium, ammonia, carbonate, sulphate and chloride;
- trace metals such as mercury, chromium, nickel, lead and cadmium;
- a wide variety of organic compounds which are usually measured as Total Organic Carbon (TOC) or Chemical Oxygen Demand (COD); individual organic species such as phenol and chlorinated organic compounds, can also be of concern;
- micro-organisms.

All household waste and most industrial waste will give rise to leachate. Leachate monitoring plays a central role in the management of landfills. The long life of a properly operated landfill, during which time significant changes could take place in landfill practices and in the character of the wastes deposited necessitates monitoring to ensure that the measures taken for environmental protection remain effective. Leachate accumulated within a landfill or collected from drainage systems designed to protect surface waters may need to be disposed of the environment, and treatment may first be needed to reduce its polluting potential (on-site and off-site treatment may be necessary). Leachate is collected in a drainage system, and then exits the landfill. Depending on the nature of the waste and the way the landfill is constructed, the water picks up various contaminants as it passes through the different layers of the landfill. Rainfall, the absorptive capacity of the wastes and the closure cover and capping at the site are critical with regard to the production and control of leachate. A drainage and collection system for leachate must be installed within the landfill that will allow leachate to be pumped to the surface for treatment prior to discharge to water systems. Leachate collected from a problem waste landfill should be examined if it exhibits hazardous characteristics and be treated accordingly.

c. Landfill gas

48. In the first instance, landfill gas should be avoided as far as practicable as they represent a potential risk to people. In this respect, monitoring of landfill gas is most important in particular for chlorinated hydrocarbons, mercury and arsenic. If the specially engineered landfill contains biodegradable/bioconvertible material, measures are needed to allow for the collection, venting, flaring or use of landfill gases that will be produced. These gas control measures must not impair the integrity of the isolation system. Although landfill gas recovery is seen as one of the end-of-the-pipe solution to the problem of escaping landfill gas such as methane, trends in a number of

countries is to discourage or prohibit the landfilling of organic wastes so that any future methane generation in the sites would be minimal or negligible. It should be noted, however, that landfill gas generation will continue because large volume of gas will continue to be formed in existing landfills. Landfill gas may contain up to about 60% methane with the balance being about 40% carbon dioxide with other materials present in trace quantities. The rate of landfill gas generation is very dependent on all the circumstances, but modern landfill practice requires that steps are taken to manage this emission to prevent hazards and when viable recover the gas for use as an energy source. Depending on the nature of the gas released, some form of gas treatment may be desirable. Incineration ***should*** be employed if the gas is rich in methane and/or volatile hydrocarbons. Other gas treatments involve wet scrubbing if the gas has a significant hydrogen sulphide content or carbon absorption in relatively small amounts of volatile hydrocarbons are present in the gas. Gas samples should be obtained and where possible the source "fingerprinted" by identification of constituents. By measuring gas quality in cracks in the soil for monitoring known or anticipated vegetation damage cause by landfill gas. Gas migration control systems should include the monitoring of peripheral boreholes for landfill gas concentration.

d. Security management

49. Access to the site should be strictly controlled. The general public should not normally have access to a problem waste landfill site as is sometimes the case with municipal landfills. Both incoming and outgoing traffic should pass through a single control point for manifest verification, sampling and any other regulatory and administrative actions. A suitable buffer zone should be provided around the perimeter of the site, no development should occur near the landfill (apart from buildings on the site). The buffer zone could incorporate beams and/or trees planted to serve as a visual screen and noise barrier. It will also serve as a margin of safety for neighbours in the event of an accidental release of contaminants. The width of the buffer zone and the visual/noise attenuation features to be incorporated into it may vary according to adjacent land use. The security of the site should be maintained by a perimeter fence to keep out unauthorized people as well as itinerant wildlife. The fence should be posted with signs to identify the site and warn trespassers to stay away. A telephone number to contact in case of emergency should be posted in an obvious place.

e. Closure of the site and long term care

50. The closure system of a completed landfill usually exhibits the following elements:

- Vegetative cover (protection of the covering soil from erosion, maximization of the evapotranspiration rate and landscape quality maintenance;
- A top substrate (with surface drainage to protect the sealing system from damage, frost, etc.);
- A sealing system to prevent infiltration;
- Gas and leachate drainage;

- A levelling layer (compensating for the irregularities of the waste surface).

f. Site monitoring

51. Site monitoring will consist of, inter alia, placing monitoring boreholes to permit the selection of landfill gas migration from the waste; wells may be established for monitoring leachate quality and levels; portable explosion-proof methane detectors should be used.

