DRAFT ENVIRONMENT IMPACT ASSESSMENT FOR SOLID WASTE MANAGEMENT & DISPOSAL FACILITY NAGAR NIGAM KOTDWAR DIST- PAURI GARHWAL, UTTARAKHAND

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SUBMITTED BY Nagar Nigam Kotdwar

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BASELINE MONITORING PERIOD: March 2022- May 2022

ENVIRONMENTAL CONSULTANT



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2022

DRAFT ENVIRONMENT IMPACT ASSESSMENT FOR SOLID WASTE MANAGEMENT & DISPOSAL FACILITY NAGAR NIGAM KOTDWAR AT KOTDWAR, DISTRICT- PAURI GARHWAL UTTARAKHAND

Project Proponent:

Nagar Nigam Kotdwar

For and on behalf of	:	Ind Tech House Consult
Approved by	:	Suman Banerjee
Signed	:	Juna Banger
Position	:	Managing Partner
Date	:	03 rd February 2023

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DECLARATION BY EXPERTS

Declaration by Experts Contributing to the DRAFT Environment Clearance for Solid Waste Management & Disposal Facility, Nagar Nigam Kotdwar ,District- PauriGarhwal ,Uttarakhand. I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above Report.

EIA coordinator: Ms. SupritiGuha

5.8

Signature and Date: Period of Involvement: February2022 to till date Contact Information: Functional Area Experts:

S. NO.	Functional areas	Name of the expert/s	Involvement(period and tasks)	Signature and date
1	АР	Mr. Suman Banerjee (FAE) Mr. Indra Kumar Sharma (TM)	February 2022 to till date Study about Air pollution source, impacts, mitigation measures and management	umar Banque
2	WP	Mr. Suman Banerjee (FAE) Mr. Indra Kumar Sharma (TM)	February 2022 to till date Study about Water Pollution source, usage, impacts, mitigation measures, management, Water quality, water conservation	uman Banger
3	SHW	Mr. Soumya Dwivedi (FAE)	February 2022 to till date Study about classification of solid waste, treatment method, disposal technics etc.	2
4	SE	Dr. DebashishBhttach arya (FAE)	February 2022 to till date Study about Socio-economic survey, demographic of study area etc.	Debasish Mathedays
5	EB	Dr. Bideh Shukla (FAE)	February 2022 to till date Study about ecologically sensitive area of study area, existing flora/fauna, national park & wildlife sanctuaries etc.	Biddle
6	AQ	Suman Chattaraj (FAE)	February 2022 to till date Study of Impact Assessment of AQ. Air Quality modelling and Collection and assessment of Baseline Data from primary and secondary sources.	Reiding

NAGAR NIGAM KOTDWAR

DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND

2022

7	SC	Dr. Bideh Shukla (FAE)	February 2022 to till date Study about soil characteristics, conservation measures, impacts on land	Biddle
			and mitigation measures etc	

8	AQ	SumanChattaraj (FAE)	February 2022 to till date Study of Impact Assessment of AQ. Air Quality modelling and Collection and assessment of Baseline Data from primary and secondary sources.	Reiding
9	SC	Dr. Bideh Shukla (FAE)	February 2022 to till date Study about soil characteristics, conservation measures, impacts on land and mitigation measures etc	Biddle
10	NV	SumanChattaraj (FAE)	February 2022 to till date Study about ambient noise quality, source, impacts, mitigation measures, traffic survey etc.	Barding
11	LU	Mr. Manish Shukla (FAE	February 2022 to till date Study about existing land use of the study area as per Master Plan, study of drainage pattern, topography of the area, etc	Minish Pr-Pholo

Declaration:

I, SupritiGuha, hereby confirm that the above mentioned experts prepared the report of Environment Clearance of Solid Waste Management & Disposal Facility, Nagar Nigam Kotdwar, District- PauriGarhwal, Uttarakhand. I also confirm that the consultant organization shall be fully accountable for any mis-leading information mentioned in this statement.

Name:Ms. SupritiGuha

9-

Designation: **EIA Coordinator** Name of the EIA consultant organization: **M/s Ind Tech House Consult**

NABET Certificate No. & Issue Date: NABET/EIA/2023/SA 0174/Rev.01 VALID TILL 29.04.2023

NABET CERTIFICATE

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2	Offshore and onshore oil and gas exploration, development & production	2	1 (b)	Α
3	River Valley projects	3	1 (c)	Α
4	Thermal power plant	4	1 (d)	Α
5	Coal washeries	6	2 (a)	Α
6	Metallurgical industries (ferrous & n <mark>on-fe</mark> rrous)	8	3 (a)	Α
7	Cement plants	9	3 (b)	Α
8	Synthetic organic chemicals industry	21	5 (f)	A
9	Oil & gas transportation pipeline	27	6 (a)	Α
10	Isolated storage & handling of Hazardous chemicals	28	-	В
11	Industrial estates/ parks/ complexes/areas, export processing Zones(EPZs), Special Economic Zones(SEZc), Piotoch Parks, Lotther Complexes	31	7 (c)	Α
12	Common bazardous waste troatmont, storage and disposal facilities (TSDEc)	22	7 (d)	٨
12	Bio-medical waste treatment facilities	32	7 (d)	B
1/	Ports barbours break waters and dredging	32	7 (da)	Δ
15	Aerial roneways	35	7 (c)	B
16	Common Municinal Solid Waste Management Facility (CMSWME)	37	7 (i)	B
17	Building and construction projects	38	8 (a)	B
18	Townships and Area development projects	39	8 (b)	B
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TERMS OF REFERERENCE

F. No. 21-35/2022-IA-III

Government of India Ministry of Environment, Forest and Climate Change (IA.III Section)

Indira Paryavaran Bhawan, Jor Bagh Road, Aliganj New Delhi –110 003 Dated: 10th October, 2022

To

M/s Nagar Palika Parishad, Kotdwara Badrinath Marg, Kotdwar Uttarakhand-246 149 Email: <u>eiakotdwar@gmail.com</u>

Sub.: Solid Waste Management and Disposal Facility at Kotdwar, District Pauri Garhwal, Uttarakhand by Nagar Palika Parishad, Kotdwara – Terms of Reference regarding.

Sir,

This has reference to above mentioned proposal No. IA/UK/MIS/260357/2022; received on 7th March, 2022 online through PARIVESH Portal for seeking Terms of Reference (ToR) for above cited project activity as per provisions under EIA Notification, 2006 as amended under Environment (Protection) Act, 1986.

2. The project/activity is covered under category 'B' of item 7(i) 'Common Municipal Solid Waste Management Facility (CMSWMF)' of the Schedule to the EIA Notification, 2006 and its subsequent amendments, and requires appraisal at State level. However, General Condition is applicable due to the presence of Uttar Pradesh – Uttarakhand state border at a distance of 7m approx. from proposed site. Accordingly, the project comes under category 'A' and requires appraisal at Central level by Sectoral EAC.

3. Accordingly, the proposal for grant of Terms of Reference (ToR) for Solid Waste Management and Disposal Facility at Kotdwar, District Pauri Garhwal, Uttarakhand by Nagar Palika Parishad, Kotdwara, has been examined by the Expert Appraisal Committee (Infra-2) in its 84th meeting of held during 16-17th March, 2022, 91st meeting held on 30th June, 2022, 92nd meeting held on 4th July, 2022 and 94th meeting held on 8th September, 2022.

4. The details of the project, as per the documents submitted by the project proponent, and also as informed during the aforesaid meeting of EAC, are provided below for reference:

- i. The project is located at Kanchan Puri, Haldukhatta, Malankham, Kotdwar, Uttarakhand.
- ii. The project is new.

- iii. In line with Swachh Bharat Mission Urban, Nagar Nigam Kotdwar under guidance of Urban Development Directorate, Uttarakhand has planned to improve the existing solid waste collection system and develop common solid waste management and disposal facility at Kotdwar. Kotdwar is a city, a municipal corporation and a tehsil in the Pauri Garhwal district of Uttarakhand, India. It is just 101 km from Pauri town, the district headquarters and is the eighth largest city in Uttarakhand.
- iv. A Detailed Project Report has been prepared and as per DPR, Nagar Nigam Kotdwar will manage approx. 80 TPD wastes including recyclable wastes [for a design period of 20 years]. It is also planned to set up decentralized segregation facilities. The proposed facility will have the following components:
 - a. Compost plant of capacity 43 TPD for processing bio-degradable waste [design period 20 years].
 - b. Sanitary landfill facility [11,800 MT capacity as of now due to unavailability of land planned for a period of 5 years] for inert materials and rejects.
 - c. Liquid effluent i.e. leachate shall be treated in onsite leachate treatment unit.
- v. Two alternative sites examined. The selected proposed site has been transferred from Forest Dept. and duly approved by the Govt. of Uttarakhand and MoEF&CC, Dehradun RO. At present, both the site is vacant under ownership of Nagar Nigam Kotdwar. Approval for diversion of forest land for the waste processing site has been obtained. The site is allocated for waste processing and landfill facility. At present, the land is devoid of any building/structure and covered with natural vegetation, bushes and shrubs. Existing vegetation needs to be cleared. Existing trees will be retained to the possible extent. The site selection criteria is given as follows:

Location Criteria	Site at Kanchanpuri, Haldukhatta Malankham, Kotdwar 29°45'23.79"N / 78°26'14.14"E
Land Availability and accessibility	At present land area of 0.998 ha is transferred by Forest Department. Site is flat and easily accessible from Haridwar Road through existing kuchha road [approx. 20 feet wide].
Lake or Pond: No landfill should be constructed within 200 m of any lake or pond. Because of concerns regarding runoff of waste water contact, a surface water monitoring program should be established if a landfill is sited less than 200 m from a lake or pond	No lake or pond within 200 m radius of the site.
River: No landfill should be constructed within 100 m of a	No river within 100 m radius. Malin river flows at a distance of 480m on

navigable river or stream. The	East.
distance may be reduced in some	
instances for non-meandering rivers	
but a minimum of 30 m should be	
maintained in all cases	
Flood Plain: No landfill should be	The project site is not located in any
constructed within a 100 year flood	flood plain
plain A landfill may be built within	nood plant.
the flood ploine of accordomy streams	
if an ambandment is built along the	
if an embankment is built along the	
stream side to avoid flooding of the	
area. However, landnils must not be	
built within the flood plains of major	
rivers unless properly designed	
protection embankments are	
constructed around the landfills	
Highway: No landfill should be	No national or state highway within
constructed within 200 m of the right	200 m of the site. NH-119 passes at a
of way of any state or national	distance 8.1 km on SE.
highway. This restriction is mainly for	
aesthetic reasons. A landfill may be	
built within the restricted distance,	
but no closure than 50 m, if trees and	
berms are used to screen the landfill	
site	
Habitation: A landfill site should be	Nearby habitation is located at a
at least 500 m from a notified	distance of 150 m on north east of
habitation area. A zone of 500 m	proposed site.
around a landfill boundary should be	
declared a No-Development Buffer	
Zone after the landfill location is	
finalized	
Public Parks: No landfill should be	No public park within 300 m.
constructed within 300 m of a public	
park. A landfill may be constructed	
within the restricted distance if some	
kind of screening is used with a fence	
around the landfill and a secured	
gate.	
Critical Habitat Area: No landfill	Not a critical habitat area.
should be constructed within critical	
habitat areas. A critical habitat area is	
defined as the area in which one or	
more endangered species live It is	
sometimes difficult to define a critical	
habitat area. If there is any doubt	
then the regulatory accord abould be	
contacted	
Wetland: No landfill should be	Not a watland
constructed within wetlands. It is	not a welland.
often difficult to define a wetland area	
Mona mou he available for	
maps may be available for some	
wenands, but in many cases such	
maps are absent or are incorrect. If	
there is any doubt, then the	

regulatory agency should be contacted.	
Ground Water Table: A landfill should not be constructed in areas where water table is less than 2 m below ground surface. Special design measures be adopted, if this cannot be adhered to.	Ground water table is approx. 5-10 m below ground level in post-monsoon period.
Airports: No landfill should be constructed within the limits prescribed by regulatory agencies (MoEF/CPCB/Aviation Authorities) from time to time.	Jolly Grant International Airport, Dehradun is located at around 53 Km on NW.
Water Supply Well: No landfill should be constructed within 500 m of any water supply well. It is strongly suggested that this locational restriction be abided by at least for down gradient wells. Permission from regulatory agency may be needed if a landfill is to be sited within the restricted area.	No centralized water supply well exists around the project site.
Coastal Regulation Zone: A landfill should not be sited in a coastal regulation zone.	Site not located in a coastal regulation zone.
Unstable Zone: A landfill should not be located in potentially unstable zones such as landslide prone areas, fault zone etc.	The area is not a potentially unstable zone.

- vi. The site can be approached from Haridwar Road through existing kuchha road [approx. 20 feet wide]. The kuchha road of approx. length 250 m will be strengthened by the Nagar Nigam.
- vii. Total Water requirement is 11 KLD fresh water through onsite groundwater abstraction (not for drinking purpose). Leachate collected will also be reused in maintain the moisture content of windrow composting. Necessary permission from the CGWA will be obtained if applicable.
- viii. Power demand for the project will be sourced from local electricity distribution authority. D.G. Set of 150 KVA will be provided at site as back up during power failure.
 - ix. No court case is pending against the project.
 - x. CRZ Clearance is not required.
 - xi. Forest Clearance is required.
- xii. NBWL Clearance is not required.
- xiii. Investment/Cost of the project is ₹15.216 Crores.
- xiv. Employment potential: 25 persons.

xv. Benefits of the project: Social Benefit – Proper management of waste as compared to current crude dumping – improved environment and aesthetics. Mandatory provision in MSW Rules 2000, necessitates proper treatment and disposal facilities for MSW. Supports recycle & reuse of waste. The waste will be collected at one place, improving aesthetic of the area. Odours due to scattered decomposed waste, will be minimized. Substantial reduction in the overall waste quantities requiring final disposal. Scientific disposal of rejects/Inerts in the proposed SLF to reduce Greenhouse gases emission. Financial Benefits - As suggested by the DPR consultant, the ULB can arrange the O&M cost by levying user charges on households and commercial establishments as the system improves. Also, revenue will be generated from sale of compost, recyclable materials etc.

5. The EAC deliberated upon the information provided by the project proponent. After detailed deliberation, EAC in its 84th meeting expressed concern on the conversion of forest land for use as a waste management/landfill site. The committee observed that the land area identified for landfill would be inadequate to meet the long term requirements (only 5 years design period has been considered). It was also noted that the PP has incorrectly submitted that 'no forest land is involved' in online Form 1 on PARIVESH Portal. Therefore, based on the information submitted and clarifications provided by the Project Proponent and detailed discussions held on all the issues, the EAC decided to defer the proposal and was of the opinion to conduct a site visit before further consideration.

6. Accordingly, the ministry approved the site inspection by Subcommittee of EAC and site inspection was carried out on 18.06.2022. The site inspection report by the sub-committee was deliberated by EAC in its 91^{st} meeting held on 30^{th} June, 2022, 92^{nd} meeting held on 4^{th} July, 2022 and 94^{th} meeting held on 8^{th} September, 2022.

7. Based on the observation during the site inspection and considering the environmental issues that may emerge from the continued use of the existing dump site and the fact that the hilly terrain with limited revenue land available, although the proposed site does not meet all the requirements of MSW site criteria, the sub-committee recommends the use of the 'proposed site' as an interim measure to process MSW scientifically with the following stipulations:

- a. The authorities shall use the proposed site as a MSW processing site and landfill site as per MSW rules by adopting all safety measures.
- b. No dry waste/recyclable waste shall be mixed in the waste.
- c. The authorities shall identify and establish a scientifically managed processing and landfill facility on non-forestry land with a life expectancy of 25 years within the next 1-2 years and develop the new site within 5 years. The proposed site at the 'end of life', shall be

properly capped as per rules, establish green cover, and return the land to the forest department.

d. This recommendation shall not be a precedent for approvals of other MSW facility.

8. Based on the detailed deliberations, the EAC in its 92nd meeting concurred with the findings of sub-committee and the same was the reiterated by EAC in its 94th meeting and recommended the proposal for the grant of standard ToR along with additional specific conditions stipulated in para 7 above and also mentioned below.

- i. Procedure/process of bio-mining for legacy waste and detailed Conceptual Reclamations Plan shall be explicitly mentioned in the EIA/EMP report.
- ii. A sensitivity analysis of the site shall be carried out as per the MoEF&CC criteria and form part of the EIA report.
- iii. The EIA would include a separate chapter on the conformity of the proposals to the Municipal Solid Waste Management Rules, 2016 and the Construction & Demolition Waste Management Rules, 2016 including the sitting criteria therein.
- iv. Characteristics and source of waste to be handled and methodology for remediating the project site, which is presently being used for open dumping of garbage.
- v. Details of storage and disposal of pre-processing and post-processing rejects/inerts.
- vi. List of proposed end receivers for the rejects/inerts should be provided. MoUs to be submitted in this regard.
- vii. Details of various waste management units with capacities for the proposed project. Details of utilities indicating size and capacity to be provided.
- viii. The EIA would also examine the impacts of the existing landfill site and include a chapter on the closure of the exiting site including disposal of accumulated wastes and capping.
- ix. The project proponents should consult the Municipal solid waste Management manual of the Ministry of Urban Development, Government of India and draw up project plans accordingly.
- x. Waste management facilities should maintain safe distance from the nearby water bodies.
- xi. Layout maps of proposed solid waste management facilities indicating storage area, plant area, greenbelt area, utilities etc.
- xii. Details of air emission, effluents generation, solid waste generation and their management.

- xiii. Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).
- xiv. Process description along with major equipment's and machineries, process flow sheet (quantitative) from waste material to disposal to be provided.
- xv. Hazard identification and details of proposed safety systems.
- xvi. 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.
- xvii. Details of effluent treatment and recycling process.
- xviii. Action plan for measures to be taken for excessive leachate generation during monsoon period.
- xix. Detailed Environmental Monitoring Plan.
- xx. Timeline for implementation of the project shall be included in the EIA Report.
- xxi. Report on health and hygiene to be maintained by the sanitation workers at the work place.
- xxii. A tabular chart with index for point wise compliance of above ToRs.

9. As per the recommendations of the EAC, the Ministry of Environment, Forest and Climate Change hereby accords Terms of Reference for preparation of the Environment Impact Assessment (EIA) Report and Environment Management Plan (EMP) for proposed Solid Waste Management and Disposal Facility at Kotdwar, District Pauri Garhwal, Uttarakhand by Nagar Palika Parishad, Kotdwara, with the above mentioned specific ToR in addition to Standard ToR provided in Annexure.

General Guidelines

- i. The EIA document shall be printed on both sides, as far 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's 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. Issues and commitments made by the project proponent on the same should be included in EIA/EMP Report in the form of tabular chart with financial budget for complying with the commitments made.
- viii. 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.
 - ix. Grant of ToR does not mean grant of EC.
 - x. 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.
 - xi. 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 04.08.2009).
- xii. 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 04.08.2009). The project leader of the EIA study shall also be mentioned.
- xiii. All the ToR points as presented before the Expert Appraisal Committee (EAC) shall be covered.

10. The above ToR should be considered for preparation of EIA/EMP report for proposed Solid Waste Management and Disposal Facility at Kotdwar, District Pauri Garhwal, Uttarakhand by Nagar Palika Parishad, Kotdwara, 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.

11. As stipulated in amendment notification No. S.O. 751(E) dated 17th February, 2020, the above ToR would be valid for a period of four years from the date of issue. The project proponent shall submit detailed final EIA Report and EMP prepared as per above ToR within the stipulated period of four years as per Ministry's OM issued vide F. No. IA3-22/10/2022-IA.III [E 177258] dated 08.06.2022.

12. As per amendment notification No. 648(E) dated 3rd March, 2016, the Environmental consultant organizations which are accredited for a particular sector and the category of project for that sector with the Quality Council of India (QCI) or National Accreditation Board for Education and Training (NABET) or any other agency as may be notified by the Ministry of Environment, Forest and Climate Change from time to time shall be allowed to prepare the EIA Report and EMP of a project and appear before the concerned EAC. The consultants involved in preparation of EIA Report would need to include a certificate in this regard in the EIA report and EMP prepared by them and details for data provided by other Organization(s)/Laboratories including their status of approvals etc.

13. This issues with the approval of the competent authority.

(Dr. Ashish Kumar) Additional Director & Member Secretary, EAC (Infra-2)

Copy to:

- 1. The Principal Secretary, Uttarakhand Forest Department, No. 85, Rajpur Road, Dehradun, Uttarakhand, India.
- 2. The Regional Officer, Integrated Regional Office, Ministry of Environment, Forest and Climate Change, 25, Subhash Road Dehradun -248001.
- 3. The Chairman, Central Pollution Control Board Parivesh Bhavan, CBDcum-Office Complex, East Arjun Nagar, New Delhi - 110 032.
- 4. The Member Secretary, Uttarakhand Pollution Control Board, Gaura Devi Bhawan, 46 B IT Park Sahastradhara, Dehradun, Uttarakhand.
- 5. Monitoring Cell, MoEF&CC, Indira Paryavaran Bhavan, New Delhi.
- 6. Guard File/ Record File/ Notice Board/MoEF&CC website.

COMPLIANCESWITHTERMSOFREFERENCE

SN	TERMSOFREFERENCE	COMPLIANCE
	STANDARD TERMS OF REFERENCE	
1	The project should bedesigned based on the project should bedesigned based on MasterPlan.	TheprojecthasbeendesignedbasedonPopulation projections of Kotdwar Nagar Palika Parishad. Given in Sub-section 2.5 of Chapter-2 of the EIA report.
2	Submit a 10 km. radius map(on survey of India Toposheet) showing co- ordinates of project site, national highway, state highway ,district road/approach road, river, canal, natural drainage; protected areas, under Wild Life (Protection) Act, archaeological site ,natural lake, flood area, human settlements (with population), industries, high tension electric line, prominent wind direction(summer and winter), effluent drain, if any and ponds etc. should be presented and impacts assessed on the same assessed on the same.	Figure 2.3 in Chapter 2 in the report presents the latest topographical map from Survey of India (Sol) covering 10 km radius from the project location showing co- ordinates of project site, national highway, state highway, district road/approach road, river, canal, natural drainage etc. and Figure2.3 (E) shows site coordinate. Table 2.3 (A) presents all the significant site features such as distance from nearest town/Railway station/airport etc. No negative impacts have been envisaged due to the proposed MSW project activity
3	Examine and submit details of alternative technologies viz. RDF shall also be evolved.	Various alternatives have been evaluated based on waste characteristics (physico-chemical), waste quantity, local environmental factors etc. The scheme for the Integrated MSW processing and disposal facility has been finalized based on Detailed Project Report. The segregated solid waste (Dry & Wet) will be collected from door to door in designated bins and will be transported at proposed MSW treatment facility for further segregation, processing & disposal. The received solid waste at site will be further segregated and processed to produce compost and rejects will be sold to recycler & reuse vendors and left out inerts will be finally disposed in propose landfills. Sub-section 2.6 of Chapter-2 of the EIA report.
4	Examineandsubmitdetails of stormwater/ leachatecollection fromthecompostarea	Separate drainage systems are proposed for storm waterand for sewage to avoid run off contamination as well asanycontaminationofsurfacewatersources. Properstormwaterdrainageandgarlandcanalwillbeconstr uctedfittedwithscreenssothatthepotentiallycontaminate d runoff water traversing the facility does not getmixedwiththe rainwater. Leachatedrainandleachatecollectiontankareproposedto collect the leachate generated in compost & landfill areafor recycling and treatment. In order to collect the

(ToR vide letter no.F. No 21-35/IA-III dated10th October 2022)

SN	TERMSOFREFERENCE	COMPLIANCE
		leachatefrom the waste body a drainage layer of 30 cm granularmaterial of permeability > 1 x10-2 cm/sec is provided overtheHDPE liner. ProposedlayoutinFigure 2.3(H)of Ch 2showingsurfacewaterdrainsandleachatecollectionsyste m. Given in Sub-section 2.6 of Chapter-2 of the EIA report.
5	Examineand submit details ofmonitoringofwaterqualityaroundthelan dfillsite.Wateranalysisshallalsoincludeforn itrateandphosphate.	Waterssampleswerecollectedfrom 3 representativelocations for ground water & 3 locations for surface waterfromstudyareaaroundtheproposedsitewithin10km radius. All samples were analyzed for physical and chemicalcharacteristics includingnitratesand phosphates. The samples of Ground & surface water were collected fromthe study area of 10 km around the project site to assess thewater quality during the study period of March 2022 to May 2022 Nitrates&phosphatesingroundwatersampleswereanalys edandfound: Detailsofwater(ground&surface)samplinglocationandan alysisresults Sub-section 3.4 of Chapter-3 of the EIA report.
6	Examineandsubmitdetailsoftheodourcont rolmeasures.	Given in Sub-section 4.3.4 of Chapter-4 of the EIA report.
7	Examineandsubmitdetailsofimpacton water bodies/rivers/ponds andmitigativemeasuresduring rainyseason	Separate drainage systems are proposed for storm water toavoidrunoffcontaminationaswellasanycontamination of surface water sources.Hence, Nonegativeimpactsonwaterbodies/rivers/pondshavebee nanticipated. Given in Sub-section 10.3 of Chapter-10 of the EIA report
8	Submit the criteria for assessingwaste generation. Anysegregationofhazardousandbio- medicalwastes.	Hazardouswaste and bio-medical wastesare not expected tobeapartofMSWstream.
9	Submit a copy of the layout planofprojectsiteshowingsolidwaste storage, green belt (width&length,33%oftheprojectarea), all roads, prominent winddirection, processing plant & buildingsetcshouldbeprovided.	ProposedplantLayoutin Chapter 2, Figure2.3 (H) showingsurfacewaterdrainsandleachatecollectionsyste m. Given in Sub-section 2.6 of Chapter-2 of the EIA report.

SN	TERMSOFREFERENCE	COMPLIANCE			
10	Submitacopyofthelandusecertificatefromt hecompetentauthority.	At present both the site is vacant under ownership of Nagar Nigam Kotdwar. Approval for diversion of forest			
		The site is allocated for waste processing and landfill facility.			
		Given in Annexure-I of the EIA report.			
11	NOC from local or nearest air port within 20 k mand any flight funnel restrictions.	There is no airport within 20 km from the project site. Nearest Jolly Grant International Airport, Dehradun is located at around 53 km on NW.			
12	Submit a copy of the status of ambient air quality and surface, groundwater quality, soil type, cropping pattern, land use pattern, pop ulation, socio- economicstatus, anticipated air and water pollution.	Thestatusofambientairquality,surfaceandgroundwaterq uality,soiltype,noiselevels,croppingpattern,landusepatte rn, socio-economiccondition around theproject of10Kmstudy area were studied which are detailed in chapter no.3Anticipated impacts on ambient air quality, water quality, land,noiselevelswereassessedandmitigationmeasuresar ewell furnishedinchapterno.4.			
13	Submitacopyofthetopography of the areaindicatingwhetherthesiterequiresanyf illing, ifso, the details of filling, quantity of fillmaterial required, its source and transportation, etc.	Figure 2.3 (A) (Chapter 2) presents the topographical map of theproposedsite. Excavatedsoils(cutvolumes)shallbereusedforleveling thelowlyingareastoavoidtransportoffillmaterial. Contour Map of the Study area is given in Sub-section 3.7 of Chapter-3.			
14	Examine and submit the detailsof impact on the drainageandnearbyhabitats/settlement (surroundings).	The details of Impact on water quality with mitigation measurearegiveninChapter-4 insectionno.4.2.3 Study are DrainageMap showing surface water network/drainage patternofthestudyareais giveninChapter-3, Sub-section-3.7			
15	Examine and submit the detailsof surface hydrology and waterregimeandimpactonthesame.	Detailsofsurfacehydrologyandwaterregimeofthestudyar eawereexaminedandwell-furnishedinChapter-3. The Impact on Hydrology and water regime is given in Chapter-4			
16	Examine and submit the detailsof one complete season AAQ data(except monsoon) with the datesofmonitoring,impactoftheprojectont heAAQofthearea(includingH2S,CH4)	Ambient Air Quality of the site and study area was monitoredandanalyzedforwinter seasoni.efromMatch 2022toMay 2022 which is wellfurnishedinChapterno. 3. And Annexure-II.			
17	Submitacopyofdetailedplanofwastemana gement	Detailedinformationontheproposedwastemanagements ystemsfor Kotdwar iswellexplainedinSection2.5ofChapterno.2			
18	Submitthedetailsofsanitarylandfill site Impermeability andwhether it would be lined, if sodetailsthereof.	GiveninChapter-2, Sub-section-2.6 of EIA report			
19	Examine and submit the detailsofimpactonenvironmentalsensitive areas.	Chapter no. 4 presents detailed study of anticipated impact onenvironmentalsensitiveareasonambientair, soil quality,			

SN	TERMSOFREFERENCE	COMPLIANCE			
		noiselevels, surface&groundwaterquality,socio-			
		economics etc.			
20	Examine and submit the details of	NoRehabilitationandResettlement(R&R)isrequiredtoesta			
	henrojecteffected people ifany	blish the proposed facility.			
21	Submit Environmental management	Detailed Environmental Management Planis provided in Ch			
	PlanandEnvironmentalMonitoringPlanwit	apterno. 10			
	hcostsandparameters.	DetailedEnvironmentalMonitoringPlanisprovidedinChap			
		ter no. 6			
22	Publichearing to be	To be conducted.			
	provisions of Environmental				
	ImpactAssessmentNotification,2006andth				
	eissuesraised by the public should be address				
	edinthe Environmental ManagementPlan.				
	The Public Hearing shouldbe conducted				
	ToRletterissuedbytheSEIAAandnotontheb				
	asisofMinutesoftheMeetingavailableonth				
	e website.				
23	AdetaileddraftEIA/EMPreport Should be	Followed &Complied			
	prepared in				
	dshouldbesubmittedtotheministryinaccor				
	dance with the Notification				
24	Details of litigation pending against the	No Litigation is pending against the project			
	project, if any, with direction /order				
	passed by any Court of Law against the				
	Project should be given				
25	The cost of the project (capitalcost and	GiveninChapter-3, Sub-section-3.7			
	recurring cost) as				
	Wellastnecosttowardsimplementation of EMP should be clearly spelt out				
26	Any further clarification on carrying out	Noted and complied			
20	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				
	Municipal Solid Wastes				
	ADDITIONALS	SPECIFIC CONDITIONS			
1	Procedure process of biomining for legal	Given in Chapter 2, Section 2.20.			
	waste and detailed conceptual replay				
	mission plan shall be explicitly				
	mention in report				

SN	TERMSOFREFERENCE	COMPLIANCE			
2	A sensitivity analysis of the site shall be carried out as per MOEF & CC criteria and form part of report	GiveninChapter-5, Sub-section-5.2			
3	The report would include a separate chapter on the conformity of the proposal to the municipal solid waste management rules 2016 and the construction and demolition waste management rule 2016 including this siting criteria therein	GiveninChapter-5, Sub-section-5.2			
4	Characteristics and source of waste to be handled and methodology for remediating the project site which is presently be used for open dumping of garbage	Charecteristics of wastes given in Figure 2.5(A) ch 2. The proposed site is a new greenfield site which will be developed for solid waste managemnet facility. The existing dumping site is located at Lakdi Padao which is centralized material recovery facility.			
5	Details of storage and disposal of Pre processing and post processing reject and inert	GiveninChapter-2, Figure 2.5 (A)			
6	List of proposed end receiver for the reject inert it should be provided MOU to be submitted in this regard.	The rejects and inert materials will be disposed in proposed sanitary landfill facility.			
7	Details of various waste management units with capacities for the proposed project. Details of utilities indicating the size and capacities to be provided	GiveninChapter-2, Section-2.5 (A)			
8	Would also examine the impact of the existing landfill site and include the chapter on closure of existing site including disposal ofaccumulated waste and capping.	Given in Chapter 2, Section 2.20.			
9	The project proponent should consult the municipal solid waste management manual of the ministry of urban development Government of India and draw of a project plan accordingly	Noted & and will be complied			
10	Waste management facility should maintain safe distance from the nearby water bodies	Noted & complied. Nearest waterbody Malin Nadi flows at a distance 480m on East of the project site.			
11	Layout map of propose solid waste management facilities include storage area, plant area, greenbelt area, utilities etc.	Layout map is given inChapter 2 - Figure 2.3 (H)			
12	Details of air emissions, effluent generation and solid waste generation and their management	Air Emission details and modelling result is given in Chapter-4, Section-4.5 Effluent generation is given in Chapter-4, Section-4.3			

SN	TERMSOEREFERENCE	COMPLIANCE		
13	Requirement of water, power with source of supply, status of approval, water balance diagram, manpower requirement [regular and contract]	Given in Chapter-2, Section-2.4		
14	Process description along with the major equipment and machineries process flow sheet [quantitative] from waste material to disposal to be provided	Given in Chapter-2, Section-2.5		
15	Hazard identification and details of proposed safety system	Given in Chapter-7, Section-7.2		
16	Details of drainage of the project up to 5 km radius of the study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as a flood occurrence frequency based on peak rainfall data of the past 30 years detail of flood level on the project side and maximum flood level on of the river shall be provided	Drainage map is given in Chapter-3, Section-3.7. As per the Hazard Profile Assessment [Fluvial and Flash Floods], the ranking of the Kotdwar Block is 60 with 4.8% proportion to be inundated to 0.3m or more based on a 100 year return period. Also, the city falls in the low – moderate flash flood hazard zone [Ref: Uttarakhand State Level Risk Atlas [report on Disaster Risk Assessment of Uttarakhand] published in 2019 by Uttarakhand State Disaster Management Authority, Govt. of Uttarakhand]. Detail maps are given in Chapter 7. Section 7.4.		
17	Details of efluent treatment and recycling process	Liquid effluent i.e. leachate shall be treated in onsite leachate treatment unit.		
18	Action plan for measures to be taken for excessive leachate generation during monsoon	Given in Chapter-2, Section-2.6		
19	Detail environmental monitoring plan	Given in Chapter-6		
20	Timeline for implementation of the project shall be included in the report	Given in Chapter-2, Section-2.19		
21	A tabular chart with index for point wise compliance of the above TORs	Noted & Complied		

EXECUTIVE SUMMARY

1. Introduction

Kotdwar is a city, a municipal corporation and a tehsil in the Pauri Garhwal district of Uttarakhand, India. It is just 101 km from Pauri town, the district headquarter. It is the eighth largest city in Uttarakhand state.

Nagar Nigam Kotdwar under the guidance of Urban Development Directorate, Uttarakhand has planned to upgrade the present system of solid waste management in the city along with establishment of waste processing, resource recovery unit and landfill facility.

The Nagar Nigam has planned to establish a solid waste processing and disposal facility in accordance of the Solid Waste Management Rules, 2016 at the earliest. A Detailed Project Report (DPR) for ISWM in Kotdwar has been prepared by the Uttarakhand Urban Sector Development Agency (UUSDA), Uttarakhand based on Regional Level Concept for Kotdwar through EveryULB Technologies Pvt. Ltd.

The project or activity is covered under category "B" of item 7(i), Common Municipal Solid Waste Management Facility of the schedule to EIA notification 2006 and its subsequent amendments and requires appraisal at state level. However, general condition is applicable due to the presence of Uttar Pradesh-Uttarakhand State border at a distance of 7 m approx. from proposed site. Accordingly, the project requires appraisal at Central level by the EAC.

M/s Ind Tech House Consult, Delhi a QCI-NABET accredited consultancy organization has been engaged bythe Nagar Nigam Kotdwar tocarryoutanEnvironmentalImpactAssessment(EIA)studyfor the proposed project aspertheprocess definedintheEIANotification,datedSeptember14, 2006andtheamendments thereafter.

Application for ToR approval was submitted to EAC on 7th March 2022. The project was examined by the EAC (Infra-2) and TOR was granted videletterno. F.No.21-35/2022-IA-III dated10th October.

2. Identification of Project

Presently there is no waste processing or treatment facilities at Kotdwar. All the wastes collected are openly dumped near Paniyali Lakdi Padao which is located 4 km away from town. A manual centralized material revory facility has been set up at this site.

Kotdwar Nagar Nigam has planned to upgrade the present system to ensure safe collection of waste from sources to the extent possible, transportation of the same either directly or to the secondary storage and subsequent transportation from there for treatment and final disposal of rejects and inert wastes. The system is designed to manage 100 percent of the waste reaching the Municipal stream- daily removal of organic matter to treatment plant for processing and need based removal of inorganic and inert to landfill site and disposal by sanitary methods.

The management plan is designed for handling 80 TPD wastes including recyclable waste [design year upto 2039] generated in the Kotdwar ULB and considers that all wastes are handled at the local

level through centralized model. A land of area 0.998 Ha has been selected for the SWM project at Kanchan Puri, Haldukhatta Malankham, Kotdwar, Uttarakhand.

3. Nature, Size, Location of the Project

Proposed solid waste management facility site is proposed to be set up at Kanchanpuri Haldukhata, Kotdwar, Block- Duggada, Dist. Paui Garhwal, Uttarakhand. The site is located on south of Haridwar Road near Umraonahgar, Kotdwar and on the West bank of river Malin.The site is easily accessible from Haridwar Road through existing kuchha road [approx. 20 feet wide].The kuchha road of approx. length 250m will be strengthened by the Nagar Nigam.

Proposed site is an undeveloped forest land [0.998 Ha] transferred to Nagar Nigam Kotdwar with the approval of the Govt. of Uttarakhand. The land has been transferred to Nagar Nigam by Lansdowne Forest Division. Approval for Diversion of Forest Land is also obtained. Projects ite coordinates are given below -

Points	Latitude	LONGITUDE			
A1	29°45'23.79"N	78°26'14.14"E 78°26'17.05"E 78°26'19.35"E			
A2	29°45'21.73"N				
A3	29°45'24.25"N				
A4	29°45'26.31"N	78°26'16.47"E			

Particulars	Details			
Nature of the Project	Solid Waste Management Facility			
Project Type	New			
Components of the proposed facility	The project involves –			
	• Processing of organic part of solid waste and production			
	of organic manure through Compost plant.			
	Landfill for rejects and inert wastes			
Size of the Project	80 TPD including recyclable waste [design year 2039]			
	1) Compost Plant – 43.2 ~ 43 TPD [design year upto 2039]			
	2) Landfill capacity – 11,800 MT [as per present availability of			
	land, now planned for a design period of 5 years]. Within			
	next 1-2 years, the Nagar Nigam shall identify and establish			
	another sanitary landfill site on non-forestry land with life			
	expectancy of 25 years and develop the site within 5 years.			
Land Area	0.998 Hectares [waste processing & sanitary landfill]			
Project site Location	Kanchanpuri, Haldukhatta, Malankham, Kotdwar			
[Composting and landfill facility]	District - Pauri Garhwal, Uttarakhand			
Land Ownership	Nagar Nigam Kotdwar			
Nearest Town and Habitation	Proposed site is on the outskirt of Kotdwar city on south.			
Nearest Railway Station	Kotdwar Railway station - 8 km on East			
Nearest Airport	Dehradun Airport – 53 km on NW			
Nearest Highway	NH 119 (8.1 km) SE			

Eco-sensitive areas around the project site: Rajaji National Park is located at an approximate aerial distance of 12.3 km on NW. Certificate from Chief Conservator of Forests regarding this has been obtained.

Site Connectivity: Kotdwar is a gateway city to the Garhwal region and is one of the main entrance points in the state of Uttarakhand. Jolly Grant International Airport, Dehradun is located at around 53 km [aerial distance] on NW. Kotdwar Railway Station is located at a distance of 8 km on East.

By road Kotdwar is 216 km North of Delhi, 120 km South of Dehradun, 208 km West of Nainital, 99 km East of Roorkee and well connected with roads to major destination of Uttarakhand state. Buses to Kotdwar from Delhi are easily available. Kotdwar is well connected with National Highway 119.

Nearest Habitation:Nearby habitation is located at a distance of 150 m on north east of proposed site. The proposed site is located on the outskirt of Kotdwar city on south. Kotdwar town has a population of approx. 175,232as per Census 2011.

Industries:Sigaddi SIIDCU Industrial Area is located 4.8km NW of project Site and it has non-polluting industries such as Paramount Green, Baluni Engineering Limited, Wipro Limited, SimpexPharma Pvt. Ltd., Print Pack Industries and Kanak Biotech, Akums Health Care Limited, KMC electronics Pvt. Ltd. etc.



LOCATION OF THE PROPOSED SOLIDWASTE MANAGEMENT FACILITY

4. Waste Generation Forecast & Waste Characteristics

To analyze future projection of population and major concentration of population, ward wise data and decadal data were taken during DPR preparation. The population projection in DPR was carried out based on following methods –

- Arithmetic increase
- Incremental increase method
- Geometric increase

In case of Kotdwar, Arithmetic projection was preferred method due to its old town and saturated population and the same was adapted for the design purpose. The average state growth rate (19.17%) is adopted for the population projection and the design purpose.

HorizonY	Arithmeticinc	Difference	NetArithmeti	Floatingpopu	PerCapit	Daily	Annual
ear	rease	inpopulation	С	lation	a,	wastegenera	wasteGenerati
	method	2011	Increase		gm/day	tion	on
2011	33035	102565	135600	20340	300	41.3	15070.9
2012	33981	103511	137492	20624	300	41.9	15324.0
2013	34927	104457	139385	20908	300	42.4	15534.9
2014	35874	105404	141277	21192	300	43.0	15745.8
2015	36820	106350	143170	21475	300	43.6	15956.7
2016	37766	107296	145062	21759	300	44.2	16211.8
2017	38712	108242	146955	22043	304	45.4	16609.5
2018	39659	109189	148847	22327	308	46.6	17058.9
2019	40605	110135	150740	22611	313	47.9	17517.7
2020	41551	111081	152632	22895	317	49.1	18035.1
2021	42497	112027	154525	23179	322	50.4	18463.9
2022	43444	112974	156417	23463	326	51.8	18951.6
2023	44390	113920	158310	23746	331	53.1	19449.5
2024	45336	114866	160202	24030	335	54.5	20012.1
2025	46282	115812	162095	24314	340	55.9	20476.0
2026	47228	116759	163987	24598	345	57.4	21005.1
2027	48175	117705	165879	24882	350	58.9	21544.9
2028	49121	118651	167772	25166	355	60.4	22156.2
2029	50067	119597	169664	25450	359	61.9	22657.9
2030	51013	120543	171557	25734	364	63.5	23231.3
2031	51960	121490	173449	26017	370	65.1	23816.4
2032	52906	122436	175342	26301	375	66.7	24480.1
2033	53852	123382	177234	26585	380	68.4	25022.3
2034	54798	124328	179127	26869	385	70.1	25643.6
2035	55745	125275	181019	27153	391	71.8	26277.3
2036	56691	126221	182912	27437	396	73.6	26997.3
2037	57637	127167	184804	27721	402	75.4	27583.1
2038	58583	128113	186697	28004	407	77.2	28255.7
2039	59530	129060	188589	28288	413	79.1	28941.7
2040	60476	130006	190482	28572	419	81.0	29722.4
2041	61422	130952	192374	28856	425	82.9	30355.0

Population Projection and Waste Generation in Kotdwar

Waste Characteristics –



5. Proposed Waste Management Plan

An integrated solid waste management (ISWM) facility will be established at Kotdwar with redesigning & improving the existing solid waste management system in an environmentally and economically sustainable manner. The project consists of –

- Segregation at source and storage of wastes [3 bin system]
- Primary 3 bins door to door collection system
- Secondary Storage cum mini material recovery facility [Small Transfer Station]
- Secondary Collection & Transportation System
- > Centralized Material Recovery Facility at Lakdi Padao
- Sanitary Waste Storage and Processing Plant at Lakdi Padao
- > Integrated Solid Waste Management Facility at Kanchan Puri, Kotdwar.

The proposed infrastructure for primary waste collection will cover about 32,600 households under door-to-door collection system, over a five-year period. Simultaneously, door step/kerbside collection to collect solid wastes everyday shall be introduced for non-domestic and other sources. All the generators through community awareness programme, will be sensitized and trained to segregate the wet and dry wastes in separate bins.

(A) <u>Segregation at source and storage of wastes [3 bin system]</u>

- ✓ At the household level MSW should be segregated into wet and dry fractions, at a minimum, and stored in separate containers.
- ✓ Ensure domestic hazardous wastes (e.g. batteries, used CFLs, tube lights, chemical/paint/insecticide containers etc.) are handed over separately at the door step or at special pick-up points specified by the municipal authority or through the relevant retail trade (e.g. for batteries). As long as there are no specific pick-up points/services for collecting such waste, these wastes may be handed over along with the dry waste fraction as an interim solution. Bi-weekly programme & two no. of recycling stations also planned for collection of such waste.
- ✓ Diapers and sanitary napkins should be wrapped securely before being put in the separate bin meant for it, for the protection of the waste handlers and should be marked with a "Red Cross" to enable further segregation and disposal.
- ✓ All the waste generators through community awareness programme and behaviour change campaigns, will be sensitized and trained to segregate their waste into 3 bin system ie. Wet, dry and sanitary waste.

HOUSEHOLD STORAGE:

At the household level dry waste and wet waste should be stored in separate garbage bins – wet wastes in green covered bin and dry wsates in covered blue bin. A container of 15 lit capacity with paddle for a family of five members would be adequate as collection will take place on daily basis.

COMMERCIAL STORAGE:

- ✓ Shops, commercial establishments and businesses will store segregated waste onsite. Designated auto tippers will collect at fixed time on daily basis. Vegetable and flower market waste generators would be instructed to deposit their waste in conveniently located large green bins.
- ✓ Typically, four wheeled, HDPE, injection molded, international standard, UV tested bins or metal bins of 60L capacity to be used.

PUBLIC PLACES:

✓ With a view to achive clean streets and public places, litter bins will be provided along the important roads of the city, markets, public places, tourist spots, bus and railway stations, etc. The distance ranging of 20m to 50 m depending on the local condition.

(B) Collection & Transportation System

Collection of wet and dry waste separately enhances the potential of efficient and cost effective treatment of such wastes and ensure optimum advantage from the recyclable material fed into the system. Waste collection services are divided into primary and secondary collection. Primary collection refers to the process of collecting waste from households, markets, institutions and other commercial establishments and taking the waste to a storage depot/ transfer station or directly to the disposal site.

(C) <u>Secondary Storage Cum Mini Material Recovery Facility (Mini Transfer Stations)</u>

Kotdwar city is distributed over 52 sq.km area with end to end distance of around 17 km hence to increase efficiency of D2D collection system (more number of trips/ shift), two secondary collection cum minim MRF centres has been proposed. In this centre segregated wet waste is transported to proposed integrated solid waste management facility at Kanchanpuri and Segregated dry and sanitary waste is transported to centralized MRF.

SN	Name	Location	Coordinates
1	Secondary collection cum Mini M	F Simmal Chor, Kotdwar	29°45'0.28"N/

	centre-1		78°29'10.74"E
2	Secondary Collection cum Mini MRF Centre-2	Near Library, Kotdwar	29°44'35.22"N/ 78°31'5.19"E

✓ Recycling centre is also planned with separate bins for electronic waste at main tourist spots and at strategic commercial locations. One such centre will be set up near Nagar Nigam office, remaining one can be set up after due discussions with all the stake holders.

(D) <u>Centralized Material Recovery Facility</u>

Kotdwar nagar nigam has already established centralized material recovery facility at Lakdi Padao which is manually operating and equipped with baling machine. This facility has been proposed for upgradation into semi mechanized MRF facility where all the dry waste from the city will be processed centrally.

SN	Name	Location	Coordinates
1	Centralized Material Recovery Facillity	Lakdi Padao	29°44'28.50"N/ 78°31'36.47"E

(E) Sanitary waste storage & processing plant, Lakdi Padao

As per provisions of the Solid Waste Management Rules 2016, Kotdwar Nagar Nigam has initiated 3 bins D2D collection system. Sanitary waste like diapers and sanitary napkin waste will be collected separately and transported to centralized sanitary waste storage and processing facility proposed at Lakdi padao near centralized MRF facility.

SN	Name	Location	Coordinates
1	Sanitary waste storage & processing facility	Lakdi Padao	29°44'29.76"N/ 78°31'36.56"E

2022

Codese transfer station With a description for your map: To a description for your map: </tr

(F) Proposed Wastes Processing and Disposal Facility

The proposed facility will have following components -

- 1) Processing of Organic Waste through Compost Plant
- 2) Processing of Recyclable Materials from Mixed Dry Wastes
- 3) Sanitary Landfill for Rejects from processing and Inerts Wates
- The primary segregated waste will be bought into tipping area and further segregated into various recycling steams (into 12 types) which will be in turn sold to nearest "Recyclers / local Kabadiwala" weekly.
- Conveyor belt with trommel system will be given of capacity 80 TPD to cater to pre-compost conversion to take out the minor size inorganic items and for easy sorting into various recycling streams. Containers will be provided to store the segregated inorganic materials to be further sold to local recyclers. The selling can be done week wise in a designated day and ULB should register the Kabadiwalas/ rag pickers for including them in the disposal of these inorganic / recyclable items.
- Step wise landfill will be provided to inert and reject wastes. The ULB will acquire additional land to cater the 30 year design period.

PROCESSING OF ORGANIC WASTE- CAPACITY 43.2 ~ 43 TPD [PLANNED UPTO DESIGN YEAR 2039].

Windrow Composting Process-

• The windrow composting process involves placing the waste into long heaps of trapezoidal shapes known as windrows with base width of 5 to 6 m, top width 2 to 3 m and height 2 to 3 m. The windrows will be placed on a covered concrete platform.

- Cow dung culture or efficient microbial culture is sprayed on the windrows to control the odour and flies. The temperature inside the window increases rapidly due to bacterial action which eradicates pathogens and weed seeds.
- Waste is turned from one windrows to other twice a week to provide aeration for enhancing the decomposition process. The process will continue over 4 weeks and the material after windrow process will be stored under shelter for a period of one week for stabilization.
- The stabilized material will be screened for extracting organic manure.
- Further to enrich the compost quality, organic additives like neem cake, rock phosphate decomposed poultry litter and micronutrients like zinc and boron will be added and the final compost product will be packed and stored for marketing.