52. Monitoring is particularly important because it is through long-term monitoring, which may continue for many years, that data is gathered to verify the hydrogeologic assessment and permit the final closure of the site. In order to serve as the reference point for subsequent monitoring efforts, the proposers of new sites should conduct a thorough baseline profile for the proposed site and immediate surrounding areas prior to the establishment of the site. The guarantee of long-term care, until the site can be finally decommissioned, is a particularly difficult and complex problem, depending on site conditions this post-closure period could well exceed 100 years. Specific closure procedures should ensure that the long-term integrity and security of the site is maintained. The closure programme should be directed towards minimizing the need for maintenance of the site after closure. The potential costs for long-term maintenance can be considerable and is an important factor to take into account when selecting a landfill concept. Prior to commencing operation, some form of contingency financing, which would also cover costs of remediation, should be provided in the event that the integrity of the landfill is breached and repairs are required either during its active life or following closure. The amount of financing required will depend on the size of the landfill, the types of wastes placed therein and pertinent site-specific factors.

4. *Operations*

53. The successful implementation of a landfill for the disposal of hazardous wastes hinges on strict control over operating and monitoring procedures. Basic elements of a quality control plan include:

- A good definition of responsibilities for the people involved in the planning, authorization, construction and management of the landfill;
- Appropriate site working plan;
- The qualifications of the workers operating the landfill;
- Work inspection modalities;
- Working inspection modalities for construction materials;
- Documentation demonstrating that the construction works have been carried out under a quality control regime;
- The preservation of all the information on the quality control of the construction works;
- The documentation of management activities and types of wastes stored.

A number of essential administrative procedures should be followed such as: procedures for all operations at the landfill site should be included in a comprehensive manual prepared specifically for the facility; a waste materials inventory control and record keeping system should be developed and rigorously followed at the site; a comprehensive vehicle and equipment maintenance manual should be prepared and kept for all mobile and stationery equipment on the

site. The placement of hazardous wastes in the landfill should follow the requirements set forth in the landfill development plan. This would give due consideration to the preferred landfill concept, cell design including a leachate control system, cell development, capping and closure requirements. Placement of wastes must also give due consideration to the segregation of incompatible materials in order to minimize the risk of dangers such as explosions, fires, and the evolution of toxic gases. An emergency procedures plan for dealing with all realistically foreseeable mishaps at the landfill site which could endanger human health or the environment should be prepared and updated on a regular basis. Examples of such incidents include fires, explosions, accidental spills of contaminants in non active areas, and the generation of unanticipated contaminated run-off and/or leachate. Instruction on the emergency procedures plan should be an integral part of the training programme for all employees at the landfill. The inventory of equipment necessary for immediate response to the mishaps outlined in the emergency procedures plan should be kept readily available at the landfill site. Equipment for medium and long-term response actions need not be immediately available on site. However, the emergency procedures plan should note specific locations nearby where it can be obtained on short notice. In this regard, the plan should be prepared in consultation with community emergency response authorities in the vicinity of the landfill site. Copies of the plan should be distributed to all nearby agencies such as police and fire departments, provincial and municipal emergency response teams which might be called upon, and local hospitals.

5. *Landfill costs and costs for containment landfill*

a. Landfill costs (both high and low costs)

54. A study done in the United Kingdom on Urban and Rural municipal waste disposal situation indicated that

Cost of land ranged between	7 to 51 % of total cost per ton
Fixed plant ranged between	3 to 10 % of total cost per ton
Site operations ranged between	18 to 47 % of total cost per ton

Costs	
Post closure costs ranged between	5 to 42 %
Based on margins	4 to 20 %

The total costs ranging between ,7.50 and ,22.50 per ton, these being seen as set to rise between ,9.50 - ,38.50. (1 UK, = US$ 1.50 approximately)
In the case of the landfilling of hazardous wastes into a proper engineered landfill site, the various costs involved could be much higher.