The main component for the above process are as follows:

- ✓ Covered aerobic compost yard
- ✓ Compost processing shed with finishing and storage area
- ✓ Reject storage area
- ✓ Laboratory
- \checkmark Leachate drain and Leachate collection tank for recycling
- ✓ Slurry tank for cowdung EM culture
- ✓ Electro mechanical equipment comprising trommels, conveyors, sieves, weighing and bagging machines

PROCESSING OF INORGANIC WASTE

After the Initial weighing, the collection vehicle transport their loads to the receiving "(tipping area) for temporary storage and initial processing. Main parts of the unit are -

- ✓ Feeder Conveyor (feeding compartment)
- ✓ Hand Sorting
- ✓ Primary separation unit (first trommel 75 mm)
- ✓ First reject belt
- ✓ Second Trommel unit (25 mm)
- ✓ Second rejection belt
- ✓ Magnetic separator
- ✓ Air separator
- ✓ Baler

SANITARY LANDFILL

Total Capacity proposed at present is 11,800 MT. As per present availability of land, now the landfill has been planned for a design period of 5 years. Within next 1-2 years, the Nagar Nigam shall identify and establish another sanitary landfill site on non-forestry land with life expectancy of 25 years and develop the site within 5 years.

Waste categories to be disposed in sanitary landfill -

- ✓ Waste that is by its nature or through pre-treatment non-biodegradable and inert;
- ✓ Pre-processing and post-processing rejects from waste processing sites;
- ✓ Non-hazardous waste not being processed or recycled.

The proposed landfill will be operated in phases to allow progressive use of the area such that at any given time a part of the site would have a final cover, a part being actively filled, a part being prepared to receive waste and a part undisturbed. A 'phase' consists of cells, lifts, daily cover, intermediate cover, liner and leachate collection facility, gas control facility and final cover over the sub-area. The term 'cell' is used to describe the volume of material placed in a landfill during one operating period, usually one day. A cell includes the solid waste deposited and the daily cover material surrounding it.

6. Landfill closure plan:

At the end of life of the proposed sanitary landfill, it will be properly capped, closed as per the povisions of the Solid Waste Management Rules and green cover will be established. The land will be returned to the Forest Department.

Phase closure: After the last set of cells of a phase are placed (on the highest lift), the final cover is constructed. If another phase is to be placed over the just completed phase, an intermediate cover is provided. However, if the completed phase has reached final height of the landfill, then final cover system and surface water drainage system are provided.

7. Post Closure Stabilisation, Operation & Care

If the landfill cover is intended to be used for a specific purpose e.g. park or golf course or vehicle parking area, then the cover shall be stabilized to achieve the end use. However, if no specific end – use is envisaged, then long – term vegetative stabilization will be undertaken to return the land to its original and natural vegetative landform.

8. Requirement of Water, Power and Manpower

WATER REQUIREMENT

Construction Phase- During construction phase, approximate water requirement will be 2.5 KLD.

Operational Phase–Water is required for different components of MSW management facility like for compost plant, general purposes like drinking, wash water, cleaning, green area etc. Water is required for maintaining the required level of moisture in the composting garbage during summer when moisture is low.

As estimated, fresh water requirement will be approx. 11 KLDfor the proposed project and will be met through onsite bore-well.

- Domestic consumption 1 KLD [@45 lit/person].
- Washing/water sprinkling/green area demand 10 KLD

POWER REQUIREMENT

Power demand for the project during operation phase[approx. 200 KVA] will be sourced from local electricity distribution authority. One DG Set of 150 KVA will be provided at site as back up during power failure.

MANPOWER REQUIREMENT

During peak construction phase approx. 50 workers (skilled & semi-skilled workers) will be hired, mostly from local areas.

Operational manpower requirement for the solid waste management facility [composting and landfill] is estimated as 25. No Housing facilities or colony will be provided. The workers shall be employed from nearby areas.

9. Proposed Project Cost

The overall estimated project cost for collection, transportation, processing and disposal of wastes at Kotdwar is INR 1369.951 lakh.

10. Baseline Environmental Status

Field investigations were undertaken for collecting the existing baseline environment for air, water, noise, soil, ecological and socio-economic conditions. A study area of 10 Km radius from the project site was identified to establish the present environmental conditions for the above environmental components. Field data generation was done during summer season from March 2022 to May 2022.

Metrological data has been collected from the IMD station at Najibabad and pre dominant wind direction recorded is from West (W) followed by East (E).

Ambient Air Quality

Ambient air quality monitoring stations were set up for 6 different locations. The locations were selected in downwind, cross wind and up wind of the proposed project. The common air pollutants namely Particulate matter (PM10 & PM2.5), Sulphur dioxide (SO2), the oxides of nitrogen (NOX), Methane (CH4), Hydrogen sulfide (H2S) were sampled and results were averaged to 24 hours to meet the requirements of the MoEF&CC and compared with the standards stipulated by CPCB.

- PM_{10} concentration in the study area varied from 53 to 92 μ g/m³
- PM_{2.5} concentrations in the study area varied from 34 to 49 μg/m³
- SO_2 concentration in the study area varied from <6.0 to 9.2 μ g/m³
- NO₂ concentration in the study area varied from 8.3 to 14.2 μ g/m³
- H_2S concentration in the study area was observed to be <1.0 μ g/m³
- CH_4 concentration in the study area was observed to be <0.1 μ g/m³

From the baseline monitoring result, it is observed that the monitored parameters (PM10, PM2.5, SO2, NO2,) are within the permissible limits as per NAAQS, 2009 during the study period.

Water Quality

In order to depict the baseline groundwater quality, samples from bore-well/tube-well and pond/canal were collected from 6 nearby locations, and analyzed for basic physico-chemical parameters (pH, conductivity, TDS, TSS, alkalinity/acidity, Total Hardness (Permanent & Temporary Hardness), sulphate, chloride, nitrate, phosphate, fluoride, calcium, magnesium, iron, manganese, copper, zinc, toxic metals (As, Ni, Pb, Hg, Cr, Cd) and coliform count. One grab sample was taken from each location for analysis during the study period.The groundwater quality of villages around the study area is fit for drinking. Analysis results of ground water reveal the following: -

- ≻pH varies from to 7.02 to 7.07
- ➤ Total Dissolved Solids varies from 230 to 262 mg/l.
- ➤ Total Hardness varies from 128 to 136 mg/l.
- ➤ Calcium varies from 22.4 to 25.6 mg/l
- ➤ Magnesium varies from 15 to 18 mg/l
- ➤ Chloride varies from 22 to 34 mg/l
- ➤ Fluoride varies was found to be <0.1 mg/l
- ➤ Nitrates varies found to be <0.1 mg/
- ➤ Sulphates varies from 7.6 to 9.6 mg/l
- ➤ Toxic Metals: <0.01 mg/l
- ➤ Total Coliform: <2</p>
- ≻ E-Coli: Absent

The above parameters indicate that the ground water of the study area is well within the permissible limit as per IS 10500: 2012

Observation on Surface water quality:

The surface water quality of the streams is fit for drinking after conventional treatment. Analysis results of surface water reveal the following: -

- ≻pH varies from to 7.78 to 7.95
- ➤ Dissolved Oxygen varies from 5.8 to 6.1 mg/l.
- ➢ BOD varies from 1.6 to 2.4 mg/l
- ➤ COD varies from 10 to 28 mg/l
- ➤ Total Dissolved Solids varies from 182 to 312 mg/l.
- ➤ Total coliform varies from 23 to 50 MPN/100 mg/l

The above parameters indicate that the surface water of the study area falls under class-B (Outdoor bathing (Organised)) as per CPCB water Quality criteria.

Ambient Noise

Baseline Ambient noise level monitoring was carried out at 8 locations around the locations where human habitations are present.Day time noise level (6 am to 10 pm) was found between 48.56 to 50.48 dB(A). Night-time (10 pm to 6 am) noise levels were found between 39.08 to 40.86 dB (A). The

noise level was meeting the national standards in project site. However, in all other locations it is exceeding marginally.

Soil Quality

The physical, chemical properties and important heavy metals concentrations were determined in 8 soil samples collected from thefields close to the location where hand pump water was taken for analysis. Soils of study area are sandy loam by nature. Specific Conductivity and pH are in normal range. Organic matter content is sufficient. The concentration of Nitrogen, Phosphorus and Potassium were medium. The soils of study area are fit for cultivation. The soil is sandy clay in nature.

Ecological Environment

Forest Block in Study Area: There are fifteen [15] reserve forests in 10 km of the study area and there are no wildlife sanctuaries, national parks, Biosphere reserves or migratory corridor of any sensitive species in the study area. Details of Forest block within 10 Km area are provided below-

S.No	Forest	Distance & Direction
1	Giwain RF	9.1 km NE
2	Sukhrao RF	7.9 km NE
3	Sattikhal RF	8.7 km NE
4	Gwalgarh RF	8.5 km NE
5	Laldhang RF -	5.5 km NW
6	Kotdwara RF	3.6kmN
7	Kotawali RF	20 m SW
8	Girdawa Sahanpur RF -	6.1 km SW
9	Kauriya RF	2.0 km SE
10	Mohanwali RF	8.6 km S
11	North Kothari RF	9.6 km SE
12	South Kothari RF	9.7 Km SE
13	Paniyal RF	7.7 Km NE
14	Sukharao Kham RF	5.2 Km NE
15	Malinkham RF	1.6 Km NE

TABLE 3.6 (C): DETAILS OF FOREST BLOCK WITHIN 10 KM AREA

The biological environment in the surrounding of the study area is dominated by grasses with tree, herbs& Shrub species, All the species reported from core zone are common and generally found in wide variety of habitat of the study area. No endemic/endangered sp. were recorded from core area of the project site. Apart from that there is no Biosphere reserve, National Park, Wildlife sanctuary, Tiger Reserve or Elephant reserve are reported within 10 Km radius of project site and project area is also devoid of any breeding and nesting ground of any faunal species. So it can be stated that proposed project and associated activities will not influence biodiversity of the area.

Socio – Economic Environment

Total population of the study area is 163967 persons. Out of which 81239 are male and 82728 are female. SC total population is 21899 out of which 11172 are male and 10727 are female.

Literacy Rate is the amount of people in a country with the ability to read and write. The analysis of the literacy levels is done in the study area. Literacy in any region is key for socio-economic progress and the Indian literacy rate grew to 79.63% in 2011.

11. Anticipated Environmental Impacts and Mitigation Measures

Matrix methodology has been adopted for the impact assessment of this project. This method incorporates a list of impacting activities and their likely environmental impacts, presented in a matrix format.

S.No Aspects		EnvironmentalAttribute						
		Air	Noise	Water	Land &	EcologyandBi	Socio	
					soil	o-diversity	Economics	
Constr	uctionPhase		_					
1	Landprocurement				V			
2	ClearanceofVegetation	٧		V	V	V		
3 ExcavationworkCutting,filling&		٧	V	٧	٧	V	V	
4	Site development, foundation work and various Civil constructions. Endowment of structure required for various project activities proposed	V	V	V			V	
5	Vehiclemovement for Raw material transportation and unloading and removal of unwanted material from site	V	V			V		
6	Storage,handlinganddisposalof solid waste	٧	V	٧	V			
7	Wastewatergeneration&dispos al			٧	√			
8	Landscaping & Greenbelt development	٧	V		٧	V		
Operat	tionalPhase							
1	Vehiclemovement	٧	V			V		
2	Storage, handlinganddisposalof solid waste	٧	٧	V	٧			
3	Waterconsumption			٧				
4	Wastewatergeneration&dispos al			٧	٧			
5	DG Operation	٧	V		V	V		

Impacts during Construction Phase

Construction phase works include site clearance, site formation, excavation, material handling, building works, infrastructure provision and any other infrastructure activities. The impacts will be mainly on air quality, water quality and soil quality. The impacts due to construction activities are short term and limited to the construction phase only.

Impacts during Operation Phase

Air Environment -During operational phase, air pollutants will be emitted mainly from the stack of the DG sets.Some foul gases will also generate from Compost plant and landfill site. The setting up and operation of the proposed project will not cause any intolerable impact on the ambient air quality as the DG will run during power failure only. Also stack of adequate height will be provided for DG set. Regular water sprinkling will be carried out. Controlled passive gas venting system will be provided at the landfill.

Noise Environment -Theoperation phase involvesmachinery and equipment which would generate noise substantially. Intermittent source of noise shallbe movement of vehicles used during the operation activities.Proper enclosures and noise shields will be used for reduction in noise levels. Also, since the project site is sufficiently away from habitation, there will not be any significant increase in the impact of the noise generated from the site. However, impact due to noise pollution can be minimized by ensuring that no noise generating activity is carried out during night hours.

Water Environment -The total water requirement of the project will be fulfilled through onsite ground water abstraction.

The possible source of the ground water contamination will be leachate discharge from landfill site and compost plant. The leaching can be controlled by construction of impervious layer in landfill site and compost plant. The impacts on ground water will be negligible due to the appropriate planning of the plant design. A final cover system at the top of the landfill to enhance surface drainage, prevent water infiltration and also to support surface vegetation.

A leachate collection and control facility will be established to collect leachate from within and from the base of the Sanitary Landfill and then recirculate/ treat the leachate in composting facility.Remaining, if any will be treated and reused in green area or dust suppression.

Separate drainage system will be designed for management of storm water run off. Storm water will be collected and reused in composting, vehicle washing during monsoon season.

Land Environment - The project site is part of forest land and construction of MSW management facility will change the land use. Green Cover of land will be enhanced leading to ecological and enhanced aesthical impact which will also act as pollution barrier. The entire operational area shall be well paved and thus there will be no leaching of any substances in case of spills.

Biological Environment - Major impacts on terrestrial ecology due to air, water and noise pollution caused by site activities, vehicular movement, wastewater and waste handling. The project operations will be carried out in a systematic manner as to minimize any disturbance of Ecological

and biodiversity of the area Development of a planation with varied variety of trees and shrubs would have a positive impact.

Socio-Economic Environment - The improvement in the social condition of the surrounding will be observed soon after the implementation of the integrated municipal waste-processing complex.

- Improvement in the social condition through Employment
- Improvement in the state of living standards of the waste-pickers and their family.

Social acceptance of the MSW management facility will be the major issue because of aesthetic sense and foul smell in surrounding areas. But the project proponent will take care of these issues and implement adequate mitigation measures to maintain the aesthetic sense of the area.

12. Site Selection and Alternative Site Analysis

One of the major constraints in identifying sanitary landfill site was its availability in near vicinity of project city as otherwise proposing a site far away from the city would increase the Operation and Maintenance cost for the improved MSW management system. Kotdwar Nagar Nigam has identified 3 alternative sites including the proposed site at Kanchanpuri. The selection of landfill site was carried out based upon various selection criteriaas per the MSW manual and finally the site at Kanchanpuri was selected.

13. Environmental Monitoring Plan

Arrangements will be made for regular site inspections by in house audit team and the independent engineer. Regular risk assessments of the operational procedure will be under taken to continue safe and efficient operations. An environmental monitoring plan is suggested to monitor environmental parameters during designing phase, construction phase and operation phase of the project. Following attributes are proposed to be regularly monitored during operation phase based on the environmental concern:

- Monitoring of Point Source emissions [stack emission]
- Monitoring of ambient air quality at plant boundary and nearby area.
- Work zone air quality monitoring*
- Groundwater quality near project site.
- Fresh water, wastewater quality& quantity
- Soil quality at project site
- Ambient Noise levels monitoring near various units and at project boundary
- Green belt plantation, maintenance, development of other forms of greenery like lawns, gardens, etc. within the site and outside area.

14. Environment Management Plan

For the effective and consistent functioning of the project, an Environmental Management Cell (EMC) will be established for the project. The Environmental Management Plan (EMP) is required to ensure a sustainable development of the plant area and the surrounding areas of the plant. Total estimated capital investment for the proposed facility is 1369.951 lakh INR. The environmental

management plan capital cost has been allocated as INR 62.11.lakh and annual recurring expenditure during the stage of operation is estimated as INR 10.44 lakhs.

15. Green Belt Development

An area of approx. 1965 sqm [33.5%] has been earmarked for development of greenbelt along the boundary, roads, and in open places available inside the facility. As planned, a 3 - 5 m wide green belt shall be developed around the plant boundary which will consist of hardy, locally available plant species.

16. Occupational Safety and Health Management

Safe working environment is essential for proper operation of the landfill site and due safety in work would be taken by all concerned. The following guidelines will be followed to cover safety and health aspects within the landfill to prevent and reduce accidents and occupational diseases among workers. The following points recommended on safety aspects will be implemented by the authorities:

- Providing workers with appropriate protective clothing, gloves, respiratory face masks and slipresistant shoes for waste transport workers and hard-soled safety shoes for all workers.
- The workplace shall be equipped with fire detectors, alarm systems and fire-fighting equipment. The equipment shall be periodically inspected and maintained in good working condition.
- Providing adequate personnel facilities, including washing areas and areas to change clothes before and after work.
- > All the employees shall be required to undergo a medical check-up before joining the facility.
- First aid facilities required to attend immediately for meeting emergency situations shall be made available at the facility.

17. Project Benefits

The contribution of the proposed project on local social infrastructure is expected to be significant. This Project will provide a significant amount of direct and indirect employment opportunities to the local people. From the proposed project the major benefits, include improving the degraded environment by establishing an Integrated Solid Waste Management Facilities. Also, a number of recyclable materials, for example paper, glass, plastic, rubber, ferrous and non-ferrous metals present in the MSW are suitable for recovery and reuse which will be beneficial for environment by conserving resources. This will also improve ecomic condition of rag pickers and recycling units.

CHAPTER 1 – INTRODUCTION

1.1 PURPOSE OF THE REPORT

Nagar Nigam Kotdwar under the guidance of Urban Development Directorate, Uttarakhand has planned to upgrade the present system of solid waste management in the city along with establishment of waste processing, resource recovery unit and landfill facility. This EIA document has been prepared for the proposed Solid Waste Management and Disposal Facilityto be developed by the Nagar Nigam Kotdwar at Kotdwar, District- Pauri Garhwal, Uttarakhand.

The project or activity is covered under category "B" of item 7(i), Common Municipal Solid Waste Management Facility of the schedule to EIA notification 2006 and its subsequent amendments and requires appraisal at state level. However, general condition is applicable due to the presence of Uttar Pradesh-Uttarakhand State border at a distance of 7 mapprox. from proposed site. Accordingly, the project requires appraisal at Central level by the EAC.

In this regard, M/s Ind Tech House Consult, Delhi a QCI-NABET accredited consultancy organization has been engaged bythe Nagar Nigam KotdwartocarryoutanEnvironmentalImpactAssessment(EIA)studyfor the proposed project andtoseekpriorenvironmentalclearanceaspertheprocess

 $defined in the {\tt EIAN otification, dated September 14, 2006 and the amendments thereafter.}$

Application for ToR approval was submitted to EAC on 7thMarch 2022and the project was examined by the EAC (Infra-2) in its 84th meeting held during 16-17th March, 2022, 91st meeting held on 30th June 2022, 92nd meeting held on 4th July 2022 and 94thmeeting held on 8th September 2022. TORwas granted undervideletterno. F.No.21-35/2022-IA-IIIdated10th October. EIA studies have carried complying with all conditions granted TOR and been out of beingpresentedhereinthestipulatedstructureofEIAdocumentasperAppendixIIIofEIANotification,2006.

1.2 IDENTIFICATION OF PROJECT & PROJECT PROPONENT

Urban solid waste management has become one of the important facets of public health. With rapid urbanization and changing lifestyles, there is an increased generation of solid wastes quantity which makes the problem of solid wastes management increasingly acute. Most of the urban areas are overwhelmed by discriminating problems related to solid waste management. The collection and disposal of solid waste is one of the pressing problems in the urban areas.

Kotdwar is a city, a municipal corporation and a tehsil in the Pauri Garhwal district of Uttarakhand, India. It is just 101 km from Pauri town, the district headquarter. It is the eighth largest city in Uttarakhand state.

Kotdwar ULB faces a number of challenges in upgrading solid waste management resulted from a number of factors such as its peculiar rural-urban continuum, pressure on land due to high density of population, and scarcity for landfill sites due to the spread of habitations. However, compared to peripheral areas of other urban centers in Uttarakhand, land holdings in the erstwhile Nigam areas of Kotdwar are comparatively higher.

Since growth is expected to be moderate, the future generation trends will be governed by population changes and will be mainly from domestic sources. The impact of tourist arrivals on generation will be much, as on an average the arrivals are around 8000-10000 persons per day on peak days. However, considering the contribution to economy by the fast-growing tourism commercial, hygienic management of waste will be important for the promotion of the industry.

Cold and dry climate makes slower decomposition of waste necessitating daily removal and safe disposal. Heavy rainfall spread over six months may result in moderate moisture content in solid wastes and a resultant low calorific value. Composting, the most feasible option for treatment will require covered compost shed.

Presently there is no processing and treatment of waste facilities in Kotdwar municipal area. All the wastes collected are openly dumped near Paniyali Lakdi Padao, located 4 km away from town.

Therefore, Kotdwar Nagar Nigam has planned to upgrade the present system to ensure safe collection of waste from sources to the extent possible, transportation of the same either directly or to the secondary storage and subsequent transportation from there for treatment and final disposal of rejects and inert wastes. The system is designed to manage 100 percent of the waste reaching the Municipal stream- daily removal of organic matter to treatment plant for processing and need based removal of inorganic and inert to landfill site and disposal by sanitary methods.

The management plan is designed for handling 80 TPD wastes including recyclable waste [design year upto 2039] generated in the Kotdwar ULB and considers that all wastes are handled at the local level through centralized model. A land of area 0.998 Ha has been selected for the SWM project at Kanchan Puri, Haldukhatta Malankham, Kotdwar.

Swachh Bharat Mission [SBM] came into effect from October 2014 and all ULBs are mandated to implement the same. In this regards, Kotdwar Nagar Nigam under guidance of Urban Development Directorate, Uttarakhand had engaged EveryULB Technology as consultant to prepare the DPR for the proposed solid waste management facility project as per the Swachh Bharat Mission 2014 and Uttarakhand State Solid Waste Management guidelines. The report envisages modernization of SWM system, improvement of services and practices to achieve 100% coverage in the ULB.

The project facilities will include waste segregation and transportation, composting of organic wastes and disposal of rejects and inert into sanitary landfill.

Applicant	Authorize signatory
M/s Nagar Nigam,Kotdwar	Mr. Kisan Singh Negi, Municipal Commissioner
Badrinath Marg, Kotdwar,	Nagar Nigam Kotdwar
Uttarakhand - 246 149	District - Pauri Garhwal, Uttarakhand
Ph # 01382 222028	

Table 1. 1 IDENTIFICATION OF PROJECT PROPONENT

1.3 NATURE, SIZE, LOCATION OF THE PROJECT

Particulars	Details	
Nature of the Project	Solid Waste Management Facility	
Project Type	New	
Components of the proposed facility	 The project involves – Processing of organic part of solid waste and production of organic manure through Compost plant. Landfill for rejects and inert wastes 	
Size of the Project	 80 TPD including recyclable waste [design year 2039] 1) Compost Plant – 43.2 ~ 43 TPD [design year upto 2039] 2) Landfill capacity – 11,800 MT [as per present availability of land, now planned for a design period of 5 years]. Within next 1-2 years, the Nagar Nigam Authorities shall identify and establish another sanitary landfill site on non-forestry land with life expectancy of 25 years and develop the site within 5 years. 	
Land Area	0.998 Hectares [waste processing & sanitary landfill]	
Project site Location [Composting and landfill facility]	Kanchanpuri, Haldukhatta, Malankham, Kotdwar District - Pauri Garhwal, Uttarakhand	
Land Ownership	Nagar Nigam Kotdwar	
Nearest Town and Habitation	Kotdwar – the proposed site is located on the outskirt of Kotdwar city on south.	
Nearest Railway Station	Kotdwar Railway station - 8 km on East	
Nearest Airport	Dehradun Airport – 53 km on NW	
Nearest Highway	NH 119 (8.1 km) SE	

Eco-sensitive areas around the project site: Rajaji National Park is located at an approximate aerial distance of 12.3 km on NW.Certificate from Chief Conservator of Forests regarding this is enclosed as Annexure to this report.

Table 1. 2 (A): List of Reserve	Forests in the Buffer Zone
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Reserve Forest	Direction & Distance with respect to project Site
Giwain RF	9.1 Km, NE
Sukhrao RF	7.9 Km, NE
Sattikhal RF	8.7 Km, NE
Gwalgarh RF	8.5 Km, NE
Laldhang RF	5.4 Km, NW
Kotdwara RF	3.6 Km, N

Kotawali RF	20 m, SW
Girdawa Sahanpur RF	6.1 Km, SW
Kauriya RF	2.0 Km, SE
Mohanwali RF	8.6 Km, S
North Kothari RF	9.6 Km, SE
South Kothari RF	9.7 Km, SE
Paniyal RF	7.7 Km, NE
Sukharao Kham RF	5.2 Km, NE
Malinkham RF	1.6 Km, NE

Site Connectivity:Kotdwar is a gateway city to the Garhwal region and is one of the main entrance points in the state of Uttarakhand. Jolly Grant International Airport, Dehradun is located at around 53 km [aerial distance] on NW. Kotdwar Railway Station is located at a distance of 8 km on East.

By road Kotdwar is 216 km North of Delhi, 120 km South of Dehradun, 208 km West of Nainital, 99 km East of Roorkee and well connected with roads to major destination of Uttarakhand state. Buses to Kotdwar from Delhi are easily available. Kotdwar is well connected with National Highway 119.

Nearest Habitation:Nearby habitation is located at a distance of 150 m on north east of proposed site. The proposed site is located on the outskirt of Kotdwar city on south. Kotdwar town has a population of approx. 175,232as per Census 2011.

SN	Facility	Name of Facility	Distance from	Direction w.r.t.
		Project Site	Project Site	
1. Roads NH-119		8.1 km	SE	
2. Railway Kotdwar Railway Station		8 km	E	
3.	Airport Jolly Grant International Airport, Dehradun		53 km	NW

Table 1. 3 (B): SITE CONNECTIVITY

Industries:Sigaddi SIIDCU Industrial Area is located 4.8km NW of project Site and it has non-polluting industries such as Paramount Green, Baluni Engineering Limited, Wipro Limited, SimpexPharma Pvt. Ltd., Print Pack Industries and Kanak Biotech, Akums Health Care Limited, KMC electronics Pvt. Ltd. etc.

1.4 IMPORTANCE OF THE PROJECT TO THE COUNTRY AND REGION

Integrated Solid Waste Management [ISWM] is an organized process of storage, collection, transportation, processing& resource recovery of solid wastes and disposal of rejects/inert wastes in sanitary landfill. It is an integrated process comprising of several collection methods, varied transportation equipment, storage, recovery mechanisms for recyclable material, resource recovery and reduction of waste volume and quantity by composting and scientific disposal of process rejects, inert wastes in an eco-friendly manner.

The Implementation of ISWM is an important component of the Government of India's "Swachh Bharat Mission" (SBM) - component IV. Considering the above, UUSDA proposes to strengthen the ISWM system in each ULB covering segregation, collection, transportation, recycling, processing and disposal.

The project shall comply with the Solid Waste Management Rules, 2016 (SWM Rules, 2016), CPHEEO manuals (including cost recovery mechanism), Operation & Maintenance (O&M) practices and service level benchmark advisories released by MoUD from time to time. SWM Rules, 2016 stipulates that each ULB should treat and dispose of the MSW generated by them in a manner so as not to cause damage to human health and environment. Government of Uttarakhand has decided to implement Integrated Solid Waste Management projects in all ULBs including landfill site either exclusively for the ULB or by forming regional landfill facility.

The local government body of the Kotdwar town is Nagar Nigam (NG) which has an elected board apart from officials. This town saw a radical shift amongst the business groups, a majority of which shifted base from Duggada to Kotdwar. This was beginning of Kotdwar's phenomenon rise as a hub of trade and commerce, which is still continuing. The Nagar Nigam has planned to establish a solid waste processing and disposal facility in accordance of the Solid Waste Management Rules, 2016 at the earliest. In this regard, Nagar Nigam Kotdwar under guidance of Urban development directorate, Uttarakhand has prepared a Detailed Project Report (DPR) for ISWM through EveryULB technology.

The importance of effective Municipal Solid Waste Management (MSWM) services is to protect public health, the environment and natural resources (Water, Land, and Air). To promote the ecological management of solid waste in compliance with the principle of the 4 R: Reduce, Reuse, Recycle, Recover and safe disposal. An effective MSWM service can be achieved only by improving the efficiency of MSWM activities, thereby leading to the reduction of waste generation, separation of MSW and recycling and recovery of materials, and generation of compost and energy.

- Reduction, reuse and recycle of the waste.
- Source Segregation & collection of waste (systematic Door to Door collection has been proposed in the project).
- > Transportation of waste in covered /closed vehicles to the site.
- Processing of waste through composting..
- Conversion of waste into a useful and marketable product (manure) as recirculation of soil nutrients.
- Good market for compost sale.
- Only inert/processing rejects to be landfilled [about 15- 20% of total waste quantity] shall be disposed into the landfill and thereby would save the future landfill are requirements.
- > Commercially viable project and long term sustainability.
- > Clean, hygienic and better infrastructure of the city.
- Increase in employment opportunities in collection and transportation, door to door collection and in processing and disposal facility.
- > Organized and scientific landfill site in order to prevent water & soil Contamination.

1.5 SCOPE OF THE EIA STUDY

Scope of the study is to carry out the Environmental Impact Assessment (EIA) studies to ascertain, predict and appraise impending environmental and socio-economic impacts which may a consequence from the proposed Solid Waste Management Facilityand to develop appropriate Environment Management Plan (EMP) to alleviate the objectionable effects, if any.

1.5.1 SECONDARY DATA COLLECTION:

Collection of secondary data comprising of information on project conception, planning and development, land details, physical, biological, geological and land use information of the project area, socioeconomic data.

1.5.2 INVESTIGATIONS AND SURVEYS:

Environmental examinations and laboratory testing for samples (air, water, noise and soil quality) and analysis of meteorological, Ecological and social surveys were also conducted in the immediate proximate area.

1.5.3 LEGAL FRAMEWORK, STATUTORY REQUIREMENTS AND INTERNATIONAL GUIDELINES:

The project or activity is covered under category "B" of item 7(i) - Common Municipal Solid Waste Management Facility of the schedule to EIA notification 2006 and its subsequent amendments and requires appraisal at state level. However, general condition is applicable due to the presence of Uttar Pradesh-Uttarakhand State border at a distance of 7 m approx. from proposed site accordingly the subject comes under category 'A" and requires appraisal at Central level by the sectoral EAC.

TOR for conducting the EIA study was granted under vide letter no. F.No.21-35/2022-IA-III dated 10th October. The EIA studies have been carried out complying with all the conditions of granted TOR and being presented here in the stipulated structure of EIA document as per Appendix III of EIA Notification, 2006.

Pointwise TOR compliance status is provided at the beginning of this EIA report. Baseline data was collected for the study area in summer season of 2022.Below data generation schedule was followed:

Sr. No	Component	No of Sampling Locations	Sampling Parameters	Sampling Period	Sampling Frequency
1	Meteorology	01	wind speed, wind	Summer	Continuous
			direction, temp, Relative	season(March to	Hourly
			humidity	May 2022)	recording

Table 1. 4 (A): DATA GENERATION SCHEDULE

C -1		No of		Commilian	Consulting
Sr.	Component	Sampling	Sampling Parameters	Sampling	Sampling
INO		Locations		Period	Frequency
2	Ambient air	06 Locations	Air quality parameters as	Summer season	24 hourly
	Quality		prescribed by the Central	(March to May	samples,
			Pollution Control Board	2022)	2samples per
			for Industrial area		week for 12
					weeks
3	Water	03 for ground	As per IS: 10500: 2012 Once in Summer		Once during
	Quality	water	[groundwater] and BDU	season.	Study Period
		&03surface	Criteria for surface water		
		water			
4	Noise	06 Locations	Sound Pressure Level	Once in Summer	Once during
				season.	study period
5	Soil	03 Locations	Soil profile, Chemical	Once in Summer	Once during
			constituents	season.	study period
6	Ecology	Study area	Flora and fauna	Field observations	and survey in
				summer seasonand	d data collected
				from secondary sou	irces.
7	Geology and	Study area	Geological history,	Data collected f	rom secondary
	Hydrogeology		drainage pattern, nature	sources	
			of streams,		
			aquifercharacteristics etc.		
8	Land use	study area	Trend of land use change	Satellite Imaginary	
	pattern		for different categories.		
	Demography	study area	Demographic profile	BasedonCensus data 2011	
9	and Socio-				
	economic				
	aspects				

1.5.4 PUBLIC CONSULTATIONS AND DISCLOSURE:

A public consultation will be done, as per the procedure prescribed in EIA Notification 2006.

1.5.5 IMPACT ASSESSMENT:

Assessment of the potential impacts with respect to environmental and social aspects has been carried out and their significance determined.

1.5.6 ENVIRONMENTAL MANAGEMENT PLAN (EMP) ALONG WITH ENVIRONMENTAL MONITORING PLAN:

Appropriate mitigation and monitoring measures are suggested to minimize any potential damaging effects or any long lasting negative consequence.

1.5.7 LEGAL FRAMEWORK, STATUTORY REQUIREMENTS AND INTERNATIONAL GUIDELINES.

Table 1. 5 (B): Legal Framework, Statutory Requirements and International Guidelines

S.No.	ApplicableRules&Regulationsforproposedproject	Responsible Agencies
1	TheEnvironment(Protection)Act1986,asamendedinApril2003;EP ARules1986, asamended in2002.	SPCB/CPCB/MoEF&CC
	EIANotification 2006, and its subsequentamendments	MoEF&CC/EAC
2	TheWater(PreventionandControlofPollution)Act,1974,amendedi n1988	SPCB/CPCB
3	TheAir(PreventionandControlofPollution)Act,1981,amendedin19 87.	SPCB/CPCB
4	TheWater(PreventionandControlofPollution),CessAct,1977includ ingRules1978 and1991	SPCB/CPCB
5	TheNoise(Regulation&Control)Rules,2000and amendments thereof.	SPCB/CPCB
6	Hazardous and Other Wastes(ManagementandTransboundaryMovement)Rules, 2016	SPCB/CPCB
7	PlasticWaste(Management&Handling)Rules2018	SPCB/CPCB
8	SolidWaste(ManagementandHandling)Rules,2016	SPCB/CPCB
9	ConstructionandDemolitionWasteManagementRules,2016	SPCB/CPCB
10	TheContractLabour(RegulationandAbolition)Act,1970ContractLa bour(RegulationandAbolition)UttarakhandRules, 1970	ChiefLabourCommissioner ,Dehradun
11	CentralGroundWaterAuthorityNotification TheCentralGroundWaterAuthority(CGWA)hasnotified43areasfor control andregulationof groundwater.If required	CGWB
12	NationalEnvironmentalPolicy2006	SPCB/CPCB

2022

1.6 SITE PHOTOGRAPHS

Figure 1. 1 : SITE PHOTOGRAPHS







CHAPTER 2 – PROJECT DESCRIPTION

2.1 TYPE OF PROJECT

An integrated solid waste management (ISWM) facility will be established at Kotdwar with redesigning & improving the existing solid waste management system in an environmentally and economically sustainable manner. The project consists of:

- Segregation and storage of Wastes [3 bin system]
- Primary 3 bins door to door collection system
- Secondary Storage cum mini material recovery facility [Small Transfer Station]
- Secondary Collection & Transportation System
- Centralized Material Recovery Facility at Lakdi Padao
- Sanitary Waste Storage and Processing Plant at Lakdi Padao
- Integrated Solid Waste Management Facility [final segregation, composting and landfill] at Kanchan Puri, Kotdwar.

Organic waste is proposed to be treated by composting technology. The objective of the plan is to ensure safe collection of waste from source to the extent possible, storage, setting up of secondary storage cum mini material recovery facility (mini transfer stations) and centralized material recovery facility as well sanitary waste storage & processing plant at Lakdi Padao, treatment and final disposal of rejects and inert wastes. The system is designed to manage 100% of waste reaching to the municipal stream, daily removal of organic matter to treatment plant for processing and disposal of removal of inorganic and inert to landfill site by sanitary method. Two nos. secondary storage cum mini material recovery facility (mini transfer stations) have been proposed. The dry waste baling facility will be installed at Centralized Material Revory Facility at Lakdi Padao and also at the Integrated Solid Waste Management Facility at Kanchanpuri.

The land available for setting up of processing cum disposal site [Integrated Solid Waste Management Facility] is located at Kanchan Puri, Haldukhatta, Malankham, Kotdwar, Uttarakhand and area allotted is 0.998 Ha (waste processing and sanitary landfill).

2.2 NEED FOR THE PROJECT

Integrated Solid Waste Management [ISWM] is an organized process of storage, collection, transportation, processing of solid wastes and disposal of rejects in an engineered sanitary landfill. It is an integrated process comprising several collection methods, varied transportation equipment, storage, recovery mechanisms for recyclable material, reduction of waste volume and quantity by methods such as composting and scientific disposal of process rejects in an eco-friendly manner.

The Implementation of ISWM is an important component of the Government of India's "Swachh Bharat Mission" (SBM) - component IV. Considering the above, Uttarakhand Urban Sector Development Agency[UUSDA] proposes to strengthen the ISWM system in each ULB covering segregation, collection, transportation, recycling, processing and disposal. The project shall comply with the Solid Waste Management Rules, 2016 (SWM Rules, 2016), CPHEEO manuals (including cost recovery mechanism), Operation & Maintenance (O&M) practices and service level benchmark advisories released by MoUD from time to time. SWM Rules, 2016 stipulate that each ULB should treat and dispose of the MSW generated by them in a manner so as not to cause damage to human health and environment. Government of Uttarakhand has decided to implement Integrated Solid Waste Management projects in all ULBs including landfill site either exclusively for the ULB or by forming regional landfill facility.

The local government body of the town is Nagar Nigam (NG) which has an elected board apart from officials. This town saw a radical shift amongst the business groups, a majority of which shifted base from Duggada to Kotdwar. This was beginning of Kotdwara's phenomenon rise as a hub of trade and commerce, which is still continuing.

The Nagar Nigam has planned to establish a solid waste processing and disposal facility in accordance of the Solid Waste Management Rules, 2016 at the earliest. A Detailed Project Report (DPR) for ISWM in Kotdwar has been prepared by the Uttarakhand Urban Sector Development Agency (UUSDA), Uttarakhand based on Regional Level Concept for Kotdwar through EveryULB Technologies Pvt. Ltd.

2.3 LOCATION (MAPS SHOWING (GENERAL LOCATION, SPECIFIC LOCATION, PROJECT BOUNDARY & PROJECT SITE LAYOUT)

The solid waste management facility site is proposed to be set up at Kanchanpuri Haldukhata, Kotdwar, Block- Duggada, Dist. Paui Garhwal, Uttarakhand. The site is located on south of Haridwar Road near Umraonahgar, Kotdwar and on the West bank of river Malin.

Location maps showing general location, specific location, 10 Km buffer map on topo-sheet, 500m buffer map, 5 Km radius map and 10 Km radius map on Google image are given below –

NAGAR NIGAM KOTDWAR DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND

2022



Figure 2. 1 (A): PROJECT SITE LOCATION (GENERAL)

2022

Notes Project site Co-ordinate 29'45'23.32''.158''E Notes Project site Co-ordinate 29'45'23.32''.158''E

Figure 2. 2 (B): SPECIFIC LOCATION [GOOGLE IMAGE]

2022



Figure 2. 3 (C): 10 KM BUFFER MAP OF PROJECT SITE ON GEOREFERENCED TOPO-SHEET

NAGAR NIGAM KOTDWAR DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND

2022

<figure>

Figure 2. 4(D): 500 M BUFFER MAP ON GOOGLE IMAGERY

Project Site Coordinates	Points	Latitude	LONGITUDE
A4	A1	29°45'23.79"N	78°26'14.14"E
A3	A2	29°45'21.73"N	78°26'17.05"E
	A3	29°45'24.25"N	78°26'19.35"E
A2	A4	29°45'26.31"N	78°26'16.47"E

Figure 2. 5 (E): PROJECT SITE BOUNDARY CO-ORDINATES AS PER GOOGLE EARTH IMAGERY

NAGAR NIGAM KOTDWAR DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND



Figure 2. 6 (F): 5 KM RADIUS MAP AROUND THE PROJECT SITE ON GOOGLE EARTH IMAGE



Figure 2. 7 (G): 10 KM RADIUS MAP AROUND THE PROJECT SITE ON GOOGLE EARTH IMAGE

Table 2. 1 (A): ENVIRONMENTAL SENSITIVITY

S. No	Areas	Aerial distance (within 15 km) from Proposed Projectlocation boundary		
1	Areasprotected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value	RajajiNationalParkislocatedatanapproximateaeri aldistanceof 12.3 km on NW.		
2	Areaswhichareimportantorsensitiveforecolo gicalreasons- Wetlands,watercoursesorotherwaterbodies, coastalzone,biospheres,mountains, forests	Giwain RF -9.1 Km, NE Sukhrao RF - 7.9 Km, NE Sattikhal RF - 8.7 Km, NE Gwalgarh RF - 8.5 Km, NE Laldhang RF - 5.4 Km, NW Kotdwara RF -3.6 Km, N KotawaliRF-20 m,SW Girdawa Sahanpur RF - 6.1 Km, SW KauriyaRF-2.0Km,SE MohanwaliRF-8.6 Km,S North Kothari RF - 9.6 Km, SE South Kothari RF - 9.7 Km, SE Paniyal RF - 7.7 Km, NE Sukharao Kham RF - 5.2 Km, NE MalinkhamRF-1.6 Km,NE		
3	Areas used by protected, important orsensitive species of flora or faunaforbreeding,nesting,foraging,resting,ov erwintering, migration	Nil		
4	Inland,coastal,marine undergroundwaters	Malin Nadi - 480 M on East SukhRaoNadi-4.8km,East Khoh Nadi-9.8 Km, SE		
5	State, National boundaries	UP-Uttrakhandstate boundary–7 m,SW		
6	Routes or facilities used by the publicforaccesstorecreationorothertourist,pi lgrim areas	HaridwarRoad–160 m, N Kotdwara-Laldhang/NH-119/Meerut-PauriRoad (534)– 8.1 kmSE		
7	Defenceinstallations	Notwithin 15km of theproject site		
8	Denselypopulated or built-up area	Kotdwartown– populationapprox.175,232.asperCensus2011.		

S. No	Areas	Aerial distance (within 15 km) from Proposed Projectlocation boundary
9	Areasoccupiedbysensitiveman- madelanduses	Therearesomesensitiveman- madehospitals,schools, college within study area however somenearbyare as follows: GovernmentHospital-2.6 Km N Dr. Arun Rawat Hospital, Devi Rd-1.9 KmNE HospitalJhandichaur-3.4 Km,NW GovernmentPolytechnic Kotdwar -500M,N NavyugPublicSchool-2 Km, NE BalBhartiSchool -1.7Km,NE GovernmentGirls College-3.2 Km, E KanwashramTemple -4.5 Km,NE Durgaand shivmandir-1KM, N ShriSiddhbali Dham, Kotdwar-9.8 Km, NE GarhwalCinema-7.8Km,E
10.	Areascontainingimportant, highquality or scarce resources	Adjacentlandsareforestlands.
11	Areas already subjected to pollutionorenvironmentaldamage	Nothingspecific
12	Areassusceptibletonaturalhazardwhichcould causetheprojecttopresentenvironmentalpro blems	TheareafallsinZoneIV, according to the Indianstand ardse is micZoning map. The site is located beyond the HFL zone of Malin River.

Project layout plan is given in Figure 2.3 (H) below -





2.4 SIZE OR MAGNITUDE OF OPERATION (INCLUDE ASSOCIATED ACTIVITIES REQUIRED BY OR FOR THE PROJECT)

The proposed solid waste management facility is planned to be established near Kanchan Puri, Hadukhatta, Malankham, Kotdwar. The site is easily accessible from Haridwar Road through existing kuchha road [approx. 20 feet wide]. The kuchha road of approx. length 250m will be strengthened by the Nagar Nigam.

Proposed site is an undeveloped forest land [0.998 Ha] transferred to Nagar Nigam Kotdwar with the approval of the Govt. of Uttarakhand. Approval for Diversion of Forest Land is also obtained.

The proposed site does not have any existing infrastructure. All facilities will be developed by the Nagar Nigam. The total area of the land available at present is 0.998 Ha which will be utilized for setting up of processing plant and development of Sanitary Landfill facilities.

The civil infrastructure for waste processing will be made considering waste generation of 43 TPD [design year 2039] within Kotdwar ULB. However, as per present availability of land, landfill facility is now planned for a design period of 5 years. Within next 1-2 years, the Nagar Nigam Authorities shill

identify and establish another sanitary landfill site on non-forestry land with life expectancy of 25 years and develop the site within 5 years.

S. No	Facilities	Unit Size (m x m)	Area (Sq m)	Percentage (%)	
1	Security Room cum weigh bridge office	3 x3	9		
2	Weigh Bridge	10 x 4	40	0.5	
3	Toilet	2 x 2	4		
4	Office Building	10 x 6	60	0.6	
5	Parking shed	12 x 6	72	0.7	
6	Storage cum Power Shed	12 x 6	72	0.7	
7	Sump	2 x 2 x 7.5	4	0.2	
8	Leachate treatment unit	5 x 5	25	0.5	
9	Leachate Pond	19 x 10	190	1.9	
10	SLF	69 x 41	2829	28.4	
11	Processing Shed	70 x 40	2800	28.0	
12	Green Area [33%]	8.5 x 393	3347	33.5	
13	Roads	4 x 120	480	E 4	
14	Other including drain	-	55 5.4		
		Total	9980	100	

Associated Activities -The associated major utilities and services which will be required for proper functioning of the proposed solid waste management facility are:

- Raw Water System [Pipeline, reservoir, pump]
- DG sets [capacity 150 KVA] to be used as small emergency back up during power cut only.
- Leachate collection, recirculation and treatment unit
- Storm water drainage system
- Fire Fighting System

2.4.1 WATER REQUIREMENT

Construction Phase- During construction phase, approximate water requirement will be 2.5 KLD.

Operational Phase–Water is required for different components of MSW management facility like for compost plant, general purposes like drinking, wash water, cleaning, green area etc. Water is required for maintaining the required level of moisture in the composting garbage during summer when moisture is low.

As estimated, fresh water requirement will be approx. 11 KLDfor the proposed project and will be met through onsite bore-well.

- Domestic consumption 1 KLD [@45 lit/person].
- Washing/water sprinkling/green area demand 10 KLD

S. No.	Usage	Fresh Water Demand [KLD]	Effluent generation [KLD]
1	Domestic Purpose [25 nos. worker & staff @45 lit/person /day]	1.0	0.9
2	Vehicle/Tyre Washing	1.0	1.0
3	Water Sprinkling on composting waste [@25 lit/ton of waste	1.0	0
4	Green Belt	7.0	0
5	Dust Suppression	1.0	0
	Total	11.0	1.9

2.4.2 POWER REQUIREMENT

Power demand for the project during operation phase[approx. 200 KVA] will be sourced from local electricity distribution authority.D.G. Set of 150 KVA will be provided at site as back up during power failure.

2.4.3 MANPOWER REQUIREMENT

During peak construction phase approx. 50 workers (skilled & semi-skilled workers) will be hired, mostly from local areas.

Operational manpower requirement for the solid waste management facility [composting and landfill] is estimated as 25. No Housing facilities or colony will be provided. The workers shall be employed from nearby areas.

2.4.4 PERIPHERAL AND INTERNAL ROADS

Good motorable peripheral roads shall be provided all round the compost yard along the perimeter. The access road to daily MSW stack and reject handling area shall be such that it can handle 15 MT vehicle weight and width shall not be less than 5m.

2.4.5 DRAINAGE SYSTEM

A Proper drainage system will be designed for management of storm water run off. The drainage system for leachate from compost plant and landfill site will be designed separately. Storm water drain shall be constructed all along the outer periphery of soil bund. Proper drainage system is will prevent the runoff from the surrounding areas entering into the active landfill area and will also prevent water logging over the final cover of the landfill facility. Storm water will be collected and reused in composting, vehicle washing during monsoon season.

2.4.6 STREET LIGHTING

Street lights will be installed for Compost Yard site. The street lighting with permanent posts has been considered for main internal roads and access roads. On the active face of Compost Yard, movable heavy-duty focus lamps shall be provided depending on the operational requirement.

2.4.7 LANDSCAPING

Adequate green cover [approx. 3347 sqm]will be developed around the project site. A thick green belt [approx.8.5 m wide]will be provided with trees of local species all along the periphery of the project site. The rows of trees will act as wind barrier. This also prevents foul smell polluting the neighboring area. Total 600 nos. of plants have been proposed considering 2m x 2m grid with 2m distance between two plants. The plants recommended are as follows:

1) Polyalthia (Outer row) -- Plant to Plant 1.5m

2) Pongamia (Middle row) -- Plant to Plant 5.0m

3) Flowering trees (Inner row) -- Plant to Plant 5.0m

The spacing between Polyalthia and Pongamia is 2m and between Pongamia and Flowering trees is 2m.

2.4.8 FIRE PROTECTION FACILITIES

Proper fire fighting equipments will be installed at various locations within the MSW management facility. Fire detectors, fire alarm, water sprinkler etc will be installed at easily accessible locations. Approval from the concerned department will be obtained.

2.4.9 TREATMENT PLANT FOR LEACHATE AND LIQUID WASTE

The leachate generated form landfill site will be collected through leachate collection system. Leachate consist of high organic loading and therefore will be recirculated and sprayed over composting piles. Composting piles gets dried over the time and which requires addition of moisture or water on regular basis. Leachate recirculation could speed up composting activity and reduce fresh water demand. Remaining leachate if any, will be is treated using physical and biological processes to obtain required level of quality and reused in green area and dust suppression within the premises. It has been recommended that any drain whether open or covered used for leachate transfer from the collection system to the treatment plant must be properly lined by means a properly laid 1.5mm thick geo membrane with joints welded to the same specification.

Sewage from toilet will be disposed through septic tank followed by soak pit. Vehicle washing effluent and leachate will be reused in composting.

2.5 CURRENTSCENARIOOFMUNICIPALSOLIDWASTEMANAGEMENT

The Nagar Nigam Kotdwar has currently 237 workers including 46 as permanent safai karamchari and remaining are Muhalla samiti excluding 16 drivers and rest are outsourced as per requirement. Currently some extend of source segregation is done, ULB has distributed 2 colour coded dustbins to most households. Collection is also done from inaccessible wards and narrow streets in handcarts which ultimately transferred to secondary collection vehicle and secondary storage community bins on daily or alternate days. Street sweeping is done daily and drain cleaning is done twice a week. Secondary bin is cleaned at least once in daily or when its full whichever is earlier.

Present Disposal – Dry waste is processed in the compactor machine at old dumping site although some fraction of plastic bottles and recycles items are sold to the recyclers. Currently there is no transfer station in Nagar Nigam, the collected waste is directly transferred to Paniyali lakdi padao wheremanual material recovery is being done and remaining wastes are openly dumped.

2.6 WASTEGENERATIONFORECAST&SOLID WASTE MANAGEMENT

To analyze future projection of population and major concentration of population, ward wise data and decadal data were taken during DPR preparation. The population projection in DPR was carried out based on following methods –

- Arithmetic increase
- Incremental increase method
- Geometric increase

In case of Kotdwar, Arithmetic projection was preferred method due to its old town and saturated population and the same was adapted for the design purpose. The average state growth rate (19.17%) is adopted for the population projection and the design purpose.

The population growth in Kotdwar MC has been 32.4 percent during the last decade (2001- 2011), which is much more than the population growth of the district (-1.41 percent) and the State (18.81 percent). Due to the merger of low-density Panchayats, the population density of the city has been decreased.

HorizonY	Arithmeticinc	Difference	NetArithmeti	Floatingpopu	PerCapit	Daily	Annual
ear	rease	inpopulation	с	lation	a,	wastegenera	wasteGenerati
	Method	2011	Increase		gm/day	tion	on
2011	33035	102565	135600	20340	300	41.3	15070.9
2012	33981	103511	137492	20624	300	41.9	15324.0
2013	34927	104457	139385	20908	300	42.4	15534.9
2014	35874	105404	141277	21192	300	43.0	15745.8
2015	36820	106350	143170	21475	300	43.6	15956.7
2016	37766	107296	145062	21759	300	44.2	16211.8
2017	38712	108242	146955	22043	304	45.4	16609.5
2018	39659	109189	148847	22327	308	46.6	17058.9
2019	40605	110135	150740	22611	313	47.9	17517.7
2020	41551	111081	152632	22895	317	49.1	18035.1
2021	42497	112027	154525	23179	322	50.4	18463.9
2022	43444	112974	156417	23463	326	51.8	18951.6
2023	44390	113920	158310	23746	331	53.1	19449.5
2024	45336	114866	160202	24030	335	54.5	20012.1
2025	46282	115812	162095	24314	340	55.9	20476.0
2026	47228	116759	163987	24598	345	57.4	21005.1
2027	48175	117705	165879	24882	350	58.9	21544.9
2028	49121	118651	167772	25166	355	60.4	22156.2
2029	50067	119597	169664	25450	359	61.9	22657.9
2030	51013	120543	171557	25734	364	63.5	23231.3
2031	51960	121490	173449	26017	370	65.1	23816.4
2032	52906	122436	175342	26301	375	66.7	24480.1
2033	53852	123382	177234	26585	380	68.4	25022.3

Table 2. 3 (A): Population Projection and Waste Generation in Kotdwar

ITHC/PRJ/22-23/EIA/52/Rev.02

NAGAR NIGAM KOTDWAR

DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND

2022

HorizonY	Arithmeticinc	Difference	NetArithmeti	Floatingpopu	PerCapit	Daily	Annual
ear	rease	inpopulation	С	lation	a,	wastegenera	wasteGenerati
	Method	2011	Increase		gm/day	tion	on
2034	54798	124328	179127	26869	385	70.1	25643.6
2035	55745	125275	181019	27153	391	71.8	26277.3
2036	56691	126221	182912	27437	396	73.6	26997.3
2037	57637	127167	184804	27721	402	75.4	27583.1
2038	58583	128113	186697	28004	407	77.2	28255.7
2039	59530	129060	188589	28288	413	79.1	28941.7
2040	60476	130006	190482	28572	419	81.0	29722.4
2041	61422	130952	192374	28856	425	82.9	30355.0

2.7 WASTE ANALYSIS



Food/ Vegetablewaste	Plastic	Paper	Leather/texti le	Glass/Ceramic	Inert/street sweeping/drainagesludg e
52 %	16 %	7 %	5 %	11 %	9 %

Figure 2. 9 (A): WASTE CHARACTERISTICS [PHYSICAL]

2.8 PROPOSED WASTEMANAGEMENT PLAN

The project consists of:

- Segregation and storage of Wastes [3 bin system]
- Primary 3 bins door to door collection system
- Secondary Storage cum mini material recovery facility [Small Transfer Station]
- Secondary Collection & Transportation System
- > Centralized Material Recovery Facility at Lakdi Padao
- Sanitary Waste Storage and Processing Plant at Lakdi Padao
> Integrated Solid Waste Management Facility at Kanchan Puri, Kotdwar.

The present system will be upgraded to ensure safe collection of waste from sources to the extent possible, transportation of the same either directly or to the secondary storage and subsequent transportation from there for treatment and final disposal of rejects and inert wastes. The system is designed to manage 100 percent of the waste reaching the Municipal stream- daily removal of organic matter to treatment plant for processing and need based removal of inorganic and inert to landfill site and disposal by sanitary methods.

The management plan is designed for handling 80 ton of wastes for design year 2039 generated in the Kotdwar ULB considering that all waste is handled at the local level through centralized model.

The proposed infrastructure for primary waste collection will cover about 32,600 households under door-to-door collection system, over a five-year period. Simultaneously, door step/kerbside collection to collect solid wastes everyday shall be introduced for non-domestic and other sources. All the generators through community awareness programme, will be sensitized and trained to segregate the wet and dry wastes in separate bins.

The detailed Plan mainly focuses the following key components:

- Promoting segregation and storage of waste at source in two bins- for biodegradable waste and recyclable / other non-biodegradable, so as to facilitate an organized and hierarchical system of waste collection and disposal;
- (ii) Organization of door to door / kerb-side collection with community participation on cost recovery basis and minimize the multiple handling of waste, improvement in the productivity of labor and equipment. Nagar Nigam will motivate segregation, storage and door step primary collection through one time supply two bins to households willing to join door step collection;
- (iii) Direct transportation of waste from large generators without an intermediate storage in covered tipper vehicles;
- (iv) Daily transportation of organic waste /mixed waste to treatment site by Container transportation using simple hydraulic system mounted dumper placer vehicles;
- (v) Need based transportation of inorganic and other dry wastes to landfill site by dumper placers;
- (vi) Collection and transportation of garden waste on pre-fixed days in tipper trucks;
- (vii) Awareness creation for segregation, storage at source, home level composting, waste reduction at source;
- (viii) Institutional strengthening and capacity building; and
- (ix) Monitoring system to increase productivity and for timely redressal of complaints.

The efficiency of the proposed Waste Management Plan will be driven by the separation of waste at the primary collection level. For this purpose, following approach needs to be adopted by the residents as well as the municipality personnel –

- Create awareness for segregation and storage of waste in three bin system for wet, dry and household biomedical/ hazardous waste
- Organize awareness campaigns for waste segregation through local NGO's, school representatives
- Regular meeting and interaction with representatives of local residents' associations, community participants, NGO's etc.
- Direct waste generators not to throw waste in the neighborhood, on streets and open areas.

However, it is not easy to implement source segregation practices immediately. A prolonged campaign will be required with adequate budgetary provisions to impress the citizens that source segregation will provide them a healthy environment and a better lifestyle.

Nagar Nigam Kotdwar aims to be cleanest, hygienic and free of any unwanted littering in the city and want to create clean and hygienic place for its residents. It is already trying to reach 100% door to door collection in all of its wards.

✓ Source segregation is key aspect and 3 color coded [wet, dry and sanitary wastes]dustbins will be provided to each household on one time basis. The commercial shops will also be encouraged to adopt the practice of segregation.

User charges is also advised to be differential i.e. take double the amount of user charges from the non-segregating households and take half the user charges from the segregating households for first six months. Also same will be levied for the commercial shops and restaurants.

- ✓ Waste from households and commercial places will be collected by the pushcart/tricycle, auto tippers & pickup vehicles. Very few collection points will be made in the city so that the primary collected waste can be directly unloaded into the auto tippers and further transported to the processing site.
- ✓ The waste will be further segregated at the processing site into various material streams. The wet waste will be shredded and sent to compost yard for making compost.
- ✓ Dry waste will be segregated on different material types like plastic, paper, glass etc. Materials like plastic bottles, hard papers are sent to compactor machine for volume reduction & further to shredder for shredding the plastic caps and hard plastics. This process increases the selling price of the plastics and due to presence of huge industrial area the ULB will be able to sell the same. The segregated and processed inorganic waste will be sold to various recyclers/vendors on regular basis.
- ✓ Compost processing rejects, inert materials and non-recyclable materials will be disposed to the proposed sanitary landfill facility at the site.

The proposed Process flow Chart & Material Balance is given in in the processing facility is given in Fig 2.5 (B) & (C) below -

NAGAR NIGAM KOTDWAR DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND



Figure 2. 10 (B): PROCESS FLOW OF SWM FACILITY

2022



Figure 2. 11 (C): MATERIAL BALANCE DIAGRAM

2.8.1 SOURCE SEGREGATION OF WASTES

Wet Waste (Greenbin)		Sanitary (Red I	Wastes Bin)						
	'	WithFurtherSub-SegregationBasic							
Foodwastesofall	Paper	Containers &	Rags	MetalsGlass	Santary	wastes			
kinds,Cooked	cardboard	packagingofallkin		(all kinds)	and diap	ers.			
anduncooked,	andcartons	dsexcluding	Rubber	Inerts					
includingeggshells,		those containing	Wood						
bones		hazardous	Discarded	House					
		materials	clothing	sweepings					
flower and fruit		Compound	Furniture	and inerts					
wastes including		packaging		(notgarden,					
juicepeelsandhouse		(tetrapak,		yard					
plantwastes		blisters etc.)		orStreet					
Soiledtissues,		andplastics		sweepings)					
Food wrappers		packagingofall							
Papertowels		kind							

Table 2. 4 (B): Source Segregation of Waste

Waste should be stored at the source of waste generation till it is collected for disposal by ULB staff or appointed contractors. It is essential to segregate wastes into wet waste (kitchen waste) and dry waste (recyclable waste and others), commonly referred to as primary segregation. Segregation of municipal solid waste needs to be linked to primary collection of waste from the door step and given high priority by the ULBs; the local community should be educated and enthused to perform the following actions to ensure collection of segregated waste:

- ✓ At the household level MSW should be segregated into wet and dry fractions, at a minimum, and stored in separate containers.
- ✓ Ensure domestic hazardous wastes (e.g. batteries, used CFLs, tube lights, chemical/paint/insecticide containers etc.) are handed over separately at the door step or at special pick-up points specified by the municipal authority or through the relevant retail trade (e.g. for batteries). As long as there are no specific pick-up points/services for collecting such waste, these wastes may be handed over along with the dry waste fraction as an interim solution. Bi-weekly programme & two no. of recycling stations also planned for collection of such waste.
- ✓ Diapers and sanitary napkins should be wrapped securely before being put in the bin meant for it, for the protection of the waste handlers and should be marked with a "Red Cross" to enable further segregation and disposal.
- ✓ All the waste generators through community awareness programme and behaviour change campaigns, will be sensitized and trained to segregate their waste into 3 bin system ie. Wet, dry and sanitary waste.

2.8.2 STORAGE OF WASTE

HOUSEHOLD STORAGE:

✓ At the household level dry waste and wet waste should be stored in separate garbage bins – wet wastes in green covered bin and dry wsates in covered blue bin. A container of 15 lit capacity with paddle for a family of five members would be adequate as collection will take place on daily basis.

COMMERCIAL STORAGE:

- ✓ Shops, commercial establishments and businesses will store segregated waste onsite. Designated auto tippers will collect at fixed time on daily basis. Vegetable and flower market waste generators would be instructed to deposit their waste in conveniently located large green bins.
- ✓ Typically, four wheeled, HDPE, injection molded, international standard, UV tested bins or metal bins of 60L capacity to be used.

PUBLIC PLACES:

✓ With a view to achive clean streets and public places, litter bins will be provided along the important roads of the city, markets, public places, tourist spots, bus and railway stations, etc. The distance ranging of 20m to 50 m depending on the local condition.

2.8.3 COLLECTION&TRANSPORTATIONSYSTEM

Collection of wet and dry waste separately enhances the potential of efficient and cost effective treatment of such wastes and ensure optimum advantage from the recyclable material fed into the system. Waste collection services are divided into primary and secondary collection. Primary collection refers to the process of collecting waste from households, markets, institutions and other commercial establishments and taking the waste to a storage depot/ transfer station or directly to the disposal site.

2.8.4 SECONDARY STORAGE CUM MINI MATERIAL RECOVERY FACILITY (MINI TRANSFER STATIONS)

Kotdwar city is distributed over 52 sq.km area with end to end distance of around 17 km hence to increase efficiency of D2D collection system (more number of trips/ shift), two secondary collection cum minim MRF centres has been proposed. In this centre segregated wet waste is transported to proposed integrated solid waste management facility at Kanchanpuri and Segregated dry and sanitary waste is transported to centralized MRF.

SN	Name					Location	Coordinates
1	Secondary	collection	cum	Mini	MRF	Simmal Chor, Kotdwar	29°45'0.28"N/
	centre-1						78°29'10.74"E
2	Secondary	Collection	cum	Mini	MRF	Near Library, Kotdwar	29°44'35.22"N/
	Centre-2						78°31'5.19"E

2.8.5 CENTRALIZED MATERIAL RECOVERY FACILITY

Kotdwar nagar nigam has already established centralized material recovery facility at Lakdi Padao which is manually operating and equipped with baling machine. This facility has been proposed for upgradation into semi mechanized MRF facility where all the dry waste from the city will be processed centrally.

SN	Name	Location	Coordinates		
1	Centralized Material Recovery Facillity	Lakdi Padao	29°44'28.50"N/ 78°31'36.47"E		

2.8.6 SANITARY WASTE STORAGE & PROCESSING PLANT, LAKDI PADAO

As per provisions of the Solid Waste Management Rules 2016, Kotdwar Nagar Nigam has initiated 3 bins D2D collection system. Sanitary waste like diapers and sanitary napkin waste will be collected separately and transported to centralized sanitary waste storage and processing facility proposed at Lakdi padao near centralized MRF facility.

SN	Name	Location	Coordinates
1	Sanitary waste storage & processing facility	Lakdi Padao	29°44'29.76"N/ 78°31'36.56"E





Figure 2. 12 (F)FLOW CHART FOR COLLECTION, TRANSPORTATION & DISPOSAL OF RESIDENTIAL & VEGETABLE MARKET WASTE

- ✓ Segregated waste must be stored on-site in separate containers for further collection and should be kept separate during all steps of waste collection, transportation and processing.Further, the transport vehicles shall be compatible with the equipment design at the waste storage depot and be able to transport segregated waste.
- ✓ It is essential to separate street sweeping and drainage waste completely from the household waste streams through all stages of collection, transport and treatment since street sweeping and drainage infiltrates significant amounts of toxic substances (e.g heavy metals and is often responsible for contamination of waste streams envisaged for composting and recycling.
- Recycling centre is also planned with separate bins for electronic waste at main tourist spots and at strategic commercial locations. One such centre will be set up near Nagar Nigam office, remaining oine can be set up after due discussions with all the stake holders.

Primary collection

Requirement of vehicles and Equipment for primary Collection: Approx. 32,600 households will be covered under door to door collection system over a 5-year period. Simultaneously door step/kerbside collection shall be introduced to collect everyday wastes from non-domestic and other households.

It is estimated that about 200 households can be covered by a hand cart In 5 hours and 350 -500 households can be covered by a 2 member collection crew with an auto tippler and pick up, three skid loader and two tractor with trolley to cover 32600 households targeted.

- ✓ As estimayed about 190 numbers of wheelbarrow with 140 lit container in one level to cover 5 km stretch
- ✓ E-Rickshaw with loader with 8 tons of 450 L container in two level of cover the narrow and inaccessible street and market
- ✓ Auto Tipper four-wheeler with 20 numbers of 2 cum container in two levels to cover 350 houses per day with one member crew and one driver
- ✓ Auto pickup four wheeler with 4 numbers of 2 cum container for in two levels to cover 500 houses per day with one crew and one driver for kerb/block collection from non-domestic/ remaining households not covered under door step collection
- ✓ Tractor with Trolley with 6 nos of 2 cum of capacity for secondary collection of waste and muck from drain cleaning.
- ✓ Skid steer loader 2nos required to quickly clear off the waste generated due to huge floating population in the city. This will in turn will help in making the city bin less.

Street Sweeping:Daily sweeping of all the lanes with dense habitation or commercial activities will be introduced. Street sweeping staff will be duputed for every 500 m highly congested areas, 750 m in medium density areas and 1000 m in low density areas. The total road length (including BT,WBM and earthen) in Nagar Nigam is estimated to be 40 km. The roads are categorised into those in city centre and busy area, in medium density area, low density and fringe areas and the following system will be followed.

- ✓ Collecting the sweepings in containerized handcart
- ✓ Depositing the sweeping & drain cleaning in the nearby container.
- ✓ Cleaning the container stations within the beat length.
- ✓ Emptying litter bins in the area

Drain Cleaning :There are about 40 km of drain and currently about 10 workers are employed for the cleaning of drains. Considering the nature of work, the following aspects will be employed.

- ✓ Small drains upto 60 cm wide and 45 cm average depth (road side drains) shall be attended by sweeping crew
- ✓ Large drains, beyond the above size shall be attended by the drain clearing team along with appropriate vehicles and equipment.

✓ Pre-monsoon clearing of major primary drains shall be carried out by engaging contractors for the purpose.

2.8.7 PROPOSED WASTES PROCESSING AND DISPOSAL FACILITY

A land of area 0.998 Ha has been selected for the SWM project at Kanchan Puri, Haldukhatta Malankham, Kotdwar. The land has been transferred to Nagar Nigam by Lansdowne Forest Division.

The proposed facility will have following components -

- 4) Processing of Organic Waste through Compost Plant
- 5) Processing of Recyclable Materials from Mixed Dry Wastes
- 6) Sanitary Landfill for Rejects from processing and Inerts Wates
- The primary segregated waste will be bought into tipping area and further segregated into various recycling steams (into 12 types) which will be in turn sold to nearest "Recyclers / local Kabadiwala" weekly.
- Conveyor belt with trommel system will be given of capacity 80 TPD to cater to pre-compost conversion to take out the minor size inorganic items and for easy sorting into various recycling streams. Containers will be provided to store the segregated inorganic materials to be further sold to local recyclers. The selling can be done week wise in a designated day and ULB should register the Kabadiwalas/ rag pickers for including them in the disposal of these inorganic / recyclable items.
- Step wise landfill will be provided to inert and reject wastes. The ULB will acquire separate land to cater the 30 year design period.

2.8.7.1 TIPPING SHARED AND MATERIAL SEGREGATION

After entering the site and noted by the security staff according to vehicle number, the incoming waste will be weighed in the weigh bridge. The waste will then go to the tipping shed for further material segregation and the organic wastes will be taken into the organic processing house.

2.8.7.2 PROCESSING OF ORGANIC WASTE

Capacity - 43.2 ~ 43 TPD [Planned for a design period of 20 years].

A) Windrow Composting Process-

- The windrow composting process involves placing the waste into long heaps of trapezoidal shapes known as windrows with base width of 5 to 6 m, top width 2 to 3 m and height 2 to 3 m. The windrows will be placed on a covered concrete platform.
- Cow dung culture or efficient microbial culture is sprayed on the windrows to control the odour and flies. The temperature inside the window increases rapidly due to bacterial action which eradicates pathogens and weed seeds.

- Waste is turned from one windrows to other twice a week to provide aeration for enhancing the decomposition process. The process will continue over 4 weeks and the material after windrow process will be stored under shelter for a period of one week for stabilization.
- The stabilized material will be screened for extracting organic manure.
- Further to enrich the compost quality, organic additives like neem cake, rock phosphate decomposed poultry litter and micronutrients like zinc and boron will be added and the final compost product will be packed and stored for marketing.

B) Windrow Composting Components-

The main component for the above process are as follows:

- ✓ Covered aerobic compost yard
- ✓ Compost processing shed with finishing and storage area
- ✓ Reject storage area
- ✓ Laboratory
- ✓ Leachate drain and Leachate collection tank for recycling
- ✓ Slurry tank for cowdung EM culture
- Electro mechanical equipment comprising trommels, conveyors, sieves, weighing and bagging machines





Table 2. 5 (B): ORGANIC WASTE PROCESSING AREA CALCLATION

Waste Processing Shed Area Calculation						
S.N	Component Description	Area (SQM)	Reference			
1	Tipping floor	560	Chapter 5.1 DPR			
2	Composting area	1100.0	В			
3	Maturation area	132.0	С			
4	Compost processing & packaging area	900.0	D			
5	Finished compost storage area	108.0	E			
	Total Area	2800				

B- composting pad area					
S.N	Item	Unit	Qty		
1	Waste generation for 2036- design year	TPD	80.0		
2	Fraction of organic content	%	55.0		
3	Quantity of organic waste	TPD	44.0		
4	Density of incoming waste for compost	kg/CUM	700.0		
5	Daily volume of waste	CUM	62.9		
6	Number of days in compost pad	days	35.0		
7	Total volume of waste for composting	CUM	2200.0		
8	Height of aerated pile	м	2.00		
9	Area required for compost pad	SQM	1100.0		
	C-Maturation Pad Area				
1	Daily volume of waste	CUM	62.9		
2	No of days in maturation pad	days	14.0		
3	Total volume of waste	CUM	880.0		
4	Volume reduction after windrow turning	%	70.0		
5	Volume of digested waste for composting pad	CUM	264.0		
6	Pile height	м	2.0		
7	Area required for maturation pad	SQM	132.0		
	D-Compost processing & packaging	area			
1	Compost processing & packaging shed area (30x30)	SQM	900.0		
	E-Finished compost storage shed a	rea			
1	Finished compost storage area (10m x 10.8m)	SQM	108		

Composting by forced aeration

To ensure adequate air supply during the composting process, a blower is used to force or draw air through the pile. No turning of material is required once the pile is formed and therefore, particular attention is to be given during blending of material to maintain porosity throughout the composting period. Wood chips, corn cobs, crop residues, bark, leaves, paper, recycled composrt etc. may be used to adjust the moisture content and texture of the primary stock and make it ahomogeneous mixture while constructing the pile.

Pile dimension will be 1.5–2.5m high and 2-5m wide. Pile length will be limited by the air distribution in the aeration pipe and shall be less than 22m. A 15 cm layer of finished compost may be used to cover the material to reduce drying, heat loss, flies and act as a biofiller for foul smelling gases.

After about 30 days, the process enters maturing or curing stage and material in the piles change colour like soil while the pile temperature falls below 50°C. Residence time at this stage is 14-15 days in maturing box.

After 14-15 days, the material is transferred for screening by using a flat frame sieve or a rotating drum sieve. Tipping area can also be used as monsoon shed during heavy rains.

2.8.7.3 PROCESSINGOF INORGANIC WASTE

After the Initial weighing, the collection vehicle transport their loads to the receiving "(tipping area) for temporary storage and initial processing. Main parts of the unit are -

- ✓ Feeder Conveyor (feeding compartment)
- ✓ Hand Sorting
- ✓ Primary separation unit (first trommel 75 mm)
- ✓ First reject belt
- ✓ Second Trommel unit (25 mm)
- ✓ Second rejection belt
- ✓ Magnetic separator
- ✓ Air separator
- ✓ Baler



The incoming solid wastes above 120mm sise is manually sorted as landfillables in a moving belt conveyor and tehn passed through magnetic separator.

The oversized material generated from 75 mm, 25 mm and 4 mm mechanical screens is fed to three different air density separators to separate lighter zand heavier fractions. The lighter fraction will be sent to magnetic separator to remove ferrous materials from the waste.

The waste is then fed to shredder and the shredded fluffy solid wastes [RDF] will undergo further mechanical screening to remove dust and then stored.

A) Feeder Conveyor or Feeding Compartment

Firstly the solid wastes are fed on the conveyor system to transfer waste from one location to other. Biodegradable waste is spread into the feeder conveyor using back hoe loader. The feeder conveyor is 8 m long and 0.75 m wide it is rectangular in shape and has a under carriage conveyor. The top of the feeder conveyor is open. The inner side has two metallic sheet which are fabricated in a fixed manner. One side is closed and other side is open to the primary separation and the chain is operated by hydraulic power pack hydro motor and reduction gear. When power pack is operated the conveyor of the feeding compartment is directed towards the opening of the first Trommel where sieving starts.

B) Hand sorting

After feeder conveyor belt the MSW is transferred to the flat belt roller conveyor where the worker segregates the waste manually into different categories. The most basic and the simple method for the separation of material from municipal solid waste is hand sorting. Workers takes position along

the conveyor belt either on one or both sides. MSW is drawn to the conveyor belt from the tipping area picking can occur at the several points along the systems and the workers have two primary function first they recover any items of potential value that do not need to be processed. Items such as metal and pet bottles are set aside in. in bins and chutes. Their second responsibility is to remove those material that are detrimental either to the workers or to downstream, to the quality of final separated products or to the system equipment. This could include removing and potential explosive items.

C) Screening

Screening is the unit operation design for the separation of waste inputs into over size and under size fractions. The screening is carried out either as wet or dry although dry separation is most common screening is classified as primary secondary or tertiary depending on if there are any chance sequence of separation steps. The primary application of screening during municipal solid waste processing include:

- ✓ Removal of over size material
- ✓ Removal of under size material
- ✓ Recovery of recyclable materials
- ✓ Separation of soil glass and great from combustible material

D) Primary separation unit [First Trommel 75 mm]

Trommel is a screen cylinder used to separate material by size. The first trommel with an opening of 75 mm, 8mm thick wire mesh, barrel size 5 m long and has a diameter of 1.5 m. The barrel is placed an inclination of 4 degree. This inclination is for the movement of garbage to the other end of the barrel while rotating. Barrel is supported by 2 nos Trommel stoppers at both ends.

Sieving of the degraded municipal solid waste is done by a rotating the barrel and the material passed through the mesh are collected in an undercarriage conveyer and carries the material to the second terminal.

The material that are retained in the trommel are directed to air separator where recyclable waste are sent to baling machines via conveyor belt that is first rejection belt. The screening efficiency of the sieve is mainly dependent on the moisture content of the material. Dry material can be shifted efficiently through final or lesser mess size.

E) Second Trommel [25 mm]

After the windows reached 35 days the next step is mechanical sieving with the help of trommel. This trammel is similar to first trammel but with an opening of 25 mm, 8 mm thick wire meshed barrel of size 5 m long, 1.5 m diameter and two pull rings at both ends.

Product obtained from the second trammel is again passed through 4 mm trammel to achieve fine quality compost. Rejects obtained are carried through a rejection belt to air separator and finally disposed to landfill.

F) Magnetic Separator

Magnetic separation is undertaken to recover magnetic materials [primarily ferrous materials] from mixed solid wastes. On an average incoming solid wastes contain approximately 5.3% ferrous materials.



Figure 2. 14 (A): MAGNETIC SEPERATOR

G) Air separator

Air separator is a unit operation designed to separate light waste component e.g. paper, plastic from heavier components (e.g., metal, glass and stones). When waste mixture is fed into an air stream of sufficient velocity, the light materials will be carried away from the air stream while the heavier components falls.

H) Baler

Baleris used for productions of bales of corrugated cardboard, newspaper, high grade paper, aluminium canes and plastic containers. Baled wastes are sold to recyclers.

SANITARY LANDFILL

Total Capacity proposed at present is 11,800 MT. As per present availability of land, now the landfill has been planned for a design period of 5 years. Within next 1-2 years, the Nagar Nigam shall identify and establish another sanitary landfill site on non-forestry land with life expectancy of 25 years and develop the site within 5 years.

Waste categories to be disposed in sanitary landfills-

- ✓ Waste that is by its nature or through pre-treatment non-biodegradable and inert;
- ✓ Pre-processing and post-processing rejects from waste processing sites;
- ✓ Non-hazardous waste not being processed or recycled.

The Proposed Sanitary Landfill consists of:-

- ✓ A liner system at the base and sides of the Sanitary Landfill to prevent contamination due to leachate or gas to the surrounding soil.
- ✓ A leachate collection and control facility to collect leachate from within and from the base of the Sanitary Landfill and then recycle/treat the leachate.
- ✓ Gas vent systemto release gas from within the Sanitary Landfill.
- ✓ A final cover system at the top of the landfill to enhance surface drainage, prevent water infiltration and also to support surface vegetation.
- ✓ Surface water drainage system which collects and removes all surface runoff from the Sanitary Landfill site.
- ✓ An environmental monitoring system will be introduced for periodical collection and analysis of air, surface water, soiland ground water samples around the landfill site.
- Closure and post-closure plan once the filling operation will be completed and the activities for long- term monitoring, operation and maintenance of the closed Sanitary Landfill.



Figure 2. 15(D)-PLAN OF THE PROPOSED LANDFILL SITE



Figure 2. 16 (E)–SECTION OF THE PROPOSED LANDFILL SITE



Figure 2. 17(F)–SLOPE OF THE PROPOSED LANDFILL SITE

2.8.7.4 LEACHATE HOLDING TANK

A drainage layer of 30 cm granular material of permeability > 1 x10-2 cm/sec is provided over the HDPE liner at the base of the landfill in order to collect the leachate. The collection layer shall comprise of a network of perforated HDPE lateral pipes laid at a slope of 2% and 20 m c/c spacing.

These laterals shall collect leachate and transfer it to the HDPE header pipe, which will be laid at a slope of 1%. The header pipe ultimately transfers the leachate into the Leachate collection sump. All operations will be planned in such a way that generation of liquid waste is minimum and the leachate directly reaches the leachate collection sump for treatment.

Apart from the leachate generated as a result of inflow of rainwater into the landfill, the seepage from the moisture content present in the solid waste and the moisture present in the daily soil cover are the few sources of leachate generation. 10 % evaporation has been considered. In order to collect and convey the leachate generated to the collection sump, a leachate collection system has been designed. It comprises of the following:

- ✓ Drainage layer
- ✓ A perforated pipe collection system
- ✓ Sump collection Area
- ✓ Treatment and disposal of the leachate

The leachate generation is a function of precipitation and is directly proportional to rainfall intensity and surface area. The quantity of leachate generation from the active rainfall is estimated by the following formula given by CPHEEO.

Leachate Generation rate, Qa = (C x I x A) / 1000 m3 / day Where A = N x a C = coefficient of runoff

I = heaviest rainfall in 24 hours, 100 mm/day for Kotdwar region

- A = effective surface area of operating phase
- N= No. of rainy days for maximum two months of rainy days, 4 days for Kotdwar region
- a = Surface area of daily cell, 2 sqm

Table 2. 6 (C):	Leachate Tank Evaluation
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1.	AverageTotalPrecipitationinKotdwar region	2374mm/year
2.	Onlyonephase isoperational peryear	
3.	Avg.planareaofeach day	2002 m ²
4.	Assuming80%	59.42m3/day
	precipitation in 4 months (monsoon period), peakle a chat	
	equantity(thumbrulebasis)	
5.	DiaofperforatedHDPEpipes	10cm
6.	Spacingofpiperequired	7

2022

7. Leachateholdingtankvolumeforpeakrainfallof 3 days 178.3 cum

2.8.7.5 GAS AND LEACHATE MANAGEMENTSYSTEM

Periodic inspection of the gas vent and leachate collection system shall be undertaken to identify broken pipes and damaged or clogged wells/sumps.

Repair work for gas and leachate management system requires skilled manpower and shall be carried out by the agencies operating the gas venting and leachate treatment facilities.



Figure 2. 18 (G)–GAS VENT DETAILS IN PROPOSED LANDFILL SITE

NAGAR NIGAM KOTDWAR

DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND



Figure 2. 19 (H)-DRAIN DETAILS IN PROPOSED LANDFILL SITE

2.9 LANDFILL PHASE OPERATION

The proposed landfill will be operated in phases to allow progressive use of the area such that at any given time a part of the site would have a final cover, a part being actively filled, a part being prepared to receive waste and a part undisturbed; A 'phase' consists of cells, lifts, daily cover, intermediate cover, liner and leachate collection facility, gas control facility and final cover over the sub-area. The term 'cell' is used to describe the volume of material placed in a landfill during one operating period, usually one day. A cell includes the solid waste deposited and the daily cover material surrounding it.

Daily cover will consist of 15 cm of native soil or inert debris or construction material that is applied to the working faces of the landfill at the end of each operating period. Waste subjected to land fillingshallbecompacted into thin layers using landfill compactors to achieve high density waste.

Prior to the commencement of monsoon season, an intermediate cover of 45cm thickness of soil shall be placed on the landfill with proper compaction and grading to prevent water infiltration during rains.

Proper drainage shall be provided to divert run off away from the active cell of the landfill. The runoff will be diverted to the garland drain provided at the site. A lift is a complete layer of cells over the active area of the landfill. Typically, each landfill phase is composed of a series of lifts.

Intermediate covers (45cm) are placed at the end of each phase; these are thicker than daily covers and remain exposed till the next phase is placed over it. The final lift includes the cover layer.

2.10 DAILY OPERATION

For an organized operation of the site total area & volume shall be calculated and the area shall be divided into different sub-plots or cells. Due to the concentration of rainfall during monsoon, movement within the landfill site becomes difficult during this season. It is thus desirable to use few sub plots near the entrance during monsoon. The subsidiary roads in the section to be utilized during monsoon shall be very carefully located and constructed to ensure trouble free and safe movement of refuse vehicles and bulldozers.

The incoming vehicle shall be directed form the main road to the sub road and then to the working face of the cell, it shall approach the unloading point in reverse gear, unload and move out in 5–10 minutes. A single pass of compaction equipment moving in the transverse direction will level the deposited waste. As subsequent loads are unloaded and leveled, the compactor operator shall ensure that at least three passes are made over every deposited refuse load. In this manner the entire cell shall be planned and after filling the cell by solid waste it shall be covered with a 15 cm cover layer on the top as well as on the sides.

After completion of one cell the second cell is taken up. During filling of one sub area, the adjacent sub area shall be prepared and kept ready for filling. The cells shall have a side slope of 3:1. The cells on periphery shall have 60 cm thick cover. There must be a provision to collect runoff water if there is a sudden rainfall. Drainage shall be provided at the site. After completing 1st layer of filling in the chosen cells, the procedure shall be repeated for subsequent layer of the cells.

After the desired lift height is reached, the top shall be provided with cover layer of 30cm thickness. This method of operation requires high quantity of cover material. The 'multiple lift' method of operation requires lower quantity of cover material. In this method, collection trucks dump waste at the top of the slope where upon dozers are deployed to compact the waste in layers of 1 m thickness. In this manner the cells are raised to the lift height with a pre-selected width by a length equal to the day's deposit. Thus daily cover is necessary only on the sloping face of the cell. Alternately, a movable tarpaulin could be used as a cover over the sloped face to prevent waste from exposure. This method requires less cover material.

After an intermediate cover has been laid, the second stage shall commence by leaving a 3 m clear berm on the outer periphery. This berm shall be provided with a 2 % slope towards the edge of the landfill and shall have vegetation for slope stability. The filling shall continue by repeating the procedure. After maximum height is reached, a final cover layer of 60 cm thickness with compaction shall be provided over the entire top surface of the landfill. This thickness is expected to be adequate to prevent the rodents from gaining access to any organic material, prevent escaping (except through the outlets specifically provided) to other portions of the landfill. The movement of compaction over the deposited waste results in primary consolidation. The dynamic forces result in rearrangement of particles and voids to give higher density. Secondary consolidation commences after this stage. The total settlement of the deposited waste depends upon initial compaction, waste characteristics, depth of over burden and degree of decomposition.

Following steps to be taken into consideration during Daily Landfill Operation:

- ✓ Waste shall be spread in thin layers and preferably compacted to achieve high density.
- ✓ Compaction shall be used on daily basis and covering it with inert material.
- ✓ The waste may be covered on daily basis with 15 cm thickness of inert material such as construction waste or soil to avoid any foul smell and breeding of rodents and insects.
- ✓ Waste shall not be allowed to be burnt at the landfill site at any point of time & proper fire safety equipment will be provided at the site.

2.11 LANDFILL CLOSURE PLAN:

At the end of life of the proposed sanitary landfill, it will be properly capped, closed as per the povisions of the Solid Waste Management Rules and green cover will be established. The land will be returned to the Forest Department.

Phase closure: After the last set of cells of a phase are placed (on the highest lift), the final cover is constructed. If another phase is to be placed over the just completed phase, an intermediate cover is provided. However, if the completed phase has reached final height of the landfill, then final cover system and surface water drainage system are provided.

An intermediate cover is made of locally available soil (preferably low permeability) and is 45cm thick. It is well compacted to achieve 95% proctor density with available means and provided a suitable gradient (3 to 5 %) to encourage surface water to run off from the cover and thus minimize infiltration. The side slopes of the intermediate cover are compacted by the crawler tracked dozer moving up and down the slope.

The final cover layer is applied to the entire landfill surface of the phase after all landfill operations are completed. The final cover usually consists of multiple layers designed to enhance surface drainage, intercept percolating water and support surface vegetation. The final cover shall have a barrier soil layer comprising of 60cm clay or blended soil with permeability coefficient less than 1 x 10-7 cm/sec.

The barrier soil layer is capped by a drainage layer of 15cm which then be capped by a vegetative layer of 45cm to support natural plant growth and to minimize erosion. Laying of the topsoil layer shall be done as soon as the protective layer construction is finished. Heavy construction equipment shall not be allowed on the finished surface.

The nutrient and liming requirements for the topsoil shall be assessed from a competent agricultural laboratory. In the absence of a regulatory recommendation / requirement regarding seed mix, a horticulturist or soil scientist shall be consulted. A combination of grass and bush type vegetation capable of surviving without irrigation water shall be planted.

At least five samples of topsoil per hectare shall be tested for nutrient and and liming requirements. Nutrient and seed mix application rates shall be supervised on site for quality control purpose. Utmost care shall be exercised in installation of the gas vents in the final cover where ever to be provided.

The final cover shall have a gradient of 3 to 5% to assist surface runoff. Lined ditches or channels are constructed on the final cover to intercept and carry surface water off the cover to the storm water basin. On the cover of each phase, settlement devices shall be installed for monitoring settlement of the landfill cover.

2.11LANDFILL SITE CLOSURE:

As each phase is completed and as the final level is reached in successive phases, the following interconnectivities are established:

- ✓ The leachate collection system of phase is sequentially connected
- ✓ The surface water drainage system for the cover of each phase is sequentially connected.
- ✓ The temporary surface water drainage system constructed at the base of each completed phase is dismantled.

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 & maintenance of landfill cover.

2.12 POST CLOSURE STABILISATION, OPERATION & CARE

If the landfill cover is intended to be used for a specific purpose e.g. park or golf course or vehicle parking area, then the cover shall be stabilized to achieve the end use. However, if no specific end – use is envisaged, then long – term vegetative stabilization will be undertaken to return the land to its original and natural vegetative landform.

Seedbed Preparation: Seedbed Preparation is necessary to set the stage for establishment of the short-term community. Initial operations may include grading, furrowing, or grouping to enhance microclimate and addition of nutrients and soil amendment, if required.

Short Term Vegetation: It is common practice, in both humid and dry environments, to rely largely on grasses for the primary 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 by irrigation.

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. All vegetation efforts shall be oriented towards self-generation and minimum management in the long term. Proper use of gas barriers with venting system prevents gas migration to the root zone. Waste may be removed from certain areas to enable planting of islands of trees.

2.13 SITE MANUAL AND RECORD KEEPING

As per the Manual on Municipal Solid Waste Management by CPHEEO, Oct. 2017, records of the various activities shall be kept on daily, weekly and monthly basis. The 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. The site manual shall contain the following information -

- ✓ Data collected during site selection
- ✓ Environmental impact assessment report
- ✓ Site investigation and characterization data
- ✓ Detailed topographical map
- ✓ Design of all landfill components
- ✓ Landfill layout and its phases
- ✓ Construction plans
- ✓ Detail of Leachate Management Plan
- ✓ Detail of Gas Management Plan
- ✓ Environmental Monitoring Program
- ✓ Closure and Post-closure Plan
- ✓ All permissions/licenses from concerned authorities.

2.14 SITEREPORT

The daily, weekly and monthly reports shall comprise of the following:

- ✓ Weighbridge data (daily inflow and outflow for each vehicle).
- ✓ Waste inspection data (daily)
- ✓ Materials, stores etc. (daily)
- ✓ Bills/ accounts (daily)
- ✓ Visitor record (daily)
- ✓ Complaints record from nearby areas (daily)
- ✓ Topographic survey at operating phase (daily / weekly)
- ✓ Photographic record at operating phase (daily / weekly)
- ✓ Environmental monitoring data (daily / weekly)
- ✓ Waste filling plan and actual progress i.e. cell construction (daily/weekly) and review (monthly).
- ✓ Leachate generation and gas generation (weekly / monthly / extreme events)
- ✓ Weather / climatic data (extreme events)
- ✓ Accidents etc.
- ✓ Others as per requirement.

2.15 WASTE INSPECTION PROCEDURE

Each vehicle carrying the waste must be checked for:

- ✓ Incoming weight (full)
- ✓ Outgoing weight (empty)
- ✓ Availability of relevant documents
- ✓ Visual check at weigh in (if feasible)
- ✓ Visual inspection after discharge at tipping area (inspection report to be filed for each vehicle).

2.16 PROPOSED PROJECT COST

The overall estimated project cost for collection, transportation, processing and disposal of wastes at Kotdwar is INR 1369.951 lakh. Summary of the project cost is given below –

S.	Item Description	Capital	Operational
No.		Expenditure	Expenditure [Annual]
1	Waste storage, collection, transportation	148,71,000	608,08,874
	and PPE cost [5 years]		
2	Materials and Machinery	170,34,000	-
3	Composting Unit and Sanitary Landfill	10,21,74,100	23,76,000
	including associated civil works		
4	Environmental Monitoring	17,56,000	450,000
5	IEC	11,60,000	-
	Total Cost	13,69,95,100	63,634,874

Table 2. 7: Summary of Capital & Operational Expenditure

2.17 PROJECT SUSTAINIBILITY

Project sustainability will be ensured if the byproducts (compost and recyclable materials) are marketable. The quality of the compost depends mainly on the efficiency of the waste sorting to avoid the presence of impurities in the final product.

2.18 PROJECT STRUCTURE AND STAKEHOLDERS RESPONSIBILITIES

Like the current system, Kotdwar Nagar Nigam may outsource the work of the proposed composting and landfill site in PPP mode for better operation and monitoring of the system. The Nagar Nigam shall also seek participation and continues feedback of the system from citizens and all other stakeholders via the MIS system.

Responsibility	Nagar Nigam	Private	Citizens
Collection/Segregation			
Implementation Plan for C&T			
Procurement of vehicles and machinery			
Manpower deployment	and the second street		
Sensitization of residents/public about segregation			
Orientation/sensitization of sanitary workers			
Provide facilities/bins for segregation			
Collection from households	A second second second		A CONTRACTOR
Involve NGO's / CBO's in awareness	A Shares		
Monitoring and supervision of agency work			
Redressal of complaints	Stand of the stand		Canad
	THE OWNER AND		
Operation & maintenance of vehicles & equipment			
Processing and Disposal Facility			
Commissioning & initial operation- biogas plant			
Procurement			
Construction of the facility	President 1	Carto Alla	
Supervision of Construction and Commissioning		Andrew States	
O&M of the facility			
User charges			

2.19 PROPOSED PROJECT IMPLEMENTATION SCHEDULE

Construction work for the proposed solid waste composting and landfill facility is likely to be started after obtaining the Environment Clearance, Consent to Establish and other necessary approvals. It will take approx. 12 months to complete the project.

Sr No	Project Activity	Months			的影響的								
51. NO.	Project Activity	121	2	3	4	5	6	7	8 1	9	10	11	12
A	Procurement of Vehicles & Equipment	13.24kg			(dis 255	1.00120	0.121		and a second to	91123012 2011	Contraction of the second second		Change of the states
1	Preparation of Specification and Bid document and Consent to establishment												
2	Invitation of Bid and Bid evaluation	199-100		(HARRING SAL	LICE STREET				1	1			
3	Procurement of vehicles & Equipment for primary collection and transportation for 5 years	CORC SATURA											
В	Material recovery facility	ET STREET	日本後生日	1.142.1615	1111556011	S. D. P. C. P.	AL PROPERTY.	NAG-BUR					
	Environmental assessment - EIA		Rolling	and a set	的松田建	1100000000 1110000000	などの言語	Real Products					
4	RFP for Development of Dry waste processing Unit		No. 2012 Provide States			24830.2014	and many						
5	Design Phase			C. DELTING	112 Kanta	Stat P							
6	Construction			IN THE OWNER	125.235	Set 1	· Restly in						
7	Commissioning			14153493536	Prove providence of	Restlements	ine partie	- CLARKER	-				
C	Composting Plant	1111111111		No. Aligi	Markan	TREAM	A STREET	(GH41) (GH41)	STREET OF	1 States and			
8	RFP for Development of CC			1. (AT) (A.)	The Penerspers	NO DE MERICE D	0000882136	CONTRACTOR AGE	And the second sector of	科学家自己的学			
9	Design Phase	COLUMN CONTRACTOR	a chesterentes	CONTRACTOR OF	134124		S a series	Case Provide					
10	Construction			AND STREET AND	stop 4 million and	an satur	· 法非规约期 · · · · · · · · · · · · · · · · · · ·	の時間目的ななないます。	See Street	S. Harris and S.			
11	Commissioning		·//				代的东南和南部	3時2時時時	And the second second	A DATE NO.			
D	Sanitary Landfill								THE ASSAULT	And Startes			
12	RFP for material supply and construction of sanitary landfill						な影響	時にい					
13	Construction			THE R. LEWIS CO.	Province advantage	the of the state of the	34代教授(1)	STATISTICS !!	Contraction and Contraction	(日本日本)の(日本)(日本)(日本)(日本)(日本)(日本)(日本)(日本)(日本)(日本)			
14	Commissioning						erre modelen til	COMPANY SECTO				-	

2.2 OBIOMINING OF THE EXISTING SOLID WASTE DUMPSITE

In absence of the composting and sanitary landfill facility in Kotdwar municipal area, all wastes collected are openly dumped near Paniyali Lakdi Padao which is located 4 km away from town.

As per the provisions of the Solid Waste Managemnt Rules, 2016, [Rule 15 - Duties and responsibilities of local authorities and village Panchayats of census towns and urban agglomerations], Kotdwar Nagar Nigam has already taken steps. Biomining work at the existing wastes dumping site at Ladki Padao was started in July 2021 through the agency named M/s Ecostane Infra Pvt Limited, Uttar Pradesh. Now processing has completed and RDF disposal is under progress. As estimated approx. 32000 MT of wastes have been processed.

Centralized material recovery facility has been already established at the existing site which will continue to operate in future as planned. The site will also have sanitary waste like diapers and sanitary napkin waste storage and processing facility near centralized MRF facility. After establishing the proposed Integrated Solid Waste Management Facility at Kanchanpuri, closure of the dumping of solid sates at existing site will be done.

CHAPTER 3-DESCRIPTION OF THE ENVIRONMENT

For the purpose of EIA study, project area is considered as the core zone (Host area) and area outside the project upto 10 km radius was considered as buffer zone. Baseline data generation was conducted for the nearby areas in the summer season of 2022.

The baseline environmental monitoring for various components of environment, viz. Air, Noise, Water and Soil quality was carried out during summer season- 5thMarch 2022 to 27thMay 2022(Site Specific Monitoring report is enclosed as Annexure II). Data on geology, hydrology, land-use, flora – fauna, socio-economic status, were collected from secondary sources and verified during the field visits. CPCB / MOEFCC approved methodology were followed in the EIA study.

The sampling locations were selected on the basis of the following: Predominant wind directions recorded by the India Meteorological Dept (IMD) Najibabad and site-specific data obtained from other sources, existing topography, roads, density habitations, forests, water body, etc.; and drainage pattern.



Table 3. 1(A): 10 KM RADIUS STUDY AREA MAP ON TOPOSHEET

2022

Historical meteorological data were obtained from Climatological tables pertaining to nearest IMD station located at Najibabad, which is presented in Table 3.2 (a) and Table 3.2(b).