The cost elements in more detail are:

- Cost of land which includes the capital cost of land purchased, leasing costs and land use royalties;

- Fixed plant costs including site buildings, fencing, access roads and stationary equipment and machinery such as weighbridges;

- Site operational costs which includes costs relating to the ongoing activity of landfill operations; e.g. labour, engineering, administration costs, etc.;

- Post closure costs which includes the actual closure costs in addition to ongoing landfill gas monitoring and leachate control, reinstatement, general site maintenance and aftercare as well as provisions for the future liabilities or insurance premiums in relation to this;

- Transport cost which includes all haulage related costs; both of a capital and revenue nature, as well as costs associated with transfer stations where applicable;

- Margin which is the element of profits from the total price per ton of landfilled waste;

- Costs of environmental impact assessment can be considerable for specially engineered landfills.

55. The following elements are relevant:

- If existing landfill facilities are short-lived, demand for new sites in a region will be higher as will be the operating costs for the remaining input if tighter operating costs are applied and if more post operational maintenance is required as a consequence of planning and/or licensing or authorizational conditions.

- The ease of development of voids impacts on all identified cost elements except transport. Additional planning requirements or higher closure standards will increase the costs of developing and operating the landfill. It encompasses all aspects of administration for the preparation of landfill sites i.e., obtaining planning permission and licensing requirements.

- The ease of engineering which is partly linked to the ease of development in that tighter operating requirements will necessitate more extensive or complicated engineering works to ensure compliance with the conditions of site licenses/authorizations

- The proximity of the disposal site to the point of waste arising which affects the transport cost element, and

- Economics of scale which measures the impact of changes in the overall volume of waste to be disposed of on all cost elements except transport rather than how costs per ton vary as a function of landfill site size.

b. Costs for containment landfill

56. Design requirements of a containment system is the most costly form of landfill construction, the principal components being as follows:

- Liner;
- Leachate Collection System (LCS);
- Recirculation system (where appropriate);
- Landfill Gas Collection System;
- Cap;
- Environmental Monitoring System;
- Long term maintenance of all comfort systems.

	Base Area ,/m2
Liner purchase; transport place and compact clay	2 - 50
2,5 mm, HDPE, provide and place	6 - 00
Leachate collection system, Herringbone HDPE pipe and drainage, protection blanket	2 - 50
Gas Collection wells (say 10 m deep site)	1 - 00
Cap purchase; transport; place and compact clay	2 - 50
	,14 - 50/m2

57. A recent costing exercise was carried out in the United Kingdom on five rural dilute and disperse sites of shallow depth 5 - 10 m and average waste inputs of between 80,000 and 200,000 tons per annum. Estimates were made of costs to build new cells in each site to a full containment principle and to a specification incorporating a composite liner.

58. In addition, operating costs were increased to take account of a full Environment Protection Act (EPA 1990) Specification, e.g. supervision by a fit and proper person, Quality Assured (QA) site management, full gate control, leachate and gas removal and treatment, roads and security, pest control and comprehensive environmental monitoring. As the sites were of varying depth and had different waste input characteristics if it was found that the increase in total capital and operating costs amounted to ,4/t and ,7/t. As it now tends to be only the larger sites which can afford the necessary development and infrastructure investment it can be seen that for depths of between 20 - 40 m, these increased costs would be in the much lower range of ,1 - 2,/t for containment, a very small price to pay on the overall costs of waste disposal.

Lateral Containment

59. Gravel extraction operations suggested minimum distance to housing of 150 m, creating void space for waste disposal. Landfill operations suggested minimum distance to housing of 250 m. Hence in general there would be at least 100 m. of excavations around the property (and up to 250 m in some locations) which would not accept waste for disposal.

V. ELEMENTS TO BE CONSIDERED FOR ENVIRONMENTALLY SOUND MANAGEMENT

60. Within a comprehensive waste management system, it should be possible to reduce to a minimum the problem potential by pre-treatment of the waste finally disposed of in a specially engineered landfill. In relation to using specially engineered landfill, it is important to consider affordable techniques that correspond to the needs and capacity of developing countries which are environmentally sound; assessment of the environmental soundness of affordable technologies should be a pre-requisite.

61. Once site selection, design of the landfill and the operative measures have been agreed upon, the fundamental question of deciding which wastes are acceptable for disposal in the hazardous waste landfill remains to be answered. Although site selection and design have taken due consideration of the types of wastes that would be disposed of at the site, rationale for determining acceptability needs to be carefully thought of.