TABLE 3. 2 (A):	: MET DATA	OF NAJIBABAD	(1981-2010)	- CLIMATOLOGI	CAL DATA FOR IMD
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	जलनायवी सारणी																						
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		एख.पी.ए hPa	डि. से ⁰ C	डि. से C	डि. से ^C C	डि. से ⁰ C	ਫ਼ਿ. ਜੋ ਂ	हि. से ⁰ C	डि. से ⁰ C		िंड्स ि⊂		प्रतिशत %	एस.पी.ए hPa	আকাঃ অন্য Oktas d	ाक गरा ofsky	मि.मि. mm		मि.मि. mm	चि.चि. mm	मि.मि. mm		कि.मी. पु. घँ. Kmph
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फरवरी FEB	I II	984.6 982.5	13.3 21.1	11.4 15.5	23.5	9.8	28.2	6.1	33.6	25 1974	0.8	9 1974	80 53	12.2 13.2	1.3 1.3	0.6 0.5	28.1	1.9	157.5 2007	0	66	14 2007	
मार्च MAR	I II	981.6 979.3	18.5 26.5	15.2 18.4	28.8	14	33.8	9	39	30 1973	2.2	3 1952	70 44	14.7 14.9	1.4 1.5	0.5 0.4	16.5	1.4	149.5 1982	0	66.4	2 1982	
अप्रैल APR	1	977.9 975	24.5 32.7	18.3 21	35.1	19	39.4	13.1	42.7	12 2010	9.1	3 1965	54 32	16.3 15.3	0.9 0.8	0.3 0.2	7.8	1	173.3 1983	0	72.4	16 1983	
मई MAY	1	974.6 971.2	28.5 35.5	21.7 23.5	37.3	23.5	41.4	18.6	45	28 1966	10.9	13 2003	54 34	20.5 19	0.6 0.7	0.2 0.1	24.1	1.8	139.1 2006	0	61	17 2006	
স্থা JUN	1 11	970.9 967.5	29.2 34.9	24.3 25.7	36.6	25.1	41.1	21	45.2	11 1960	14.6	28 1968	66 48	26.5 25.7	2 1.2	1.3 0.6	80.7	4.4	411.7 1984	2.6 1977	93.5	12 1984	
जुलाई JUL	1	970.7 968	27.8 31.5	25.9 27.1	33.1	25	37.2	22.5	43	2 1974	14.9	12 2003	85 70	31.8 32.2	4.2 3.3	3.6 2.4	295.7	9.3	1012.2 2010	14.4 2002	425	22 2010	
अगस्त AUG	I II	972.5 969.9	27.2 30.5	25.7 27	32.1	24.6	35.6	21.9	37.4	1 1987	16.9	1 2003	88 75	31.8 32.9	4.6 3.5	4.1 2.8	282.3	10.5	737.9 1978	32.4 1997	238	21 1985	
सितम्बर SEP	I II	976.5 973.7	25.9 30.3	24.2 25.8	32.1	23.3	34.9	20	36.7	13 1968	15.6	30 1962	86 69	28.9 29.7	2.6 2	2.3 1.6	163.7	5.7	594.2 2010	8 2001	193	6 1993	
अक्तूबर OCT	I II	981.9 979.1	22.3 28.6	19.5 22.4	31.3	18.2	33.9	13.4	35.7	2 2009	7.1	19 1998	76 57	20.6 22.3	0.4 0.4	0.3 0.2	14.3	0.9	279.2 1956	0	160.5	9 1956	
नगम्बर NOV	I II	985.5 982.9	16.5 23.9	14.3 18.3	27.5	12.4	31	8	35	1 1952	0	8 1997	77 56	14.7 16.7	0.3 0.3	0.1 0.1	3.9	0.3	35 1981	0	35	4 1981	
दिसम्बर DEC	1 11	987.3 985	11.7 19.5	10.3 14.9	22.6	7.9	27.1	4.2	30.4	10 2008	-1	19 1986	83 60	11.5 13.4	0.9 0.8	0.4 0.2	12	1	67.9 1977	0	47.2	27 1977	
आर्थिक योग या माख ANNUAL	Ĩ	979.3	21.3	18.3	30.0	17.6	41.9	4.1	45.2	11	-2.9	29	76	20	1.6	1	950.7	39.7	2100	135	425	22	
TOTAL OR MEAN		976.7	27.7	21.1					6	1960	1	1964	55	20.7	1.3	0.7			2010	1999	7	2010	
গম্যাকা ম NUMBER OF YEARS	1	30	30	30	30	25	30	25	57		57		30	30	30	30	30	30	51	51	51		

Table 3.1 (B): MET DATA OF NAJIBABAD (1981-2010) - CLIMATOLOGICAL DATA FOR IMD

स्टेशन : न	जीवाव	वाद															00	UA	L 1.	ADL																
STAION :	Naj	ibabad	Ŧ	ौसम प	रिघटना			Ĩ.					म	वन												मेघ					1			दुश्यता		
	के साथ दिनों की संख्या					पलन की मती के साथ दिनों की संख्या (विंद भी, प्र. धी.) प्रस्ताका प्रतिवत्त							मेय मान्ना (सभी मेथ) सहित गिम्न स्तरी मेथ मान्ना सहित दिनों की संख्या - अण्डमांश दिनों की संख्या - अण्डमांश							दुख्धता सहित दिनों की संख्या																
माह		कर्पण 0.3 मि.मि.या अधिक	ओले	गर्जन	कुला	धूल भरी ओंधी	चांड बात	62 या अभिक	20- 61	1- 19	0	3	उप्	ų	वप्	द	दप	ч	उप	হাল	0	लं-2	3-5	6-7	8	0	ले-३	3-5	6-7	8	जुहरा 8	1 कि.मी. तक	1-4 कि.मी.	4-10 कि.मी.	10-20 कि.मी.	20 कि.मी. से अधिक
	No. OF DAYS WITH				No. OF DAYS WITH WIND SPEED				PERCENTAGE No. OF DAYS WIND FROM					No. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS)				No. OF DAYS WITH LOW CLOUD AMOUNT				D														
MONTH		PPT 93mm Ormane	HAL	DECEN	*00	THE STORM	SOL AL	E2 Or more	23-61	1-12	0	N	чE	E	se	5	s\v	w	EW.	CAU/		T-2	2-5	27	-	0	2	34	6-7	e	FOG	UP TO	1.4	4-10	10-23 bas.	OVER 30 Kins
जनवर्रा JAN	1 H	2.7	0	0	1.7	0	0	0	0 0	24 26	7 5	2 0	2 1	14 13	3 3	0	5 6	19 35	31 25	24 17	22 23	2	2 3	2 2	3 1	27 28	0	1	1 1	2	0	4.4 0.5	5.7 4.3	14.4 16.1	6.4 10.1	0
फरवरी FEB	1 11	3.3	0	0	0.3	0	0	0	0	25 25	3 3	1 0	5 1	17 16	4 4	0 1	4 4	31 42	27 22	11 10	22 20	23	2 3	1 1	1 1	25 25	0 1	1	1 0	1	0	1.1 0	2 0.6	8.1 8.5	16.8 18.9	0
मार्ज MAR	1	2.8	0	0	0	0	0	0	0	29 29	2 2	1 0	32	19 14	5 3	0	3 4	37 51	25 19	7 7	22 22	2 3	3 4	2 1	2 1	28 29	0	1 1	1 0	1 1	0	0 0	0.3 0	5.4 5.8	25.3 25.2	0
अप्रैल APR	1 11	1.8	0	0	0	0	0	0	0 0	27 28	3 2	1 0	3 1	25 12	7 4	0	3 2	37 62	15 12	9 7	25 23	2 3	1 2	1 1	1 1	27 29	1 1	0 0	1 0	1 0	0	0 0	0 0.1	5.9 6	24.1 23.9	0
нई MAY	1 11	2.8	0	0.1	0	0	0	0	0	28 27	3 4	0	2 1	49 24	9 5	0	2 3	25 49	5 5	8 13	26 25	22	1 2	1	1 1	30 31	1 0	0 0	0 0	0	0	0 0	0 0.1	6.4 7.1	24.6 23.8	0
जून JUN	1 11	6	0	0.1	0	0	0	0	0	27 27	3 3	1 0	2 1	54 29	9 5	0 0	3 3	17 45	5 6	9 11	20 22	2 3	3 3	3 1	2 1	24 26	1 2	2 1	2 1	1 0	0	0 0	0.2 0.1	7.1 6.8	22.7 23.1	0
जुलाई JUL	1	13.1	0	0	0	0	0	0	0	28 26	3 5	0 0	2 2	60 38	10 9	0 0	3 3	11 28	4 5	10 15	14 5	3 6	4 14	5 4	5 2	18 20	2 3	4 4	4 3	3 1	0	0 0	0.1 0.1	7.6 6.4	23.2 24.5	0.1 0
अगस्त AUG	$\frac{1}{11}$	14	0	0	0	0	0	0	0	26 25	5 6	1 0	2 1	54 38	8 5	0 0	3 3	11 27	6 6	15 20	4 4	3 6	4 15	5 4	15 2	17 18	2 3	3 5	5 3	4 2	0	0 0	0.3 0.3	9.1 6.7	21.6 24.1	0
सितम्बर SEP	1 11	7.5	0	0	0	0	0	0	0	26 24	4 6	1 0	2 1	43 23	8 3	0 0	3 3	21 43	9 9	13 18	18 18	3 6	4 3	2 2	3 1	22 22	1 4	3 2	2 1	2 1	0	0 0	0.1 0	7.3 6.5	22.6 23.5	0
अम्राूखर OCT	1 11	1.5	0	0	0	0	0	0	0	27 25	4 6	2 0	4 1	44 10	6 2	0	2 4	20 54	11 10	11 19	28 27	1 2	1 1	1	0 0	30 30	1 1	0	0	0	0	0 0	0.1 0	6.9 6.9	24 24.1	0
नवम्बर NOV	1	0.5	0	0	0	0	0	0	0	25 22	5 8	2 0	4	31 9	4 2	0 0	4 5	23 49	16 9	16 25	27 28	1 1	1	1 0	0 0	30 30	0	0 0	0	0	0	0 0	0.6 2.4	7.4 7.2	22.1 20.4	0
विसम्बर DEC	$\frac{1}{1}$	1.5	0	0	0.8	0	0	0	0 0	26 26	5 5	1 1	4 1	17 10	4 4	0 1	4 5	29 48	26 13	15 17	26 25	1 2	2 2	1 1	1 1	30 31	0	0 0	0 0	1 0	0 0	1.8 0.2	3 3.8	11.9 10.4	14.3 16.7	0 0
वार्षिक योग वा माम्प ANNUAL TOTAL OR MEAN	1	57.5	0	0.2	2.8	0	0	0	0	319 309	46 56	1	3	37 20	6	0	3	23 44	15 12	12 15	263 257	25 39	28 39	24 19	25 11	308 314	8 15	14 17	17 12	18 7	0	7.2	12.3	96.4 92.9	248.9 259.6	0.1
वर्षीकी से NUMBER OF YEARS	1			_30	1				2	5						26							30					3(0					30		

जलबायबी सारणी CLIMATOLOGICAL TABLE

The wind speed and direction readings observed during Site specific Micro-meteorological data generated during summer season of 2022 are presented as wind rose diagram in Figure 3.1 (B).

2022



Figure 3. 1 (B): SITE SPECIFIC WIND ROSE DIAGRAM

Temperature –The yearly daily mean minimum temperature is around 17.6oC and yearly daily mean maximum temperature is around 30.0oC. May is the hottest month with daily mean maximum temperature at 37.3oC and daily mean minimum temperature at 23.5oC.

For the study period as per the IMD the daily mean minimum temperature was found to be 23.5 oC and daily mean maximum temperature around 37.3oC.

Relative Humidity –April and May are driest with relative humidity between 32-54%. The maximum humidity during rainy season is 88% and minimum was 48 %. High humidity is found during daytime and low humidity values during nighttime in all the months. During the study period the humidity levels were found to be 32-70 %.

Rainfall – The average annual rainfall based on IMD data, is about 950.7 mm. The monsoon sets in the month of July and continues till September. The maximum amount of rainfall (295.7 mm) occurs in the month of July. Maximum number of rainy days was observed in the month of July.

Calm Periods – Calm period is more during night time than daytime. Maximum calm period occurs during winter months.

Wind Speed– The wind speed ranges from 1.0 – 19.0 km/hour.

Wind Direction – The predominant wind direction during summer season is from East, West and North West direction. During monsoon season the wind flows from East and West direction. During winter months the wind flows predominantly from West direction.

Cloud Cover – Clear weather prevails during post monsoon, winter and summer seasons. Only during monsoon months of July, August and September moderate clouds are observed.

3.2 AMBIENT AIR QUALITY

No.	Location	Distance from site	Direction wrt site	Justification	Parameters monitored & Frequency				
AAQ-1	Project Site 29°45'23.79"N 78°26'14.14"E	-	-	Project Site	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ ,CH ₄ & H ₂ S				
AAQ-2	Chandravati Tiwari Law College, Vill-Purvi jahndi chaud Kotdwar 29°45'51.67"N 78°24'56.54"E	2.31 km	W	Upwind Direction location	Twice a week for 12 weeks				
AAQ-3	Bal Bharti Public School,Vill- Padampur,Motadhak,Kot dwar 29°45'28.83"N 78°27'23.20"E	1.83 km	NE	1 st Downwind Direction					
AAQ-4	Baluni Public School, Vill- Motadhak, Kotdwar 29°44'16.29"N 78°26'51.59"E	2.77 km	SSE	2 nd Downwind direction					
AAQ-5	Shiv Temple, Vill- Motadhak,Kotdwara 29°44'36.40"N 78°27'34.45"E	2.54 km	SE	Downwind direction					
AAQ-6	Government Degree College,Vill- Maganpur,Kotdwar, Uttarakhand 29°46'45.58"N	2.66 km	NNW	2 nd Upwind / Cross wind direction					

Table 3. 3 (A): NAME OF MONITORING LOCATIONS



Figure 3. 2(A): AIR QUALITY MONITORING LOCATION

Code	Location	Description	PM ₁₀	PM _{2.5}	SO2	NO ₂	CH₄	H₂S				
			μg/m³									
AAQ-1	Project site	Minimum	54	34	<6	8.3	<1.0	<0.1				
		Maximum	84	49	8.8	14.2	<1.0	<0.1				
		98 % tiles	83.54	48.08	8.65	14.15	<1.0	<0.1				
		Average	71.29	40.71	7.34	10.95	<1.0	<0.1				
AAQ-2	Hanuman	Minimum	56	35	<6	8.3	<1.0	<0.1				
	Mandir, Raipur	Maximum	86	49	8.8	14.2	<1.0	<0.1				
		98 % tiles	85.54	49	8.8	14.15	<1.0	<0.1				
		Average	73.67	42.46	8.02	11.16	<1.0	<0.1				
AAQ-3	Govt. Senior Sec	Minimum	54	35	<6	8.7	<1.0	<0.1				
	school, Dabra,	Maximum	85	49	8.3	14.2	<1.0	<0.1				
		98 % tiles	84.54	48.54	8.46	14.15	<1.0	<0.1				
		Average	72.83	41.42	7.59	11.08	<1.0	<0.1				
AAQ-4	Shiv Mandir,	Minimum	53	34	<6	8.4	<1.0	<0.1				
	Sector-1	Maximum	88	47	8.1	13.9	<1.0	<0.1				
		98 % tiles	85.24	47	8.32	13.81	<1.0	<0.1				

Table 3. 4 (B) SUMMARY OF AIR QUALITY RESULTS

2022

Code	Location	Description	PM ₁₀	PM _{2.5}	SO2	NO ₂	CH₄	H₂S					
			μg/m³										
		Average	70.75	39.83	7.05	10.7	<1.0	<0.1					
AAQ-5	Goga Ji Temple,	Minimum	54	34	<6	9.8	<1.0	<0.1					
	Badi Satrod	Maximum	92	49	8.9	14.1	<1.0	<0.1					
		98 % tiles	88.78	49	8.86	13.92	<1.0	<0.1					
		Average	74.92	43.42	8.21	11.46	<1.0	<0.1					
AAQ-6	Hanuman	Minimum	61	39	<6	9.1	<1.0	<0.1					
	Mandir,	Maximum	89	49	9.2	14.2	<1.0	<0.1					
	Mahavir Colony	98 % tiles	87.62	49.62	9.16	14.2	<1.0	<0.1					
		Average	75.83	44.21	8.42	12.25	<1.0	<0.1					
	NAAQ Standa	100 (24 hrs)	60 (24 hrs)	80 (24 hrs)	80 (24 hrs)								

Observations and Interpretation on Ambient air quality

- PM_{10} concentration in the study area varied from 53 to 92 μ g/m³
- PM_{2.5} concentrations in the study area varied from 34 to 49µg/m³
- SO_2 concentration in the study area varied from <6.0 to $9.2\mu g/m^3$
- NO₂ concentration in the study area varied from 8.3 to 14.2 μ g/m³
- H₂S concentration in the study area was observed to be <1.0µg/m³
- CH₄ concentration in the study area was observed to be <0.1 μ g/m³

All the Parameters are found to be well within the standards as prescribed by NAAQS.

The graphical presentation of maximum, minimum and mean values of PM10, PM2.5, NO2 and SO2 at all the eight locations are shown below in figure-3.2 (B).











Figure 3. 3(B): GRAPHICAL PRESENTATION OF MAXIMUM, MINIMUM AND MEAN VALUES OF PM10, PM2.5, SO2 AND NO2
3.3 AMBIENT NOISE QUALITY

Baseline Ambient noise level monitoring was carried out at 8 locations around the locations where human habitations are present. The name of noise monitoring locations is given in Table 3.5 (a) and Fig 3.5 (a). Table 3.6 (b) shows Noise Level Monitoring results.

No.	Location	Distance from site	Direction wrt site	Justification
NQ-1	Project Site 29°45'23.79"N 78°26'14.14"E	-	-	Project Site
NQ-2	Chandravati Tiwari Law College, Vill-Purvi jahndi chaud Kotdwar 29°45'51.67"N 78°24'56.54"E	2.31 km	W	Locations surrounding the site
NQ-3	Bal Bharti Public School,Vill- Padampur,Motadhak,Kotdwar 29°45'28.83"N 78°27'23.20"E	1.83 km	NE	
NQ-4	Baluni Public School, Vill- Motadhak, Kotdwar 29°44'16.29"N 78°26'51.59"E	2.77 km	SSE	
NQ-5	Shiv Temple, Vill- Motadhak,Kotdwara 29°44'36.40"N 78°27'34.45"E	2.54 km	SE	
NQ-6	Government Degree College,Vill-Maganpur,Kotdwar, Uttarakhand 29°46'45.58"N 78°25'51.02"E	2.66 km	NNW	

Table 3. 5 (A): NOISE LEVEL MONITORING LOCATIONS

2022



Figure 3. 4 (A): NOISE QUALITY MONITORING LOCATION

SN	Location	Category	Day Time	Standard	Night time	Standard
NQ-1	Project Site	Industrial	49.16	75	39.67	70
NQ-2	Chandravati Tiwari Law College, Vill-Purvi jahndi chaud Kotdwar	Silent	48.56	50	40.11	40
NQ-3	Bal Bharti Public School,Vill- Padampur,Motadhak,Kotd	Silent	50.03	50	39.08	40
NQ-4	Baluni Public School, Vill- Motadhak, Kotdwar	Silent	49.71	50	40.54	40
NQ-5	Shiv Temple, Vill- Motadhak,Kotdwara	Silent	50.48	50	41.06	40
NQ-6	Government Degree College,Vill- Maganpur,Kotdwar,	Silent	49.44	50	40.86	40

Table 3. 6(B): NOISE LEVEL MONITORING RESULTS

Observation on Ambient noise quality:

Day time noise level (6 am to 10 pm) was found between 48.56 to 50.48 dB(A). Night-time (10 pm to 6 am) noise levels were found between 39.08 to 40.86 dB (A). The noise level wasmeeting the national standards in project site. However, in all other locations it is exceeding marginally.

Conclusion:Noise level in the study area is more or less comply with the prescribed national standards. Only the NQ-3 and NQ-4 values are marginally higher than the prescribed national standards. This can be attributed to the fact that these monitoring locations are located close to the roads and the noise levels are mainly due to vehicular movement in the region.

3.4 WATER QUALITY

In order to depict the baseline groundwater quality and predict the impact of the discharges from project, if any, samples from bore-well/tube-well and pond/canal were collected from 6 nearby locations, and analyzed for basic physico-chemical parameters (pH, conductivity, TDS, TSS, alkalinity/acidity, Total Hardness (Permanent & Temporary Hardness), sulphate, chloride, nitrate, phosphate, fluoride, calcium, magnesium, iron, manganese, copper, zinc, toxic metals (As, Ni, Pb, Hg, Cr, Cd) and coliform count. One grab sample was taken from each location for analysis during the study period.

The name of ground water and surface water monitoring locations are given in Table 3.7 (a) and Table 3.8 (b). Locations of ground and surface water monitoring are given in figure 3.6 (a) and figure 3.7 (b)

SN	Location	Distance	Direction	Justification
GW1	From Haldukhatamata mandir,village- Umraonagar,Kotdwar	0.68	NW	Villages
GW2	Shiv mandirvillage-Motadhak,Kotdwar	2.49	SE	surrounding
GW3	Sidhabalimandir,village- JhandichaudUttari,Kotdwar	3.07	NW	the site

Table 3. 7 (A): GROUNDWATER QUALITY MONITORING LOCATIONS

2022



Figure 3. 5 (A) GROUND WATER QUALITY MONITORING LOCATION

Observation on Groundwater quality:

The groundwater quality of villages around the study area is fit for drinking.

Analysis results of ground water reveal the following: -

≻pH varies from to 7.02 to 7.07

- ➤ Total Dissolved Solids varies from 230 to 262 mg/l.
- ➤ Total Hardness varies from 128 to 136 mg/l.
- ➤ Calcium varies from 22.4 to 25.6 mg/l
- ➤ Magnesium varies from 15 to 18 mg/l
- ➤ Chloride varies from 22 to 34 mg/l
- ➤ Fluoride varies was found to be <0.1 mg/l</p>
- ➤ Nitrates varies found to be <0.1 mg/</p>
- ➤ Sulphates varies from 7.6 to 9.6 mg/l
- ➤ Toxic Metals: <0.01 mg/l
- ➤ Total Coliform: <2
- ≻ E-Coli: Absent

The above parameters indicate that the ground water of the study area is well within the permissible limit as per IS 10500: 2012

2022

SN	Location	Distance	Direction	Justification
SW1	Milini River, Kotdwar (29°45'58.81"N 78°27'2.58"E),	1.68 km	NE	Upstream of project site
SW2	Milini River, Kotdwar (Downstream) (29°4	0.82 km	SE	Downstream of project site
SW3	Khohriver, Kotdwar (29°45'13.33"N 78°28'51.62"E)	4.12 km	E	Within a study area



Figure 3. 6 (B) SURFACE WATER QUALITY MONITORING LOCATION

Observation on Surface water quality:

The surface water quality of the streams is fit for drinking after conventional treatment. Analysis results of surface water reveal the following: -

- ≻pH varies from to 7.78 to 7.95
- ➤ Dissolved Oxygen varies from 5.8 to 6.1 mg/l.
- ➤ BOD varies from 1.6 to 2.4 mg/l
- ➤ COD varies from 10 to 28 mg/l
- ➤ Total Dissolved Solids varies from 182 to 312 mg/l.

➤ Total coliform varies from 23 to 50 MPN/100 mg/l

The above parameters indicate that the surface water of the study area falls under class-B (Outdoor bathing (Organised)) as per CPCB water Quality criteria.

3.5 SOIL QUALITY

The physical, chemical properties and important heavy metals concentrations were determined in 8 soil samples collected from thefields close to the location where hand pump water was taken for analysis. The samples were collected by ramming a core-cutter into the soil up to a depth of 90 cm in 3 sections of 30 cm each. The samples were homogenized using quartering and conning technique. Soil sampling locations are given in Table 3.9 (a) and in Fig-3.8 (a).

SN	Location	Distance	Direction	Justification	
SQ1	Project site	0	0	Project Site	
SQ2	Village-Maganpur, Kotdwar, 29°46'20.36"N 78°25'50.29"E	1.99 km	NE	Villages surrounding	
SQ3	Village-Motadhak, Kotdwar 29°44'19.46"N 78°26'51.65"E	2.11 km	SE	the site	

Table 3. 9 (A): SOIL QUALITY MONITORING LOCATIONS



Figure 3. 7 (A) SOIL QUALITY MONITORING LOCATION

Observations and Inference on Soil quality:

Soils of study area are sandy loam by nature. Specific Conductivity and pH are in normal range. Organic matter content is sufficient. The concentration of Nitrogen, Phosphorus and Potassium were medium. The soils of study area are fit for cultivation. The soil is sandy clay in nature.

3.6 BIOLOGICAL ENVIRONMENT

The biodiversity we see today is the fruit of billions of years of evolution, shaped by natural processes. The vast array of interactions among the various components of biodiversity makes the planet habitable for all Species, including humans. There is a growing recognition that, biological diversity is a global asset of tremendous value to present and future generations. At the same time, the threat to species and ecosystems has never been as great as it is today. Species extinction caused by human activities continues at an alarming rate. Protecting biodiversity is in our self-interest.

The biological study was under taken by Ecology & Biodiversity Expert, as a part of the EIA study report to understand the present status of ecosystem prevailing in the study area, to compare it with past condition with the help of available data, to predict changes in the biological environment as a result of present activities and to suggested measures for maintaining its health.

A survey was conducted to study the flora around 10 km radius. Some of the information was gathered from the local habitants. All the collected data were classified to interpret the impact of pollution on the flora and fauna of that region. Survey of the mild plants as well as cultivated crop plants was made and all the available information was recorded. The primary data collected was compared with the Secondary data collected from Forest Department.

3.6.1 SCOPE AIM AND OBJECTIVES OFTHE STUDY:

- ✓ To inventories the floral and faunal components of the project area (Project site or core zone and 10 km radius buffer zone)
- ✓ To locate demarcate and understand ecological setting of the project area in term of National Park/Wildlife sanctuary/Reserve Forest/ Eco-sensitive area/wetland etc. within 10 km radius of project site (if any).
- ✓ To identify schedule-I, rare, endemic and endangered species within the study area and prepare conservation plan for the same.
- ✓ To identify impact zone and evaluate the likely impact of the project on floral and faunal component of project study area.
- ✓ To suggest/prepare action plan to mitigate likely impact on biodiversity of project area through plantation around project area.

The information present in this chapter has been collected through field study, consultation with local people and collation of available literature with various institution and organization. The summary of data collected from these sources as a part of EIA study is outlined. With change in environmental condition the

vegetation cover as well as animal reflects several changes in it's structure, density and composition respectively.

3.6.2 SURVEY METHODOLOGY:

The primary objective of survey was to describe the floral and faunal communities within the study area. The aim was to set baselines in order to monitor and identify trends after the commissioning of the mining activity. Emphasis has been placed on presence of endemic species, threatened species if any present in the study area. The information presented in this chapter has been Collation of available published literature including those from relevant organizations like the Botanical survey of India, and wildlife institute of India. The respective forest department of the state concerned ,researchpapers, articlebooks ,and reliable website available. Apart from that Primary field survey was carried out for Floral & Faunal Inventory/Importance by Field Studies.

- ✓ Field Study: The ecological survey has been conducted for one season in two zone in and around the project site. All data were collected in pre-monsoon periodin order to reduce metrological biasness. The details are given as below:
- ✓ Study Period: Mar 2022-May 2022
- ✓ Core zone: Within the project site
- ✓ Buffer zone: Around the project site within 10 km radius.

Sampling Locations & Materials/Equipments Required:

The ecology and biodiversity survey was conducted in 10 km radius in the study area and surrounding area. It is observed that human settlements are present within the study area of 10 km radius and many of villages have moderate range of plantation. During site survey several species of flora & Fauna encountered with in 10 km radius area. The list of Materials/Equipments required for survey are provided below-

S.NO.	Material/Equipment				
1	Camera	Binocular	Sample bag		
2	GPS	Measuring tape	Field notes		
3	Compass	Rope			
4	Magnifying glass	Adhesive tape			

|--|

3.6.3 FLORA

Methodology for Floral Study:

The information provided in present study has been collation of field survey of the area which was conducted during pre monsoon period (March-May 2022) and published literature including those from relevant organization like the Botanical Survey of India (BSI) and Wildlife Institute of India (WII, Dehradun). The respective forest department of the state concerned etc research papers, articles; book and reliable

website available within and adjacent to study area were compiled and invented as "Secondary Floral Diversity Database".

The local flora was identified by their morphological observation, such as it's shape and size of leaf, flowers, fruits and also by their habitat with the help of secondary sources like colleges and forest department. The plant which are not identifiable at site were collected and identified using standard reference book and internet. Beside this information were also collected by interaction through local inhabitant. Data on forest type legal status and their extent in the study area has been collected from Forest Department. The other relevant data on biodiversity economically important plant species and medicinal plant, rare and endangered species in the study area have also been collected during site visit and from different secondary sources.

The climatic, edaphic and biotic variations with their complex interrelationship and composition of species, which are adapted to these variations, have resulted in different vegetation cover, characteristic of each region (Ohasi, 1975). The tree species, herbs, shrubs, climbers and major crops, were documented during the baseline study. The study area is located in the Kanchanpuri, Haldukatha, Malankham Kotdwar Tehsil of Pauri garhwal district in state of Uttarakhand. The site cordinates of four point of project as per google map are provide below-

Table 3. 11 (B): SITE COORDINATE

Point A1	29°45'23.79"N / 78°26'14.14"E	Point A2	29°45'21.73"N / 78°26'17.05"E	
Point A3	29°45'24.25"N / 78°26'19.35"E	Point A4	22 ⁰ 5'3.24" N, 84 ⁰ 51'22.09" E	Tho

district of Pauri Garhwal as part of the Western Himalaya presents a unique set of ecological characteristics over a complex variety of systems that incorporate forests, meadows, savannah grasslands, marshes and rivers, as well as wildlife, geology and several other phyto-geographically distinctive peculiarities. The occurrence of diverse topographical and climatic factors has resulted in the remarkable biodiversity of the district as a result of which flora also correspondingly differs over its different parts. Forests dominate in the phyto-geography and also constitute the most valuable natural resource of the district. Total geographical area of Kotdwar is 5329 Sq.km and it lies between 29°45'8.64" North lattitude and 78°31'36.85" East longitude. it is bordered by Zahrikhal block in East, Yamkeshwar block in north and to the west by Najibabad block. The Village is located 454 mts above mean sea level. The climate in kotdwar is generally temperate although it varies from tropical from hot in summer to severely cold. The forest in Kotdwar range have heterogenous vegetation due to topographical variation with plant of the plain as well as the hill. The forest in the region are subtropical moist deciduous type.

Forest Block in Study Area: There are fifteen [15] reserve forests in 10 km of the study area and there are no wildlife sanctuaries, national parks, Biosphere reserves or migratory corridor of any sensitive species in the study area. Details of Forest block within 10 Km area are provided below-

Table 3. 12 (C): DETAILS OF FOREST BLOCK WITHIN 10 KM AREA

S.No	Forest	Distance & Direction
1	Giwain RF	9.1 km NE
2	Sukhrao RF	7.9 km NE
3	Sattikhal RF	8.7 km NE
4	Gwalgarh RF	8.5 km NE
5	Laldhang RF -	5.5 km NW
6	Kotdwara RF	3.6kmN
7	Kotawali RF	20 m SW
8	Girdawa Sahanpur RF -	6.1 km SW
9	Kauriya RF	2.0 km SE
10	Mohanwali RF	8.6 km S
11	North Kothari RF	9.6 km SE
12	South Kothari RF	9.7 Km SE
13	Paniyal RF	7.7 Km NE
14	Sukharao Kham RF	5.2 Km NE
15	Malinkham RF	1.6 Km NE

Table 3. 13 (D) : FOREST COVER AREA IN PAURI GARHWAL DISTRICT OF UTTARAKHAND(Area in Sq Km)

Geographical Area	Very Dense Forest	Mod Dense Forest	Open Forest	Total	% of Green Area	
5329 574.26 1902.03 918.70 3394.99 63.71						
Source: India State Forest Report, Uttarakhand, 2019						

NAGAR NIGAM KOTDWAR

DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND



Figure 3. 8 (A): FOREST COVER IN PAURI GARHWAL DISTRICT OF UTTARAKHAND

Floral biodiversity: Ageneral study of floral community for both core area and buffer zone are carried out separately the details are provided below-

Core Zone- The core zone of project site is vacant and has natural vegetation [bushes and shrubs].

Buffer Zone-The vegetative community of the area can be divided in to six main category of tropical dry deciduous forest, Sal Forest, Oak, Deodar, Fir and Spruce forest and finally the alpine forest. The flora in the Kotdwar Forest Range comprises of tree Sal, Deodar, chir, Haldu etc and Mango, Ficus, Amla, Tamarind, trees that are of economic and religious importance along with Herbs and shrubs like Brahmi and Ashwagandha.

Trees: The dominant trees around the study area are lListed below in the Table

Table 3. 14 (E): DOMINANT TREES IN AND AROUND THE STUDY AREA

S.No.	Botanical Name	Common Name	Family
1	Albizzia lebbeck	Siris	Fabaceae
2	Aegle marmelos	Bel	Rutaceae
3	Azadirachta indica	Neem	Meliaceae
4	Acacia nilotica	Babool/Kikar	Fabaceae
5	Alstonia scholaris	Saptparni	Apocyanaceae
6	Acacia catechu	Khair	Fabaceae
7	Artocarpus heterophyllus	Jackfruit	Moraceae
8	Alianthus exelsa	Mahaneem	Simorubiaceae
9	Adina cardifolia	Kadam	Rubiaceae
10	Angeissus latifolia	Dhau	Combretaceae
11	Angeissus pendula	Kardhai	Combretaceae
12	Alangium salviflorum	Akola	Alangiceae
13	Abies balsamia	Fir	Pineaceae
14	Bauhinia variegate	Kachnar	Fabaceae
15	Butea monosperma	Palash	Fabaceae
16	Bombax ceiba	Semur	Malvaceae
17	Buchanania lanzan	Charoli	Anacardiaceae
18	Boswellia serrata	Salai	Burseraceae
19	Cassia fistula	Amaltas	Caesalpiniaceae
20	Callistemon lanceolatus	Bottle Brush	Myrtaceae
21	Cassia siamea	Chakunda	Caesalpiniaceae
22	Carrisa karandas	Karaunda	Apocyanaceae
23	Delbergia sisso	Sheesham	Fabaceae
24	Delonix regia	Gulmohar/Krishnachura	Caesalpeniaceae
25	Diospyros melanoxylon	Tendu	Ebenaceae
26	Emblica officinalis	Amla	Euphorbiaceae
27	Eucalyptus sp.	Safeda	Myrtaceae
28	Ficus racemose	Goolar	Moraceae
29	Ficus virens	Pakad	Moraceae
30	Ficus benghalensis	Bargad	Moraceae
31	Ficus religiosa	Pipal	Moraceae
32	Ficus infectoria	Pilkhan	Moraceae
33	Ficus palmate	Anjeer	Moraceae
34	Haloptelia integrifolia	Chilbil	Ulmaceae
35	Kigelia pinnata	Balamkheera	Bignoniaceae
36	Leucaena leucocephala	Subabool	Mimoseaceae
37	Lagerstromia parviflora	Jarul	Lytheraceae
38	Morus alba	Sahtoot	Moraceae
39	Mangiifera indica	Aam	Anacardiaceae

S.No.	Botanical Name	Common Name	Family
40	Madhuca longifolia	Mahua	Sapotaceae
41	Mimusops elengii	Moulasari	Sapotaceae
42	Moringa oleifera	Sahjan	Moringaceae
43	Prosopis julifera	Khejri	Fabaceae
44	Psidium guajava	Amrood	Myrtaceae
45	Polyalthia longifolia	Asoka	Annonaceae
46	Pongamia pinnata	Karanj	Leguminoceae
47	Pithecolobium dulce	Jungle jalebi	Fabaceae
48	Plumeria alba	Champa	Apocyanaceae
49	Pinus roxburghii	Chir	Pinaceae
50	Quercus suberos	Oak/Cork	Fagaceae
51	Syzygium cumini	Jamun	Myrtaceae
52	Shorea robusta	Sal	Dipterocarpaceae
53	Terminalia bellirica	Bahera	Combretaceae
54	Terminalia arjuna	Arjun	Combretaceae
55	Tamarindus indicus	Imli	Fabaceae
56	Tectona grandis	Teak/Sagaun	Lamiaceae
57	Toona ciliate	Indian Mahogany	Meliaceae
58	Ziziphus mauritiana	Ber	Rhamnaceae

Source: On the basis of primary site visit and in consultation with Local Peoples and concerned State forest department and published papers

Herbs Shrubs& Grasses: The species observed in the study area are listed below in the in the Table

|--|

S.No.	Botanical Name	Common Name	Family			
HERBS						
1	Achyranthus	Chirchita	Amaranthaceae			
2	Amaranthus gracilis	Cholai	Amaranthaceae			
3	Argemone maxicana	Satyanasi	Papavaraceae			
4	Ageratum conyzoides	GandhauriGhas	Asteraceae			
5	Andropogan paniculata	Bhuinimb	Acanthaceae			
6	Aloe vera	Ghrit Kumari	Liliaceae			
7	Asperagus racemosus	Satawari	Asperigaceae			
8	Calatropisprocera	Madar	Asclepiadaceae			
9	Cannabis sativa	Bhang	Cannabaceae			
10	Cassia tora	Chakramuda	Fabaceae			
11	Cyperus rotundus	Motha	Cyperaceae			
12	Commelina benghalensis	Kankauwa	Commelinaceae			
13	Croton sparsiflorous	Ban tulasi	Euphorbiaceae			
14	Cleome viscosa	Hur hur	Cleomaceae			

S.No.	Botanical Name	Common Name	Family			
15	Dhaturainoxia	Dhatura	Solanaceae			
16	Euphorbia hirta	Dudhi	Euphorbiaceae			
17	Hyptis suaveolens	Vilayati Tulsi	Lamiaceae			
18	Leonitis napetifolia	Bada gumma	Lamiaceae			
19	Mentha arvensis	Pudina	Lamiaceae			
20	Martynia annua	Vaghnakhi	Martyniaceae			
21	Ocimum sanctum	Tulsi	Lamiaceae			
22	Parthenium hysterophorus	Gajar Ghas	Asteraceae			
23	Solanum nigrum	Makoi	Solanaceae			
24	Tribulus terrestris	Gokaharu	Zygophyllaceae			
25	Tephrosia purpurea	Vajradanti	Fabaceae			
	SHRU	IBS				
1	Abutilon indicum	Kanghi	Malvaceae			
2	Abrus precatorious	Ratti	Fabaceae			
3	Agave Americana	Gwarpatha	Agavaceae			
4	Bougainvellia glabra	Bougainvellia	Nyctaginaceae			
5	Cestrum nocturnum	Raat Rani	Solanaceae			
6	Carrisa carandas	Karaunda	Apocyanaceae			
7	Citrus aurentifolia	Lime	Rutaceae			
8	Capparis decidua	Kareer	Caparaceae			
9	Callicarpa macrophylla	Phalini	Verbenaceae			
10	Dendrocalamus strictus	Bamboo	Poaceae			
11	Helictieres isora	Marorfali	Sterculiaceae			
12	Ipomea	Besharam/Behaya	Convolvulaceae			
13	Jasminum sessiliforum	Jasmine	Oleaceae			
14	Lawsonia inermis	Mehandi	Lytharaceae			
15	Lantana camara	Raimunia	Verbenaceae			
16	Mimosa pudica	Chui Mui	Fabaceae			
17	Murrayakoeniigi	Curry patta	Rutaceae			
18	Nerium indicum	Kaner	Apocyanaceae			
19	Nyctanthes-arbor-tristis	Parijat	Oleaceae			
20	Prosopis juliflora	Vilayati Babool/Shami	Fabaceae			
21	Riccinus communis	Arandi	Euphorbiaceae			
22	Sacchrummunja	Moonj	Gramineae			
23	Tridax procumbens	Baramasi	Asteraceae			
24	Tinospora cordifolia	Giloy	Menispermaceae			
25	Vinca rosea	Sadabahar	Apocyanaceae			
26	Vitex negundo	Begunia	Lamiaceae			
27	Woodfordia fruticose	Dhawai	Lytheraceae			
	GRASSES					
1	Aristida hystrix	Needle grass	Poaceae			
2	Cyanodondactylon	Dub	Poaceae			
3	Cymbopogan martini	Lemon Grass	Poaceae			
4	Desmostachya	Kusha	Poaceae			
5	Digitariasp	Crab Grass	Poaceae			

S.No.	Botanical Name	Common Name	Family
6	Heteropogan contortus	Spear grass	Poaceae

Source: On the basis of primary site visit and in consultation with Local Peoples and concerned State forest department and published paper

Medicinal Plant Species of the area:. The common medicinal tree plants of the region are Aegle marmelos, Azadirachtaindica, Emblica officinalis, Terminalia arjuna, etc. The herb species which are recorded in area having medicinal values are Aloe vera, oscimum sanctum etc.

Table 3. 16(G) : LIST OF MEDICINAL PLANT SPECIES OF THE AREA AND THEIR MEDICINAL USE:.

SN	BOTANICAL	FAMILY	COMMON	MEDICINAL USE	
	NAME		NAME		
IREE	5				
1	Acacia nilotica	Fabaceae	Babool	Pharmacy, preparing emulsions, Tablets, pills	
2	Aegle marmelos	Rutaceae	Bel	Anti-inflammatory, anti-pyretic, anti-fungal	
3	Azadirachta indica	Meliaceae	Neem	Antiseptic, insecticidal, oil as stimulant	
4	Bauhinia purpurea	Caesalpiniaceae	Kachnar	Used in dropsy, pain, rheumatism, thigh swelling, convulsion, intoxication, blackness	
5	Buteamonosperma	Fabaceae	Palash	Gum is astringent for treatment of diarrhea	
6	Cassia fistula	Fabaceae	Amaltas	Control fever, gas trouble, and laxative	
7	Emblica officinalis	Euphorbiacea	Amla	Source of Vitamin C, coolant & laxative	
8	Eucalyptus sp.	Myrtaceae	Safeda	Oil used as an antiseptic, Hypertension, pulmonary hemorrhage	
9	Madhuca indica	Sapotaceae	Mahua	Flower liquor as an appetizer, pulmonary hemorrhage, hypertension	
10	Magnifera indica	Anacardiaceae	Aam	Control stomach pain, diarrohea, urine sugar	
11	Syzygium cumini	Myrtaceae	Jamun	Anti: bacterial, fungal, viral, inflammatory, diarrheal, allergic, cancer,diabetic, ulcerogenic,cardio-protective, hypoglycemic	
12	Terminalia arjuna	Combretaceae	Arjun	Bark of tree used in High BP and cholestrol control	
13	Ficus religiosa	Moraceae	Peepal	Leaves of the tree are used to deal with asthma, stomach pain, and heart issues	
14	Mimusops elengii	Sapotaceae	Moulasari	useful in treating gum problems and dental disorders such as bleeding gums, loose teeth, sensitive teeth, cavities, etc	
SHRU	IBS				
14	Calatropisprocera	Asclepiadeacea	Madar	Useful in digestive disorder, diarrhea, stomach ulcer, toothache, Cramps	
15	Citrus aurentifolia	Rutaceae	Nimbu	Rich source of Vitamin C	
HERBS					

16	Argemonemaxican a	Papavaraceae	Satyanasi	Painkiller, diuretic, and anti-inflammatory. The seed is used as a purgative
17	Dhaturainoxia	Solanaceae	Dhatura	Treat asthma, malarial fever, palpitation, hypertension, distrace, aortic disorder
18	Tribulus terrestris	Zygophyllacea e	Gokharu	Useful in kidney, bladder, urinary tract, and uro-genetial related conditions
19	Tridex procumbens	Asteraceae	Baramasi	Antibacterial, anti-inflammatory, reduce high blood sugar, wound healing etc.
20	Aloe vera	Liliaceae	Ghritkum ari	Aloe vera is known for its antibacterial, antiviral, and antiseptic properties
21	Cleome viscosa	Cleomaceae	Hurhur	Useful in rheumatic arthritis, hypertension, malaria, neurasthenia, and wound healing
22	Tephrosiapurpurea	Fabaceae	Vajradanti	used in liver cirrhosis and splenomegaly
23	Ocimum sanctum	Lamiaceae	Tulsi	Used in common cold, heart diseases, headaches, stomach disorders, kidney stones

Source: On the basis of primary site visit, in consultation with local people and concerned State forest dept.

Economically Important Flora of Study Area:

Agricultural Crops: The climatic condition of a region affect the agricultural cropping pattern of different are. Thus it produce different crop. Amongst the host of climatic factor i,e rainfall, temperature,humidity, wind velocity and duration of sunshine affect the cropping pattern in significant way, Annual rainfall and it's distribution over the entire year and regimes of diurnal and annual temperature are by far the prominent factor affecting agriculture and life style of people.Cropping pattern is shown in Table-

Table 3. 17(H): CROPPING PATTERN OF THE STUDY AREA

Crop	Name	Season
Rabi	Wheat, Gram, Mustard, Seeds, Potatoes, Onion	September-April
Kharif	Paddy,Maize,Bajra,Groundnut,Sugarcane,Rice	June-October

Different fruits like Banana, Papaya, Mangoes, and Vegetables like potatoes, chilli, brinjal, cauliflower, capsicum are also grown by local peoples. The consultation with local peoples reveals that farmers are cultivating the improved varieties in the fields

Table 3. 18(I): MAJOR CROPS OF THE STUDY AREA

KHARIF			RABI			
S.NO.	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME	COMMON NAME		
CEREALS	CEREALS					
1	Oryza sativa	Rice	Triticum aestivum	Wheat		
2	Sorghum vulgare	Jwar				
3	Millets	Bajra				
4	Zea mays	Maize	2			
PULSES						
5	Cajanus cajan	Arhar	Cicer arietinum	Gram		

2022

KHARIF			RABI			
S.NO.	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME	COMMON NAME		
6	Phaseolus angularis	Urad				
7	Phaseolus aurens	Moong				
OIL SEED	S					
8	Sesamum indicum	Til				
9	Arachis hypogea	Groundnut				
VEGETA	BLES					
10	Capsicum annum	Chilly	Solanum tuberosum	Potato		
11	Zinziber officinale	Ginger	Coriandrum annum	Coriander		
12	Allium cepa	Onion	Allium sativum	Garlic		
13	Vitis vinifera	Grapes	Daucus carota	Carrot		
14	Solanum melongena	Brinjal	Pisum saivum	Реа		
15			Solanum lycopersicum	Tomato		
FRUITS	FRUITS					
16	Citrus reticulata	Orange	Citrus aurentifolia	Nimboo		
17	Citrus sinensis	Malta	Magnifera indica	Aam		
18	Pyrus communis	Naspati	Syzigium cumini	Jamun		
19	Psidium guajava	Amrood				

Source: On the basis of primary site visit and in consultation with Local Peoples and concerned State forest department.

Waste Land: Wasteland are also observed in the area which are found dominated by Lantana, IpomeaCalatropis, Parthenium, Argemone.etc

Vegetation in and Around Human Settlement-The common species grown near village are Neem Mahua, Jamun, Imli, Safeda, Bargad etc.

Rare, Endangered & Endemic Species: No rare, endangered or endemic species of flora is recorded from core area as well as buffer zone of the project site.

3.6.4 FAUNA

Methodology- Fauna includes all invertebrates and vertebrates animal with plant these animal maintain balance of ecosystem and therefore fauna of particular region indicates environmental condition and well being of population residing in area. As the animals are very sensitive and capacity to move from one place to another any change or modification in ecosystem may leads to death or migration from region and therefore they are considered as best indicator of ecosystem function. It helps to understand pollution level, biological richness, habitat change as well as to quantify any change in species composition. Following methodology is being used to prepare a comprehensive list of fauna of study area-

1- Secondary sources like Government Gazzete, News articles and published literatures.

- 2- Interaction with local peoples.
- 3- Sighting of animal during survey visit.
- 4- Birds & Animal calls.

5-Nesting & Roosting

Faunal biodiversity A general study of faunal community for both core area and buffer zone are carried out separately the details are provided below-

Core Zone-The core zone of the project area doesn't have any unique faunal community as the habitat and environmental conditions of core area is similar to buffer zone so some faunal species from buffer zone frequently visit to core zone in search of food and water.

Buffer Zone-The species observed in buffer zone (10 Km around the project area) are listed in the table given below-

SN	ZOOLOGICAL NAME	COMMON NAME	FAMILY	STATUS IN WPA 1972	STATUS IN IUCN CATEGORY		
MAN	AMALS						
DON	DOMESTIC SPECIES						
1.	Felis catus	Domestic Cat	Felidae	Schedule II	Least Concern		
2.	Sus scrofa	Pig	Suidae	Schedule III	Least Concern		
3.	Bos taurus	Cow	Bovidae	Not Enlisted	Not Evaluated		
4.	Canis lupus	Dog	Canideae	Not Enlisted	Not Evaluated		
5.	Capra aegagrus hircus	Goat	Bovidae	Not Enlisted	Not Evaluated		
6.	Bubalus bubalis	Buffalo	Bovidae	Not Enlisted	Not Evaluated		
7.	Equus asinus	Donkey	Equidae	Not Enlisted	Not Evaluated		
WILL	SPECIES						
8.	Herpetesedwardsii	Nevala	Herpestidae	Schedule II	Least Concern		
9.	Funambulus pennantii	Gilhari	Sciuridae	Schedule IV	Least Concern		
10.	Rattus rattus	Chuha	Muridae	Schedule V	Least Concern		
11.	Rousettusleschenaultia	Indian Fruit Bat	Pteropodidae	Schedule V	Least Concern		
12.	Semnopithecus entellus	Langur	Cercopethicidae	Not Enlisted	Least Concern		
13.	Maccaca mulata	Monkey	Cercopethicidae	Schedule II	Least Concern		
14.	Canis aureus	Jackal	Canideae	Schedule II	Least Concern		
15.	Lepus nigricolis	Indian hare	Leporidae	Schedule IV	Least Concern		
16.	Hystrix indica	Porcupine	Erethizontidae	Schedule IV	Least Concern		
REPTILES							
17.	Ptyas mucosus	Common ratsnake/Dhaman	Colubridae	Schedule II	Least Concern		
18.	Bungarus caeruleus	Common Indian Krait	Elapidae	Schedule IV	Least Concern		
19.	Hemidactylus maculates	Rock Gaeko	Gekkonidae	Not Enlisted	Not Evaluated		

Table 3. 19(J): FAUNAL BIODIVERSITY OF STUDY AREA

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20.	Chamaleo	Chameleon	Gekkonidae	Not Enlisted	Not Evaluated
	chamaleons				
21.	Hemidactylus brooki	Chipkali	Gekkonidae	Not Enlisted	Not Evaluated
	gray				
AMP	HIBIANS				
22.	Rana tigrina	Common Frog	Ranidae	Schedule IV	Least Concern
23.	Rana hexadactyla	Indian Pond Frog	Ranidae	Schedule IV	Least Concern
24.	Bufo bufo	Toad	Bufonidae	Not Enlisted	Not Evaluated
BUTT	TERFLIES/INSECTS				
25.	Delias eucharis	Common jezebel	Pieridae	Schedule II	Least Concern
26.	Danaus chrysippus	Plain tiger	Nymphalideae	Schedule IV	Least Concern
27	Eurema hecabe	Common grass yellow butterfly	Pieridae	Schedule II	Least Concern
28	Papilio polymnestor	Blue mormon	Papilionidae	Schedule IV	Least Concern
29	Acheta domesticus	Jhingur/Cricket	Gryllidae	Not Enlisted	Not Evaluated
30.	Apis dorsata	Honey Bee	Apidae	Not Enlisted	Not Evaluated

Source: On the basis of primary site visit and in consultation with Local Peoples and concerned State forest department.

Birds: The List of Avifauna present in and around the study area are listed below in the Table:

Table 3. 20(K): LIST OF AVIFAUNA PRESENT IN AND AROUND THE STUDY AREA

SN	ZOOLOGICAL	COMMON	FAMILY	STATUS IN	STATUS IN IUCN
	NAME	NAIVIE		WPA 1972	CATEGORY
1	Gallus gallus	Jungli Murghi	Phasianidae	Schedule IV	Least Concern
2.	Achridotherus tristris	CommonMyna	Sturnidae	Schedule IV	Least Concern
3.	Corvus splendens	Crow	Corvidae	Schedule IV	Least Concern
4.	Eudynamys scolopaceous	Koel	Cuculidae	Schedule IV	Least Concern
5.	Psittacula krameri	Parrot	Psittaculadae	Schedule IV	Least Concern
6.	Pycnonotus cafer	Bulbul	Pycnonotidae	Schedule IV	Least Concern
7.	Saxicoloides fulicatus	Robin	Muscicapidae	Schedule IV	Least Concern
8.	Ploceus philippinus	Baya Weaver	Plocidae	Schedule IV	Least Concern
9.	Coturnix coturnix	Bater	Phasianidae	Schedule IV	Least Concern
10.	Vanellus indicus	Red Wattled Lapwing	Charadriidae	Schedule IV	Least Concern
11.	Bubulcus ibis	Bagula	Ardeidae	Schedule IV	Least Concern
12.	Bubo bubo	Owl	Strigidae	Schedule IV	Least Concern

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SN	ZOOLOGICAL NAME	COMMON NAME	FAMILY	STATUS IN WPA 1972	STATUS IN IUCN CATEGORY
13.	Ardeola grayii	Pond Heron	Ardeidae	Schedule IV	Least Concern
14.	Columba livia	Pigeon	Columbidae	Not Enlisted	Least Concern
15.	Passerdomesticus	Sparrow	Passeridae	Not Enlisted	Least Concern
16.	Alcedo atthis	Kingfisher	Alcedinidae	Schedule IV	Least Concern
17.	Ergetta garzetta	Karchiya Bagla	Ardeidae	Schedule IV	Least Concern
18.	Ploceus phillipinus	Baya weaver	Ploceidae	Not Enlisted	Least Concern
19.	Alectoris graeca	Chakor	Phasianidae	Schedule IV	Least Concern
20.	Francolinus pondicerlanus	Titar	Phasianidae	Schedule IV	Least Concern
21.	Coturnix coturnix	Commonquail	Phasianidae	Schedule IV	Least Concern
22.	Dicrurus macrocercus	Black drangos	Dicruridae	Schedule IV	Least Concern
23	Dendrocopos auriceps	Woodpecker	Picidae	Schedule IV	Least Concern
24	Megalaima virens	Great barbet	Piciformes	Schedule IV	Least Concern

Source: On the basis of primary site visit and in consultation with Local Peoples and concerned State forest dept.