62. Some useful data which may be helpful in establishing appropriate loading (input) rates can be found in the European Commission (EC) amended proposal for a Directive on the Landfill of Wastes COM (93) 275. In this there are figures based on the use of a leachate test to assess whether wastes are hazardous or non hazardous, the latter being disposable into a wider range of disposal sites. The analytical procedures proposed are based on IS0 or DIN tests; other methods are however considered more appropriate in many circumstances and this is recognized. Where hazardous (problem) wastes are to be jointly disposed of in a beneficially interactive mode with municipal waste, a different approach is allowed for, which is based on allowable inputs per ton of municipal waste subject to a number of qualifications. In addition, limit values given in respect of heavy metals and in some cases organic compounds in soil and sewage sludge in the EC Directive on the Use of Sewage Sludge in Agriculture (Directive 86/278/EEC) may also be found helpful.

63. On the basis of past experience the following substances should as far as possible be prevented from entering the water system:

- Organohalogen compounds and substances which may form such compounds in the aquatic environment;
- Organophosphorus compounds;
- Organotin compounds;

- Substances which possess carcinogenic, mutagenic or teratogenic properties in or via the aquatic environment;
- Mercury and its compounds;
- Cadmium and its compounds;
- Mineral oils and hydrocarbons;
- Cyanides.

64. It would be important to limit the deposit of a number of substances which represent a threat to human health and the environment and can cause serious pollution of all environmental media, such as:

- Metalloids metals and their compounds: Zinc, Copper, Tin, Barium, Nickel, Beryllium, Chrome, Boron, Lead, Uranium, Selenium, Vanadium, Arsenic, Cobalt, Antimony, Thallium, Molybdenum, Tellerium, Titanium, Silver, Biocides and their derivatives;
- Biocides and their derivatives;
- Substances which have a deleterious effect on the taste and or odour of groundwater, and compounds liable to cause the formation of such substances in such water and to render it unfit for human consumption;
- Inorganic compounds of phosphorus and elemental phosphorus;
- Fluorides;
- Ammonia and nitrates/nitrites

It should be noted that ammonia represents a particularly serious and growing threat in terms of water quality and pollution.

V. TECHNICAL COOPERATION

65. Even the countries with years of experience in the disposal of hazardous wastes in specially engineered landfill are faced with great difficulties in ensuring sound and efficient disposal of such wastes.

Co-operation among countries is seen as an essential element to aim at the environmentally sound management of landfills. Training and exchange/sharing of experience, and in particular providing technical and financial assistance to developing countries are considered as an important part of the immediate and more long term measures to take.

66. Chapter 20 of UNCED Agenda 21 recommends that States through bilateral and multilateral co-operation, including the United Nations and other relevant international organizations should:

a. Identify, develop and harmonize methodologies and environmental quality and health guidelines for safe waste discharge and disposal.

b. Review and keep abreast of developments and disseminate information on the effectiveness of techniques and approaches to safe waste disposal and ways of supporting their application in countries.

VI. CONCLUSION

67. It can be seen from the foregoing material that the setting up, operating and closing of any landfill requires a highly professional approach. This is even more the case for specially engineered landfills where up to 36 scientific and technological disciplines may need to be accessed in pursuit of an optimal environmentally sound overall operation.

68. The essential core disciplines are seen as geology, hydrogeology, civil and mechanical engineering, chemistry and biochemistry and because active deposits are by way of being macro reactors, chemical and biochemical engineering are also involved. It is this macro aspect which makes the application of an efficient unit operational process to landfill difficult and as a consequence of this is promoting an increasing degree of pre- and post-deposit treatment to render materials to be deposited, environmentally inert or to optimize the in situ stabilization process.