S.No.	Schedule of Wildlife Protection Act 1972	Number of Species
1	Schedule I	0
2	Schedule II	7
3	Schedule III	1
4	Schedule IV	29
5	Schedule V	2
6	Schedule VI	0

Aquatic Ecology Study:

Plankton is an important component of ecosystem, which responds to ecosystem alterationsrather rapidly. It is due to the fact that planktonic organisms, which react to different types ofwater pollution, play a key role in turnover of organic matter and energy through the ecosystem. This reaction is very rapid because of relatively short lifetime and highre production rates of the organisms.

Table 3. 22 (M): LIST OF FRESH WATER FISHES OBSERVED IN STUDY AREA

S.No.	Common Name	Scientific Name
1.	Rohu	Labiorohita
2.	Singhi	Heterophneustesfossilis
3.	Illisi	Hilsa ilisa
4.	Indian carp	Catlacatla

5	Seula	Ophiocephalusstriatus
6	Chenga	Ophiocephalusgachua
7	Balia	Wallagoniaattu
8	Mangur	Clariusbatracus
9.	Channa	Channa punctata
10.	Mrigal	Ciirrhiniamrigala
11.	Chital	Notopteruschitala

Source: On the basis of primary site visit and in consultation with Local Peoples and concerned State fisheriesdepartment.

Methodology Sample Collection, Preservation & Analysis:

The samples were collected from 10 cm depth below the water surface in polyethylene bottles presoaked in 10% nitric acid solution for 24 hours and thoroughly rinsed with distilled water before use.

Preservation of sample is done by adding 5 ml of 4% Formalin. The preserved samples were kept undisturbed for 24 hrs to allow the sedimentation of plankton suspended in water. After 24 Hrs the supernatant was discarded carefully without disturbing the sediment and final volume of concentrated sample was maintained 50 ml.

Qualitative analysis of Phytoplankton is done by Lackey Drop Method (Lackey,1938). A drop of sample is placed on the strip of slide and covered with covers lip. Now the no. of individual of each microorganism is counted under microscope and the no. is expressed per ml of sample.

For zooplanktondesired volumes of water were filtered through plankton net having mesh size of 75µ torepresent all the available groups. Drop count method for the analysis were followed, asprescribed in APHA (1995).

Phytoplankton: The Phytoplankton community in the study area comprises of mainly Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglinophyceae. Chlorophyceae and Cyanophyceae were the most dominant group observed in the study area. Dominant Species observed are *Microcystis, Nostoc, Anabeena, Scendesmus* and *chlorella* etc.

Family	Species	Family	Species
Chlorophyceae	Scenedesmus sp.	Cyanophyceae	Anabaena sp.
	Closterium sp.		Nostoc sp.
	Ulothorix sp.		Microcystis sp.
	Chlorella sp.		Oscillatoria sp.
	Volvox sp.		Lyngbya sp.
	Oedogonium sp	Euglenophyceae	Euglena sp.
Bacillariophyceae	Fragilaria sp.		
	Cymbella sp.		
	Nitzchia sp.		

Table 3. 23(N) : LIST OF PHYTOPLANKTONS PRESENT IN AND AROUND THE STUDY AREA

Family	Species	Family	Species
	Navicula sp.		
	Cyclotella sp.		
	Diatoms sp.		

Zooplankton

The Zooplankton of the study area comprises of four group i.e., Protozoans, Rotifers, Copepods and Cladocerons. List of zooplankton species identified are provided below in table:

Table 3. 24 O) : LIST OF ZOOPLANKTONS PRESENT IN AND AROUND THE STUDY AREA

GROUP	SPECIES	GROUP	SPECIES
Protozoans	Arcellia sp.	Rotifers	Brachionus sp.
	Actinophryssp		Monostyla sp.
			Mytilina sp.
Cladocerons	Daphnia sp.	Copepods	Cyclops sp.
	Moina sp.		Mesocyclops sp.

Conclusion

The biological environment in the surrounding of the study area is dominated by grasses with tree, herbs& Shrub species, All the species reported from core zone are common and generally found in wide variety of habitat of the study area No endemic/endangered sp. were recorded from core area of the project site. Apart from that there is no Biosphere reserve, National Park, Wildlife sanctuary, Tiger Reserve or Elephant reserve are reported within 10 Km radius of project site and project area is also devoid of any breeding and nesting ground of any faunal species. So it can be stated that proposed project and associated activities will not influence biodiversity of the area.

Secondary Source For Biodiversity Assessment

- ✓ BSI (2016). State wise Distribution of Endemic and Threatened plant texa of India. http://www.bsienvis.nic.in/Database/E_3942.aspx
- Champion, H.G. and Seth (1968). A revised survey of the forest types of India. Govt. of India Press, Nasik, India.
- ✓ ENVIS Centre on Wildlife & Protected Areas Schedule Species Database http://wiienvis.nic.in/Database/ScheduleSpeciesDatabase_7969.aspx.
- ✓ Forest survey of India, State of Forest Report -2017
- ✓ IUCN Red List of Threatened Species,
- ✓ https://www.iucn.org/resources/conservation-tools/iucn-red-list-threatened-species.
- ✓ CPCB Guideline for developing Greenbelts
- ✓ http://cpcbenvis.nic.in/scanned%20reports/PROBES75%20Guidelines%20For%20Developing%20G reenbelts.pdf
- ✓ Forest Survey of India

- ✓ https://fsi.nic.in/isfr19/vol2/isfr-2019-vol-ii-up.pdf
- ✓ ENVIS center for Faunal Diversity
- ✓ http://www.zsienvis.nic.in/
- ✓ Zooplankton Methodology, Collection & Identification - a field manual
- https://drs.nio.org/drs/bitstream/handle/2264/95/Zooplankton_Manual.pdf?sequence=1&isAllow ed=y
- ✓ Flora and Fauna Survey Guideline
- ✓ https://www.lakemac.com.au/files/assets/public/hptrim/land-use-and-planning-planningdevelopment-control-plans-dcp-lake-macquarie-control-plan-dcp-2014-original-dcp-2014-andrevision-4-warners-bay-review/dcp-2012-adopted-11-june-2013/flora-and-fauna-surveyguidelines-version-4-2-adopted-8-april-2013-revision-1.pdf
- ✓ Forests of Uttarakhand: Diversity, Distribution, Use Pattern and Conservation.
- ✓ Vishwambher Prasad Sati, S.K Bandooni; ENVIS Bulletin Himalayan Ecology, Vol 26, 2018, Pg 21-27
- http://gbpihedenvis.nic.in/ENVIS%20Bullitin/ENVIS%20Bulletin,%20Vol.%2026,%202018/Forests_ Uttarakhand_V.P._Sati.pdf

3.7 SATELLITE IMAGERY & LULC MAP OF STUDY AREA

The study of land use in the area enables one to know about the present land use practices as well as to know the type of land that can be used for various development activities envisaged in post project scenario. The land use pattern indicates the manner in which different parts of land in the study area is being utilized. It is an important indicator of environmental health and human activity and a degree of inter-play between these two. The land-use map of the study area was prepared by utilizing principal resources: -

- Survey of India topo-sheet of 1:50,000 scale (440/16);
- Satellites imagery data without any cloud cover of year 2021 Sentinel 2A Satellite Image. Sentinel-2 carries the Multispectral Imager (MSI). This sensor delivers 13 spectral bands ranging from 10 to 60-meter pixel size. Its blue (B2), green (B3), red (B4), and near-infrared (B8) channels have a 10-meter resolution. Next, its red edge (B5), near-infrared NIR (B6, B7 and B8A) and short-wave infrared SWIR (B11 and B12) have a ground sampling distance of 20m. Finally, its coastal aerosol (B1) and cirrus band (B10) have a 60 m pixel size.
- This Land use Land Cover Map is prepared with help of Sentinel 2A Satellite Image (downloaded from https://earthexplorer.usgs.gov/) with using tools Knowledge Base Classification of Arc GIS 10.8 and ERDAS Imagine 2016 Software.
- Ground validation for interpretation of the FCC imagery

The impacts on land environment would be in the form of permanent change in landuse pattern as well as direct and indirect impacts on surrounding land due to discharge of wastes on the land and unscientific means of disposal. Area statistics of land-use classes has been generated within 10 Km radius of mine lease area (Core zone and Buffer zone).

3.7.1 CONTOURMAP

Contours are lines that connect points of equal value (such as elevation, temperature, precipitation, pollution, or atmospheric pressure). Contour map is prepared by using surface tool which is present in Spatial analyst tool which can be achieved by using Arc GIS 10.8. The contour map of the study area is given as Figure-3.7 (A).

Interpretation (Contour Map)

- ✓ Project site and its surrounding area is situated on Hilly and undulated terrain. Contour elevation within project site varies between 398m AMSL to 400m AMSL . Moderate slope within the premises of project site is towards North East and Eastwards direction.
- ✓ Map is showing maximum elevated contour of 1390m AMSL at Top of the hillock in North-Eastern part of the Map.
- ✓ While lowest contours is located within study area in South & Southwest part of Map showing 290m AMSL.
- ✓ Whitish portion of the map showing the equal altitude of the area.
- ✓ Contour map comprising in 10 km buffer study area from the project site which is situated near river bed of river Malin within undulated hilly terrain.
- ✓ Contour topography reveals that terrain is Hilly and slopes towards Southern direction along the flow direction of river Malin.
- ✓ In the Study area map is showing dense contours in Hillocks and ridges which are situated in Northern Part of the Map .while less dense contour occurs in Southern part of Map.
- ✓ Contour map clearly demonstrate that area is structurally controlled by Structural Features like Plateaus , Hillocks and ridges in the Study area.
- ✓ Contour map clearly demonstrates area is overlain by Alluvial terrain.

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Figure 3. 9 (A): CONTOUR MAP OF THE STUDY AREA

3.7.2 DRAINAGE MAP

The study area displays a variety of drainage pattern which is governed by the arrangement of lithological boundaries, drainage network and distribution of linear structural features such as faults, lineaments and thrusts. The drainage map of the study area is given as Figure-3.10 below-

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Figure 3. 10 (B): DRAINAGE MAP OF THE STUDY AREA

Interpretation (Drainage Map):-

- ✓ This drainage map is prepared in10 km radius area from the project site and which covers about 319 SqKm.
- ✓ After interpretation map reveals 5 no's of Drainage Orders.
- ✓ The Lease area & Surrounding area sloping towards 1st order Drainage (First Order)
- ✓ First order drainage (Blue Color) having characteristic situated at high elevation with smallest distance in comparison with other drainage in its drainage Basin.
- ✓ While 5th order drainage (Red Colour) situated at lowest elevation and having greater length than other drainage in its drainage Basin.
- ✓ First ,Second, Third & fourth order of drainage successively meet to fifth order drainage which is the main channel of whole Catchment area and flows towards South direction.
- ✓ Drainage map is showing dominantly Dendritic to sub dendritic and Parallel drainage pattern.
- ✓ Drainage map showing system is structurally controlled by Structural Features like Plateaus , Hillocks and ridges in the Study area.

3.7.3 LAND USE LAND COVER MAP



Figure 3. 11(C): LAND USE LAND COVER MAP OF THE STUDY AREA

Sr. No	Color Code	Class Name	Area in SQKM	Area in %
1		Water Body	8	3
2		Cropped Land	4	1
3		Plantation	24	8
4		Barren Land	29	9
5		Built Up Area	14	4
6		Hilly Area with Vegetation	202	63
7		Fallow Land	38	12
		Total	319	100

Table 3. 25 (A): DESCRIPTION OF LAND USE

Interpretation (LULC Map)

63 % of the land of the study area comprises of Hilly area with vegetation.

3.8 HYDROGEOLOGY

As increasing industrialization & modernization in lifestyle, issue of water crisis either quality &/orquantity of water is being critical day by day. The main source of such crisis is found to be the activities requiring huge quantityoffreshwater and generating huge quantityofwaste water. Hence, whilestudying the probable impacts of industrial project, it is very important to determine the existing status of water quality quantity. The water resource for such investigations groundwater & can be orsurfacewaterorbothdependinguponthewaterspecificplanningoftheproposedproject.

BlockName	Pauri(AsperCGWAClassification)
CategoryofBlock	Safe(Non-Notified)

Ground Water is occurring in the zone of Secondary Porosity, under unconfined condition. Groundwater is the prime source of water supply in the district for drinking purpose. Ground water in themajorpartofthedistrictoccursinlocalized, disconnected bodies underfavorable geological conditions. Thus there is no homogenous aquifer system having wide aerial extent. Ground Wateroccurs along the thrustplains, strikeslip fault/normal fault plains, tensilejoints, synclinal folds, tensile fractures and at the contact of two different rock formation setc.

Further it also occurs in solution cavities, channels etc. in the carbonate rocks. In alluvial formation itoccurs in the valley fill deposits, terraces, river terraces and glacial valleys, weathered rockcover andin moraines and glacial deposits. On the hill slope ground water mostly occurs in the form of seepages, springs and gadheras under gravity and favorable geological structures interceptingthetopography.

The occurrence of springs and seepages is controlled by geological structures and physiography of thearea. Most of the springs are originating from higher reaches of the mountains. Two-three springsjointlymakes a highdischargegadhera also originatingandmeeting athigherreaches and flowsthrough contacts of mountains / rocks under gravity. The discharge and temperature of the springsfluctuate throughout the year depending upon its recharge and discharge factor. During the rains thefavorable geological structures get recharged and resulting in higher discharge of spring and gadherasafter the monsoons. During postmonsoon period their discharge reduces graduallywith time anditisminimuminpre-monsoonperiod.

The ground water discharge and its temperature of spring/gadheras located in various litho tectoniczones significantly vary. The maximum discharge in the area through spring is observed in CentralCrystallinelitho-tectoniczoneintherockformationsofgneissesandschistsofhigh-grademetamorphic facies. In this litho-tectonic zone the discharge varies from 1 to 50 lpm in springs and approximately 30 to 1200 lpm in gadheras / gads. The temperature of ground water generally variesfrom17.00Cto22.50Cinsprings.

The Tapt Kund spring which is hot water (460 C) sulphur springs located at Gaurikund shows that thewater in the spring is coming through deepseated fractures. Mostlythe springs in the area are ofgravitational type except the hot spring, which is deep seated and non-gravitational type. The majorpart of the district is occupied by Central Crystalline lithotectonic unit. In Garhwal lithotectonic unit,thedischargesofthespringsvary1lpmto18lpmwithtemperaturerangingbetween180Cand240

C. The springs of this zone are of gravitational type and are of VII to V order of magnitude (after Meinzers Class). In this zone ground water occurs mainly in the secondary structures.

Generally all the cold springs distributed in the different litho-tectonic zones are not as deep seated asin the case of hot springs found in the Himalayas. The cold springs are gravitational spring originatingfromhigheraltitudes.Themeteoricandsurfacewaterdirectlyrechargethefavorablegeologicalstruct ures controlling the springs. Direct rainfall and snow melt infiltrates through the joints, fissures,faultplainsandweatheredzonesoftherocksandthethinveneerofsoilcover.

TheperennialRiversandstreamsalsorechargethespringslocatedonthevalleysideandnearstreambeds. The potential recharge areas in the hilly terrain are flat ridges, hills, saddles, spurs, floodplains developed on terraces of major rivers, fault plains, sheared zones along the riverbed etc. The discharge takes places through springs/ gadheras on the hill slops where the structurally weak and saturated zones intercepts the topography. The ground water budgeting in the hillyterrain is notpossibleduetohilly, ruggedtopography and hydrogeological discontinuity.

Hydro-geologicalstudiesoverthelastdecadesconfirmthediminishingwaterresourcesandtheworsening cries as caused by the following factors which have resulted in the decrease in undergroundseepages. These have directly contributed the reduction of the water availability in and reduction of discharge in nallas as well as extensive disappearance of spring-the regions primary source of drinkingwater.

There has been a dimensing regulatory effect of glaciers of the great Himalayan zone. There is a long-terndecreasingtrendofstreamdischarges. The capacities of the lakes haved windled. Surfacer unoff on the hills has shown high increase. There has been an increase in flood water and decrease inbase flow water in channels and Rivers. Extensive soil erosion and landslips are phenomena in the region.

As Per Latest Ground Water Year Book Uttarakhand (2019 -2020) Ministry of Jal Shakti Department ofWaterResources,RiverDevelopmentandGangaRejuvenation,CentralGroundWaterBoard,Uttaranchal Region, Government ofIndia,Dehradun,March–2021, report.

3.8.1 BEHAVIOUR OF WATER LEVEL AND SPRING DISCHARGE

The water levels and spring discharge of Ground Water Monitoring Wells of Pauri Garhwal were measured four times during the period 2019-2020 (May 2019, August 2019, November 2019 and January 2020. The ground water levels in different seasons were analyzed to evaluate the temporal behaviour of water level. The behaviour of water levels in each season during the period May 2019 – January 2020 has been compared with the water levels of previous year as well as with average water level for the last decade to ascertain the changes in ground water regime.

Apart from this, the fluctuation of water levels during the current year and previous year has also been evaluated in order to assess the adverse impact on hydrogeological regime, if any.

3.8.2 MONITORING DATA OF GROUND WATER MONITORING WELLS, PAURI GARHWAL DISTRICT.

Sr. No.	Location	May-19	Aug-19	Nov-19	Jan-20
1	Kaudiya(Kotdwar)	60.8	68	50.53	50.92

Thewater

leveldepthrangesfrom 50 mbelow ground level to 68 mbelow ground level. In the month of August' 2019 the ground water level reported 50.53 mbgland in January, 2020 the ground water level reported 50.92 mbgl.

3.8.3 SURFACE WATER:

Alaknanda, Nayyar River is the major river of the district and is one of the major tributies of Alaknandawhich is called Nayyar after the confluence of eastern and Western Nayyar at Satpuli. Both the Nayyarsoriginate from the Dudatoli range and drain their water to the south. The high ranges in the Nayyarcatchments are Thailisain (Dudatoli –Chakisain ridge), Baijro (Pokhra –Demdeval ridge), Khirsu-Mandakhal (Pauri – Adwani – Kanskhet ridge), Bironkhal (Lansdowne – Gumkhal – Dwarikhal ridge) &Rathwadhab(Dugadda–Kandiridge).

The region of Paury Garhwal is well drained by numerous and rivulets locally known as Gad, Gadheraand Naula. All the River tributaries of the district are the part of the Ganges system draines the majorpart of the region covering the whole of the district East Nayar, West Nayar, malan, Sukhro, Khoh and some part of thealknanda and otherGadetc., ultimately contributing to thewater of Ganges.TheNayar which drains more than a halfarea of the Garhwal district is an importanttributaryoftheGanga.TheYamuna-Tonssystemisalsolocatedregion.

3.8.4GROUND WATER:

It is an important source of water in the study area. There are many bore wells, dug well hand pump inthestudyarea.Watersamplescollectedfromnearprojectsite andbufferzonearea.

3.8.5 GROUND WATER RESOURCES:

Groundwater assessment has not been carried out as the groundwater abstraction is done mainly through handpumps with almost negligible discharges.

3.8.6 STATUS OF GROUND WATER DEVELOPMENT

GroundwaterabstractionismainlydonethroughBorewell,handpumpswithverynegligibledischarges. Ground Water Development The district Pauri Garhwal is mainly occupied by HimalayanMountain ranges. Around 50% of the area is perennially covered under snow. Hence there is no scopeof ground water development in this area. However, at lower reaches, there is scope of ground waterdevelopment through bore well and hand pumps. For this, hydrogeological investigation is required atmicro level soasto decipherthewater bearingrockformations, hassufficient which secondaryporositylikejoints, fractures, lineamentsetc. These discontinuous aquifers along with favorable physio graphical set-up can help to develop ground water by hand pumps. Besides, there are number of natural springs which can be utilized to cater the need for drinking and irrigation. There are numeroussprings with sufficient discharge; the water of these springs can be channelized for irrigation. Duringnonmonsoonperiod, the discharge of springs gets reduced. To augment the discharge and sustainability of these springs, small surface water reservoir can be developed suitable locations at onhigherlevel. The reservoir can be developed by constructing gully plugs, check dams, gabion structures etc. at suitable will only places. These reservoirs not provide surface water availability butwillalsohelpinrechargingtheaquifers.Groundwatermaybedevelopsinvalleysareasbyconstructing largediameterdugwells and shallowtube wells. Thelargediameter dug wellsandshallowtubewellswillabletosustainthedischargesbetween250to1000lpm.

3.8.7 WATER CONSERVATION AND ARTIFICIAL RECHARGE

Groundwater, in the area, is mainly developed through hand pumps. The area replenishing the handpumps be identified precisely. Suitable groundwater recharge structures like should gullying plugs, checking dams, gabion structure setc. can be constructed so that the yieldofthehandpumpissustained round the year. Further, ground water is also developed naturally through springs. It oozesout in the under gravity and favorable geological structures intercepting the topography. Basicallyspring is a localized natural discharge ground the land surface through of water issuing on outlets. The discharge of spring may vary from a trickle to as big as a stream.

Rain water harvesting structures like gully plugs, check dams, gabion structures etc. may be constructed in the nearby vicinity of the springs and nalas having negligible to low discharges.



Figure 3. 12 (A):CONCEPTUALLAYOUT OFSPRINGRECHARGESAREA

Source:-Ground Water Year Book Uttarakhand (2019-2020)-Ministry of Jal Shakti Dept of Water Resources,

3.9 GEOLOGY

The topography of Pauri Garhwal is by and large rugged and except for the narrow strip of Bhabar, the entire region is mountainous. The highest point of the area is 3116m at Dudatoli and the lowest point of the area is 295m near chilla. The village located at the hightest level is Dobri, which is 2480m high. The cross profiles of the fluvial valleys show convex form with steep valley sides, interlocking spurs descending towards the main channel, hanging valleys, waterfalls and rapids and terraced agricultural fields on the gentle slopes on the valley sides. The clustering of villages is confined mainly on the gentle slopes of the ridges on the fluvial terraces. The forest cover is the

maximum in Thailisain block and the minimum in the Pauri block. Most of the part of the area is approachable by road from its district headquarter. Most of these roads are not yet metalled and are prone to land slips, slides, dusty, except few main roads. The district of Pauri Garhwal as part of the Western Himalaya presents a unique set of ecological characteristics over a complex variety of systems that incorporate forests, meadows, savannah grasslands, marshes and rivers, as well as wildlife, geology and several other phyto-geographically distinctive peculiarities. Forests dominate in the phyto-geography and also constitute the most valuable natural resource of the district.

3.9.1 GEOGRAPHY/ GEOMORPHOLOGY

This district is ringed by the districts of Chamoli, Rudraprayag & Tehri Garhwal in North, Bijnor & Udhamsingh Nagar in South, Almora & Nainital in East, Dehradun & Haridwar in West. The District is administratively divided into nine tehsils, viz., Pauri, Lansdown, Kotdwar, Thalisain, Chobattakhal, Srinagar, Satpuli, Dhumakot & Yamkeshwar and fifteendevelopmental blocks, viz., Kot, Kaljikhal, Pauri, Pabo, Thalisain, Bironkhal, Dwarikhal, Dugadda , Jaihrikhal, Ekeshwer, Rikhnikhal, Yamkeswar, Nainidanda, Pokhra & Khirsu. Alaknanda, Nayyar River is the major river of the district and is one of the major tributies of Alaknanda which is called Nayyar after the confluence of eastern and Western Nayyar at Satpuli. Both the Nayyars originate from the Dudatoli range and drain their water to the south. The high ranges in the Nayyar catchments areThailisain (Dudatoli - Chakisain ridge), Baijro (Pokhra – Demdeval ridge), Khirsu-Mandakhal (Pauri – Adwani – Kanskhet ridge), Bironkhal (Lansdowne - Gumkhal - Dwarikhal ridge) & Rathwadhab (Dugadda - Kandi ridge). The region of Pauri Garhwal is well drained by numerous and rivulets locally known as Gad, Gadhera and Naula. All the River tributaries of the district are the part of the Ganges system draines the major part of the region covering the whole of the district East Nayar, West Nayar, malan, Sukhro, Khoh and some part of the alknanda and other Gad etc., ultimately contributing to the water of Ganges. The Nayar which drains more than a half area of the Garhwal district is an important tributary of the Ganga. The Yamuna-Tons system is also located region.

3.9.2 REGIONAL & LOCAL GEOLOGY

The geology of the region shows that the Himalayas are the young mountains in the world. During early Mesozoic times, or the secondary geological period, the land mass now covered by them was occupied by the great geosynclinals Tethys sea. The probable date of the commencement of the elevation of the Himalayas is about the close of the Mesozoic period, but the unravelling of the story of their structure has only just begin, and in many cases no dating of the rocks is yet possible, though they include ancient and relatively recent crystalline intrusive, rocks and sediments allied to the peninsular part of India.

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Figure 3. 13 (A): INDEX HIMALAYAN SEQUENCE

3.9.3 GEOLOGIC SUCCESSION

Stratigraphy of rock succession in Uttarakhand giving various geological units and their lithological characteristics:

Group Formation		Lithology		
Granite(1100Ma)				
(ii) VaikrrtaGro up(part)/Jaunsa r Group	Undifferentiated Vaikrita/ Mandhali—Chandpur- Nagthatformations	Purple, grey quartzite, grits and conglomerate, th inbedded limestone- phyllite/slate, laminated green is hgrey phyllite/sl atewith lenticular grey wacke, purple green quartz ite, grit, conglomerate		
	Granite(1900Ma&1600Ma)			
	BerinagFormation	Quartzite with pencontemporaneousmaficvolcanics		
(i) GarhwalGroup	Disconformity			
	DeobanFormation	Limestone-dolomite, shale		
	RautgaraFormation	Quartzitewithenecontemporaneousmaficvolca nics		
	Granite(2200-2100Ma)			
	UttarkashiFormation	Quartzitewithpencontemporaneous maficvolcanic, dolomite-limestone, shale		

3.9.4 GARHWALGROUP

It consists of thick succession of low grade meta-sediments made up of quartzite with pencontemporaneous met basics and carbonate rocks lying between the Main Central Thrust inthenorthand the Main Boundary Faultin the south. The Garhwal Group is intruded by granites dating ca. 2100, 1900, 1800, 1600, 1200-1100 Maandy oungerbiotite and tour maline granites.

The Garhwal group is subdivided intofive formations Acid and basic igneous rocks intrude the rocks of Garhwal Group. Different formations of the Garhwal Group can be subdivided intoseveralmemberswhomayoccurlocally.

3.9.5 LITHO-STRATIGRAPHYOFGARHWALGROUP

Formation	Member	Lithology		
BerinagFor	Hudoli member	Thickbeddedmassivequartzite,quartzite-phyllite.		
mation	Nawagaon	White, massive, fine-grained togritty, current bedded		
	member	${\tt quartz} it ewith {\tt lenticular} information {\tt alconglomerate}, with {\tt phyllitic}$		
		partingsandmaficmetavolcanics.		
Deoban	Patetslate	Blackcarbonaceous slate/phyllite and bluish grey		
Formation		limestone, with bands of magnesite and talc-schist.		
	Balgaddolomite	Massivedolomite with limestone and talc-chlorite- sericiteschist.		
	Naularaphyllite	Blackcarbonaceous phylliteandgreenslate, chlorite phyllite, quartzite, felds pathic grit.		
	Tejamdolomite	Massivedolmnitewithdolomite.limestoneandtalcsericiteschist.		
	Simgadmember	Purplequartz-piedmontitesiltstoneand		
		purplephyllite, banded greenish quartzite		
		andcalcareousphylliteanddolomite		
RautgaraFor	Bhekunametavo	Maficamygdaloidallavas(spilitic)altered tohornblende-		
mation	icanics	actinolite-chloritephyllite, withveinsor		
	Nagpatha	epidoteanutourmaine.		
		-silicateinunnernart		
	Karnanravag	Mafic spilitic lava and keratophyre amygdaloidal		
	metavolcanics	occasionallyporphyritic.chloritephyllite.actinolite-biotite-		
		albitephyllitewithveinsofepidote.Intertrappeanpurplephyllite.		
	Harvaligu	Massive,		
	artzite	gritty, coarset of inegrained with occasional p		
		ebblebed,currentbeddedandgraded		
		Bedded, ripple marked with thinpartings		
		ofchocolatephyllite,lenticulardolomite/limestone		
	Wiari	Maficamygdaloidal		
	metavolcanics	lavaflows,alteredtodrabgreenchlorite		
		phyllite, with phyllite and bands of quartzite.		

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UttarkashiF ormation	Khattukhal	Grayishblack tograyishbluelimestoneanddolomitewiththinlybeddedgrey slate.
	Dhanerislate	Banded, grey green and purple slates interbedded with quartzite
	Netalamember	Whitetobuff, tine- grained, current bedded quartzite and interbeddeds latewith minor lenses of limestone

3.9.6 RAUTGARAFORMATION

Rautgara Formation consist of massive, cream coloured, purplish and brownish fine grained quartzite interbedded with purple green mottled slate and calcareous phyllite. In the Alaknanda valley, it is made up of alternating bands of quartzite and metavolcanic. It is subdivided into five members, namely, Dhari metavolcanics, Haryali quartzite, Karnprayag metavolcanics, Nagnath quartzite and Bhikuna metavolcanics.

3.9.7 DEOBANFORMATION

It is essentially made up of carbonates, conformably overlying the Rautgara Formation and is overlain by the Berinag Formation. In the Alaknanda basin it is exposed in the form of an anticline and is known as Cale Zone of Chamoli. It is subdivided into five members, i.e. Simgad member, Tejam dolomite, Naulara phyllite, Balgad dolomite and Patel slate.

3.9.8 VAIKRITAGROUP/JAUNSAR GROUP

These groups consist of undifferentiated Vaikrita/ Mandhali - Chandpur - Nagthat formations. These are characterized by purple, grey quartzites, grits mid conglomerates, thin bedded limestones, phyllite/states; laminated greenish grey phyllite/state with lenticular greywacke, purple green quartzite, grit and conglomerate.

3.9.9 BERINAGFORMATION

Lithologically it is similar to the Rautgara Formation and comprises of a thick succession of quartzite with pene contemporaneous mafic meta-volcanics. It distinguishes from Rautgara Formation in having lower number of interbedded volcanic flows. The Berinag Formation is better developed in the western Uttaranchal and has the status of a Group where it is divisible into the Nawagoan member at the base and the Hudoli member at the top.

3.10 SOCIOECONOMIC STUDY

3.10.11 NTRODUCTION: SOCIO-ECONOMIC IMPACT ASSESSMENT

Socio-Economic Impact Assessment (SEIA) refers to systematic analysis of various social and economic characteristics of human being living in a given geographical area (study area/impact area). The prime objective of SEIA is to identify and evaluate potential socio-economic and cultural

impacts of a project on the lives & conditions of people, their families and communities. If the potential impacts are significant and adverse, SEIA assist the developers and other stakeholders to reduce, remove or prevent these impacts from happening. Also, it examined how a development project changes the lives of local residents. The outcome of the study relies on both quantitative and qualitative measure of impacts. The impacts are evaluated in terms of changes in community demographics, housing, employment, market effects, public services, retail business, quality of life and artistic qualities of the community. Further, assessing proposed developments in socio-economic context help the community leaders and local people identify potential social equity issues, evaluate the adequacy of social services and determine whether the project has adverse effects on overall social well-being or not.

SEIA also provides a forum for planning how to maximize the beneficial impacts of a project. Beneficial impacts can include:

- a) A better standard of living due to increased access to employment, business opportunities, training, education & health
- b) Greater access to and from a community and
- c) Increase funding to improve social infrastructure and cultural maintenance.

3.10.2 OBJECTIVES OF THE STUDY

The objectives of Socio-Economic Impact Assessment of the project are as follows:

- a) To comprehend socio-economic status of the people living there in.
- b) To assess probable impact of the project on social and economic aspects.
- c) To measure the impact of the project on quality of life of the people.
- d) To ensure sustainability of positive impacts.
- e) suggest mitigation measures & agency responsible for taking action in case of adverse impact.

Steps taken to prepare the SEIA Report

- ✓ Literature Review.
- ✓ Identification of the study area and important landmarks therein.
- ✓ Preparation of list of habitations located in the study area.
- ✓ Firming up of approach and methodology.
- ✓ Collection of Secondary Data from Census Report, district profile, published and un-published literatures, administrative records etc.
- ✓ Data Entry and Data Validation.
- ✓ Generation of Tables.
- ✓ Data Analysis and preparation of report.

3.10.3 METHODOLOGY

✓ For Socioeconomic Impact Assessment of the project, we recourse to systematic analysis By Geoinformatics application of village level dynamic studies in various socioeconomic
characteristics, both in terms of quality and quantity. Accordingly, both qualitative and quantitative data of the study area was collected through various sources.

✓ For collection of information, we approached Census of India for published data/information, visited state & district portals and referred to administrative records of the state & district administration. Codes were extensively used during collection of qualitative data. They were decoded after data processing to facilitate data analysis and report writing.

Study Area

The study area defines the circle radius of 10 km buffer zone around the project site. M/S Nagar Palika Parishad Kotdwar, Solil Waste Management & Disposal Facility Project is located in District Pauri Garhwal, Uttarakhand state, India. Project study area also covers District Haridwar, Uttarakhand and District Bijnor Uttar Pradesh. 113 habitations identified given in the Maps and table below:



Figure 3. 14 (A): SOCIO ECONOMIC HABITATION MAP

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Table 3. 26 (A) : LIST OF HABITATION

S.No.	Habitation	District	State
1	Kotridhank	Pauri Garhwal	Uttarakhand
2	Lalpani Palli	Pauri Garhwal	Uttarakhand
3	Saneh Palli	Pauri Garhwal	Uttarakhand
4	Saneh walli	Pauri Garhwal	Uttarakhand
5	Koriya	Pauri Garhwal	Uttarakhand
6	Kashi Rampur	Pauri Garhwal	Uttarakhand
7	Ratanpur	Pauri Garhwal	Uttarakhand
8	Jadhanpur	Pauri Garhwal	Uttarakhand
9	Harsinghpur	Pauri Garhwal	Uttarakhand
10	Lalpani walli	Pauri Garhwal	Uttarakhand
11	Shi Rajpur	Pauri Garhwal	Uttarakhand
12	Kotdwar	Pauri Garhwal	Uttarakhand
13	Manpur	Pauri Garhwal	Uttarakhand
14	Shibbu Nagar	Pauri Garhwal	Uttarakhand
15	Dev Rampur	Pauri Garhwal	Uttarakhand
16	Ratanpur	Pauri Garhwal	Uttarakhand
17	Balasaur	Pauri Garhwal	Uttarakhand
18	Khunibarh	Pauri Garhwal	Uttarakhand
19	Kumbhichaur	Pauri Garhwal	Uttarakhand
20	Jeetpur	Pauri Garhwal	Uttarakhand
21	Balbhadrapur	Pauri Garhwal	Uttarakhand
22	Vishanpur	Pauri Garhwal	Uttarakhand
23	Umraopur	Pauri Garhwal	Uttarakhand
24	Jhandi chaur West	Pauri Garhwal	Uttarakhand
25	Chota Talla	Pauri Garhwal	Uttarakhand
26	Lalpur	Pauri Garhwal	Uttarakhand
27	Jhandi chaur East	Pauri Garhwal	Uttarakhand
28	Shivpur	Pauri Garhwal	Uttarakhand
29	Padampur Sukhran	Pauri Garhwal	Uttarakhand
30	Haldwkha talla	Pauri Garhwal	Uttarakhand
31	Simalchaur	Pauri Garhwal	Uttarakhand
32	Durgapur	Pauri Garhwal	Uttarakhand
33	Sitabpur	Pauri Garhwal	Uttarakhand
34	JIwanandpur	Pauri Garhwal	Uttarakhand
35	Dhurwapur	Pauri Garhwal	Uttarakhand
36	Jhatari	Pauri Garhwal	Uttarakhand
37	Mawakot	Pauri Garhwal	Uttarakhand
38	Velba Bada	Pauri Garhwal	Uttarakhand

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S.No.	Habitation	District	State
39	Kanda	Pauri Garhwal	Uttarakhand
40	Nandpur	Pauri Garhwal	Uttarakhand
41	SatiChaur	Pauri Garhwal	Uttarakhand
42	Amkholi	Pauri Garhwal	Uttarakhand
43	Jhandichaod uttri	Pauri Garhwal	Uttarakhand
44	Neenbuchaur	Pauri Garhwal	Uttarakhand
45	Padampur	Pauri Garhwal	Uttarakhand
46	Ghamandpur	Pauri Garhwal	Uttarakhand
47	Teliwara	Pauri Garhwal	Uttarakhand
48	Udaya Rampur	Pauri Garhwal	Uttarakhand
49	Sarda sakali	Pauri Garhwal	Uttarakhand
50	Gorakhapur	Pauri Garhwal	Uttarakhand
51	Shri Rampur	Pauri Garhwal	Uttarakhand
52	Bhawanipur	Pauri Garhwal	Uttarakhand
53	Umalda	Pauri Garhwal	Uttarakhand
54	Urkhel Gaon	Pauri Garhwal	Uttarakhand
55	Ghota Malla	Pauri Garhwal	Uttarakhand
56	Davrana	Pauri Garhwal	Uttarakhand
57	Chanda palla	Pauri Garhwal	Uttarakhand
58	Ramdayalpur	Pauri Garhwal	Uttarakhand
59	Veldachota	Pauri Garhwal	Uttarakhand
60	Kothala	Pauri Garhwal	Uttarakhand
61	Nayabad Udaya Rampur	Pauri Garhwal	Uttarakhand
62	Sylinga	Pauri Garhwal	Uttarakhand
63	Mandevpur	Pauri Garhwal	Uttarakhand
64	Jayadevpur	Pauri Garhwal	Uttarakhand
65	Katal	Pauri Garhwal	Uttarakhand
66	Edamalla	Pauri Garhwal	Uttarakhand
67	Dalipur	Pauri Garhwal	Uttarakhand
68	Lokmaripur	Pauri Garhwal	Uttarakhand
69	Kishan Devpur	Pauri Garhwal	Uttarakhand
70	Ginthala	Pauri Garhwal	Uttarakhand
71	Balli	Pauri Garhwal	Uttarakhand
72	Gwirala	Pauri Garhwal	Uttarakhand
73	Edabara	Pauri Garhwal	Uttarakhand
74	Edachota	Pauri Garhwal	Uttarakhand
75	Kandai	Pauri Garhwal	Uttarakhand
76	Simalna Bichala	Pauri Garhwal	Uttarakhand
77	Simliyan laga Simalna Bichla	Pauri Garhwal	Uttarakhand
78	Mathana malla	Pauri Garhwal	Uttarakhand

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S.No.	Habitation	District	State		
79	Mathana Talla	Pauri Garhwal	Uttarakhand		
80	Dhurapauri	Pauri Garhwal	Uttarakhand		
81	Gandriyakhal	Pauri Garhwal	Uttarakhand		
82	Bhupdevpur	Pauri Garhwal	Uttarakhand		
83	Hardaspur	Hardwar	Uttarakhand		
84	Rahman Nagar	Bijnor	Uttar Pradesh		
85	Haldu Khata	Bijnor	Uttar Pradesh		
86	Ramnagar	Bijnor	Uttar Pradesh		
87	Rampur Chatta	Bijnor	Uttar Pradesh		
88	Kouriya	Bijnor	Uttar Pradesh		
89	Sherawala	Bijnor	Uttar Pradesh		
90	Madduwala	Bijnor	Uttar Pradesh		
91	Motadhar	Bijnor	Uttar Pradesh		
92	Ramsahaiwali	Bijnor	Uttar Pradesh		
93	Chaha Saluno	Bijnor	Uttar Pradesh		
94	Chatruwala	Bijnor	Uttar Pradesh		
95	Mothla	Bijnor	Uttar Pradesh		
96	Sanywala	Bijnor	Uttar Pradesh		
97	Telipara	Bijnor	Uttar Pradesh		
98	Rajpur Kot	Bijnor	Uttar Pradesh		
99	Haloowali	Bijnor	Uttar Pradesh		
100	Qadarganj	Bijnor	Uttar Pradesh		
101	Sulema Shikohpur	Bijnor	Uttar Pradesh		
102	Shankerpur	Bijnor	Uttar Pradesh		
103	Mohammad Amikhanpur	Bijnor	Uttar Pradesh		
104	Aurangjebpur Shahalipur	Bijnor	Uttar Pradesh		
105	Jafrabad	Bijnor	Uttar Pradesh		
106	Saboowala	Bijnor	Uttar Pradesh		
107	Murtajapur	Bijnor	Uttar Pradesh		
108	Mohmmad Taharpur	Bijnor	Uttar Pradesh		
109	Sahanpur Nanu	Bijnor	Uttar Pradesh		
110	Bijar Khata	Bijnor	Uttar Pradesh		
111	Muthrapur Mor	Bijnor	Uttar Pradesh		
112	Biruwala	Bijnor	Uttar Pradesh		
113	Nathewali	Bijnor	Uttar Pradesh		

The main agricultural commodities in the study area are Rice, Wheat, Barley, Finger Millet, Barn Yard Millet, Maize, Black Gram, Horse Gram, Lentil, Arhar, Soybean, Lahi / Mustard are the major crops. And fruits are Apple, Pear, Peach, Plum, Apricot, Walnut, Citrus and in case of vegetables are Pea, Radish,

French Bean, Cabbage, Cauliflower, Onion, Okra, Tomato, Brinjal, Potato and other seasonal vegetable. The majorly grown crops are Rice, Wheat, Soyabean, Mustard, Potato have been found in the study area these are the crops of the district.

3.10.4 BASELINE DATA

Baseline data with respect to population and amenities available in the study area has been worked out as under:

S. No.	Description	Number	Percentage to Respective Total
1	Total Population	163967	100
	Male	81239	49.55
	Female	82728	50.45
	Sex Ratio		1018
2	Population (0-6 age group)	20247	100
	Male	10868	53.68
	Female	9379	46.32
	Sex Ratio		863
3	Population- Scheduled Caste	21899	100
	Male	11172	51.02
	Female	10727	48.98
	Sex Ratio		960
4	Population- Tribe Caste	720	100
	Male	363	50.42
	Female	357	49.58
	Sex Ratio		983
5	Total Literates	125771	100
	Male	65225	51.86
	Female	60546	48.14
	Gender Gap in Literacy Rate		3.72
6	Overall Literacy Rate		79.63%
	Male		88.33
	Female		70.70
	Gender Gap in Literacy Rate		17.63
7	Total Workers	43775	100
	Male	34126	77.96
	Female	9649	22.04
	Gender Gap in Work Participation Rate		55.92
8	Main Workers	34611	100
	Male	28272	81.69

Table 3. 27(B) : DEMOGRAPHIC PARTICULARS/POPULATION DETAILS	:
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	Female	6339	18.31
	Gender Gap in Work Participation Rate		63.37
9	Marginal Workers	9164	100.00
	Male	5854	63.88
	Female	3310	36.12
	Gender Gap in Work Participation Rate		27.76
10	Household Industrial Workers	1525	100
	Male	963	63.15
	Female	562	36.85
11	Total Agricultural Workers	11159	100
	Male	7197	64.50
	Female	3962	35.50
12	Cultivators	5982	100
	Male	3610	60.35
	Female	2372	39.65
13	Agricultural Labour	5177	100
	Male	3587	69.29
	Female	1590	30.71
14	'Other Workers'	31091	100
	Male	25966	83.52
	Female	5125	16.48

3.10.5 POPULATION COMPOSITION

According to Census 2011, total population of the study area has been worked out to 163967 in which 81239 (49.55 %) are males and remaining 82728 (50.45 %) are females. The overall sex ratio in the study area has been worked out to 1018 females per 1,000 males which is high than the State sex ratio (963 females per 1000 males).



ITHC/PRJ/22-23/EIA/52/Rev.02

Figure 3. 15 (B): TOTAL POPULATION DISTRIBUTION

3.10.6 CHILD POPULATION DISTRIBUTION

In the study area, the total child population of age group of 0-6 year has been worked out to 20247 which constitute about 12.35 per cent of the total population. Of the total child population, 53.68 per cent are boys and remaining 46.32 per cent are girl child. The sex ratio of population in this age group is 863 girls per 1,000 boys which is low than the state child sex ratio (886 girls per 1000 boys) in the same age group.



Figure 3. 16 (C):CHILD POPULATION DISTRIBUTION

3.10.7 SOCIAL GROUP POPULATION DISTRIBUTION

In the study area, Scheduled Caste population is 21899 which constitute 0.44 per cent of the total population of the study area. Of this, 50.42 per cent is male and remaining 49.58 per cent is female. The sex ratio among Scheduled Caste population has been worked out to 983 females per 1,000 males.



Figure 3. 17 (D):SOCIAL GROUP POPULATION DISTRIBUTION

Household and Household Size

The entire population of the study area is distributed into approx. 36012 households and the average household size is five.

3.10.8LITERATES, LITERACY RATE AND GENDER GAP IN LITERACY RATE

In the study area, 125771 populations are literate in which 65225 are male and 60546 are female literates. The overall literacy rate has been worked out to 76.71 per cent which is less than State literacy rate 79.63%. The male literacy rate is 51.86 per cent and female literacy rate is 48.14 per cent, creating a gender gap in literacy rate of 3.72 per cent less than the (State gender gap of literacy rate i.e. 17.63%).



Figure 3. 18 (E): LITERATES, LITERACY RATE AND GENDER GAP IN LITERACY RATE

3.10.9 WORKERS AND WORK PARTICIPATIONRATE

Based on Census 2011, total number of workers in the study area has been worked out to 43775 which constitute 26.70 per cent of the total population. Of the total workers, 77.96 per cent are males and the remaining 22.04 per cent are females. In absolute term, the total number of male workers is 34126 and that of female is 9649. The gender gap in work participation rate is 55.92 per cent.

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Figure 3. 19 (F) : WORKERS AND WORK PARTICIPATION RATE

Further, Number of the total workers 34611, 79.07 per cent are main workers and the remaining 20.93 per cent is marginal workers. Of the total main workers 81.69 per cent are male and remaining 18.31 per cent are female which creates a gender gap in work participation of 63.37 per cent. In case of marginal workers, 63.88 per cent are male and 36.12 per cent are female that creates a gender gap of 27.76 per cent in this segment of work participation. The workers are further divided into Agricultural Workers, Household Industrial Workers and 'Other Workers'. Their shares in the total workers are 25.49 per cent, 3.48 per cent and 71.02 per cent respectively.



Figure 3. 20 (G): Distribution of Workers





Figure 3. 21 (H): SHARE OF WORKERS

Of the people working in agricultural sector, 13.67 per cent are Cultivators and remaining 11.83 per cent are Agricultural Labour. From the above distribution of workers it is clear that the economy of the study area is mainly dependent on agriculture, either cultivators or agricultural labourers.

3.10.10BASIC AMENITIES

F					
	FRUCATION				
	EDUCATION				
Educational	Type of Institutes	Number			
Institutions	Pre- Primary School (Pvt.)/Primary School (Govt.				
	& Pvt.)/Middle School (Govt. & Pvt.)/Secondary	128			
	School (Govt. & Pvt.)				
	HEALTH				
Health Facilities	Type of Facilities	Number			
	Primary Health Sub-Centre/ASHA/Anganwadi				
	Centre (Nutritional Centre)/Nutritional Centre				
	(ICDS)/Non-govt. Medical Facilities for out patient				
	WATER				
Drinking Water	Means of Drinking Water	No of Habitations			
	Tap (Treated)	60			
	Tap (Untreated)	17			
	Hand Pump	52			
	Well (Covered)	02			
	Well (Uncovered)	00			
	Tube Well	25			
	ELECTRICITY				
Electricity Supply	Power for Domestic Uses	83			

Table 3. 28(C): BASIC AMENITIES AVAILABLE IN THE STUDY AREA

	Power for Agriculture Uses	52
	Power for Commercial or Industrial Uses	31
	ROAD	
Approach Road	Black Topped (Paved/Pucca) Road	54
	Gravel (Mud/Kachcha) Road	23
	Water Bounded Macadam (WBM)	22
	Footpath Road	85
	TRANSPORTATION	
Road Transportation	Bus Services	29
	Private Bus Service	20
	Auto/Modified Auto Services	32
	OTHER AMENITIES	
Other Amenities	Public Distribution System (PDS) Shop	36
	38	
	Sports Field	14
	Birth & Death Registration Office	54

Source: Desk Research & Census of India

3.10.11SOCIO-ECONOMIC IMPACT OF THE PROJECT

Impact on Demographic Composition

There will be no significant increase in overall population of the study area as preferably local people will be recruited for employment. Hence, there will be no significant impact on the population composition in the study area. Since there will be no significant change in population, the overall sex ratio will remain more or less same.

Impact on Employment Opportunities

It is expected that a satisfactory number of people may get direct employment opportunities including skilled and unskilled workers along with some indirect employment opportunities. The benefits of employment to the job seekers are expected to include, at a household and individual level, in increase in socio-economic and health status, improvement to their quality of life & living condition, and the benefits from greater household expenditure on education & healthcare resources.

Industrial Development

It may expect that due to the proposed project, the scope for further industry movement will increase towards the similar projects in the states and across the nation.

Impact on Law & Order

No major law & order problem is experienced so far due to the project. It is expected that the workers attend to their duties from their residences and return to their homes after the day's work.

Conclusion

The project activities would continue to contribute to the local economy by providing direct or indirect employment opportunities and recycled revenues through the local economy. Indirect impacts could occur as a result of new economic development (e.g., new jobs at businesses that support the expanded workforce or that provide project materials). The opportunity for further industry development may increase towards the similar kind of projects to support production of the petroleum products. With time, the occupational pattern of the people in the area has changed making more people engaged in industrial & business activities due to which local people got opportunity to enhance their social & economic status.