GLOSSARY

Aerobic Decomposition	Occurs in moist conditions in the presence of i.e. oxygen (produces strong leachate and no gas)
Anaerobic Decomposition	Occurs in moist conditions in the absence of i.e. oxygen (produces landfill gas and weak leachate)
Attenuation	Gradual reduction in concentrations of contaminants in leachate, due to physical, chemical and biological activities as it passes through soil and various subsoils
Biodegradable	Organic material which can be broken down chemically by biological action
Cap	A layer of clay or other material to prevent ingress of rainwater
Clay layer	A layer of clay applied to the base of walls of a site to prevent leachate or gas migration. Also applied to surface - see Cap
Cover material	Any inert material used to cover waste during landfill; usually applied towards the end of the working day
Containment site	One where the bottom and sides are or have been made impermeable to liquids using natural elements or synthetic liner
Groundwater	Water occurring naturally, below the surface
Hazardous wastes	Those wastes which are listed in Annex I to the Basel Convention and exhibit one or more of the hazardous characteristics specified in Annex III to the Convention.
Heavy metals	Usually refers to lead, zinc, cadmium, copper
Hydrogeology	The study of groundwater movement and chemistry, etc.
Lagooning	A technique for settling out fine solids by forming a settling pond with a long residence time, usually days or weeks
Landfill gas	Generated under anaerobic conditions and is a mixture of methane (CH4) and carbon dioxide (CO2) approximately 60:40 by volume
Leachate	Liquid drainage from a landfill site containing dissolved solids and products of decomposition of organic matter

Leachate recycling	Pumping of leachate from a collecting sump back over the surface of the waste and letting it run into the waste in order to accelerate decomposition both of the waste and organic compounds in the leachate
Municipal waste	Wastes collected by municipalities or by their order, including wastes from households (not household hazardous wastes) and similar wastes from commercial activities, office buildings, institutions and industry that dispose of waste at municipal facilities.
Stabilization	Achieved when all organics have decomposed

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ANNEXES

ANNEX I

A. SITING CHARACTERISTICS

B. LANDFILL SITE SELECTION CRITERIA

ANNEX II

ELEMENTS FOR CONTROL AND MONITORING PROCEDURES

ANNEX I A

SITING CHARACTERISTICS[3]

In selecting a site for the construction of a hazardous waste landfill, several geographical and hydrogeological factors of the location must be considered. These factors will have a significant bearing on the level of environmental protection provided by the landfill. Geographical and hydrogeological factors of a site also will influence the design of the landfill, including the type of liner system, drainage network, and groundwater monitors installed.

In addition, the degree of urbanization and its proximity to a landfill site should be considered. When an urban centre is near, extra effort must be taken to reduce any social disturbances the landfill may impose. Such disturbances include impacts on the landscape and sewage systems, noise levels, odour levels, and traffic patterns. Also, great care must be taken in developing an emergency preparedness plan in the event of a gas leak or other accident.

Hydrogeological Characteristics

All drinkable water supply points, and distances between these points, in the area surrounding a landfill should be identified. The landfill must be located far enough away from these sources so that in the event of an accident and contamination, there will be enough time to provide warning and alternative drinking water supplies to communities that rely on the water aquifer that could be contaminated.

The surface hydrology of an area also should be considered, so as to avoid areas prone to flooding or susceptible to erosion. At a minimum, 100 years of return time of frequency, is recommended for flooding.

In studying the hydrology of an area, seasonal variations in water table depth, and the table's maximum historical height, must be determined. The depth of a landfill bottom must be placed some meters above the maximum water table increase.

Geographical Characteristics

The most important geographical factor involved in choosing a landfill site is the stability of the area. The morphology of a location also must be carefully considered.

[3] Selection of siting characteristics prepared by ISWA Series 1991, Number 1 - Safe Hazardous Waste Management Systems A - State-of-the-Art Guide for Decision Makers ISWA Working Group on Hazardous Wastes.

Depending on geographical and morphological factors, three different types of landfills are generally constructed: superficial, depression and slope. In addition, underground structures located in lithologically stable areas are sometimes used for the disposal of highly toxic stable wastes.

ANNEX I B

LANDFILL SITE SELECTION CRITERIA

Engineering

Geophysical site (geographical criteria): Should be large enough to accommodate waste for life of production facility.

Proximity: Locate as close as possible to production or treatment facility to minimize handling and reduce transport cost. Locate away from water supply (suggested minimum 500 feet) and property line (suggested minimum 200 feet, more for landfill gas).

Access: Should be all-weather, have adequate width and loan capacity, with minimum traffic congestion; one way system on site whenever possible.

Topography: Should minimize earth-moving, take advantage of natural conditions. Avoid natural depression and valleys where water contamination is likely.

Geology: Avoid areas with earthquakes, slides, faults, underlying mines, sinkholes, and solution cavities.

Soils: Should have natural clay liner or clay available for liner, and final cover material available.

Environmental

Surface water: Locate outside 100-year floodplain. No direct contact with navigable water. Avoid wetlands.

Groundwater: No contact with groundwater. Base of fill must be above high groundwater table. Avoid sole-source aquifer. Avoid areas of groundwater recharge.

Air: Locate to minimize fugitive emissions and odour impacts.

Terrestrial and aquatic ecology: Avoid unique habitat area (important to propagation of rare and endangered species) and wetlands.

Noise: Minimize truck traffic and equipment operation noise.

Land use: Avoid populated areas and areas of conflicting land use such as parks and scenic areas.

Cultural resources: Avoid areas of unique archaeological, historical and paleontological interest.
Legal/regulatory: Consider national, regional and local requirements for permits.
Public/political: Gain local acceptance from elected officials and local interest groups.

Economic

Property acquisition: Actual land cost plus related costs.

Site development: Excavation, grading, liner, new roads, and other development costs.

Annual costs: Fuel costs, operating labour, maintenance, land preparation, utilities, and overhead.

Salvage value: Do not consider: site probably will not be an asset.

Conflicts with the objective of setting up and operating towards a stable system particularly in respect of organic matter and in some cases heavy metals (comment seen as relevant to mono deposit with ong term storage prospects).

ANNEX II
ELEMENTS FOR CONTROL AND MONITORING PROCEDURES

1 METEOROLOGICAL DATA

1.1 States should supply data on the collection method for meteorological data. The data shown in table 1 could be collected from monitoring at the specially engineered landfill or from the nearest meteorological station.

1.2 It is recognized that water balances are an effective tool for evaluating whether leachate is building up in the landfill body or whether the site is leaking.

		Operation phase	Aftercare phase
1.1	Volume of precipitation	Daily	Daily, added to monthly values
1.2	Temperature (min., max., 14.00h CET)	Daily	Monthly average
1.3	Direction and force of prevailing wind	Daily	Not required
1.4	Evaporation (lysimeter)[4]	Daily	Daily, added to monthly values
1.5	Atmospheric humidity (14.00h CET)	Daily	Monthly average

TABLE 1

2 EMISSION DATA: WATER, LEACHATE AND GAS CONTROL

2.1 Sampling of leachate and surface water if present must be collected at representative points. Sampling and measuring (volume and composition) of leachate must be performed separately at each point where leachate is discharged from the site.

2.2 Monitoring of surface water if present shall be carried out at not less than two points, one upstream from the landfill and one downstream.

2.3 Gas monitoring must be representative for each section of the specially engineered landfill.

2.4 Table 2 indicates the frequency of sampling and analysis.

[4] Or through suitable methods

		Operating phase	Aftercare phase (3)
2.1	Leachate volume	monthly (1)(3)	every 6 months
2.2	Leachate composition (2)	quarterly (3)	every 6 months
2.3	volume and composition of surface water (7)	quarterly (3)	every 6 months
2.4	Potential gas emissions and atmospheric pressure (4) (CH_4, CO_2, O_2, H_2S, H_2 etc.)	monthly (3)(5)	every 6 months(6)

(1) The frequency of sampling could be adapted on the basis of the morphology of the landfill waste (in tumulus, buried, etc.). This has to be specified in the permit.
(2) The parameters to be measured and the substances to be analyzed vary according to the composition of the waste deposited; they must be laid down in the permit document and reflect the leaching characteristics of the wastes.
(3) If the evaluation of data indicates that longer intervals are equally effective, they may be adapted. For leachates, conductivity must always be measured at least once a year.
(4) The measurements are relevant mainly to landfills receiving large quantities (>25% w/w) of organic waste.
(5) CH_4, CO_2, O_2 regularly, other gases as required, according to the composition of the waste deposited, with a view to reflecting its leaching properties.
(6) Efficiency of the gas extraction system must be checked regularly.
(7) On the basis of the characteristics of the landfill site, the competent authority may determine that these measurements are not required.

2.1 and 2.2 apply only where leachate collection takes place.

TABLE 2

2.5 For leachate and water a sample, representative of the average composition, shall be taken for monitoring.

3. PROTECTION OF GROUNDWATER

A. Sampling

3.1 The measurements must be such as to provide information on groundwater likely to be collected by the discharging of waste, with at least one measuring point in the groundwater inflow region and two in the outflow region. This number can be increased on the basis of specific hydrogeological survey and the need for an early identification of accidental leachate in the groundwater.