Aside, the study area has ample scope for further development or improvement in education and health sectors in addition to provide better education & health facilities for achieving better quality or standard of life to the people residing in the area. Based on the observation, the institutions for basic health facilities as Primary Health Centre (PHC), Hospital/ Dispensaries, Maternity & Child Welfare Centre and Community Health Centre etc. can be established or increased& enhanced in context to provide better health facilities in the area.

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CHAPTER 4 – ANTICIPATED IMPACTS AND MITIGATION MEASURES

4.1 INTRODUCTION

This chapter presents identification and appraisal of various impacts related to the project due to the activities during construction and operation phase in the study area. Prediction of impacts is the most important component in the Environmental Impact Assessment studies. it helps in minimizing adverse impacts on environmental quality during pre and post project execution.

As a first step, the entire process has been divided into a number of smaller sub-activities for construction and operation phases.

The possible worst case emission and waste generation from the proposed project and also taking into considering the base line environmental status at the proposed project site, the environmental factors that are likely to be affected (impacts) are identified, quantified and assessed. Both beneficial (+ve) and damaging (-ve) impacts are accounted for this purpose.

As a first step, the entire process has been divided into a number of smaller sub-activities of operation phases. Table 4.1 lists various activities of operation and maintenance phase and probable impacts on various sectors of environment. Most of these impacts are long term.

Construction activities may cause adversarial impacts on nearby environment unless proper Environmental Management Plan is embraced. Selecting suitable mitigation actions in terms of site selection, technology, machinery and operations can minimize the conceivable deleterious impacts.

An attempt has been made to categorize and enumerate probable impact on various environmental parameters such as air, water, land, noise and socio-economic factors. The following aspects of environment have been deliberated to identify the possible impacts due to the Proposed Project.

- ✓ Land Environment
- ✓ Air Environment
- ✓ Water Environment
- ✓ Ecological Environment
- ✓ Noise Environment
- ✓ Socio-economic Environment

4.2 DETAILS OF ANTICIPATED ENVIRONMENTAL IMPACTS DUE PROPOSED PROJECT DURING CONSTRUCTION & OPERATION PHASE

		EnvironmentalAttribute					
S.No	Aspects	Air	Noise	Water	Land & soil	EcologyandBi o-diversity	Socio Economics
Constru	ConstructionPhase						

Table 4. 1: ImpactIdenti fication Matrix

NAGAR NIGAM KOTDWAR

DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND

		EnvironmentalAttribute						
S.No	Aspects	Air	Noise	Water	Land & soil	EcologyandBi o-diversity	Socio Economics	
1	Landprocurement				V			
2	ClearanceofVegetation	٧		٧	V	V		
3	ExcavationworkCutting,filling& Levelling)	٧	V	V	٧	V	V	
4	Site development , foundation work and various Civil constructions. Endowment of structure required for various project activities proposed	V	V	7			V	
5	Vehiclemovement for Raw material transportation and unloading and removal of unwanted material from site		V			V		
6	Storage,handlinganddisposalof solid waste	٧	V	٧	V			
7	Wastewatergeneration&dispos al			٧		V		
8	Landscaping & Greenbelt development	٧	V		V	V		
Operat	tionalPhase							
1	Vehiclemovement	٧	V			V		
2	Storage, handling and disposal of solid waste	٧	V	V	V			
3	Waterconsumption			V				
4	Wastewatergeneration&dispos al			٧	٧			
5	DG Operation	٧	٧		٧	V		

4.3 IMPACTSDURINGCONSTRUCTIONPHASE

Construction phase works include site clearance, site formation, excavation, material handling, building works, infrastructure provision and any other infrastructure activities. The impacts due to construction activities are short term and limited to the construction phase only. The impacts will be mainly on air quality, water quality and soil quality.

4.3.1IMPACTSDUETOSOLIDWASTEGENERATED

Thiscategoryofwastegenerationintheproposedprojectisduetodifferenttypesofrawmaterialsbein gusedduringconstructionstage ingeneralmaycomprise thefollowing.

- ✓ Cement concrete
- ✓ Bricks, tiles,
- ✓ Cement plaster
- ✓ Paints/varnishes and other construction material

- ✓ Steel (RCC, door/ window frames, roofing support, railings of staircase etc)
- ✓ Rubble, sand, Stone (Marble, granite, sand stone)
- ✓ Timber/wood

Table	4.	2:	Construction	Phase	ImpactIdentification,	Quantification	and	Mitigation	Measures	for	Land
Enviro	nm	ent									

Environ-	Possible	Impact	Im	pact Charac	teristics		
Attribute	Impact	Quantification	Nature	Duration	Reversibility	Mitigation Measures	
Land Environ- ment	Change of land use	Land Area = Gross Plot area of <u>9980 sq m</u>	Direct Negative	Long term	Reversible	Kanchanpuri site has been already transferred by the Forest Dept. to the Nagar Nigam and duly approved by the Govt. of Uttarakhand and MoEF&CC, Dehradun RO.	
	Removal Of Top Soil due to Cutting, filling & Levelling. Due to activities like site clearance, levelling activities, constructio n of Structures and foundations . top soil will be lost. This will have impact of permanent loss of fertile soil, which would have been utilized for agricultural purpose.	Top soil of 20 cm depth will amount to <u>1996 cum</u> of fertile top soil will be lost if not preserved.	Direct Negetive	Long	Irreversible	 The topsoil will be collected & preserved separately as per below. Top soil Preservation Procedure ✓ Spread finely chopped grass trimmings as a mulch over the surface of the topsoil. ✓ Prevent soil run-off by planting shrubs and trees along the edge. Shrubs and trees act as a natural barrier and prevent your topsoil from running into drains. ✓ Add adequate ground cover to shield the topsoil from rain, wind and other natural elements that gradually erodes the top layer of the soil After implementing the measures suggested, the nature of impact will be direct positive, short term and reversible. 	
	Soil Erosion	Land Area = Gross Plot area of 9980 sq m	Direct Negative	Long term	Irreversible	No loose soil will be allowed to store at site to avoid runoff during rains. Proper compaction and stabilization will be ensured during filling and levelling.	

NAGAR NIGAM KOTDWAR

DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND

Environ-	Possible	Impact	Im	pact Charac	teristics	
mental Attribute	Impact	Quantification	Nature	Duration	Reversibility	Mitigation Measures
	Likely occurrence of/ accidental spillage of	Will be limited to the Land Area near the DG spent/ used oil storage area	Direct Negative	Short term	Reversible	Hazardous waste such as used oil of DG sets shall be collected and stored in leak proof containers and kept in isolated place and will be given to authorised recyclers of CPCB.
	accidental spillage of DG Spent /Used Oil, fuels of allied machineries , spillage of paints and other liquid/ sludge/ solid hazardous materials/ chemicals are anticipated. This will lead to contaminati on of soil quality upto the area of spillage	DG spent/ used oil storage area				isolated place and will be given to authorised recyclers of CPCB. Diesel and other fuels shall be stored in separate dyke enclosures
	impact. This will lead to loss of fertility of soil, impact on vegetation, and also to the animals if grazing nearby. Further to this, impact of human health, who have direct interference with the contaminate d area.					

Environ-	Possible	Impact	Im	pact Charac	teristics	
Attribute	Impact	Quantification	Nature	Duration	Reversibility	Mitigation Measures
	Disposal of Constructio n and demolition waste	C & D waste in terms of excavated soil will be generated from the proposed project	Direct Negative	Short term	Reversible	Being predominantly inert in nature, construction and demolition waste does not create chemical or biochemical pollution. Hence maximum effort will be made to reuse and recycle them for filling/leveling of low-lying areas. Any additional C & D waste will be disposed to designated disposal site via authorized vendors.

4.3.2 ADDITIONAL MITIGATION MEASURES

- ✓ The top soil from the proposed project will be stored in separate pre-demarcated area and will be used for green belt development during the operation phase.
- ✓ The excavated loose soil will be utilized for leveling oflowlyingareasinsidetheplant. Thus, the impact onto pography during construction phase is ignificant
- ✓ The solid waste generated during this period being predominantly inert in nature. Hence determined effort would be made to reuse and recycle them. The most of the solid waste material can be used forfiling/flattening oflow-layingareaswithinthesite.Followingmeasures will be taken at site.
 - Construction waste shall be stored within the site itself. A proper screen guard will be provided sothatthewastedoesnot getscattered.
 - Waste will be segregated into different heaps as far as possible sothattheirfurthergradationandreuseisfacilitated.
 - Materials, which can be reused for purpose of construction, levelling, making roads/pavement will also be those which are to be sold or land filled.
- ✓ Constructionwastewill be used in the following manner.
 - Reuseofbricks, tiles, stoneslabs, timber, pipingrailingsetctotheextent possible based on the condition
 - Disposal with Authorized vendor of materials for the material which cannot be used
 - Plastics,brokenglass,scrapmetaletcwillbestoredandprocessedduring the operation phase.
- ✓ Rubble/brickbatscanbeusedforlevelling activities. Largersize piecescanbesentforfilinguplowlayingareas nearby.

4.3.3IMPACTON AMBIENT AIR QUALITY

All of the developmental activity viz. construction work , operation of diesel driven equipment and machinery, excavations, loading and unloading of materials, movement of materials, dumping and stacking of construction material and debris cause generation of fugitive dust particulates over the proposed area and in the neighborhood.

Also movement of vehicles cause both emission of exhaust gases and also wheel laden fugitive dust particulates. The fugitive particulate load generated daily depends upon the duration of construction activities which may be said to be temporary lasting for a few months. This phase will be short term in nature. The gaseous pollutants namely CO, SO2, and NOX released due to construction vehicular exhausts are noxious in nature. The construction phase is temporary and ceases after a few months. This impact will be temporary and short in nature.

Table 4. 3: Construction PhaseImpactIdentification, Quantification and Mitigation Measures

Environ-	Possible	Impact	Im	pact Charac	teristics	
Attribute	Impact	Quantification	Nature	Duration	Reversibility	Mitigation Measures
Air Environ- ment	Wind Erosion & Dust emission due to constructio n and site developme nt activities	Dust / TSP generated per Year = 0.00259 Tonne per Year Basis : CPCB / Air quality monitoring, emission inventory and source apportionment study for Indian cities	Direct Negative	Short term	Reversible	Covering of any aggregate or dusty material storage piles to reduce emissions. Where this is not practicable owing to frequent usage, watering shall be applied to aggregate fines. Open stockpiles shall be avoided or covered. Where probable, prevent placing dusty material storage piles. Tarpaulin covering of all dusty vehicle loads conveyed to, from
	Dust emission due to movement of vehicles and vehicular exhaust	Based on ARAI emission documents considering number , type of vehicles and vehicle km travelled.				and between site locations. Use of vehicle wheel and body washing facilities at the exit points of the site. Dusty activities should be re- scheduled where conceivable if high-wind conditions are encountered. Commencement of an
	Air emission due to operation of DG set during constructio n phase	Emission in g/s Based on Generator capacity of 120 KVA PM10 0.0086 PM2.5 0.005 SO2 0.034 NOx 0.138				environmental monitoring and appraising program to monitor the construction process in order to implement controls and modify method of work if dusty conditions arise. Regular water sprinkling was carried out. Only vehicles with

[Air Environment]

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Environ-	Possible	Impact	Im	pact Charac	teristics	
Attribute	Impact	Quantification	Nature	Duration	Reversibility	Mitigation Measures
		CO 0.083 120 KVA is considered based of site activities required during construction phase. The size of the DG is considered conservatively and the same will be much less during the actual construction scenario.				valid PUC were allowed Metal sheet barricades were provided around the construction site For DG sets Sufficient stack height will be provided

Additional Mitigation measure

The vehicles involved for garbage transportation shall be covered fully with tarpaulins and shall be prevented from spillage of dirt during transit.

- ✓ The vehicles to be deployed for transportation of construction material shall be have PUC certificate.
- ✓ Periodic maintenance of the vehicles involved shallbe doneasper themanual requirement.
- ✓ Regular Sprinkling of water will be done on the roads to prevent release of fugitive emission

IMPACT ON WATER QUALITY

ImpactonGroundwater

- ✓ Domestic wastewater/Sewage will be generated from workers during construction activities atthesitewhich cancontaminate groundwaterif notmanagedortreated.
- ✓ Spillage of oil and grease from the heavy vehicles and wastewater stream generated fromonsite construction activities such as vehicles washing, workshop etc can percolate and reachtillgroundwaterandresults incontamination.
- ✓ Soilrunofffrom thesiteleadingtooff-sitecontamination.

Impacts for Surface Water

✓ Variousconstructionactivitiesinvolvedintheproposedprojectliketransportation, soilexcavatio n, unloading&loadingetc.ofmaterialswillgeneratefugitivedustandalsoduringrain there could be material run off which may increase the suspended solids, oil & grease, etcinnearbysurface bodies.

Table 4. 4 : ImpactIdentification, Quantification and Mitigation Measures on WaterEnvironment due to Construction Phase

Environ-	Possible	Impact	Impact Characteristics			Mitigation Measures
mental Attribute	Impact	Quantification	Nature	Duration	Reversibility	
Water Environ- ment	Water Holding capacity of soil will decrease	Removal of vegetative cover will be done as per site contour requirement	Direct Negative	Short term	Irreversible	Regular water sprinkling will be will be carried out. Once the construction period is over.
	Change in drainage pattern	Natural drainage pattern of the surrounding area was maintained	Direct Neutral	Neutral	Neutral	No Mitigation Measure envisaged
	Degradation and Loss of Water Resources	Construction water requirement of 2.5 KLD	Direct Neutral	Neutral	Neutral	No Mitigation Measure envisaged as water supply for the same will be from onsite borewell approved by CGWB or Tanker water will be used from
	Impact on Stream Hydrology					authorised vendorr To reduce consumprion of curing water. Concrete structure will be
	Impact on Water Pollution, Nutrients and Aquatic Life					covered with thick cloth/gunny before spraying of water.
	Domestic water requirement of workers and labours	Domestic water Requirement of ~1 KLD	Direct Negative	Short	Reversible	The domestic water requirement will be met from water Tankers from Authorised vendors
	Generation of sewage from workers and labours	Sewage generation of ~0.8 KLD	Direct Negative	Short	Reversible	Mobile toilets will be used as per standards practices and regulatory requirement.
	Water Logging of the Site leading to soil erosion	Based on Land Area = Gross Plot area of 9980 sq m and rain fall intensity	Direct Negative	Short	Reversible	Suitable drainage network would be made to ensure proper draining of wastewater from the construction sites, so that such water do not form stagnant pools nor aggravate soil erosion. A sediment trap will be provided to prevent the discharge of excessive suspended solids
	Contaminatio n due to spillage of DG	the Land Area near the DG spent/ used oil	Negative	term	Keversible	of DG sets shall be collected and stored in leak proof containers and kept in isolated place and

Environ-	Possible	Impact	Imp	oact Charact	eristics	Mitigation Measures
mental Attribute	Impact	Quantification	Nature	Duration	Reversibility	
	Spent /Used Oil	storage area				will be given to authorised recyclers of CPCB. Diesel and other fuels shall be stored in separate dyke enclosures
	Vehicle parking area runoff	Will be limited to the Land Area near Vehicle Parking Area	Direct Negative	Short term	Reversible	Runoff from fueling area, vehicle parking areas, etc. will be passed through oil interceptor.

Additional Mitigation measure for Ground water

- ✓ Mobile Toilets will be used to avoid infiltration of domestic wastewater/sewerage into the ground water system.
- ✓ Vehicle/machinery and equipment used during construction will be properly & regularly maintained in way to avoid spillage of fuels and lubricants.
- ✓ Excavation to be avoided during monsoon season.
- ✓ Runoff water and equipment washed water from the site will be collected and treated to arrest the suspended solids and treated water will be reused for dust suppression.

Additional Mitigation measures for Surface Water

- ✓ Water sprinkling at site is proposed and will be maintained periodically for avoiding generation of fugitive dust.
- ✓ The Runoff water should be collected and safely treated and disposed off / reused for dust suppression.

4.3.4 IMPACTOFNOISE/VIBRATIONS

Due to the various construction activities such as loading and unloading, fabrication and handling of equipment and construction materials, there will be short-term increase in noise level at the immediate vicinity of the project corridor. This shall account only during day time. The construction activities include:

- Operation of DG sets, concreting and mixing
- Excavation for basements and foundations with excavator
- Construction plant and heavy vehicle movement.
- Piling and hammering activities

The areas affected are those close to the project site. At the peak of construction, increase in the noise level is expected to occur.

Description	Typical Noise Level Range , dB (A)	Reference Distance, m
Front loaders	72-84	1.0
Backhoes	72-93	1.0
Tractors	76-96	1.0
Scrapers, Graders	80-93	1.0
Pavers	86-88	1.0
Trucks (>1200 cc)	82-94	1.0
Concrete mixers	75-88	1.0
Concrete pumps	81-88	1.0
Crane (moveable)	75-86	1.0
Crane (derrick)	86-88	1.0
Pumps	69-71	1.0
Compressors	74-86	1.0

Table 4. 5: Typical Noise Levels from Construction Equipment

Overall, the impact of noise on the environment will be insignificant, reversible and mainly confined to the day hours. Noisy construction activities will be carried during the day time only and this will effectively reduce the night time ambient noise level.

As per best practice all the noise generating activities shall be undertaken during day hours and enclosure shall be provided wherever applicable to further minimize noise pollution.

These impacts will be short term during construction phase, with provision of proper enclosures for high noise generation sources and use of proper personal protective devices i.e. ear plug and ear muff will marginalize the impact.

Table 4. 6: Construction PhaseImpactIdentification, Quantification and Mitigation Measures

Environ- Possible		Impact		Im	pact Charac	teristics	
Attribute	Impact	Quantification		Nature	Duration	Reversibility	witigation measures
Noise Environ- ment	Noise due to various constructio n activity	Distan ce (m) 8 15 30 61	Typical Noise Level dB(A) 82 - 102 75 - 95 69 - 89 63 - 83	Direct Negetive	Short term	Reversible	Activities to be planned such that activities with the greatest potential to generate noise are conducted during the day which will result in the least disturbance. Minimize the noise from construction equipment by using vehicle silencers and by fitting jackhammers with noise-reducing mufflers. Avoid loud random noise from sirens, air compression, etc.

[Noise Environment]

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Environ-	Possible	In	npact	Impact Characteristics		teristics	
Attribute	Impact	Quantification		Nature	Duration	Reversibility	Mitigation Measures
		91 122	59 – 79 57 – 77				If specific noise complaints are received during construction, the contractor may be required to implement one or more of the
		152 305	55 – 75 49 - 69				following noise mitigation measures:
							Locate stationary construction equipment as far as possible from nearby noise-sensitive areas.
							Installations of noise barriers at sensitive locations.
							Turn off idling equipment.
							Reschedule construction operations to avoid periods of noise annoyance identified in the complaint.
							Notify nearby residents whenever extremely noisy work is planned.
							Follow Noise Pollution (Regulation and Control) Rules, 2000, day time ambient noise levels should not exceed 65 dB(A) in commercial areas, 55 dB(A) in residential areas and 50 dB(A) in a silence zone.

Additional Mitigation measures

- ✓ During construction, the machinery used will be of highest standard of reputed make and will adhere to the CPCB Guidelines. Proper enclosures and noise shields will be used for reduction in noise levels. Also, since the project site is sufficiently away from habitation, there will not be any significant increase in the impact of the noise generated from the site.
- Periodic maintenance of the machineries and equipment as well as the vehicles involved shall be done as per the manual requirement.

4.3.5 IMPACT ON BIOLOGICAL ENVIRONMENT

- ✓ Land clearing activities will result minor impact on the Ecological and biodiversity
- ✓ During the construction stage removal of shrubs and herbs will reduce the habitat for a few faunal species
- ✓ There will be impacts on terrestrial ecology due to air, water and noise pollution caused by site activities, and vehicularmovement.
- ✓ Thepresentvegetationatprojectlandiscomprises of some shrubsandbushesand it does not have any sensitivespecies offlora and fauna. Hence no Majorim pactis reported.

✓ As the proposed project is developed on barren land, No significant impact on flora and fauna is assessed.

Environ-		Impact	Im	pact Charac		
mental Attribute	Possible Impact	Quantification	Nature	Duration	Reversibility	Mitigation Measures
Biological	Removal of	Removal of	Direct	Short	Reversible	Clearance of vegetation
Environ-	shrubs, herbs	vegetative	Negative	term		will be limited to project
ment	and grasses	cover will be				area footprint based on
	Habitat	done as per site				project layout
	Destruction	contour				
	Habitat	requirement				
	Degradation	and layout plan				
	Habitat					
	Fragmentation					

Table 4. 7: Construction PhaseImpactIdentification, Quantification and Mitigation Measures [Biological Environment]

Additional Mitigation Measures:

- ✓ The project operations will be carried out in a systematic and phased out manner as to minimize any disturbance of Ecological and biodiversity of the area.
- ✓ The TOP soil from the proposed project will be stored in separate pre-demarcated area and will be used for green belt development during the operation phase

4.3.6 IMPACT ON SOCIO ECONOMIC ENVIRONMENT

The social impact during the construction stage will be of beneficial nature. Around 50 workers will be engaged during construction stage. Local people will be preferred for employment and depending upon their skill and experience they will be allotted jobs.

- ✓ There is no displacement of people involve in any stage of the project as the processing site located farawayfromthenearestresidential area
- ✓ The proposed project is likely to provide more opportunities in employment to this area. The preference in employment will be provided to the local residents in this area. Thus, population of the study area will be benefited due to the project in terms of direct and indirect employment opportunities.

Table 4. 8: ImpactIdentification, Quantification and Mitigation Measures on Socio economicEnvironment during Construction Phase

Environ-	Possible	Impact	Im	pact Charac	teristics	
Attribute	Impact	Quantification	Nature	Duration	Reversibility	Willigation Measures
Socio- economic Environm ent	Employ- ment to local	During peak construction phase approx. 50 workers (skilled & semi-skilled workers) will be hired, mostly from local areas	Direct Positive	Short term	Reversible	Proper maintenance of the area and facility would be done regularly to maintain hygienic condition. However, few people from other nearby area may migrate in this area for business opportunities.

4.4. IMPACTSDURINGOPERATIONPHASE

4.4.1 IMPACTONAIRQUALITY

During this phase, the sources of fugitive dust are due to movement of garbage laden vehicle to and fro to the processing site. The unloading of garbage trucks and tractors release suspended particulates.

Further; the operation of wheel loader during levelling operations (of the dumped solid waste) creates fugitive particulates. The gaseous pollutants referred to above shall be emitted by the trucks and tractors plying for the transportation of daily garbage. This component of the gaseous pollutants shall be small as compared to the quantum generated during constructionphase.

4.4.4.1 AIR QUALITY MODELING DUE TO OPERATION OF EMERGENCY DIESEL GENERATOR SET[150 KVA]

The ground level concentrations (GLCs) of the pollutants from the stack are computed using numerical simulation model & software packages, namely ISC-AERMOD View (version 9.7.0) which is an interface for the U.S. EPA ISCST3, ISC-PRIME and AERMOD. This package was developed by Lakes Environmental, Canada. The Industrial Source Complex - Short Term regulatory air dispersion model (ISCST3) is a Gaussian plume model and is widely used to assess pollution concentration and/or deposition flux on receptors, from a wide variety of sources. The Industrial Source Complex - Plume Rise Model Enhancements (ISCPRIME) dispersion model is similar to the ISCST3 model but contains enhanced building downwash analysis. AERMOD is the next generation air dispersion model which incorporates planetary boundary layer concepts. The model can be considered as a comprehensive approach for computation of the ground level concentrations (GLCs) of a pollutant (for a specified period of time) over a predefined area due to emission from the stack. This calculation is done on the basis of the site-specific micrometeorological data obtained by field monitoring during the period under consideration. The methodology of using the numerical simulation model is adopted as per the US EPA guideline.Model Input Data The model needs following sets of data:

- i) Meteorological Data
- ii) Source Data
- iii) Project Data

Meteorological Data

The meteorological data required for the model are:

- Hourly Wind direction.
- Hourly Wind speed. *
- Hourly Dry bulb temperature
- Cloud cover
- Cloud ceiling height

Hourly values of the first three (3) parameters were recorded from 15.03.2015 to 14.06.2016 for three months using appropriate measuring and monitoring instruments

Source Data

Source data required for the model are as follows:

- Stack height (m)
- Stack exit diameter (m)
- Flue gas exit velocity (m/s)
- Pollutant Emission rate (g/s)
- Exact location of the Emission Source (Latitude, Longitude)
- Flue gas temperature (deg. C)
- Project Data
- Building dimension
- Terrain category (Urban/Rural)
- Period of computation
- Pollutant
- Receptor distribution considering the location of the stack and the nature of the area within a radius of 10 km.

This model has been used to estimate the predicted increase in GLC and its distribution due to the emission from the existing stacks. The GLC has been computed for four major pollutants namely SO2, NOX, PM2.5 and PM10. Gaussian Plume Model is a conservative model i.e., no atmospheric decay / deposition of the pollutants has been considered. Thus, for same set of meteorological and other data, GLC at different receptors for the different pollutants emitted from the same source are solely dependent on the emission rate (in gm/s) of that pollutant. Here the software run has been done for SO2, NOx and PM10. The receptor location has been considered upto a maximum distance of 20 km. in either direction from the existing stack. However, in order to represent the receptors suitably, they have been considered to be distributed over a rectangular grid area of 20 km x 20 km with the stack at their centre. The receptors have been chosen at 1 km. interval along both the axes i.e., in total there are 441 (21 x 21) no. receptors for which the computation has been done.

The maximum ground level concentration (GLC) is superimposed over the measured ambient level [maximum values] of PM₁₀, PM_{2.5},SO₂ and NO_x and the resultant scenario is shown in **Table 4.9**.

Parameter	Background level, Maximum µg/m3	Predicted Max Ground Level Conc. µg/m3	Total Concentration μg/m3	NAAQS (Nov 2009) μg/m3
SO ₂	9.2	0.041	9.241	80
NOx	14.2	0.166	14.366	80
PM ₁₀	92	0.01	92.01	100
PM _{2.5}	49	0.006	49.06	60

Table 4.0. Immed	A him O wallity of the		the Dreiset (04 h	a
Table 4. 9 : Impact of	of Air Quality of the	e Study Area due to	the Project (24-n	avg in µg/m3)

The predicted MGLC using mathematical modeling is 0.01 μ g/m³for PM₁₀, 0.006 μ g /m³ forPM_{2.5}, 0.041 μ g /m³ for SO₂ and 0.166 μ g/m³ for NOx as NO₂. Baseline maximum concentration is 92 μ g/m³ for PM10, 9.2 μ g /m³ for SO₂ and 14.2 μ g/m³ for NO_x. The isopleths of PM₁₀, SO₂ and NO₂ are shown Figures below. The maximum GLC values are occurring attowards the East direction.

From the above it can be concluded that the pollution load contribution to the environment is negligible considering the existing background level concentration.



Figure 4. 1(A): ISOPLETH OF PM₁₀AROUND THE PROJECT



Figure 4. 2 (B): ISOPLETHS OF PM2.5AROUND THE PROJECT



Figure 4. 3 (C): Isopleth of SO₂ around the Project







Figure 4. 5 (E): Isopleth of CO around the Project

4.4.1.2 LANDFILL GAS MANAGEMENTAND IMPACT& MITIGATION OF FOUL ODOUR

The proposed project is of Municipal Solid Waste Management Facility for Nagar Palika Parishad, Kotdwar . The project is proposed to facilated with source segregation of waste and then transporting the same to composting yards for processing, recycling and disposal. The organic waste would be converted into manure while the rejects would go to landfill. The recyclable material would be collected separately and given to the recycling route. The inert material collected at source mainly comprising of soil from road sweeping would come to landfill.

A large part of mixed waste (50%–60%) consists of biodegradable parts which produce methane gas. With a view to reduce GHG emissions and thereby reduce environmental impacts, it is mandatory to install a degassing system for the sanitary landfill.

The gas management strategies should follow one of the followingoptions

- ✓ controlledpassiveventing;or
- ✓ controlledactivecollectionandtreatmentorreuse.

CONTROLLED PASSIVE VENTING

The proposed provision of composting is present, only inert material will be deposited in the landfill. For all sanitary landfills, controlled passive degassing systems in the form of gas windows covered by suitable passive gas vents is recommended (Illustrated in below Figure : 4.1). The gas windows are to be installed in the frame of the final covering. It has openings in the cover system which may be filled with compost to avoid the generation of bad odours.. Some quantity of rejects of large size organics from the compost plant will also get into the landfill. It is expected that not more than 5% of the waste in the landfill would be biodegradable. As the particle size of organic rejects of compost plant is large, its degradation will be very slow and will continue for a long time in the Dry Tomb Landfill.

Hence it is suggested to have passive gas wells for gas management.

Design Method : The size should be not less than 1 m x 1 m, and the distance between two gas windows should be about 20 m.



Figure 4.6 : PLACEMENT OF PASSIVE VENTS IN A LANDFILL

IMPACT& MITIGATION OF FOUL ODOUR

Althoughtheodouremanatingfromalandfilloperationisaninescapableproblem, but the problem can be mitigated if proper measures are taken. Foul smelling gases like CH4 and H2S creates majorimpactif windrowoperationisnot done properly.

Mitigation measures for foul odour

- ✓ Theproject proposesto cover thewasteswithdaily and intermediatecoversofsoil on aregularbasis to ensure that odourgenerationisminimized.
- ✓ To mitigate the foul Odour emanating from the wastes, the windrows will be punctured beforehandsothatfoulsmellinggaseslikeCH4andH2Sgetslowlyreleased.Thiswouldreducetheint ensityoffoulsmellinggasesatthe time of firstturning.
- ✓ Spray of herbal sanitizers and inoculums will be done to remove odour. The compost facilities, roads, equipmentand the surrounding areashall also be cleaned regularly to remove theo dourgenerating wastes. The processed compost is stored in sheds so as to avoid attraction to birds and runoff due to rain or wind blown entrainment of particles.

Table 4. 10: ImpactIdentification, Quantification and Mitigation Measures on Air Environment during to Operation Phase

Environ- mental Attribute	Possible Impact	Impact Quantification	Im	pact Charac	teristics	
			Nature	Duration	Reversibility	Wiltigation Measures

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Environ-	Possible	Impact	Impact Characteristics		teristics	
Attribute	Impact	Quantification	Nature	Duration	Reversibility	Wiltigation Measures
Air Environ- ment	Air emission due to operation of DG set	Emission in g/s Based on Generator capacity of 150 KVA PM10 0.010 PM2.5 0.006 SO2 0.042 NOX 0.172 CO 0.097 Maximum Ground level concentration based on Table titled Impact of Air Quality of the Study Area due to the Project (24-h avg in µg/m3) above.	Direct Negative	Short term	Reversible	For DG sets Sufficient stack height will be provided Regular water sprinkling was carried out. Use of ultra-low Sulphur diesel variety DG sets to comply with the applicable emission norms and to be operated during power failure only.
	Dust emission due to movement of vehicles and vehicular exhaust	Based on ARAI emission documents considering number , type of vehicles and vehicle km travelled.	Direct Negative	Short term	Reversible	Only vehicles with valid PUC were allowed Adequate green area development to reduce the impact of Air pollution Proper vehicle parking facilities and traffic flow to avoid traffic congestion. The haulage trucks and tractors involved for garbage transportation shall be covered fully with tarpaulins and shall be prevented from spillage of dirt during transit.
	Gas and foul odour release from sanitary landfill site	sanitary land fill area of 2829 sq.m area	Direct negative	Long term	Irreversible	Gas vent system to release gas from the Sanitary Landfill site will be implemented The project proposes to cover the wastes with daily and intermediate covers of soil on a regular basis to ensure that odour generation is minimized. To mitigate the foul Odour emanating from the wastes, the windrows will be punctured beforehand so that foul smelling gases like CH4 and H2S get slowly released. This would reduce the intensity of foul smelling gases at the

Environ-	Possible	sible Impact Impact Characteristics					
Attribute	Impact	Quantification	Nature	Duration	Reversibility	Mitigation Measures	
						time of first turning. Spray of herbal sanitizers and inoculums will be done to remove odour. The compost facilities, roads, equipment and the surrounding area shall also be cleaned regularly to remove the odour generating wastes. The processed compost is stored in sheds so as to avoid attraction to birds and runoff due to rain or windblown entrainment of particles.	

Additional Mitigation measure

- ✓ The haulage trucks and tractors involved for garbage transportation shall be covered fully with tarpaulins and shall be prevented from spillage of dirt during transit.
- ✓ The trucks and tractors to be deployed for haulage of garbage shall be ensured for PUC certificate
- ✓ Periodic maintenance of the machineries and equipment as well as the haul trucks/tractors involved shall be done as per the manual requirement.
- ✓ The operators, semi-skilled workers and drivers of the vehicles and machinery involved shall be trained for the job requirements and their skills shall be updated and monitored regularly for smoother functioning for maintaining clean environment.
- ✓ A dense green belt with fast growing floral species as recommended by CPCB with climatological adaptability shall be developed along the periphery of the landfill site.
- ✓ The development of the green belt shall be such that bushes and shrubs shall be placed inwards towards the site while the taller species shall be placed on the outer area towards the boundary. This shall ensure development of a barrier both for noise and dust particulates. The fully developed green belt shall present an appealing landscape and would be scientific also in purpose.
- Compaction of haulage road within the landfill site by using water bowser on the haul road both in morning and afternoon hours during winters and one additional trip in the evening in summer season which shall suppress the fine fraction of soil clay on the haul roads.

4.4.2 IMPACTONGROUND&SURFACEWATER

- ✓ Leachategeneratedfrommunicipalwastemaypercolatetowatertableandcontaminategroundw aterif not treatedor managed.
- ✓ Leachate, discharged from land fills ite and windrow compost plantrun off caused by monsoon from the waste may reach and contaminate surface water body.

 BlockageofLeachateinnarrowroworgatherataplaceifpropercollectionsystemanddrainsarenot installed.

Table 4. 11 : ImpactIdentification, Quantification and Mitigation Measures on Water Environmentduring Operation Phase

Environ-	Possible	Impact	Impact Characteristics			
Mental Attribute	Impact	Quantification	Nature	Duration	Reversibility	Milligation Measures
Water Environ- ment	Consumption of water by domestic use and landscape development	Total water Requirement of 11 KLD	Direct Negative	Long term	Irreversible	Water will be drawn from Onsite borewell with approval from CGWB
	Generation of sewage	Sewage generation of ~0.8 KLD	Direct Negative	Long term	Reversible	During the Operation phase, a septic tank /soak pit system shall be provided to treat the domestic wastewater generated due to workers.
	Water Logging of the Site leading to soil erosion	Based on Land Area = Gross Plot area of 9980 sq m and rain fall intensity	Direct Negative	Long Short	Reversible	Suitable drainage network would be made to ensure proper draining of rain water from the sites, so that such water do not form stagnant pools nor aggravate soil erosion.
						Runoff water and equipment washed water from the site will be collected to working pit to arrest the suspended solids and if any over flow is, it will be diverted to nearby greenbelt/plantation area. The settled water will be reused for construction purposes, and for sprinkling on roads to control the dust emission, etc.
	Water Contaminatio n due to spillage of DG Spent /Used Oil	Will be limited to the Land Area near the DG spent/ used oil storage area	Direct Negative	Short term	Reversible	Hazardous waste such as used oil of DG sets shall be collected and stored in leak proof containers and kept in isolated place and will be given to authorised recyclers of CPCB.
						blesel and other fuels shall be stored in separate dyke enclosures
	Ground Water contaminatio	As per rainfall intensity and sanitary land fill	Direct negative	Long term	Irreversible	A liner system at the base and sides of the Sanitary Landfill will prevent contamination due to

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Environ-	Possible	Impact	Im	pact Charac	teristics	
mental Attribute	Impact	Quantification	Nature	Duration	Reversibility	Mitigation Measures
	n due to Leachate	area of 2829 sq.m area				leachate or gas to the Ground water.
						A leachate collection and control facility to collect leachate from within and from the base of the Sanitary Landfill and then recirculate/ treat the leachate. A final cover system at the top of the landfill to enhance surface drainage, prevent water infiltration and also to support surface vegetation. Surface water drainage system which collects and removes all surface runoff from the Sanitary

ADDITIONAL MITIGATION MEASURE FOR SURFACE WATER

- ✓ The proposed sanitary landfill will be using a Geosynthetic Clay Liner system to prevent leakage of leachate from the landfill site. A geotextile is a woven or nonwoven sheet of material that is impervious to liquid as compared to geo-membrane and is more resistant to penetration damage.
- ✓ In order to collect the leachate from the waste body a drainage layer of 30 cm granular material of permeability > 1 x10-2 cm/sec will be provided over the HDPE liner.
- ✓ Proper garland drains equipped with baffles to prevent run off from the site to contaminate surface or ground water resources.
- ✓ To prevent surface and ground water contamination by oil/grease, leak proof containers will be used for storage and transportation of oil/grease. The floors of oil/grease handling area will be kept effectively impervious by laying a sheet of plastic over the ground surface.
- ✓ The leachate generated from the landfill & windrow area is collected in the leachate pond through collection system and will be reciulated in the composting piles. Remaining, if any will be treated and reused in green area or dust suppression.
- ✓ Regular checking for functioning of leachate collection, treatment and disposal system.
- ✓ Monthly monitoring of ground water at project site shall be carried out to check and monitor for any contamination as per CGWA Guideline 2020.
- ✓ An environmental monitoring system is proposed to periodically collect and analyses air, surface water, soil-gas and ground water samples around the Sanitary Landfill site.

4.4.3 IMPACT ON LAND ENVIRONMENT

Proposed plan is for setting up of Waste processing/disposal facility with provision of compost plant for organic waste and landfill. The proposed project shall have direct impacts occurring through direct interaction of an activity with an environmental, social, or economic component.

Seepage of generated leachate containing suspended solids and pathogens from the waste disposal site may lead to contamination of land and soil quality. Due to the pollution potential and on aesthetic considerations, the land values may diminish in the immediate surroundings of the proposed disposal site.

Table	4.12:	ImpactIdentification,	Quantification	and	Mitigation	Measures	for	Land
Environment during Operation Phase								

Environ-	Possible	Impact Impact Characteristics		teristics		
Attribute	Impact Quantification Nature		Duration	Reversibility	Wiltigation Measures	
Land Environ- ment	Land Contaminati on due to spillage of DG Spent /Used Oil	Will be limited to the Land Area near the DG spent/ used oil storage area	Direct Negetive	Short term	Reversible	Hazardous waste such as used oil of DG sets shall be collected and stored in leak proof containers and kept in isolated place and will be given to authorised recyclers of CPCB. Diesel and other fuels shall be stored in separate dyke enclosures
	Developme nt of green belt	Green Area development of 1965 Sq.m	Direct Positive	Long term	Reversible	Green Cover of land will be enhanced leading to ecological and enhanced aesthical impact. Will also act as pollution barrier.
	Land contaminati on due to Leachate	As per rainfall intensity and sanitary land fill area of 2829 sq.m area	Direct negative	Long term	Irreversible	A liner system at the base and sides of the Sanitary Landfill will prevent contamination due to leachate or gas to the surrounding soil. A leachate collection and control facility to collect leachate from within and from the base of the Sanitary Landfill and then recirculate/ treat the leachate. A final cover system at the top of the landfill to enhance surface drainage, prevent water infiltration and also to support surface vegetation.
ADDITIONAL MITIGATION MEASURES:

- All solid and other wastes from the complex shall be properly collected, stored and disposed.
 An integrated solid waste management plan shall be developed.
- ✓ Disposal of waste from the project site should be within the capacity of the local environmentto absorb without unacceptable degradation of its future waste absorptive capacity or otherimportantservices.
- Theentireoperational areashallbewellpavedandthustherewillbenoleachingofanysubstancesincase ofspills.

4.4.4 IMPACT OF NOISE / VIBRATIONS

Theoperation phase involvesmachinery and equipment which would generate noise substantially. Intermittent source of noise shallbe movement of vehicles used during the operation activities. Theoperational phase shall see a noise generated by various machineries shall be comparatively lesser than the levelsduringConstructionPhase.RCCwallthoughtoutthesitewhereeverpossibleplusfencingisrecommended.

The equipment noise level monitored at the plant does not exceed 90 dBA except few areas. For noise modeling purpose, the Lmax value was considered. Noise generation is assumed at 2 m above ground level and spreading on a flat terrain devoid of any barriers. The maximum noise level at the main office of the project is measured as 57-65 dB(A) this is well within the limit for industrial area 75 dB(A).



Figure 4. 7 : STANDARD NOISE CONTOURS FROM 90DB SOURCE

(SOURCE HTTPS://NOISETOOLS.NET/DBMAP)

Table 4.13 : ImpactIdentification, Quantification and Mitigation Measures on Noise Environmentduring Operation Phase

Environ-	Possible	Impact	Impact Characteristics			
Attribute	Impact	Quantification	Nature	Duration	Reversibility	Mitigation Measures
Noise Environ- ment	Noise due to working of DG set	Noise Generation DG set of 150 KVA Noise limit viz. 75 dB(A) at 1 m	Direct Negative	Short term	Reversible	DG sets will be installed with inbuilt acoustic enclosure and Anti vibration mount (AVM) pads will be provided to absorb the vibration and to minimize noise.
	Vehicular Noise	Based on number of vehicle entry and exit	Direct Negative	Short term	Reversible	Adequate parking, road signage and traffic management to avoid traffic congestion & noise Free flow of traffic movement shall be maintained. Proper plantation will be done all along the roads & periphery to reduce noise.

Additional Mitigation measures

Proper enclosures and noise shields will be used for reduction in noise levels. Also, since the project site is sufficiently away from habitation, there will not be any significant increase in the impact of the noise generated from the site. However, impact due to noise pollution can be minimized by ensuring that no noise generating activity is carried out during night hours. All vehicles entering into the project will be informed to maintain speed limits, and not blow horns unless it is required. In this context, it is to be noted that:

- ✓ Periodic maintenance of the machineries and equipment as well as the haul trucks/tractors involved shall be done as per the manual requirement.
- ✓ The operators, semiskilled workers and drivers of the vehicles and machinery involved shall be trained for the job requirements and their skills shall be updated and monitored regularly for smoother functioning for maintaining clean environment.
- ✓ A dense green belt with fast growing floral species as recommended by CPCB with climatological adaptability shall be developed along the periphery of the landfill site.
- The development of the green belt shall be such that bushes and shrubs shall be placed inwards towards the site while the taller species shall be placed on the outer area towards the boundary. This shall ensure development of a barrier both for noise and dust particulates. The fully developed green belt shall present an appealing landscape and would be scientific also in purpose. Also the Green belt will act as a barrier for noise.
- ✓ As there are no major sources of noise pollution critical impacts to neighboring communities and wild animals is not envisaged.

- ✓ Regular noise level monitoring
- ✓ use of ear muff/ ear plug wherever required
- ✓ Employee training on noise exposure hazards and enforcement of the use of protective devices.
- Regularly maintenance of machines and equipment, provision of PPEs. Specific attention is paid to rollers and handling, cutting and grinding activities

4.4.5 IMPACT ON BIOLOGICAL ENVIRONMENT

Major impacts on terrestrial ecology due to air, water and noise pollution caused by site activities, vehicular movement, wastewater and waste handling.

Table 4. 14 : ImpactIdentification, Quantification and Mitigation Measures for Biological Environment during Operation Phase

Environ-	Possible	Impact	Im	pact Charac	teristics	
Attribute	Impact	Quantification	Nature	Duration	Reversibility	witigation Measures
Land Environ- ment	Developme nt of green belt	Green Area development of 1965 Sq.m	Direct Positive	Long term	Reversible	Green Cover of land will be enhanced leading to ecological and enhanced aesthical impact. Will also act as pollution barrier.

Additional Mitigation Measures:

- ✓ Measures to develop vegetation cover and providing peripheral green belt development with evergreen trees and local species have been incorporated to mitigate the dust and odour emissions.
- ✓ 33 % green belt area will be developed and maintained around the plant, which will provide more habitats to birds, rodents and small mammals. The landfill cover will also be landscaped with local plants species.
- ✓ Local species will be selected around the plant and on the landfill cover.
- ✓ Tree plantation may not be possible, will be covered with shrubs and grass to prevent erosion of topsoil.
- ✓ The project operations will be carried out in a systematic manner as to minimize any disturbance of Ecological and biodiversity of the area Developmentofaplanationwithvariedvarietyoftreesandshrubswouldhaveapositiveimpact.

4.4.6 IMPACT ON SOCIO ECONOMIC ENVIRONMENT

The following are the impacts on Socio environment associated with this project:

Quality of life: The proposed Municipal Solid Waste Management Project will help in reducing burden of municipal solid waste in the city. It will help the families to look after themselves, their children's education and future savings because of healthy surrounding's. The Municipal Solid

Waste Management project will help a better and decent lifestyle. The additional manpower recommended will also add to employment opportunities for local residents.

Increase in revenue & strengthening of ULB: This will bring additional revenue to the ULB by selling of compost and recycle items. Decrease in heath spending due to better hygiene. With time this will have an incremental show of revenue generation with time with more and more people segregating waste and participating in community programmes.

Impact on Social Status

The proposed project is likely to provide more opportunities in employment to this area. The preference in employment will be provided to the local residents in this area. Thus, population of the study area will be benefited due to the project in terms of direct and indirect employment opportunities.

Impact on Human Settlement

There is no displacement of any habitation or personnel and hence the rehabilitation and resettlement action plan is not required.

Impact on Civic Amenities

Waste processing also creates an unpleasant view and leads to emission of mal odour. It will control the diseases menace which gets spread due to the unattended waste lying, which attracts flies, rats, and other creatures that in turn spread diseases in society. This leads to unhygienic conditions and thereby causes rise in the health problem.

Aesthetics

The landfill will be capped and the topmost layer will be landscaped thereby improving the aesthetics of the area.

Impact on Public Health

Efficient waste collection & disposal of waste will improve the living &health condition of inhabitants in the area. Littering of waste creates nuisance due to unpleasant viewand emission of foul odour. It will eliminate the ground for breeding of mosquitoes & disease causingpathogens.IntegratedSolidwastemanagementprojectwillensuretimely

collectionofwaste, efficient treatment & disposal in scientific & environment friendly manner. This will reduce the chances of spreading of diseases. This project will improve the health condition of the area and society.

Impact on Traffic:

The project envisages unidirectional pathways for both incoming and outgoing waste trucks/vehicles to avoid traffic congestion. There will be dedicated corridors of specific pathways for the incoming and outgoing vehicular traffic for meeting the movement of finished product. Therefore, there will not be any significant impacts on traffic in the area and on the site.

Impact on Health Care Facilities

While MSW activities, sufficient care will be taken in providing health facilities to the employees besides organizing various medical camps for the surrounding villages. The improved health care facilities improve the quality of life in the area.

Impact on Economic Aspects

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

Economic Benefits to Local Municipality:

Development of the facility will create more jobs in the area and also present the opportunity to provide improved products or services to people in the area. During the operation phase, one of the project activities would comprise of manual segregation of waste. The locals inhabiting or rag pickers, who have been performing the task of informal waste collection, can be employed for this specific activity during the operational phase. There will be fixed source of income on monthly, weekly or daily basis to the rag pickers of the area, who otherwise depend upon the collection of recyclables from various dump sites across the city. Therefore, the positive impacts on rag pickers due to sustenance of livelihood and improvement in living conditions are anticipated.

Impact on Occupational Health & Safety

Healthy and safe working conditions are among the first expectations for sustainability, i.e. Occupational injuries and ill-health have huge social and economic implications for individuals, their families and communities.

- ✓ Injury due improper handling, operation and execution
- ✓ Occupational hazards like high noise, electric shocks etc.
- ✓ Trip and fall, inadequate fall safe arrangements
- ✓ Diseases from unhygienic surrounding
- ✓ Exposure to hazardous substances etc.
- ✓ Workers at times are not accustomed to use of Personal Protection Equipment, their attitude to avoid PPE may result in accident/hazard

Mitigation measures

- ✓ Workers will be provided with required PPEs to be used at site;
- ✓ The necessary safety measures will be taken up before and during the construction.
- ✓ Good Waste Handling practices will be implemented which will greatly reduce foul smell and reduce impact from odors.

Details of Infrastructural Facilities for Worker-

- ✓ Water for drinking & other purpose will be arranged.
- ✓ All the safety equipment's such as helmets, safety shoes, goggles, dust masks etc.

- ✓ A well-equipped first aid facilities,
- ✓ Periodic (Half-Yearly)medical health check-ups
- ✓ Rest shelter, washrooms etc. will provided near the working blocks.

Table 4. 15: Impact Identification, Quantification and Mitigation Measures on Socio economic Environment during Operation Phase

Environ-	Possible Impact		Im	pact Charac	teristics	
Attribute	Impact	Quantification	Nature	Duration	Reversibility	Mitigation Measures
Socio- economic Environm ent	Employ- ment to local People Developme nt of other supply chain business related to SWM project	During peak Operation phase approx. 25 workers (skilled & semi- skilled workers) will be hired, mostly from local areas Alleviate the problems associated with unmanaged disposal of solid waste in Kotdwar ULB. Kotdwar town has a population of approx. 175,232 as per Census 2011.	Direct Positive	Short term	Reversible	Proper maintenance of the area and facility would be done regularly to maintain hygienic condition. However, few people from other nearby area may migrate in this area for business opportunities. The project will also Alleviate the problems associated with unmanaged disposal of solid waste in Kotdwar ULB.

Mitigation measure

The socio-economic conditions in the study area indicate the quality of life of the people. The important indicators which decide the quality of life and required to be improved for better living conditions are literacy levels, occupational structure, industrial development, infrastructural facilities, transportation, communication linkages, land development and cropping pattern. The project proponents are envisaging undertaking the following socio-economic measures.

4.5 ENVIRONMENTAL IMPACT MATRIX

Discipline	Potential impacts	Mitigation measures
Land	Potential negative impact due to	• All storage will be done on top of a
Environment	storage of solid waste - due to leaching	concreted / lined area to avoid leaching of
	of toxic components, fugitive dust	materials during monsoon.
	emission and release of untreated	• Abatement of dust emission through
	wastewater	adoption of suitable measures
		• Soil testing & TCLP analysis done regularly

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Discipline	Potential impacts	Mitigation measures			
Surface water	Potential Adverse impact due to	• No Surface water is used for the proposed			
Resource &	withdrawal of surface water	project			
quality					
Groundwater	Ground Water abstraction will be done.	• Concrete box drains to prevent seepage			
	Possible Impact on ground water quality	and ground water contamination.			
	due to seepage and leaching	• concrete/lined floor to avoid leaching			
		through soil bed leading to contamination			
		of ground water.			
Air	Adverse impacts on health	Maintenance of Plant roads and water			
Environment	&environment due to emission of PM,	sprinkling on regular basis.			
	SO ₂ , NO ₂	Vehicles to have PUC certificate			
		Proper designated vehicles parking area.			
Noise	Detrimental impact on the health of	• The equipment noise level monitored at			
	working personnel in and around the	the plant does not exceed 90 dBA except			
	plant premises.	near bag house.			
		• Wherever required acoustic enclosures will			
		be used along with anti vibration pads			
		• Personnel working in high noise prone area			
		are provided with appropriate PPEs.			
Socio-	Local employment opportunities, as per	Preference to locals for employment			
Economics	required skill set are given				
Ecology	Potential adverse impact on terrestrial	• Development of greenbelt adsorbing dust			
	& marine ecology due to air pollution,	& absorbing specific pollutants and			
	generation of noise, release of	maintaining overall ecological balance			
	untreated wastewater, solid waste				
	storage& other industrial activity				

CHAPTER 5: ANALYSIS OF ALTERNATIVE

5.1 INTRODUCTION

This section analyses various alternatives to meet the objective of the project from certain identified angles as recommended in the EIA Manual published by the MOEF. These are:

- ✓ No project
- ✓ Siting of the project
- ✓ Technology/Process

5.2 ALTERNATE SITE

The selection of landfill site is carried out based upon various selection criteria; such as location from nearby water bodies, airports, geological conditions, tourist consideration, nearby habitation, connectivity with roads, public parks, location in steep slopes, historical and cultural values, critical habitats (e.g. national parks, wild life sanctuaries etc.). One of the major constraints in identifying sanitary landfill site; is its availability in near vicinity of project city as otherwise proposing a site far away from the city would increase the operation and maintenance cost for the improved MSW management system. Considering this, Nagar Nigam Kotdwar has identified 3 alternative sites including the proposed site at Kanchanpuri. The selection of site has been made based upon the site selection criteria as given below:

5.3 SITE SELECTION CRITERIA:

The main criteria for the site selection of Municipal Solid Waste Mmanagement Facility are as follows –

- > The area which contains low permeability formation.
- Shallow hard rock basement which prevents the groundwater percolation.
- Shallow thick clay zone, which does not allow the surface water recharge.
- > Protect surface water body and visual corridors of scenic & wild rivers.
- > Avoid watersheds and reservoirs for the protected water supply (PWS).
- > Areas of poor groundwater potential.
- Areas of deep water table.

A landfill site is generally being selected considering the following factors:

- Lake or Pond: No landfill should be constructed within 200 m of any lake or pond. Because of concerns regarding runoff of waste water contact, a surface water monitoring program should be established if a landfill is sited less than 200m from a lake or pond.
- **River**: No landfill should be constructed within 100 m of a navigable river or stream. The distance may be reduced in some instances for nonmeandering rivers but a minimum of 30 m should be maintained in all cases.
- Flood Plain: No landfill should 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.

- **Highway**: No landfill should be constructed within 200m of the right of way of any state or national highway. This restriction is mainly for aesthetic reasons. A landfill may be built within the restricted distance, but no closer than 50 m, if trees and berms are used to screen the landfill site.
- Habitation: A landfill site should be at least 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.
- **Public parks**: No landfill should be constructed within 300 m of a public park.
- **Critical Habitat Area**: No landfill should be constructed within critical habitat areas. A critical habitat area is defined as the area in which one or more endangered species live.
- Wetlands: No landfill should be constructed within wetlands.
- **Ground Water Table:** A landfill should not be constructed in areas where water table is less than 2m below ground surface. Special design measures be adopted, if this cannot be adhered to.
- **Airports**: No landfill should be constructed within the limits prescribed by regulatory agencies (MOEF/ CPCB/ Aviation Authorities) from time to time.
- Water Supply Well: No landfill should be constructed within 500 m of any water supply well. It is strongly suggested that this locational restriction be abided by at least for down gradient wells. Permission from the regulatory agency may be needed if a landfill is to be sited within the restricted area.
- **Coastal Regulation Zone**: A landfill should not be sited in a coastal regulation zone.
- **Unstable Zone:** A landfill should not be located in potentially unstable zones such as landslide prone areas, fault zone etc.
- **Buffer Zone:** A landfill should have a buffer zone around it, up to a distance prescribed by regulatory agencies.
- Other criteria may be decided by the planners.

Based upon the mentioned criteria an alternative analysis has been made for 3 sites as below:

Location Criteria	Site at Kanchanpuri, Haldukhatta Malankham, Kotdwar 29°45'23.79"N / 78°26'14.14"E	SIDCUL Site, Kotdwar 29°47'33.42"N/ 78°24'11.81"E	Site near Khoh river 29°41'33.29"N/ 78°31'20.43"E
Land Availability and accessibility	At present land area of 0.998 Ha is transferred by Forest Department. Site is flat and easily accessible from Haridwar Road through existing kuchba road [approx 20]	Approx. 2 Ha land is available. Site is undulating and not accessible at present by vehicular road	Only 0.5 Ha land is available. Site is flat and accessible.
Lake or Pond: No landfill should be constructed within 200 m of any lake or pond. Because of concerns regarding runoff of waste water contact, a surface water monitoring program should be established if a landfill is sited less than 200 m from a lake or pond.	feet wide]. No lake or pond within 200 m radius of the site	No lake or pond within 200 m radius of the site	No lake or pond within 200 m radius of the site
River: No landfill should be constructed within 100 m of a navigable river or stream. The distance may be reduced in some instances for non-meandering rivers but a minimum of 30 m should be maintained in all cases	No river within 100 m radius. Malin river flows at a distance of 480m on East.	No river within 100 m radius. A seasonal stream is located at a distance of 140m on North.	Khoh river is approx. 10m away from the site on west.
Flood Plain: No landfill should 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	The project site is not located in any flood plain.	The project site is not located in any flood plain.	The site is adjacent to Khoh river.
Highway: No landfill should be constructed within 200 m of the right of way of any state or national highway. This restriction is mainly for aesthetic reasons. A landfill may be built within the restricted distance, but no closure than 50 m, if trees and berms are used to screen the landfill site	No national or state highway within 200 m of the site. NH-119 passes at a distance 8.1 km on SE	No national or state highway within 200 m of the site. NH-119 passes at a distance 11.5 km on SE	No national or state highway within 200 m of the site. NH- 119 passes at a distance 4.6 km on NW

Table 5. 1 (A) : ALTERNATIVE ANALYSIS FOR THREE (3) SITES

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Location Criteria	Site at Kanchanpuri, Haldukhatta Malankham, Kotdwar 29°45'23.79"N / 78°26'14.14"E	SIDCUL Site, Kotdwar 29°47'33.42"N/ 78°24'11.81"E	Site near Khoh river 29°41'33.29"N/ 78°31'20.43"E
Habitation: A landfill site should be at least 500 m from a notified habitation area. A zone of 500 m around a landfill boundary should be declared a No-Development Buffer Zone after the landfill location is finalized.	Nearby habitation is located at a distance of 150 m on north east of proposed site.	The site is located in SIDCUL Industrial Area. Nearby residential habitation is located at a distance of approx. 350 m on South.	 Forest Range Headquarter - at a distance of 150 m on north east Kotdidhang Post Office - at a distance of 320m on north. Lalit Rawat Business School – at a distance of 260m on NE
Public Parks: No landfill should be constructed within 300 m of a public park. A landfill may be constructed within the restricted distance if some kind of screening is used with a fence around the landfill and a secured gate.	No public park within 300m.	No public park within 300m.	SANEH Childrens' Pa rk is at a distance of 50m on south
Critical Habitat Area: No landfill should be constructed within critical habitat areas. A critical habitat area is defined as the area in which one or more endangered species live. It is sometimes difficult to define a critical habitat area. If there is any doubt then the regulatory agency should be contacted	Not a critical habitat area.	Not a critical habitat area.	Not a critical habitat area.
Wetland: No landfill should be constructed within wetlands. It is often difficult to define 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 regulatory agency should be contacted	Not a wetland.	Not a wetland.	Not a wetland.
Ground Water Table: A landfill should not be constructed in areas where water table is less than 2 m below ground surface. Special design measures be adopted, if this cannot be adhered to.	Ground water table is approx. 5-10 m below ground level in post- monsoon period.	Ground water table is approx. 5-10 m below ground level in post- monsoon period.	Ground water table is approx. 3-5 m below ground level in post-monsoon period.

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2022

Location Criteria	Site at Kanchanpuri, Haldukhatta Malankham, Kotdwar 29°45'23.79"N / 78°26'14.14"E	SIDCUL Site, Kotdwar 29°47'33.42"N/ 78°24'11.81"E	Site near Khoh river 29°41'33.29"N/ 78°31'20.43"E	
Airports: No landfill should be constructed within the limits prescribed by regulatory agencies (MoEF/CPCB/Aviation Authorities) from time to time	Jolly Grant International Airport, Dehradun is located at around 53 km on NW.	Jolly Grant International Airport, Dehradun is located at around 48 km on NW.	Jolly Grant International Airport, Dehradun is located at around 64 km on NW.	
Water Supply Well: No landfill should be constructed within 500 m of any water supply well. It is strongly suggested that this locational restriction be abided by at least for down gradient wells. Permission from regulatory agency may be needed if a landfill is to be sited within the restricted area	No centralized water supply well exists around the project site.	No centralized water supply well exists around the project site.	No centralized water supply well exists around the project site.	
Coastal Regulation Zone: A landfill should not be sited in a coastal regulation zone.	Site not located in a coastal regulation zone	Site not located in a coastal regulation zone	Site not located in a coastal regulation zone	
Unstable Zone: A landfill should not be located in potentially unstable zones such as landslide prone areas, fault zone etc.	The area is not a potentially unstable zone.	The area is not a potentially unstable zone.	The area is not a potentially unstable zone.	

The reason behind selecting the Site at Kanchanpuri, Haldukhatta Malankham, Kotdwar as againsttheir alternative sites are given below:

- \checkmark River located at a safe distance of 480 m from the Kanchanpuri site;
- ✓ No public park is located nearby;
- ✓ Proximity and availability of access road from Haridwar road;
- ✓ No vehicular access road available at present for SIDCUL site;
- ✓ Site near Khoh River is located very near to the river and in the flood plain.
- ✓ Kanchanpuri site has been already transferred by the Forest Dept. to the Nagar Nigam and duly approved by the Govt. of Uttarakhand and MoEF&CC, Dehradun RO.

5.4 TECHNOLOGY

Solid Waste Management (SWM) proposes a waste management hierarchy with the aim to reduce the amount of waste being disposed, while maximizing resource conservation and resource efficiency. The ISWM hierarchy ranks waste management operations according to their environmental, economic and energy impacts.



Figure 5. 1(A) : MUNICIPALSOLIDWASTEMANAGEMENTHIERARCHY



Figure 5. 2 (B): MSW TREATMENT TECHNOLOGIES

Detail evaluation of various waste treatment options as listed below was done before selection of treatment technologies for the proposed facility. Various treatment options available were as follows:

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	Technologies	Pros	Cons
Bio-methanation	Biochemicalconversionoranaerobicdigest ionprocess whereinsolid wastes (food wastes free ofplasticsandash)withalargeproportionof organicmatterissubjectedtoanaerobic decomposition and underfavourableconditionsproducesagas eousmixtureofMethaneandCarbondi- oxideknown as biogas.This process is quite stable andgivesagoodperformanceatdetentionti meof25days.	 ✓ Treatment at source ✓ Gas/power generation 	 ✓ Onlyapplicabletoorga nicfractionofMSW
Incineration	Incinerationistheprocessof waste burning athightemperature in controlled envirobment.Thisinvolvesthecombustion ofprocessedwaste to generate heat which isused forelectricitygeneration.Thethermalconv ersion efficiency varies from80- 90%andelectricityconversionefficiencyisa round14%.Carbondioxide,watervapour, ash and noncombustiblematerialswillbetheendpr oducts. However, it is suitableforwasteswithhighcalorificvalue, low moisture content andisassociatedwithriskssuchasairpolluti on.	 ✓ Reductioninvolumeof wastegoingto landfill ✓ Productionofenergywh ichcould be used forvariouspurposes ✓ Reductionintoxicityofw asteandpathogens. 	 ✓ Release of harmful emissionsinthe air. ✓ Treatmentoftheby- productsisimperative ✓ Skilledoperators ✓ NIMBYsyndrome

Table 5. 2 (A): Treatment Options

5.5 TECHNOLOGY ADOPTED

As per the pre-feasibility study undertaken by the DPR Consultants, the most feasible technology option recommended for the Kotdwarcity based on the quality, quantity and characteristics of waste to be processed, present land availability (limited in the area), proximity to habitation, capital cost and maintenance cost, is windrow composting for processing of bio-degradable organic wastes. Inert wastes will be segregated, stored separately in a designated storage area and final disposed of in proposed sanitary landfill.

CHAPTER 6: ENVIRONMENTAL MONITORING PLAN

6.1 ENVIRONMENTAL MONITORING PROGRAM

Environmental Monitoring is a process to check the effectiveness of the measures and management plan prescribed and adopted. Monitoring also checks the proper operation of the systems. The monitoring plan also ensures compliance with the environmental legislation and consent. It helps to

- Assist in detecting the development of any unwanted environmental situation, and thus, provides opportunities for adopting appropriate control measures, and
- Define the responsibilities of the project proponents, contractors and environmental monitors and provides means of effectively communicating environmental issues among them.
- Define monitoring mechanism and identify monitoring parameters.
- Evaluate the performance and effectiveness of mitigation measures proposed in the Environment Management Plan (EMP) and suggest improvements in management plan, if required,
- Identify training requirement at various levels.

Environmental monitoring has to be conducted at MSW landfill and composting facility to ensure that no contaminants that may affect public health and surrounding environment are released from the environment. In case the monitoring results found non-complying, it is always suggested to review the operation process, operation efficiency, and training need of workers, efficiency of machines / equipment and effectiveness of the management plan. Environmental monitoring plan has been suggested for construction and operation phase of the project.

6.2 OPERATION PHASE

Following attributes are proposed to be regularly monitored based on the environmental concern:

- Monitoring of Point Source emissions [stack emission]
- Monitoring of ambient air quality at plant boundary and nearby area.
- Work zone air quality monitoring*
- Groundwater quality near project site.
- Fresh water, wastewater quality& quantity
- Soil quality at project site
- Ambient Noise levels monitoring near various units and at project boundary
- Green belt plantation, maintenance, development of other forms of greenery like lawns, gardens, etc. within the site and outside area.

6.2.1 ENVIRONMENTAL MONITORING PROGRAM

Table6 1(A): Environmental Monitoring Planduring Construction&Operation Phase with Institutiona
Responsiblities

Environmental	Project		InstitutionalRe			
Component	Phases	Parameters	Standards	Frequency	Duration	sponsibility
Air	Pre-Construct ionPhase	PM10,PM2.5,SO2, NH3,CH4,CO, NOx	AsperSolid WasteManage ment Rules,2016and Air(Preventiona ndControl	8 hourly samples per dayforCO,CH4and NH3.24hrssamplin gforPM,andSO2	Once	Contractor
	ConstructionP hase	PM10,PM2.5,SO2, NOx,NH3,CH4, CO		8 hrs samples per day forCO,CH4,NH3onc einamonth.24hrss amplingforPM,and SO2	Quarterlytill completion of constructio nphase	Contractor
	OperationPha se	PM10,PM2.5,SO2, NH3,CH4,CO, NOx		3locations,8hoursa mplesperday,and monitoringforthre eSeasons.	Continuous 8hour/orfor 1 full working day, twice ineachseaso nexcept monsoon.	Contractor
GroundWater	Pre-Construct ionPhase	pH,TotalDissolvedS olids(TDS),heavy metals likeAs,Cd,Cr,Co,CN, Pb, Hg, Ni, Znetc.,Nitrate,Fe, Chloride,PhenolicC ompoundsand Sulphate.	AsperSolid WasteManage ment Rules,2016and water qualitystandard sby CPCB/IS10500: 1991	Grabsamplingatab oveselectedlocatio ns	Twiceayear	Contractor
	ConstructionP hase	pH,TotalDissolvedS olids(TDS),heavym etalslikeAs,Cd, Cr, Co, CN,Pb,Hg,Ni,Znetc. ,Nitrate,Fe,Chlorid e,PhenolicCompou ndsand Sulphate	AsperSolid WasteManage ment Rules,2016and water quality standardsbyCP CB/IS10500:19 91	6 Samples in Pre monsoonand6sam plesinpostmonsoo n during operationphase	Twiceinever yyearduring operationph ase	Contractor

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Environmental	Project		InstitutionalRe			
Component	Phases	Parameters	Standards	Frequency	Duration	sponsibility
	OperationPha se	Do	AsperSolid WasteManage ment Rules,2016and Waterqualityst andards byCPCB/ IS10500:1991			
Noise	Pre- Construction Phase	Noiselevelon dB(A)scale	NoisebyCPCB standards	Hourlymonitoringf or24 hours atonce	Once	
	ConstructionP hase	NoiselevelondB(A) scale	Noisestandards byCPCB	Hourlymonitoringf or24hours atonce	Twiceayear	
	OperationPha se	Noise levelond B(A)scale	Noisestandards byCPCB	Hourlymonitoringf or24hours atonce	Quarterly	
Soil	Pre-Construct ionphase	Color,pH,Electrical Conductivity,Moist ureContent, Organic Carbon,Bicarbonat e,Chloride, P, K, Ca,Mg,Na,SAR,N, Texture	AsperEnvironm ent(Protection) Act, 1986an dSolid WasteManage ment Rules,2016	Representativesam plesform in and around projectsite	Once	Contractor
	OperationPha se	-Do-	AsperEnvironm ent(Protection) Act,1986andAs perSolid WasteManage ment Rules,2016	Representativesam plesform in and around projectsite	Twiceayear	Contractor
Leachate	OperationPha se	Suspended solid,Dissolvedsoli d,pH, AmmonicalNitroge n,TotalKjeldhal Nitrogen,BOD,COD ,As,Hg,Pb,Cd,Cu, Cr,Zn,Ni,CN,Fluorid e,Phenoliccompou nd	AsperSolid WasteManage ment Rules,2016	Beforedischarging ofLeachatefor reuse after treatment.	Quarterly throughout operationph aseofthepro ject	Contractor

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Environmental	Project	Monitoring				InstitutionalRe
Component Phases		Parameters	Standards	Frequency	Duration	sponsibility
Compost quality	OperationPha se	Arsenic,Cadmium, Chromium,Copper, Lead, Mercury,Nickel,Zin c,C/N Ratio,pH	AsperSolid WasteManage ment Rules,2016	Beforesellingtheco mpost	Throughout operationph aseofthepro ject	Contractor
SocialFactors	Pre-constructi onphase	Aesthetics, Vectors, Odor, Healthofsurr ounding Habitantsa ndworkers, commu nicable disease and occupational diseas es (likeskin infection, lung infection, fung al infection, etc	AsperSolid WasteManage ment Rules,2016	Once	Once	Contractor
	ConstructionP hase	Aesthetics,Odor, Vectors, Health of surroundingHabita nts,Communicable Diseases	AsperSolid WasteManage ment Rules,2016	Yearlymonitoringo fworkershealthand monitoringofdisea sesinthe surroundingcomm unity	Duringconst ructionphas e	Contractor

6.3 OPERATIONAL MONITORING FOR PROCESSING UNIT

Arrangements will be made for regular site inspections by in house audit team and the independent engineer.Regular risk assessments of the operational procedure will be under taken to continue safe and efficient operations. A copy of these will be provided in the progress reports to the authority.

These audits would be quarterly for first 3 years of operation and thereafter semi-annual and audit reports will be submitted from time to time. The reports will indicate the following:

- ✓ Summaryofmonitoringstatusincludingairquality, noise, groundwater, and surface water.
- ✓ Accidents, spills and emergencies
- ✓ Complaintsandtheirredress
- ✓ EHSIssuesandtheirmitigation
- ✓ Operation statistics The amount of waste received, recycled, processed and disposed, efficienciesofoperationsof equipmentandprocesses;
- ✓ Statusofcompliancewithvariousregulations;and

6.4 OPERATION MONITORING FOR LANDFILL

Regular monitoring of the various components of the physical environment is planned during the operational period of the facility. It is proposed to undertake the following monitoring as a part of the normal operations of the facility.

- ✓ Leachatequantityandquality.
- ✓ Surfacewaterqualitybothupanddown-streamofthefacilityforimportantparameters.
- ✓ Groundwaterqualityinsurroundingareasofthefacilityandinnearbyvillagecommonwatersupplybore s.
- ✓ AmbientAirqualitywithinandimmediatelysurroundingareasofthesite.
- ✓ Stabilityoffinalcover

6.5 PUBLIC HEALTH MONITORING

A two-stage health-monitoring program is proposed.

- ✓ Monitor the health of workers within the project site to identify adverse health effects, and
- ✓ By organizing health camps on a regular basis.

POST CLOSURE MONITORING

Post-closure monitoring of the landfill will be done primarily as a compliance requirement in addition to social responsibility; this also provides an early warning towards possible adverse impacts on human health and the environment. The post-closure program of monitoring for water quality in the ground water and surface waters down gradient of the landfill will be similar to that established for the operational stage of the facility. The frequency of monitoring may be varied from time to time depending on changing circumstances. There is a need for the post-closure monitoring of air quality, noise or visual effects during the post closure period however this need will be reviewed periodically and should any aspects warrant further monitoring they will be included in the program

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Table 6. 2: Environmental Monitoring Plan

Environmental	Project Phase	Monitoring			Institutional Responsibility		Annual Cost(in	
Component		Parameters	Standards	Frequency	Duration	Implementation	Supervision	Lac Rupees)
Air	Pre-Construction	PM ₁₀ , PM _{2.5} , SO ₂ , NH ₃ ,	As per Solid Waste Rules, 2016	8 hrly samples per day for CO,	Once	Contractor through	PMC	0.2
	Phase	CH ₄ , CO	and Air (Prevention and Control	CH4 and NH3. 24 hrs		approved monitoring		
			of Pollution) Rules, 1984	sampling for PM, and SO2		agency		
	Construction Phase	PM ₁₀ , PM _{2.5} , SO ₂ , NH ₃ ,	As per Solid WasteManagement	8 hrs samples per day for CO,	Quarterly till completion	Contractor through	PMC	1.0
		CH ₄ , CO	Rules, 2016 and Air (Prevention	CH4, NH3 once in a month. 24	of construction phase	approved monitoring		
			and Control of Pollution) Rules,	hrs sampling for PM, and SO2		agency		
			1984					
	Operation Phase	PM ₁₀ , PM _{2.5} , SO ₂ , NH ₃ ,	As per Solid WasteManagement	3 locations, 8 hour samples	Continuous 8 hour/or for	Contractor through	PMC	1.5
		CH ₄ , CO	Rules, 2016 and Air (Prevention	per day, and monitoring for	1 full working day, twice	approved monitoring		
			and Control of Pollution) Rules,	three seasons.	in each season except	agency		
			1984		monsoon.			
Ground Water	Pre-Construction	pH, Total Dissolved Solids	As per Solid Waste Management	Grab sampling within 500	Once	Contractor through	PMC	0.07
	Phase	(TDS), heavy metals like	Rules, 2016 and Water quality	meters radius of the project		approved monitoring		
		As, Cd, Cr, Co, CN, Pb, Hg,	standards by CPCB/ IS	site		agency		
		Ni, Zn etc., Nitrate, Fe,	10500:1991					
		Chloride, Phenolic						
		Compounds and						
		Sulphate.						
	Construction Phase	pH, Total Dissolved Solids	As per Solid WasteManagement	Grab sampling at above	Twice a year	Contractor through	PMC	0.15
		(TDS), heavy metals like	Rules, 2016 and Water quality	selected locations		approved monitoring		
		As, Cd, Cr, Co, CN, Pb, Hg,	standards by CPCB/ IS			agency		
		Ni, Zn etc., Nitrate, Fe,	10500:1991					
		Chloride, Phenolic						
		Compounds and Sulphate						
	Operation Phase	Do	As per Solid WasteManagement	6 Samples in Pre monsoon and	Twice in every year	Contractor through	PMC	1.6
			Rules, 2016 and Water quality	6 samples in post monsoon	during operation phase	approved monitoring		
			standards by CPCB/ IS	during operation phase		agency		
			10500:1991					
Noise	Pre-construction	Noise level on dB(A) scale	Noise standards by CPCB	Hourly monitoring for 24 hours	Once	Contractor through	PMC	0.05
	Phase			at once		approved monitoring		
						agency		

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Environmental	Project Phase	Monitoring			Institutional Responsibility		Annual Cost(in	
Component		Parameters	Standards	Frequency	Duration	Implementation	Supervision	Lac Rupees)
	Construction Phase	Noise level on dB (A) scale	Noise standards by CPCB	Hourly monitoring for 24 hours at two locations	Twice a year	Do	РМС	0.2
	Operation Phase	Noise level on dB(A) scale	Noise standards by CPCB	Hourly monitoring for 24 hours in every three month at two locations.	Quarterly	Do	РМС	0.4
Soil	Pre-Construction phase	Color, pH, Electrical Conductivity, Moisture Content, Organic Carbon, Bicarbonate, Chloride, P, K, Ca, Mg, Na, SAR, N, Texture	As per Environment (Protection) Act, 1986 and Solid Waste Management Rules, 2016	Representative samples form in and around project site	Once	Contractor through approved monitoring agency	РМС	0.05
	Operation Phase	Do	As per Environment (Protection) Act, 1986 and Solid Waste Management Rules, 2016	Representative samples form in and around project site	Twice a year	Contractor through approved monitoring agency	PMC	0.1
Leachate	Operation Phase	Suspended solid, pH, Dissolved solid, Ammonical Nitrogen, Total Kjeldhal Nitrogen, BOD, COD, As, Hg, Pb, Cd, Cu, Cr, Zn, Ni, CN, Fluoride, Phenolic compound	As per Solid Waste Management Rules, 2016	Before discharging of Leachate for reuse after treatment.	Quarterly throughout operation phase of the project	Contractor through approved monitoring agency	PMC	0.40
Compost quality	Operation Phase	Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc, C/N Ratio, pH	As per Solid Waste Management Rules, 2016	Before selling the compost	Throughout operation phase of the project	Contractor through approved monitoring agency	РМС	1.2
Social Factors	Pre-construction phase	Aesthetics, Vectors, Odor, Health of surrounding Habitants and workers, communicable disease and occupational diseases (like skin infection, lung infection, fungal infection, etc)	As per Solid Waste Management Rules, 2016	Once	Once	Contractor through approved monitoring agency	PMC	0.5

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Environmental	Project Phase		Monito	oring		Institutional Respons	sibility	Annual Cost(in
Component		Parameters	Standards	Frequency	Duration	Implementation	Supervision	Lac Rupees)
	Construction Phase	Aesthetics, Vectors,	As per Municipal Solid Waste	Yearly monitoring of workers	During construction	Contractor through	PMC	0.5
		Odor, Health of	(Management & Handling) Rules,	health and monitoring of	phase	approved monitoring		
		surrounding Habitants,	2016	diseases in the surrounding		agency		
		communicable diseases		community.				
	Operation Phase	Do	Do	Yearly monitoring of workers	During operation phase	Contractor through	PMC	0.5
				health and seasonal		approved monitoring		
				monitoring of diseases in the		agency		
				surrounding community.				
				Annual assessment of the ratio				
				of the incident of particular				
				disease related to the project				
				activity				

CHAPTER 7: ADDITIONAL STUDIES

- > Public Consultation Awaited
- ➢ RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

7.1 RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

Risk Assessment policies are essential tools to prevent and mitigate undue harm to people during the development process. When identifying and designing a project, Risk Assessment help assess the potential physical, environmental and social risks and impacts (Positive and Negative) associated with a development intervention.

A hazard is something that can cause harm, viz., chemicals, electricity, working on height, noise due to machines/ running of plant, work stress etc. However, risk is the chance or the scale say high or low that any hazard will actually cause somebody harm.

7.2 HAZARD IDENTIFICATION

Hazard can be described as any source of potential damage, harm or adverse health effects on something/ someone. The potential hazards associated with operations of the IMSWMF may be categorized as below:

✓ Physical Hazards

- Fire hazard in windrow composting
- Heavy equipments and machinery for waste tipping
- Turning windrows
- Pre-screening, processing of waste
- Rough sharp waste items
- Trip Hazards due to pipes/ hoses
- Chemical Hazards
- Confined spaces/ covered compost pads
- Inhalation/ ingestion/ skin contact
- Chemical reactions within the stored mixed waste or waste windrow

✓ Biological Hazards

- Allergies from pathogen and airborne dust
- Pests/ bugs at site

✓ Natural Hazards

- The avy Rainfall/ Cloud Burst/ Fluvial Flood
- Landsliding
- Earthquake

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Table 7.1 (A) Associated Hazards and Proposed Control Measures

SI	Hazard	Cause&Consequences/	ControlMeasures/	ControlPhase
No.	Name	Condition	ActionRequired	controll hase
	1	Phys	icalHazard	
1	Fire	Firehazardmayexistwith	Periodicmixingofcompostingmaterial	Design, Operatio
	hazardinwi	composting processas	and maintenance of	ns
	ndrowcomposti	elevated temperaturesand	theproperwatercontentshouldbedonet	
	ngdue	drying may	ocontrolwindrowcomposttemperature	
	toelevated	increasethepotentialforspo	andpreventfires.	
	temperatures	ntaneouscombustion.	A well-designed fire	
			suppressionsystemwithsufficientwater	
			capacityandatsufficientpressures to	
			adequately control	
			afirewithinthefacilityandapprovedbyth	
			elocalfireauthoritywillbeinstalled	
			Sufficientinternalroadnetworkisdesign	
			ed for the proposed	
			projectforthemovementoffiretenders	
			duringaccident/hazard.	
2		Duringcoilevequationandea		Construction On
2	ntcandmaching		when approaching operating equipment	construction, Op
	nutar	korsmay be soriously	, meapproachshouldbemaderromtheir	
	wastoti	injurodorkillodbyboowogui	ontandwithinviewortheoperator, prefer	liance
	nning	nment such as front-	Haaywaquinmontshouldbooquinnod	
	hhing	endloadersandscrapers	Heavyequipments nourobeequipped	
		endioadersandscrapers.	withabackupalarinto alertworkers.	
3	Accidentsdurin	Windrows	All moving or rotating	Construction,Op
	gWindrowsoper	require	equipmentmustbeguardedtopreventac	erations,Mainte
	ation	periodicaerationusingspeci	cidentalcontact.Workersshouldonlyop	nance
		alizedequipmentforturning	eratethesystemwiththemachineguardsi	
		the compost.	nplace.	
		i nemixingequipmentmayb		
		eequippedwitharotary		
		device which lifts and		
		turns the material		

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SI No	Hazard	Cause&Consequences/	ControlMeasures/	ControlPhase
4	Accidents during Pre- screening, processing of waste	Pre-screening or sizing equipment, such as grinders, shakers, and screeners, may pose machine guarding hazards with unguarded equipment. Appendages or loose clothing may become entangled in pulleys, drive shafts, andother moving equipment.	Workers should keep clear of operating equipment and approach only when within view of the operator.	Construction, Operations, Maintenance
5	Rough sharp waste items	Workers may be exposed to puncture and cut hazards to feet and hands from rough or sharp waste material during composting operations.	Workers should wear safety boots with steel shanks to prevent cuts to the bottom of the foot. Workers should minimize manual handling of waste material, and wear cut- resistant gloves if contact with wastematerials is necessary.	Construction, Operations, Maintenance
6	Trip Hazards due to pipes/ hoses	Trip hazards may exist with hoses and piping systems used for irrigation of the composting unit.	Workers should exercise caution when walking over hoses and pipes. In heavily travelled areas, extra lighting may be needed to ensure walkways are adequately illuminated	Design, Maintenance
		Chem	ical Hazards	
1	Confined spaces/covered compost pads(CO2, NH3,CH4)	Since a closed shed is proposed for the compost plant, it may be considered that the workers entering the facility enter a confined space. Elevated levels of CO2 may Accumulate during composting process. It is also typical for some ammonia gas to be generated during composting. Exposure to ammonia vapors may occur, especially during windrow turning operations.	Prior to each entry into the enclosed or tented area, the atmosphere within the tent should be tested to ensure a safe atmosphere. If the testing indicates atmospheric contaminants or oxygen depletion, a confined-space entry program shouldbe developed and implemented.	Design, Operations

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SI	Hazard	Cause&Consequences/	ControlMeasures/	ControlPhase
No.	Name	Condition	ActionRequired	controlFnase
		Although aerobic conditions should be maintained in the compost, if anaerobic conditions can develop, methane and hydrogensulfide may be generated.		
2	Inhalation/ ingestion/ skin contact	Workers may be exposed to contaminants and degradation products of contaminants. Exposure may occur via inhalation/ ingestion/ skin contact routes of exposure during loading, unloading, pre- processing, tilling, turning and other operations where soils are agitated.	An analysis of the work tasks and potential for chemical exposure should be performed to determine the correct personal protective equipment (PPE) and/or respirator cartridge(s), if needed. The analysis should include obtaining specific chemical hazard information to ensure that the PPE specified will be appropriate for the respective chemical hazard. Workers may also use respiratory protection including the use of an air- purifying respirator equipped with HEPA (N100, R100, P100) filters and organic vapor cartridges.	Operations, maintenance
3	Chemical reactions within the stored mixed waste or waste windrow	Some materials used in composting may be explosive, especially when in contact with other incompatible materials (e.g. ammonium nitrate and fuels). Others may be hygroscopic, which may result in chemical reactions.	Workers should minimize contact with acidic or corrosive chemical materials by using mechanical chemical delivery methods. Where contact is required, workers should wear gloves (e.g. nitrile) and other personal protective equipment that is resistant to the materials handled. All chemical reagents used in composting should be segregated to prevent accidental mixing of reactive chemicals, especially ammoniumnitrate fertilizers and fuels.	Operations, main tenance
		Biolo	gical Hazard	

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SI No.	Hazard Name	Cause&Consequences/ Condition	ControlMeasures/ ActionRequired	ControlPhase
1	Allergies from pathogen and airborne dust	During dry and windy periods microbe- entrained dusts may becomeairborne from soil agitation. Exposure to mold spores,including Aspergillus fumigates and thermophyllic actinomyctes mayoccur during composting operations. Inhalation of pathogenic microbes may cause allergic reactions or illlness.	Periodic application of water to the active area. Personal protective equipment, such as rubber gloves, should be used Respiratory protection(e.g. air- purifying respirator with HEPA (N100, R100, P100) filter/cartridge) may be used during dusty periods	Operations, Maintenance
2	Pests/ bugs at site	Workers may be exposed to a wide array of biologicalhazards, including snakes, bees, wasps, massive flyhatches, ticks, hornets, and rodents which get attracted to the higher temperatures associated with composting operations and other hideout warm places.	Workers should be informed of the potential for snakes and other animals around the compost facility, especially during cooler periods. Periodic inspections of the site shall be performed to identify stinging insect nests and for the presence of snakes professional exterminating companies should be consulted for their removal.	Operations, Maintenance
		Natı	ıral Hazard	
3	Heavy Rainfall/ Cloud Burst/ Flooding etc.	Flooding situation may arise due to heavy rainfall, sudden cloud burst etc. Also, poor drainage condition (silted/ uncleaned) can worsen the flooding situation.	Close co-ordination with Indian Meteorological Department, Dehradun & State Disaster Management Authority, Uttarakhand well before arriving of monsoon. To train the staff to climb up the roof/ elevated place nearby when the site is flooded. Keep an emergency kit ready. In all the different types of emergency, it is better to be prepared than to get ready, to get information so as to get organized, to wait rather that act too hastily. Beware of water contamination, wait until the water is declared safe before	Design, Operation and District Administration

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SI	Hazard	Cause&Consequences/	ControlMeasures/	ControlPhase
No.	Name	Condition	ActionRequired	control hase
			drinking or boil the water before drinking. Clean and disinfect the room that is flooded.	
			During storms and hurricanes do not go out once the storm has been announced.	
			Do not use the telephone, except to call for help, so as to leave Telephone lines free for the organization of response. Listen to the messages broadcast by radio and the various media so as to be informed of development	
4	Landsliding/ Sheet erosion etc.	It may destruct the plant set-up/ transportation route etc.	To ensure that no loose debries/ rocks stay hanging over the plant area in uphill side and on transportation route. Restricted speed limit in such area. No overloading of vehicles. To make aware district authorities for instant help.	Design, Operation and Dist. Administration
5	Earthquake	It may destruct the plant set-up/ transportation route etc. and it is a severe threat to the lives.	A strong and earth-quake resistance builing and plant design may be adopted. To trains staff to crouch under some heavy furniture or stand under the doorframe for self cover. Carry out the official instructions given over the radio or by loudspeaker. Close co-ordination with State Disaster Management Authority, Uttrakhand well before arriving ofmonsoon.	Design, Operation and Dist. Administration

7.1.1. HEALTH AND SAFETY

The site will be managed by the concerned contractor who will be responsible and accountable for all activities on site. He will delegate authority for the day to day running as deemed appropriate but liaise with those with delegated authority daily to discuss and close out health and safety issues that have been identified.

Staffs shall be trained and will be responsible for their own safety, for their actions that may affect the safety of those they are working with or persons who may be working nearby. In this respect and they have the obligation to report unsafe actions and situations to the client/ Site Manager. It is everyone's duty to prevent unsafe situations and actions. The health and safety of all those who works at the plant shall be ensured, as far as is reasonably practicable by:

- ✓ Assessing the risk of all work activities, recording the significant findings and developing method statements as appropriate.
- ✓ Providing and maintaining safe plant and systems of work, together with appropriate personal protective equipment.
- ✓ Minimising risks associated with hazardous substances including waste to be processed, materials used and the by-products of waste treatment processes.
- ✓ Minimising risks associated with other occupational health risks including noise, vibration and manual handling.
- ✓ Maintaining the plant in safe condition including as regards workplace transport and fire risks.
- Providing appropriate information, instruction, training and supervision to those working at the Plant or visiting the Plant, including information and training about the emergency procedures.
- ✓ Implementing effective systems for active and reactive monitoring of compliance, including by inspections, audits and incident/ near miss investigation
- Ensure the safety end absence of risk to health in connection with the use, handling, storage and transport of articles and substances.
- ✓ Make regular risk assessment available to employees
- ✓ Take appropriate preventive/protective measures staff must follow plant's in-house rules and regulations as described further in this HSE plan. In addition, the following rules & regulations if any, are also imposed to each staff:
- ✓ The client's worksite safety rules and regulations
- ✓ The general safety rules imposed by Indies Government legislation
- ✓ If hazard arises, or suspected to be present, they shall be reported immediately and, if necessary, all work stopped, and persons withdrawn from the area.

7.1.2 SAFETYDURINGCONSTRUCTION

Safety during construction is will be maintained through the site management organisation put into place. Before opening a construction site, concern contractor prepares a set of documents ruling the entire construction process. Part of this document is called safety file which contains local safety regulations to be observed and project safety instruction.

7.1.3 SAFETY DURING OPERATION

Plant safety as regards normal and disturbed operation will be is being developed during the conceptual and details design phases of the plant e.g. fire protection concept, emergency evacuation concept, safety interlocks of control system etc. for each piece of equipment the relevant safety standards are observed. The operating and maintenance manual handed over to the customer before commissioning contains all information for a safe operation and maintenance of the plant. A special section "safety" provides hints and warnings as to potential hazards or risks

arising during normal operation, start-up, shut- down and maintenance. The training program of future staff will also focus on safety aspects.

7.2 HANDLING AND MANAGEMENT OF MUNICIPAL SOLID WASTE

7.2.1 SWMFACILITY

- ✓ Utmost care and safety regulations should be followed.
- ✓ SWM Facility shall be provided with boundary wall and provided with proper gate to monitor incoming vehicles or other modes of transportation.
- ✓ The facility shall be well protected to prevent entry of unauthorized persons and stray animals. Further, the site should be clear of unnecessary obstruction to avoid danger to these persons,
- ✓ Approach and other internal roads for free movement of vehicles and other machinery shall exist at the Facility.
- ✓ Utilities such as drinking water, bathing facilities, toilets for workers and lighting arrangements for operations at the Facility when carried out in night hours shall be provided.
- ✓ Regular health inspections of workers at the solid waste management facility shall be periodically made
- ✓ Safety of all persons entitled to be on the Site, by ensuring the use of protective gears amongst sanitary workers, vehicle drivers, guard, gateman, while working and handling waste at ISWM Facility should be looked out. Hand gloves, high boots made of tough leather, goggles and masks to all workers for handling municipal solid waste should be provided.

7.2.2 ENGAGEMENT OF STAFF AND LABOUR

Arrangements for the engagement of all staff and labour, local or otherwise, and for their payment and extending other facility in compliance to the applicable law should be done. Encouragement, to the extent practicable and reasonable, to employ staff and labour with appropriate qualifications and experience from places not limited to but near to geography should be there.

7.3 DISASTER MANAGEMENT PLAN

The proposed facility will have appropriate storage for MSW. To mitigate potential fire problems, adequate measures such as water hydrants with adequate pressure or dry powder type will be provided. Prolonged periods of storage of MSW in its wet form can also lead to spontaneous fires due to biological decomposition and production of methane. To mitigate the situation, provisions have been made in the processing plant not to store raw MSW for more than 72 hours so that the fire hazard possibility is eliminated.

The main occupational hazard likely to occur can be fire, gaseous discharges and noise. Fire protection systems will be provided as per LPA (loss prevention association) norms. Adequate numbers of hydrantsshall be provided in the plant. The fire protection system will be provided with main electricity driven pump, one standby diesel engine operated pump with requisite pressure and head, and one jockey pump. The plant and the equipment will be designed and specified with a view to minimize noise pollution to levels of 75 dBA at a distance of 1 m from the equipment. Employees will be provided with ear protection devices. In addition, the proper mechanical/ electrical

shutdown procedures will be adopted by ensuring a permit card system (to be placed and issued from the Control Room). Positive isolation of drives from the circuit breaker will be ensured during electrical shutdown and earthing of outgoing will also be done as and when necessary. Proper ventilation system shall be required for preprocessing section to make the working environment conducive for workers.

Workers will be trained to adapt to environmentally benign practices. "No Smoking" and hazard/ danger warning stickers will be put up at appropriate places. Emergency numbers will also be put up at appropriate places. Empty fuel drums/ tanks and other inflammable material will be removed from the premises as soon as possible. Storage yard for chemicals and fuel lubricants will also be provided with fire extinguishers and sand bucket racks. The general safety features adopted will have a provision of fire extinguishers, over pressure relief devices, safe storage of all chemical and fuels, grounding of all electric equipment, safe location of electric gear, proper building and equipment layout, instrumentation alarms, guard railings, security personnel. Silencers will be provided for safety valves and vents of the plant to ensure noise control in the plant.

Disaster is a major emergency, which has the potential to cause serious injury or loss of life. It may be due to malfunction of the normal operating procedure or an intervention of outside force such as a cyclone, earthquake and flood. Disaster management has assumed significant role with an aim of taking precautionary step to control the hazard propagation and avert disaster and also to take such actions after the disaster, which limits the damage to the minimum.

7.3.1 TYPESOFANTICIPATEDDISASTERSATTHESITE

Following are the disasters which may occur at the solid waste Management Facility:

Man-Made Diasasters	Fire
	Oil Spilage
	Electrocution
Natural Disasters	Heavy Rainfall/ Fluvial Flood/ Cloud Burst
	Earthquake

Table 7. 2 (A): Types of Disaster / Accidents

In any plant there are various activities or area which pose substantial threat to the workers and hence hazardous in nature. The potentially hazardous areas and the likely accidents with the concerned area have been enlisted below.

S.No.	Hazardous Area	Likely Accident
1.	Oil Tanks	Fire and Spillage
4.	Electrical Rooms	Fire and Electrocution
5.	Transformer Area	Fire and Electrocution
6.	Cable Tunnel	Fire and Electrocution
7.	Storage Facilities	Fir/Spillage

Accident Level

If there is any disaster in any part of plant/work place due to any reason, the classification of areas which may be affected and nature of accidents canbe made as follows:

S.No.	Accident Levels	
1.	Level I	Operator level
2.	Level II	Local community level
3.	Level III	Regional/national level
4.	Level IV	International level

Table 7. 4 (C): Accident Levels

Out of the above, only level-I and level-II class of accidents can be considered applicable to the plant as they occur at operator, local community level.

7.3.2 DISASTERPREVENTIVEMEASURE

To prevent disaster due to fire, explosion, oil spillage, electrocution and other accidents following preventive measures shall be adopted.

- ✓ Provision of adequate access way for movement of equipment and personnel shall be kept.
- $\checkmark\,$ Minimum two no. of gates for escape during disaster shall be provided.
- ✓ Adequate Fire fighting system as per approval obtained from the Fire Department.

7.3.3 SITEEMERGENCYCONTROLROOM

In order to control the disaster more effectively, a Site Emergency Control Room (SECR) will be established at the plant site. The facilities proposed to be provided are given in following sections:

- ✓ Plant Layout
- ✓ Plant Layout with inventories and locations of fuel oil/furnace oil storage tanks, etc.
- ✓ Hazard identification chart, maximum number of people working, assembly points etc.

- ✓ Population around factory
- ✓ Internal telephone connections
- ✓ External telephone connections
- ✓ Hotline connection to district collector, police control room, fire brigade, hospital etc.
- ✓ Public address system
- ✓ Torch-lights
- ✓ List of dispensaries and registered medical practitioners around factory
- ✓ Area map of surrounding village
- ✓ Nominal roll of employees
- ✓ Notepad and ball pen to record message received and instructions to be passed

7.3.4 SAFETY DEPARTMENT

Safety department will be manned by experienced engineers and other supporting staff who shall bring safety consciousness amongst the workforce of plant. The safety department will conduct regular safety awareness courses by organizing seminars and training of personnel among the various working levels.

7.3.5 CONTINGENCYPLANFORMANAGEMENTOFEMERGENCY

The emergency organisation will be headed by emergency leader called Site Main Controller (SMC) who will be site incharge. In his absence, senior most people available at site shall be emergency leader till arrival of Site Incharge.

Besides the above mentioned officials, rest of the employees will be divided into three action teams namely A, B, C, and a Non-action Group D. Action team 'A' will consist of staff of section in which accident has occurred. Action team 'B', will consist of staff of non-affected sections and maintenance department. Action team 'C' will consist of supporting staff i.e. Security supervisor, Shift Supervisor etc. Group 'D' will consist of people not included in those teams like contractor, labour, security men etc.

Team 'A' comprising staff of affected section will be taking up the action in case of an emergency. Team 'B' will help team 'A' by remaining in their respective sections ready to comply with specific instructions of SMC. Team 'C' consisting of supporting staff will help team 'A' as required and directed by Team 'B'. Group 'D' will be evacuated to safe region under supervision of Team 'C'. A multi-channel communication network shall connect SECR to control rooms of plant, various shops, and other departments of plant, fire station and neighbouring industrial units.

7.3.6 OUTSIDE ORGANIZATIONS INVOLVED IN CONTROL OF DISASTER

In the event of massive occurrence of fire, population inside and outside plant boundaries, vegetation and animal etc. may be affected. State and Local authorities: may also take place. In such an event, help will be taken from outside agencies also.

- ✓ The organizations that will be involved District Collector, Revenue Divisional Officer etc
- ✓ Environmental agencies: Member Secretary of State Pollution Control Boards, District Environmental Engineer
- ✓ Fire Department: District Fire Officer
- ✓ Police Department: District Superintendent of Police, SHOS of nearby Police Stations Public Health Department:
- ✓ District Medical Officer –
- ✓ Divisional Engineer Telephones

The outside organisations will directly interact with district magistrate who in consultation with SMC will direct to interact with plant authorities to control the emergencies.

7.3.7 HAZARDEMERGENCYCONTROLPROCEDURE

The onset of emergency will in all probability, commence with a major fire or explosion the following activities will immediately take place to interpret and take control of emergency.

- ✓ Staff member on duty will go to nearest fire alarm call point and trigger off the fire alarm.
- ✓ On site fire crew led by fire man will arrive at the site of incident with fire foam tenders and necessary equipment.
- ✓ Site Main Controller will arrive at SECR, from where he will receive information continuously from incident controller and give decisions and direction to the incident controller, plant control room, and emergency security controllers and to the site medical officer to take care of casualties.

Site Main Controller (SMC) will be directing and deciding a wide range of following desperate issues. In particular SMC has to decide and direct:

- ✓ Whether incident controller requires reinforcement of manpower and facilities
- ✓ Whether plant is to be shut down or more importantly kept running.
- ✓ Whether staff in different locations is to remain indoors or to be evacuated and assembled at designated collection center.
- ✓ Whether missing staff members are to be searched or rescued.
- ✓ Whether off-site emergency plan to be activated and a message to that effect is to be sent to district headquarter.

When the incident has eventually been brought under control as declared by the Incident Controller, the SMC shall send two members of his advisory team as inspectors to incident site for:

- ✓ An assessment of total damage and prevailing conditions with particular attention to possibility of re- escalation of emergency which might, for the time being, be under control.
- ✓ Inspection of other parts of site which might have been affected by impact of incident.
- ✓ Inspection of personnel collection and roll call centers to check if all persons on duty have been accounted for.
- ✓ Inspection of all control rooms of plant to assess and record the status of respective plants and any residual action deemed necessary.

✓ Post emergency, the inspectors will return to SECR with their observations and report of finding and will submit the same to SMC.

7.3.8 MISCELLANEOUSPREVENTIVEMEASURES

AlarmSystemtobefollowedduringDisaster

On receiving the message of disaster from Site Main Controller, fire station control room attendant will sound Siren I, wailing type, for 5 minutes. Incident controller will arrange to broadcast disaster message through public address system.

On receiving the message of "Emergency Over" from Incident Controller the fire station control room attendant will give All "Clear Signal" by sounding alarm straight for two minutes. The features of alarm system will be explained to one and all to avoid panic or misunderstanding during disaster.

- ✓ Actions to be taken on hearing the warning signal
- ✓ On receiving the disaster message, following actions will be taken:
- ✓ All the members of advisory committee, personnel manager, security controller, etc. will reach the SECR.
- ✓ The process unit persons will remain ready in their respective units for crash shutdown on the instruction from SECR.
- ✓ The persons from other sections will report to their respective officer.
- ✓ Resident of township will remain alert.

7.3.9 SAFETY DEVICES/EQUIPMENT

In order to make the services more effective, the workers and rescue team will be provided with the safety equipment and items like gas mask respirators, fire entry suits, fire blankets, rubber shoes or industrial shoes, rubber glove, ladders, ropes, petromax lamp torches, etc.