3.2 Sampling must be carried out in at least three locations before the filling operations in order to establish reference values for future sampling.

B. Monitoring

3.3 The parameters to be analyzed in the samples taken must be derived from the expected composition of the leachate and the groundwater quality in the area. In selecting the parameters for analysis account should be taken of mobility in the groundwater zone. Parameters could include indicator parameters in order to ensure an early recognition of change in water quality.[5] Table 3 provides information on the selection of parameters.

	Operation phase	Aftercare phase
Level of groundwater	Every 6 months (1)	Every 6 months (1)
Groundwater composition	Site-specific frequency (2)(3)	Site-specific frequency (2)(3)

(1) If there are fluctuating groundwater levels, the frequency must be increased.
(2) The frequency must be based on possibility for remedial actions between two samplings if a trigger level is reached, i.e. the frequency must be determined on the basis of knowledge and the evaluation of the velocity of groundwater flow.
(3) When a trigger level is reached (see C), verification is necessary by repeating the sampling. When the level has been confirmed, a contingency plan (laid down in the permit) must be followed.

TABLE 3

C. Trigger levels

3.4 Significant adverse environmental effects should be considered to have occurred in the case of groundwater, when an analysis of a groundwater sample shows a significant change in water quality. A trigger level must be determined taking account of the specific hydrogeological formations in the location of the landfill and the groundwater quality. The trigger level must be laid down in the permit whenever possible.

3.5 The observations must be evaluated by means of control charts with established control rules and levels for each downgradient well. The control levels must be determined from local variations in groundwater quality.

[5] Recommended parameters: pH, TOC, phenols, heavy metals, fluoride, As, oil/hydrocarbons.

4 TOPOGRAPHY OF THE SITE

4.1 Data on the specially engineered landfill body should be collected as indicated in Table 4

		Operating phase	After-care phase
4.1	Structure and composition of landfill body (1)	yearly	
4.2	Settling behavior of the level of the landfill body	yearly	yearly reading

(1) Data for the status plan of the concerned landfill: surface occupied by waste, volume and composition of waste, methods of depositing, time and duration of depositing, calculation of the remaining capacity still available at the landfill.

TABLE 4

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal was adopted in 1989 and entered into force in 1992. Presently, there are more than 150 Parties to the Basel Convention. Its objective is to protect human health and the environment from the adverse effects caused by the generation, management and transboundary movements of hazardous wastes.

The fundamental aims of the Basel Convention are the reduction of the transboundary movements of hazardous wastes, the prevention and minimization of their generation, the environmentally sound management of such wastes and the active promotion of the transfer and use of cleaner technologies.

In December 1999, the Parties to the Basel Convention adopted the Basel Protocol on Liability and Compensation for Damage resulting from the Transboundary Movements of Hazardous Wastes and Their Disposal.

www.basel.int

Secretariat of the Basel Convention
International Environment House
15 chemin des Anémones,
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XIV. The Commissioner may hand over such PPL to any agency to transparent bidding procedures for its operations and maintenance upon such terms and conditions as deem fit and proper. However in any condition such PPL shall not be allotted to concerned land owners/ housing society/ association of apartment owners of occupiers in the plot of PPL.

XV. No public parking lots shall generally be more than 500 vehicles. However in exceptional cases Commissioner may permit PPL for 1000 vehicles for the reasons to be recorded in writing.

XVI. PPL connectivity to nearest station of Local/ Mono/ Metro/ BRTS etc. may also be insisted if propose PPL is within 250 m. by skywalk and underground connectivity within 100 m. These area shall also be counted for giving incentive FSI and shall not be included for calculating limits of vehicles.

XVII. For every sectors Commissioner shall endeavour to evaluate total need of PPL and shall cause it to be declared in local newspaper within three months of promulgation of these regulation for every 5 years. Total PPL sanctioned in any sector shall not increase beyond that for next 5 years. PPL shall be allowed only after studying traffic impact analysis of area with the periphery of 250 m. of PPL.

10.2.4 Development around Hazardous Industries (Chemical Zone Areas).

a) Green Belt -

i) There shall be green belt of 100 m. around the boundary of the Hazardous Chemical Industries as shown on plan attached with the report of authority.

ii) The creation of the green belt, its development and maintenance as per report of authority will be the responsibility of Municipal Corporation.

iii) The cost of acquisition of land for the green belt, around the Hazardous Chemical Industries will be borne by the Industry / Industry Association. The private land owner will be given Transfer of Development Rights based on FSI for the present land usage. The cost of acquisition to be borne by industry will be exclusive of the value of TDR.

iv) The existing authorised structures should be tolerated. However, only repairs to such existing structures should be allowed in future and no reconstruction or new construction should be allowed in the Green Belt.

v) Unauthorised structures should be removed or relocated by the Thane Municipal Corporation as per the existing Public Policy.

b) Creation of Low Density Zone

i) Beyond the Green Belt, another belt of 150 m. should be created as "Low Density Zone" as shown on plan, attached with the report of the Authority.

ii) The FSI in the Low Density Zone shall be 0.5 and only Ground plus two storey structures should be allowed.

iii) The existing buildings if already authorised with the higher FSI and plan of the proposed building already approved by the Thane Municipal Corporation and Commencement Certificate have been given to such structure should be allowed to continue, be completed and occupied by the issuing Occupation Certificate. Where the plans have been approved by the Thane Municipal Corporation but commencement certificates have not been issued, they should be reviewed and the permission should be revised in accordance with the Low Density Zone Regulation, now be prescribed.

iv) The development proposals in Low Density Zone shall be scrutinised and permission shall be granted as per these UDCPR.

c) Development between 250 and 1000 Meters.

The Development proposals beyond the area of 250 m. shall be scrutinised and permissions shall be granted as per these UDCPR.

d) Other Stipulations -

i) The original land under Chemical Industry, which has been certified by the Director of Industries/ Director of Industrial Safety and Health/ Competent Authority as permanently closed or having shifted elsewhere shall be allowed to be developed as per the relevant provisions in the prevailing Development Control Regulations.

Upon certification by the Director of Industries/ Director of Industrial Safety and Health/ Competent Authority that the Chemical Industry has been permanently closed or has shifted elsewhere, the 100 m. Green belt and the further 150 m. low density belt around the plot boundary of such Chemical Industry shall suo-moto cease to exist.

10.2.5 Development around Air Force Stations.

i) As per Government of India, MoD SRO No. 4, dated 13 January, 2010 which was published in Part-II Section 4 of Gazette Notification dated 23 January, 2010. Air Force Station Thane falls within the 100 m. restriction zone. As per notification, no construction should be permitted within the restricted zone of 100 m. from the outer parapet of the Air Force boundary. Similarly, live hedges, tree/rows or clumps of trees or orchards shall not be maintained, planted, added to or altered within the 100 m. restricted zone. The restriction is equally applicable for construction of underground structure, wherein no digging and/ or change in the level of ground is permitted within the notified zone.

ii) Beyond the notified zone of 100 m., no restriction is required to be imposed as per the Works of Defence Act 1903 and no NOC from Air Force Station, Thane is necessary. [1] (--)

[2] ***10.2.6 Development around Defence Establishment.***

Following restrictions are imposed in and around the land in the vicinity of the said unit as per the plan enclosed with Notification No.TPS-1203/1254/C.R.193/05/UD-12, Dt.30/12/2006.

Village : Kolshet/Kavesar/Waghbil (within the limit of Thane Corporation)

Circle / Taluka : Thane, District : Thane, State: Maharashtra

Height Restrictions:-

(a) The height restrictions to any of the future constructions on North, North-West, West and South-West sides will be as follows:-

Sr. No.	*Height Limiting zones from unit boundary (Zones indicated by colours)*	*Permissible height in meters*	*Remarks.*
A	*Red*	*Nil*	*Unit Area*
B	*Brown*	*Nil*	*Buffer Zone (No Dev.Zone)*
C	*Orange*	*18*	*--*

[1] No. (iii) & (iv) deleted vide Govt. Corrigendum No. CR 236/18, dt. 9th Dec. 2020.

[2] Substitued vide Corrigendum / Addendum No. CR 121/21, dt. 02nd December, 2021.

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NGT: Appeal 40/2022 "Taloja Manufacturers Association Vs UoI & Ors ": R5: Circulation of the Affidavit in Reply

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SIR,
The matter is listed as Friday 17/03/2023
This is an email with Affidavit being uploaded to NGT website, copy for advance circulation.

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