7.3.10 FIRE PROTECTION AND SAFETY MEASURES

In order to prevent disaster due to fire, explosion, oil spillage, electrocution and other accidents, following preventive measures will be adopted:

- Design, manufacture and construction of all plant and machineries building will be as per national and international codes as applicable in specific cases and laid down by statutory authorities
- ✓ Provision of adequate access way for movement of equipment and personnel shall be kept.
- ✓ Minimum two no. of gates for escape during disaster shall be provided.
- ✓ System of fire hydrants comprising electrical motor division and diesel engine driver's fire pumps with electrical motor driver jokey pump for keeping the fire hydrant system properly pressurized and automatic water sprinkling system for all important transformers.
- ✓ Fire hydrants with fire hoses in all areas where fire can break.

7.4 ANTICIPATED NATURAL DISASTERS

Floods: The area is not prone to floods but however cloudbursts may cause floods & flashflood near the proposed site. Precautionary measures will be taken and in disaster management it will be considered to avoid the impending effects on the workers at the site if the disaster occurs.



Figure 7. 1 (A): FLOOD PRONE ZONE OF UTTARAKHAND

Source:UttrakhandStateDisasterManagementAuthority, Http://Usdma.Uk.Gov.In/

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Figure 7. 2 (B): Simulated Flood Depths with a return period of 100 Years

Source:UttrakhandStateDisasterManagementAuthority, <u>https://usdma.uk.gov.in/PDFFiles/Atlas_Vol3A_20190131.pdf</u> - Page 68

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Figure 7. 3(C): Flash flood hazard zones in Uttarakhand, based on simulated flood depths and velocities

Source:UttrakhandStateDisasterManagementAuthority, https://usdma.uk.gov.in/PDFFiles/Atlas_Vol3A_20190131.pdf - Page 69

Earthquake: The lease area falls in seismic zone IV [as per IS 1893 (Part-I): 2002].

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Figure 7. 4 (D): SOURCE: UTTRAKHAND STATE EARTHQUAKE ZONATION

Land slide: The area lies in low to moderate landslide zone as per the mapping shown here.



Figure 7. 5 (E) : Landslide Susceptibility Map of Uttarakhand State

Source:UttrakhandStateDisasterManagementAuthority,

https://usdma.uk.gov.in/PDFFiles/Atlas_Vol3A_20190131.pdf - Page 123

7.5 DISASTERMANAGEMENT:

At present Disaster Mitigation & Management Centre is working as autonomous institute under aegis of Department of Disaster Management Government of Uttarakhand and Disaster Mitigation and Management Centre (DMMC) is the apex center in the field of Disaster Mitigation & Management in Uttarakhand, to protection of the community and the environment from the over whelming obliteration caused by disasters. (Source: https://dmmc.uk.gov.in/).

- ✓ District Level Cell and State Level Cell are to take timely precautionary measures to avoid effects of impending disasters.
- ✓ The State Level Cell will be in continuous touch with State Govt. to pass on message like heavy rainfall etc. as received from IMD and take precautionary action to prevent any consequential disaster.
- ✓ A Nodal Officer at State Level Cell will be made in charge for the timely dissemination of the information & monitoring to the District Level Cells.
- ✓ "Disaster Warning System" as developed will be strictly implemented.
- ✓ Identification of nearby hospitals with route & contact number for emergency assistance.

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- ✓ Evacuation plan for the workers at site including contract labours will be developed in nearby shelters.
- ✓ "Emergency Helpline Number" will be displayed at all levels.
- ✓ Further, an additional/separate study on Risk management/Disaster management is suggested from competent third party for better stability of project stuctures on such areas and for specific management plan considering natural disasters in the region.

CHAPTER 8: PROJECT BENEFITS

8.1 INTRODUCTION

Municipal Solid waste processing facility project at Village: Kanchanpuri, Haldukhatta Malankham, Kotdwar, District - Pauri Garhwal (Uttarakhand) by Nagar Palika Parishad, Kotdwar will be established for Compost Plant – $43.2 \sim 43$ TPD [Planned for a design period of 20 years], Landfill capacity – 11,800 MT [As per present availability of land, now planned for a design period of 5 years]. In future, additional land will be acquired to increase the landfill for additional design period of 15 years.

8.2 BENEFITS OF LANDFILL

Landfills minimize the natural impact of solid waste on the environment by the following ways:-

- ✓ Complete Isolation of inert waste through containment
- ✓ Elimination of polluting conduits

8.3 RECYCLING

A number of recyclable materials, for example paper, glass, plastic, rubber, ferrous and non-ferrous metals present in the MSW are suitable for recovery and reuse. This will benefit rag pickers.

Plastic recycling

The following are the benefits of the recycling of waste plastics.

- Reduction in Greenhouse Gas Emissions
- Can increase the life our landfill sites
- Energy Conservation
- Beneficial Reuse
- Plastic Recycled Supply and Demand etc

Paper Recycling Benefits

- Energy conservation 60-70% energy savings over virgin paper production
- Resource conservation Recycled paper uses 55% less water and helps preserve our forests
- Pollution reduction, Recycled paper reduces water pollution by 35%, reduces air pollution by 74%, and eliminates many toxic pollutants
- Livelihood creation Recycling of waste paper creates more jobs

8.4 OTHER BENEFITS

Implementation of this project will have multiple benefits:

Benefit to the Urban Local Body: Due to implementation of this project, the ULB of Haldwani will comply with the Solid Waste Management Rules 2016, wherein it has been stated that the ULBs are responsible for scientific collection, transportation, segregation and disposal of municipal

solid waste within this limits.

- The waste dumping practiced as on date will be stopped and due to availability of this project, there will be scientific disposal of municipal solid waste, which will have overall positive impact in the environment
- Organised Collection of MSW: The systematic collection, transportation, segregation and disposal of the municipal wastes will lead to an organized, accountable and reliable mechanism of disposal of waste.
- Compost Facility: The segregated waste will have composting facility (to obtain composted fertilizer), Refuse Derived Fuel (as a source of alternative fuel from waste), which otherwise would have been wasted if dumped indiscriminately.
- Environmental Benefits: Regular monitoring of the surrounding will keep the area environmentally safe and under any adverse circumstance, immediate measures will be taken and enacted upon.
- The facility will be run and operated by professionally expert and organization having prior experience or organization having expertise for performing this activity, will lead to proper performance of the facility.
- The areas catered under this scheme will benefit from timely waste cleanup from the area/ vicinity/ locality, which otherwise, create unhygienic and filthy condition in the surrounding
- Spreading of diseases generated from the dump site of municipal solid waste will be reduced significantly, since the waste will be collected, transported and disposed of regularly and in scientific manner

S. No	Benefit Description	Qualitative Impacts and Underlying Assumptions	Comments
		Benefits to Individuals	
1	Improved working conditions and environment	Livelihoods would be improved and formalized Workers will have access to better infrastructure and safety equipment for waste collection. Appropriate training will be provided	The rag- pickers could be substituted as waste collectors
2	Improve workers morale	Instills a sense of recognition and dignity	Improved working efficiency

Table 8. 1: Benefits of the Project:

ITHC/PRJ/22-23/EIA/52/Rev.02

NAGAR NIGAM KOTDWAR

DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND

S. No	Benefit Description	Qualitative Impacts and Underlying Assumptions	Comments
			Assists in proper maintenance of infrastructure
3	Employment Opportunities	PPP model provides large infrastructure facilities which is a source of employment for several people (waste collectors, drivers, security guards, helpers etc)	New infrastructure facilities with multiple lines of processing, such as composting, sanitary landfill and RDF generation are proposed
		Benefits to society	
1	Easy access	Door-to-door collection to all households The collection and transportation of the MSW from various generators would be efficient	Door-to-door collection will be done in all localities For collection of MSW auto tippers and tricycles would be used
2	Coverage	MSW from all households and other generators will be collected, processed and disposed	Coverage would extend to all areas of the city, including residential, commercial and slum areas. The strategy integrates the complete chain of waste management such as collection, storage transportation, treatment and disposal
3	Service quality	Would be beneficial in the long term in terms of environmental and public health benefits.Sale of byproducts would ensure higher soil fertility (Compost) and electricity generation (RDF)	Enhanced MSW services in collection and transportation, as competent private operators would be rendering the services Enhanced MSW services as the processing facility and landfill facility would be operated by the private operator
4	Supply continuity	Management of MSW is a continuous process and when practiced would result in multiple benefits (reduction in odour, more hygienic road side condition, reduction in spread of diseases etc)	Collection, transportation, treatment and disposal of MSW would be carried out on a daily basis
5	Improved quality of life	Improved surroundings, cleaner environment and a lower spread of diseases	
6	Improved awareness and civic sense in people	Dissemination of information, education and communication among the general public	Training and awareness of people is essential part of MSW management
7	Cost and time savings	Time and cost saving would improve the efficiency of the system	Time has monetary value. Due to treatment and disposal of MSW in an area on the outskirts of the city, air pollution and ground water contamination would be prevented, resulting in indirect cost savings
		Benefits to environment	
1	Environmental Improvement	In the long run, lower pollution levels would ensure cleaner environment and improve the ambiance of the cluster	No dumping of waste on ground and open areas Covered waste handling, to prevent spreading of foul odour at collection points

ITHC/PRJ/22-23/EIA/52/Rev.02

S. No	Benefit Description	Qualitative Impacts and Underlying Assumptions	Comments
			No open burning of MSW
			Recycling of MSW
			Composting of biodegradable waste
			Development of Sanitary landfill RDF could be as a source of energy
2	Improvement in soil fertility		Composting provides the dual benefits of Generation of revenue for the system and restoring fertility to the soil Does not carry harmful chemicals.
3	Energy from RDF		Energy generation from waste
4	Pollution reduction	Based on 4R principle (Reduce, Reuse, Recycle and Recover)	
		Health and safety benefits	
1	Improved heath	Workers are trained in the appropriate techniques of waste handling Reduction in spread of diseases, lower emissions, improved ground water quality and soil fertility	Reduced exposure to waste Segregation of wastes and inspection prior to land filling will ensure that hazardous waste are not mixed with the MSW Elimination of road side disposal would reduce the health hazards caused due to open decomposition
2	Safety Measures	Implementation of the proposed strategy would result in safe disposal of MSW. Safety standards implemented at multiple levels, would result in safer working conditions for the waste collectors	Providing protective gear to waste collectors would prevent injuries when in contact with unsafe waste disposed

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CHAPTER 9 – ENVIRONMENTAL COST BENEFIT ANALYSIS

Not recommended in scoping Stage

CHAPTER 10 – ENVIRONMENTAL MANAGEMENT PLAN

10.1 INTRODUCTION

Environmental Management Plan (EMP) is a site specific plan developed to ensure that the project is implemented in an environmental sustainable manner. This EMP also describes the role and responsibilities of staff supervising the project, personnel deployed at the project site and contractors, if any, who will be responsible for implementing this EMP

EMP also ensures that the project implementation is carried out in accordance with the design by taking appropriate mitigation measures to reduce adverse environmental impacts during its life cycle. The EMP Environmental management plan can be effectively implemented to mitigate pollution levels by observing the measures like avoidance, source reduction, on site recycling, by product extraction, and offsite recycling as first choice followed by treatment, release and disposal.

The plan outlines existing and potential problems that may adversely impact the environment and recommends corrective measures where required. Also, the plan outlines roles and responsibility of the key personnel and contractors who are responsible to manage the project site.

The key benefits of the EMP are that it provides the organization with means of managing its environmental performance thereby allowing it to contribute to improved environmental quality. The other benefits include cost control and improved relations with the stake holders.

10.2 ENVIRONMENTALANDSOCIALMANAGEMENTCELL

For the effective and consistent functioning of the project, an Environmental Management Cell (EMC) will be established for the project. The major duties and responsibilities of Environmental Management Cell will be as follows

- ✓ 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.

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- \checkmark To minimize environmental impacts of operations as by strict compliance to the EMP.
- \checkmark To initiate environmental monitoring as per approved schedule.
- ✓ Review and interpretation of monitored results and corrective measures in case monitored results are above the specified limit.
- ✓ Maintain documentation of good environmental practices and applicable environmental laws as ready reference.
- ✓ Maintain environmental related records.

10.3 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 summarized in Table 11.2 below:-

Parameters	Particulars		
SolidWasteHandlinga	Dailyquantityofwastereceive		
nd Disposal	Dailyquantitysenttolandfill		
Wastewater	Dailyquantities oftreatedeffluentdisposed		
	Quantityandpointofusageoftreatedwastewater		
	Treatedwastewaterquality		
RegulatoryLicenses(E nvironmental)	EnvironmentalPermits/ConsentsfromStatePCB		
MonitoringandSurvey	Recordsofallmonitoringcarriedoutas perthe		
	finalizedmonitoringprotocol		
Accidentreporting	Dateandtimeoftheaccident		
	Sequenceofeventsleadingtoaccident		
	Chemical data she et as sessing effect of accident on health and environment		
	Emergencymeasuretaken		
	Steptopreventrecurrenceofsuchevents		
Others	Logbookofcompliance		
	Employee environmental, health and safety records		
	Equipmentinspection and calibration records, where applicable		
	Vehiclemaintenanceandinspectionrecords		

Table 10. 1 (A): Recordkeeping Details for the Propososed Project

10.4 ENVIRONMENTAL MANAGEMENT PLANF OR PROPOSED PROJECT

Although the impacts on the environment during the construction phase would be temporary in nature and are expected to culminate on completion of the construction activities, implementation of management plans for various environmental attributes will further reduce the impact in terms of its spread, duration and intensity.

Table 10. 2 (A) . ENVIRONMENTAL MANAGEMENT DIFFERENT PHASES

Description of Impacts		Magnitudeof Impact	MitigationMeasures Proposed	Responsibility Implementation
	DESIGNSTAGE	DESIGNSTAGE		
	Existence	Permanent/lo w	Layouthasbeenfinalizedgivingmaxim umclearancetotheadjacentdevelop ment.Highcompoundwallandgreen belt around the site havebeenprovidedtoformaphysicals eparationandvisual screentothedevelopment.	NagarNigam,Kot dwar
	Ground w atercontamination due tohighwatertablea tthesite.	Permanent/m edium	Design of the system finalizedtominimizegroundwatercon tamination. Design includes with leachatecollection, recirculation andtreatmentfacilities. Twotierleachatecollectionsystem(le achate collectionatthe bottom of the compost padand catch drain all around thesite) Highercapacityfortreatment planttoaccommodatetheshockload.	NagarNigam,Kot dwar
	Existenceofsurface watersource.Wate rqualitymaybeaffe ctedduetostorm water runoff	Permanent/lo w AGE	Designincludesdiversionofstorm water from other areasby providing diversion drains/channelallalongtheperiphery ofthesite.	NagarNigam,Kot dwar
Siltrunoff construction operations causingsoilerosi onand damageto waterquality/ad iacent land	from	Temporary/lo w	Sitepreparationtominimize clearance to adjoining vegetation and natural resources; Protection of unstable soil surface from high velocity runoffwith interception drains and stabilization; Proper siting and protection of construction materials:	Contractor

Description of Impacts		Magnitudeof Impact	MitigationMeasures Proposed	Responsibility Implementation
	Noise, dust or hazardous materials arisingfrom construction activity.	Temporary/ low	Plant and equipment employed in the construction will complywith environmental standards. Regular wetting of stock piles of sand, metals; Dust curtain will be provided to the construction site.	Contractor
	Water & land contamination due improper disposal ofwaste	Temporary / low	Proper sanitation facilities will be provided to the labour quarters/ settlement.	Contractor
	Contamination dueto indiscriminate disposal of spoil/silt	Temporary / low	Proper stock piling of silt/spoil at site;Examine thereuse opportunities for silt/ spoil; Identification of sitefor disposal of silt/ spoil; proper covering the disposal site on completion of work; Protection against pollutionduring transportation; and mainten ance of the transpo rtation vehicles	Contractor
	Exposure of workers tositeduringconstr uction	Temporary/m edium	Provision of appropriate protective gears (Gum boots, gloves, masks etc.); training to workers regarding the potential dangers and health effects and need for the use of protective gears	Contractor
			O&MSTAGE	
	Hazards to health and safety of workman	Permanent /low	Develop and implement Occupational Safety Plan for the workforce; provision of appropriate protective gears to the workers at the site; Training to the workers at site regarding the dangers including the potential health effects of waste.	O&M Contractor

Description of		Magnitudeof	MitigationMeasures	Responsibility
Impacts		Impact	Proposed	Implementation
	Fugitive Dust, loading& unloading	Temporary/lo w	Paving of roads inside the site; daily compacting, spreading and covering of incoming waste; select the working face to minimize the truck movement.	O&M Contractor

Table 10.3 (B): ProposedEnvironmentalMitigationMeasure

S.No.	Pollution	Pollution	Mitigation Measures		
	Source	Emitted			
		AirpollutionMitig	ationMeasures		
1.	Construction	SO2,NOX,	Dustsuppressionbywatersprinkling.		
	activities	Particulates, Odouretc	Bitumencovered internal roads.		
2.	Vehicular Movement		WheelWashingBayattheentrypoint.		
2			Vehicles carrying of construction materials andwastetobecovered with tarpaulin/plasticsheet		
3.	Loading and				
	unioaungorrucks		Proper ventilation and moisture in the compostplantandwindrowareatobemaintainedand herbalinsecticidestobesprayedaroundodourgenera		
4.	DGSet		tion areas at regular intervals.		
5.	Processing of waste		Secured landfill except the current waste handling area rest to be covered by polyethylene sheets		
			Green belt would be provided along the internalroads and plant boundary.		
		Water Pollution Mit	igation Measures		
6.	Domestic Waste	Suspended Solids,	Leachate Holding Tank and recirculation in		
7.	Leachatefrom Windrow	BOD etc.	composting piles.		
	Compost unit		ETP for recycling. Impermeable liner in the landfill nit		
8.	Leachatefrom		Storm water drainage system for collection and		
	landfill		recycling		
	Solid Waste Management				
9.	Construction	Construction	Recycled or used for filing/ levelling of low- lying		
		materialse.g. coarse	areas within the site or transported outside.		
		aggregate, fines			
		aggregate,bricks,			
		steel etc.			

NAGAR NIGAM KOTDWAR

DRAFT EIA REPORT FOR PROPOSED SOLID WASTE MANAGEMENT & DISPOSAL FACILITY BY NAGAR NIGAM KOTDWAR, DISTRICT- PAURI GARHWAL, UTTARAKHAND

S.No.	Pollution Source	Pollution Emitted	Mitigation Measures
10.	ETP sludge or evaporation pond	ETP sludge or evaporation pond settled particulates	Sanitary Landfilling

Table 10. 3 (C) : Odour, Litter & Insect Control Management Plan

S. NO.	ΙΜΡΑCΤ	MITIGATION
1.	Odour: Odour is one of the main concerns in vicinity to the proposed project. However, the impacts due to odour nuisance have been envisaged to be low as the designing of the facility has been planned in such a manner that the odour will be contained within the boundaries of the facility. Although the odour emanating from site is an inescapable problem, but the problem can be mitigated if proper measures are taken Offensive odors at landfill sites may emanate from a number of sources such as waste material which has decomposed significantly prior to land filling, leachate and small amount of landfill gas	 Waste storage & processing of waste is in a completely cover shed, this complete shed area is maintained under negative pressure by sucking odour gases so that the foul smell can't escape outside. Foul smelling gases like CH4 and H2S creates major impact if windrow operation is not done properly. To mitigate the Foul Odour emanating from the wastes, the windrows will be punctured beforehand so that foul smelling gases like CH4 and H2S get slowly released. This would reduce the intensity of foul smelling gases at the time of first turning. Spray of herbal sanitizers and inoculums will be done to remove odour. The compost facilities, roads, equipment and the surrounding area shall also be cleaned regularly to remove the odor generating wastes. The processed compost is stored in sheds so as to avoid attraction to birds and runoff due to rain or windblown entrainment of particles.
		Plantation will also help to get rid from foul smell.
2.	Litter: Poor litter control, both on and off site is particularly offensive to neighbours	Consideration of prevailing wind direction Strategically placed mobile screen close to the tipping area or on the nearest downwind crest. Etc
3.	Birds & insects: Birds are attached to the landfill site in large numbers mainly where site receive appreciable amounts of food wastes	Employment of good landfill practice Working in a small active areas Progressive prompt covering of waste

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S.NO.	Parameter	Location	Measurement	Frequency	
ConstructionPhase					
1.	Ambient air quality	Construction Site and the vicinity	Suspended Particulate Matter (SPM),Sulphur dioxide, Methane, Ammonia (24 hour average) and Carbon monoxide (1hour average)	Quarterly	
2.	Noise	Just outside landfillsiteonall4sidesan d at one locationawayfromthela ndfill	Soundlevel,Leq,(day time and nighttime)	Quarterly	
Operatio	onPhase				
1.	Ambientairqu ality	Atlandfill siteandatvicinity	SuspendedParticulateMatter (SPM,Sulphur dioxide,Methane, Ammonia(24houraverage)and Carbonmonoxide(1houraverage)	Half-yearly	
2.	Noise	Just outside landfillsiteonall4sidesan datonelocationawayfro mthesite.	Soundlevel,Leq,(day time and nighttime)	Half-yearly	

10.5 LEACHATE MANAGEMENT PLAN

The landfill facility essentially generates significant quantity of leachate due to biodegradation of the organic matter present in the waste body. The leachate is impregnated with harmful chemicals and pollutants. It is to be collected, removed from the landfill facility, re-circulated in the composting piles. Remaining if any, will be treated and recycled in green area or dust suppression measures within the premises.

10.6 OCCUPATIONAL HEALTH & SAFETY MANAGEMENT PLAN

The Occupation Health & Safety Management Plan (OHSMP) is applicable for all project operations which have the potential to adversely affect the health and safety of construction workers, MSW facility operators and other labours.

The Occupation Health & Safety Management Plan (OHSMP) have been formulated to address the occupational health and safety related impacts that may arise from proposed project activities particularly during waste handling and segregation, waste unloading, processing and disposal.

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10.6.1 MANAGEMENT MEASURES

- Providing workerswithappropriateprotectiveclothing,gloves,respiratoryfacemasksandslipresistantshoes for wastetransportworkersandhard-soledsafetyshoes forallworkers.
- Theworkplaceshallbeequippedwithfiredetectors, alarm systems and fire-fighting equipment. The equipment shall be periodically inspected and maintained ingood working condition.
- Providingadequatepersonnelfacilities, includingwashingareas and areastochangeclothes before and after work.
- > Alltheemployeesshallberequiredtoundergoamedicalcheck-upbeforejoiningthefacility.
- Firstaidfacilitiesrequiredtoattendimmediatelyformeetingemergencysituationsshallbemadeavailab le atthefacility.

10.6.2 COMMUNITY HEALTH & SAFETY MANAGEMENT PLAN

The Community Health & Safety Management Plan shall be applicable construction as well as operation phase to minimize adverse impacts on health and safety of nearby community.

10.6.3 MANAGEMENT MEASURES

Efforts will be made for best housekeeping practices within the project site, so that no water get accumulated in small depressions or low lying areas or within any empty tanks, containers, tyres or debris , which can become breeding areas for mosquitoes. To minimize odour generation from the facility, maximum efforts will be put in to maintain aerobic conditions in the windrows to facilitate decomposing of biodegradable waste in oxygen rich environment, thereby minimizing chances of production of odorous gases like methane, ammonia and hydrogen sulphide. Regular monitoring of ambient air quality and noise levels will be undertaken in and around the facility.

10.7 GREENBELTDEVELOPMENT

In order to arrest air-borne fugitive dust, a 3-5 m wide green belt shall be developed around the plant boundary which will consist of hardy, locally available plant species. An area of approx. 1965 sqm would be earmarked for development of greenbelt/greenery along the boundary, roads, and in open places available inside the facility. The green belt developed would help to capture the fugitive emissions,

Selection of Plant Species

Proposed additional green belt will be developed as per CPCB guidelines 2000. The species selection depends upon type of soil and local species with good survival rate. Evergreen, quick growing and native species have been selected /suggested for green belt development. Greenbelt has been already developed along most of the periphery of the project area as well as along roads for avenue plantation. Any tree that does not survive will be replaced. Ornamental trees will also be planted to

improve the aesthetic looks of the project area. The following characteristics have been taken into consideration while selecting plant species for green belt development and tree-

Criterion for Selection of Plant Species-

- 1- Fast Growing and native
- 2- Dense and shade providing
- 3- Capacity to endure water stress and climate extremes after initial establishment;
- 4- Larger leaf area

5- Perennial and evergreen.

Plantation Technique

Following Procedure will be adopted for plantation-

1- For tree plantation pits of size 1m3 with proper spacing will be made.

2- The pit should be filled with soil with 3:1:1 ratio of sand, silt and compost.

3- Nursery raised healthy saplings of 2–3 feet height of trees and shrubs will be purchased from local nursery and Forest Dept.

4-1 m diameter ring bund around the planted sapling for water retention will be constructed.

5- Provision for regular and liberal watering during the summer period during the commissioning stage of the plant will be arranged from the local available resources.

General Guideline for Green Belt Development- The general guidelines for development of greenbelt will be as follows:

- Trees growing up to 5 m or more will be planted along the plant premises and along the road sides.
- Planting of trees will be undertaken in rows.
- Open areas inside the plant boundary will be covered with grass.
- The spacing between the trees will be maintained slightly less than the normal spaces, so that the trees will grow vertically and slightly increase the effective height of the green belt.
- Since the trunks of the tall trees are generally devoid of foliage, it will be useful to have shrubs in front of the trees so as to give coverage to this portion
- Shrubs and trees will be planted in encircling rows around the project site.
- Trees should be planted along road sides, to arrest auto-exhaust and noise pollution.

S.No	CommonName	BotanicalName	Remark		
1	Bel	Aegle marmelos (L.)Corr.	Medicinal		
2	Chhal	Anogeissus latifolia	constructionagriculturalimplementstannin		
		(Roxb.exDC.)	blackdye		
3	Pipal	Ficusreligiosa	Medicinal & Deciduous inwinter		
4	Kachnar	Bauhinia variegata L.	Medicinal,		
			ConstructionfurnitureOrnamental&Decid		
			uousinwinter		
5	Amaltas	Cassia fistula L.	Medicinal, Barkfruitpulp		
6	Khair	Acacia catechu (L.f.)Willd.	Medicinal,Bark		
7	Kadam	Adina cordifolia	Medicinal,		
		(Roxb.)Hook.f.exBrandis	Constructionfurniture, Agriculturalimple		
			ments		
8	Semal	Bombax ceiba L.	Flowerbudsasvegetablesmedicinal		
9	Tooun	Toona ciliata M.Roem.	ConstructionfurnitureandDye		

Table 10. 5 (A) : PROPOSEDPLANTATIONSPECIES

10.8 EMP BUDGET

Table 10. 6(A): EMP BUDGET DURING OPERATION PHASE

SN	Particulars	Capitalcost (in lakhs)	Annual recurring cost (in lakhsperYear)
1	Environmental Pollution control	10	1.5
2	Storm water drainage and rainwater holding tank	27.05	2.0
2	Environment Monitoring	17.56	4.5
3	Occupational Heallth and Safety	1.1	0.5
4	Green Belt	7.5	1.94
	Total	62.11	10.44

The project proponent is committed in the development and welfare of local people. CERFund Allocation will be finalized based on the issues raised during public hearing.

CHAPTER 11 – SUMMARY AND CONCLUSION

11.1 INTRODUCTION

Kotdwar is a city, a municipal corporation and a tehsil in the Pauri Garhwal district of Uttarakhand, India. It is just 101 km from Pauri town, the district headquarter. It is the eighth largest city in Uttarakhand state.

Kotdwar ULB faces a number of challenges in upgrading solid waste management resulted from a number of factors such as its peculiar rural-urban continuum, pressure on land due to high density of population, and scarcity for landfill sites due to the spread of habitations. However, compared to peripheral areas of other urban centers in Uttarakhand, land holdings in the erstwhile Nigam areas of Kotdwar are comparatively higher.

The present study was aimed at identifying the potential environmental impacts due to the proposed Common Municipal Solid Waste Management Facility (CMSWMF) to be developed by the Nagar Nigam Kotdwar, at Kotdwar, District- Pauri Garhwal, Uttarakhand.In this study, the various activities likely to take place during the construction and operation phases of the project have been analyzed in relation to the baseline condition of different environmental components. The mitigation measures proposed have also been reviewed and the potential impacts discussed.

The project or activity is covered under category "B" of item 7(i), Common Municipal Solid Waste Management Facility of the schedule to EIA notification 2006 and its subsequent amendments and requires appraisal at state level. However, general condition is applicable due to the presence of Uttar Pradesh-Uttarakhand State border at a distance of 7 m approx. from proposed site. Accordingly, the project requires appraisal at Central level by the EAC.

11.2I DENTIFICATION OF PROJECT PROPONENT & PROJECT

Presently there is no processing and treatment of waste facilities in Kotdwar municipal area. All the wastes collected are openly dumped near Paniyali Lakdi Padao, located 4 km away from town.

Therefore, Kotdwar Nagar Nigam has planned to upgrade the present system to ensure safe collection of waste from sources to the extent possible, transportation of the same either directly or to the secondary storage and subsequent transportation from there for treatment and final disposal of rejects and inert wastes. The system is designed to manage 100 percent of the waste reaching the Municipal stream- daily removal of organic matter to treatment plant for processing and need based removal of inorganic and inert to landfill site and disposal by sanitary methods.

The management plan is designed for handling 80 TPD wastes including recyclable waste [design year upto 2039] generated in the Kotdwar ULB and considers that all wastes are handled at the local level through centralized model. A land of area 0.998 Ha has been selected for the SWM project at

Kanchan Puri, Haldukhatta Malankham, Kotdwar. Project facilities will include waste segregation, transportation, material recovery, composting and sanitary landfilling.

The Nagar Nigam has planned to establish a solid waste processing and disposal facility in accordance of the Solid Waste Management Rules, 2016 at the earliest. A Detailed Project Report (DPR) for ISWM in Kotdwar has been prepared by the Uttarakhand Urban Sector Development Agency (UUSDA), Uttarakhand based on Regional Level Concept for Kotdwar through EveryULB Technologies Pvt. Ltd.

Table 11. 1: PROJECT PROPONENT

Applicant	Authorize signatory
M/s Nagar NogamKotdwar	Mr. Kisan Singh Negi, Municipal Commissioner
Badrinath Marg, Kotdwar,	Nagar Palika Parishad,Kotdwara
Uttarakhand - 246 149	District Pauri Garhwal, Uttarakhand
Ph # 01382 222028	

11.3 NATURE, SIZE, LOCATION OF THE PROJECT

Proposed solid waste management facility site is proposed to be set up at Kanchanpuri Haldukhata, Kotdwar, Dist. Paui Garhwal, Uttarakhand. The site is located on south of Haridwar Road near Umraonahgar, Kotdwar and on the West bank of river Malin.The site is easily accessible from Haridwar Road through existing kuchha road [approx. 20 feet wide].The kuchha road of approx. length 250m will be strengthened by the Nagar Nigam.

Proposed site is an undeveloped forest land [0.998 Ha] transferred to Nagar Nigam Kotdwar with the approval of the Govt. of Uttarakhand. The land has been transferred to Nagar Nigam by Lansdowne Forest Division. Approval for Diversion of Forest Land is also obtained. The proposed site does not have any existing infrastructure. Projects site coordinates are given below -

Points Latitude		LONGITUDE		
A1 29°45'23.79"N		78°26'14.14"E		
A2	29°45'21.73"N	78°26'17.05"E		
A3	29°45'24.25"N	78°26'19.35"E		
A4	29°45'26.31"N	78°26'16.47"E		

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Site Connectivity: Kotdwar is a gateway city to the Garhwal region and is one of the main entrance points in the state of Uttarakhand. Jolly Grant International Airport, Dehradun is located at around 53 km [aerial distance] on NW. Kotdwar Railway Station is located at a distance of 8 km on East.

By road Kotdwar is 216 km North of Delhi, 120 km South of Dehradun, 208 km West of Nainital, 99 km East of Roorkee and well connected with roads to major destination of Uttarakhand state. Buses to Kotdwar from Delhi are easily available. Kotdwar is well connected with National Highway 119.

SN	Facility	Name of Facility	Distance from Project Site	Direction w.r.t. Project Site
1.	Roads	NH-119	8.1 km	SE
2.	Railway	Kotdwar Railway Station	8 km	E
3.	Airport	Jolly Grant International Airport, Dehradun	53 km	NW

Nearest Habitation: Nearby habitation is located at a distance of 150 m on north east of proposed site. The proposed site is located on the outskirt of Kotdwar city on south. Kotdwar town has a population of approx. 175,232as per Census 2011.

Industries:Sigaddi SIIDCU Industrial Area is located 4.8km NW of project Site and it has non-polluting industries such as Paramount Green, Baluni Engineering Limited, Wipro Limited, SimpexPharma Pvt. Ltd., Print Pack Industries and Kanak Biotech, Akums Health Care Limited, KMC electronics Pvt. Ltd. etc.

Particulars	Details		
Nature of the Project	Solid Waste Management Facility		
Project Type	New		
Components of the proposed facility	 Processing of organic part of solid waste and production of organic manure through Compost plant. Landfill for rejects and inert wastes 		
Size of the Project	 80 TPD including recyclable waste [design year 2039] 1) Compost Plant – 43.2 ~ 43 TPD [design year upto 2039] 2) Landfill capacity – 11,800 MT [as per present availability of land, now planned for a design period of 5 years]. Within next 1-2 years, the Nagar Nigam shall identify and establish another sanitary landfill site on non-forestry land with life expectancy of 25 years and develop the site within 5 years. 		
Land Area	0.998 Hectares [waste processing & sanitary landfill]		
Project site Location [Composting and landfill facility]	Kanchanpuri, Haldukhatta, Malankham, Kotdwar District - Pauri Garhwal, Uttarakhand		
Type of Land	Forest Land. Permission for diversion of forest land has been obtained.		
Land Ownership	Nagar Nigam Kotdwar		

Project Salient Features

EstimatedProjectCost	INR -1369.951 lakh		
WaterRequirement	Construction Phase- Approx. 2.5 KLD.		
	Operational Phase - Fresh water demand [approx. 11 KLD]		
	will be met through onsite borewell.		
	 Domestic consumption – 1 KLD [@45 lit/person]. 		
	 Washing/water sprinkling/green area demand – 10 KLD 		
ManpowerRequirement	During construction phase approx. 50 workers (skilled &		
	semi-skilled workers), rest will be outsourced based on need.		
	Estimated operational manpower requirement - 25.		
	No Housing facilities or colony will be provided. The workers		
	shall be employed from nearby areas.		
Nearest Town and Habitation	Kotdwar – the proposed site is located on the outskirt of		
	Kotdwar city on south.		
	Nearby habitation is located at a distance of 150 m on north		
	east of proposed site.		

11.4 ENVIRONMENTAL SETTING OF THE PROPOSED SITE

Eco-sensitive areas around the project site: Rajaji National Park is located at an approximate aerial distance of 12.3 km on NW. Certificate from Chief Conservator of Forests regarding this has been obtained.

S. No	Areas	Aerial distance (within 15 km) from Proposed Projectlocation boundary
1	Areasprotected under international conventions, national or local legislation for their ecological, lands cape, cultural or other related value	RajajiNationalParkislocatedatanapproximateaeri aldistanceof 12.3 km on NW.
2	Areaswhichareimportantorsensitiveforecolo gicalreasons- Wetlands,watercoursesorotherwaterbodies, coastalzone,biospheres,mountains, forests	Giwain RF -9.1 Km, NE Sukhrao RF - 7.9 Km, NE Sattikhal RF - 8.7 Km, NE Gwalgarh RF - 8.5 Km, NE Laldhang RF - 5.4 Km, NW Kotdwara RF -3.6 Km, N KotawaliRF-20 m,SW Girdawa Sahanpur RF - 6.1 Km, SW KauriyaRF-2.0Km,SE MohanwaliRF-8.6 Km,S North Kothari RF - 9.6 Km, SE South Kothari RF - 9.7 Km, SE Paniyal RF - 7.7 Km, NE Sukharao Kham RF - 5.2 Km, NE MalinkhamRF-1.6 Km,NE

S. No	Areas	Aerial distance (within 15 km) from Proposed Projectlocation boundary
3	Areas used by protected, important orsensitive species of flora or faunaforbreeding,nesting,foraging,resting,ov erwintering, migration	Nil
4	Inland, coastal, marine undergroundwaters	Malin Nadi - 480 M on East SukhRaoNadi-4.8km,East Khoh Nadi-9.8 Km, SE
5	State, National boundaries	UP-Uttrakhandstate boundary–7 m,SW
6	Routes or facilities used by the publicforaccesstorecreationorothertourist,pi lgrim areas	HaridwarRoad–160 m, N Kotdwara-Laldhang/NH-119/Meerut-PauriRoad (534)– 8.1 kmSE
7	Defenceinstallations	Notwithin 15km of theproject site
8	Denselypopulated or built-up area	Kotdwartown- populationapprox.175,232.asperCensus2011.
9	Areasoccupiedbysensitiveman- madelanduses	Therearesomesensitiveman- madehospitals,schools, college within study area however somenearbyare as follows: GovernmentHospital-2.6 Km N Dr. Arun Rawat Hospital, Devi Rd-1.9 KmNE HospitalJhandichaur-3.4 Km,NW GovernmentPolytechnic Kotdwar -500M,N NavyugPublicSchool-2 Km, NE BalBhartiSchool -1.7Km,NE GovernmentGirls College-3.2 Km, E KanwashramTemple -4.5 Km,NE Durgaand shivmandir-1KM, N ShriSiddhbali Dham, Kotdwar-9.8 Km, NE GarhwalCinema-7.8Km,E
10.	Areascontainingimportant, highquality or scarce resources	Adjacentlandsareforestlands.
11	Areas already subjected to pollutionorenvironmentaldamage	Nothingspecific
12	Areassusceptibletonatural hazard which could cause the project to presenten vironmental pro blems	TheareafallsinZoneIV, accordingtotheIndianstand ardseismicZoningmap. ThesiteislocatedbeyondtheHFLzoneofMalinRiver.

11.5 POPULATION PROJECTION AND WASTE GENERATION IN KOTDWAR

Arithmetic projection was preferred method due to its old town and saturated population and the same was adapted for the design purpose. The average state growth rate (19.17%) is adopted for the population projection and the design purpose.

HorizonY	Arithmeticinc	Difference	NetArithmeti	Floatingpopu	PerCapit	Daily	Annual
ear	rease	inpopulation	с	lation	a,	wastegenera	wasteGenerati
	method	2011	Increase		gm/day	tion	on
2011	33035	102565	135600	20340	300	41.3	15070.9
2012	33981	103511	137492	20624	300	41.9	15324.0
2013	34927	104457	139385	20908	300	42.4	15534.9
2014	35874	105404	141277	21192	300	43.0	15745.8
2015	36820	106350	143170	21475	300	43.6	15956.7
2016	37766	107296	145062	21759	300	44.2	16211.8
2017	38712	108242	146955	22043	304	45.4	16609.5
2018	39659	109189	148847	22327	308	46.6	17058.9
2019	40605	110135	150740	22611	313	47.9	17517.7
2020	41551	111081	152632	22895	317	49.1	18035.1
2021	42497	112027	154525	23179	322	50.4	18463.9
2022	43444	112974	156417	23463	326	51.8	18951.6
2023	44390	113920	158310	23746	331	53.1	19449.5
2024	45336	114866	160202	24030	335	54.5	20012.1
2025	46282	115812	162095	24314	340	55.9	20476.0
2026	47228	116759	163987	24598	345	57.4	21005.1
2027	48175	117705	165879	24882	350	58.9	21544.9
2028	49121	118651	167772	25166	355	60.4	22156.2
2029	50067	119597	169664	25450	359	61.9	22657.9
2030	51013	120543	171557	25734	364	63.5	23231.3
2031	51960	121490	173449	26017	370	65.1	23816.4
2032	52906	122436	175342	26301	375	66.7	24480.1
2033	53852	123382	177234	26585	380	68.4	25022.3
2034	54798	124328	179127	26869	385	70.1	25643.6
2035	55745	125275	181019	27153	391	71.8	26277.3
2036	56691	126221	182912	27437	396	73.6	26997.3
2037	57637	127167	184804	27721	402	75.4	27583.1
2038	58583	128113	186697	28004	407	77.2	28255.7
2039	59530	129060	188589	28288	413	79.1	28941.7
2040	60476	130006	190482	28572	419	81.0	29722.4
2041	61422	130952	192374	28856	425	82.9	30355.0

11.6 CURRENT SCENARIO OF MUNICIPAL SOLID WASTE MANAGEMENT

The Nagar Nigam Kotdwar has currently 237 workers including 46 permanent safai karamchari and remaining are Muhalla samiti excluding 16 drivers and rest are outsourced as per requirement. Currently some extent of source segregation is done, ULB has distributed 2 colour coded dustbins to most households. Collection is also done from inaccessible wards and narrow streets in handcarts which ultimately transferred to secondary collection vehicle and secondary storage community bins on daily or alternate days. Street sweeping is done daily and drain cleaning is done twice a week. Secondary bin is cleaned at least once in daily or when its full whichever is earlier.

Present Disposal – In absence of the composting and sanitary landfill facility in Kotdwar municipal area, all wastes collected are openly dumped near Paniyali Lakdi Padao which is located 4 km away from town.Dry waste is processed in the compactor machine at the dumping site although some fraction of plastic bottles and recycles items are sold to the recyclers. Currently there is no transfer station in Nagar Nigam, the collected waste is directly transferred to Paniyali lakdi padao where manual material recovery is being done and remaining wastes are openly dumped.

11.7 BIOMINING OF THE EXISTING SOLID WASTE DUMPSITE

As per the provisions of the Solid Waste Managemnt Rules, 2016, Kotdwar Nagar Nigam has already taken steps to clear the existing wastes. Biomining work at the existing wastes dumping site at Ladki Padao was started in July 2021 through the agency named M/s Ecostane Infra Pvt Limited, Uttar Pradesh. Now processing has completed and RDF disposal is under progress. As estimated approx. 32000 MT of wastes have been processed.

Centralized material recovery facility has been already established at the existing site which will continue to operate in future as planned. The site will also have sanitary waste like diapers and sanitary napkin waste storage and processing facility near centralized MRF facility. After establishing the proposed Integrated Solid Waste Management Facility at Kanchanpuri, closure of the dumping of solid wsates at existing site will be done.

11.8 DESCRIPTION OF PROPOSED PROJECT

The project consists of:

- Segregation and storage of Wastes [3 bin system]
- Primary 3 bins door to door collection system
- Secondary Storage cum mini material recovery facility [Small Transfer Station]
- Secondary Collection & Transportation System
- > Centralized Material Recovery Facility at Lakdi Padao
- Sanitary Waste Storage and Processing Plant at Lakdi Padao

> Integrated Solid Waste Management Facility at Kanchan Puri, Kotdwar.

The proposed common solid waste management facility will have following components -

- 7) Processing of Organic Waste through Windrow Composting
- 8) Processing of Recyclable Materials from Mixed Dry Wastes
- 9) Sanitary Landfill for Rejects from processing and Inerts Wates
- The primary segregated waste will be bought into tipping area and further segregated into various recycling steams (into 12 types) which will be in turn sold to nearest "Recyclers / local Kabadiwala" weekly.
- Conveyor belt with trommel system will be given of capacity 80 TPD to cater to pre-compost conversion to take out the minor size inorganic items and for easy sorting into various recycling streams. Containers will be provided to store the segregated inorganic materials to be further sold to local recyclers. The selling can be done week wise in a designated day and ULB should register the Kabadiwalas/ rag pickers for including them in the disposal of these inorganic / recyclable items.
- Step wise landfill will be provided to inert and reject wastes. The ULB will acquire additional land to cater the 30 year design period.

Associated Activities -The associated major utilities and services which will be required for proper functioning of the proposed solid waste management facility are:

- Raw Water System [Pipeline, reservoir, pump]
- DG sets [capacity 150 KVA] to be used as small emergency back up during power cut only.
- Leachate collection, recirculation and treatment unit
- Storm water drainage system
- Fire Fighting System

TREATMENT PLANT FOR LEACHATE AND LIQUID WASTE -

The leachate generated form landfill site will be collected through leachate collection system and will be recycled in composting piles. Leachate recirculation could speed up composting activity and reduce fresh water demand. Remaining leachate if any, will be is treated using physical and biological processes to obtain required level of quality and reused in green area and dust suppression within the premises.

Sewage from toilet will be disposed through septic tank followed by soak pit. Vehicle washing effluent and leachate will be reused in composting.

11.9 LANDFILL CLOSURE PLAN:

At the end of life of the proposed sanitary landfill, it will be properly capped, closed as per the povisions of the Solid Waste Management Rules and green cover will be established. The land will be returned to the Forest Department.

Phase closure: After the last set of cells of a phase are placed (on the highest lift), the final cover is constructed. If another phase is to be placed over the just completed phase, an intermediate cover is provided. However, if the completed phase has reached final height of the landfill, then final cover system and surface water drainage system are provided.

11.10 POST CLOSURE STABILIZATION, OPERATION & CARE

If the landfill cover is intended to be used for a specific purpose e.g. park or golf course or vehicle parking area, then the cover shall be stabilized to achieve the end use. However, if no specific end – use is envisaged, then long – term vegetative stabilization will be undertaken to return the land to its original and natural vegetative landform.

11.11 BASELINEMONITORINGSTATUS

Study area of 10 Km radius around the project site has been identified to establish the present environmental conditions for the above environmental components. The generation of primary data as well as collection of secondary data and information from the site and surroundings was carried out during summer season i.e. March 2022 to May 2022. The various environmental components which are thoroughly studied during the study period include:

- WaterEnvironment(surfaceandgroundwater)
- AirEnvironment
- NoiseEnvironment
- BiologicalEnvironment
- Socio-EconomicEnvironment

The metrological data is collected from the IMD station at Najibabad and the pre dominant wind direction recorded is from West (W) to East (E).

Ambient Air Quality

Ambient air sampling were done at six [6] different locationsselected in downwind, cross wind and up wind of the proposed site. The monitored parameters (PM10, PM2.5, SO2, NO2,) are within the permissible limits as per NAAQS, 2009 during the study period.

Water Quality

Water samples from bore-well/tube-well and pond/canal were collected from 6 nearby locations, and analyzed for basic physico-chemical parameters and coliform count. One grab sample was taken from each location for analysis during the study period. The parameters were found well within the permissible limit as per IS 10500: 2012. The groundwater quality of villages around the study area is

fit for drinking. Surface water of the study area falls under class-B (Outdoor bathing (Organised)) as per CPCB water Quality criteria. The surface water quality of the streams is fit for drinking after conventional treatment.

Ambient Noise

Baseline Ambient noise level monitoring was carried out at 8 locations around the site where human habitations are present. The noise level was meeting the national standards in project site. However, in all other locations it exceeded marginally.

Soil Quality

The soil samples collected from in 8 locations. Soils of study area are sandy loam by nature. The soils of study area are fit for cultivation. The soil is sandy clay in nature

Biological Environment

There are fifteen [15] reserve forests in 10 km of the study area. There are no wildlife sanctuaries, national parks, Biosphere reserves or migratory corridor of any sensitive species in the study area. The biological environment in the surrounding of the study area is dominated by grasses with tree, herbs& Shrub species, All the species reported from core zone are common and generally found in wide variety of habitat of the study area. No endemic/endangered sp. were recorded from core area of the project site.

Apart from that there is no Biosphere reserve, National Park, Wildlife sanctuary, Tiger Reserve or Elephant reserve are reported within 10 Km radius of project site and project area is also devoid of any breeding and nesting ground of any faunal species. So it can be stated that proposed project and associated activities will not influence biodiversity of the area.

As per LULC map of the study area, 63 % of the land of the study area comprises of Hilly area with vegetation.

Socio – economic Environment

Total population of the study area is 163967 persons. Out of which 81239 are male and 82728 are female. SC total population is 21899 out of which 11172 are male and 10727 are female. The analysis of the literacy levels is done in the study area. Literacy in any region is key for socio-economic progress and the Indian literacy rate grew to 79.63% in 2011.

There will be no significant increase in overall population of the study area as preferably local people will be recruited for employment.

11.12 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Impacts during Construction Phase

Construction phase works include site clearance, site formation, excavation, material handling, building works, infrastructure provision and any other infrastructure activities. The impacts due to construction activities are short term and limited to the construction phase only. The impacts will be mainly on air quality, water quality and soil quality.

Impacts during Operation Phase

Impacts on Air Quality -During operation phase, the sources of fugitive dust are due to movement of garbage laden vehicle to and fro to the processing site. The unloading of garbage trucks and tractors release suspended particulates. Also the DG set of 150 KVA as emergency power back up will emit emission occasionally. The impact of DG emission was assessed and predicted MGLC using mathematical modeling is 0.01 μ g/m³for PM₁₀, 0.006 μ g /m³ forPM_{2.5}, 0.041 μ g /m³ for SO₂ and 0.166 μ g/m³ for NOx as NO₂. Baseline maximum concentration is 92 μ g/m³ for PM10, 9.2 μ g /m³ for SO₂ and 14.2 μ g/m³ for NO_x. The maximum GLC values are occurring at towards the East direction. The pollution load contribution to the environment is negligible considering the existing background level concentration.

Controlled passive venting system will be provided at the landfill to manage the gases generated from the landfill.

Noise Environment -Theoperation phase involvesmachinery and equipment which would generate noise substantially. Intermittent source of noise shallbe movement of vehicles used during the operation activities. Proper enclosures and noise shields will be used for reduction in noise levels. Also, since the project site is sufficiently away from habitation, there will not be any significant increase in the impact of the noise generated from the site. However, impact due to noise pollution can be minimized by ensuring that no noise generating activity is carried out during night hours.

Water Environment - The total water requirement of the project will be sourced through onsite ground water abstraction. Necessary permission will be obtained. The are fall in the safe zone as per CGWB.

The possible source of the ground water contamination will be leachate discharge from landfill site and compost plant. The leaching can be controlled by construction of impervious layer in landfill site and compost plant. The impacts on ground water will be negligible due to the appropriate planning of the plant design. A final cover system at the top of the landfill to enhance surface drainage, prevent water infiltration and also to support surface vegetation.

A leachate collection and control facility will be established to collect leachate from within and from the base of the Sanitary Landfill and then recirculate/ treat the leachate in composting facility.Remaining, if any will be treated and reused in green area or dust suppression.

Separate drainage system will be designed for management of storm water run off. Storm water will be collected and reused in composting, vehicle washing during monsoon season.

Land Environment - The project site is part of forest land and construction of MSW management facility will change the land use. Green Cover of land will be enhanced leading to ecological and enhanced aesthical impact which will also act as pollution barrier. The entire operational area shall be well paved and thus there will be no leaching of any substances in case of spills.

Biological Environment - Major impacts on terrestrial ecology due to air, water and noise pollution caused by site activities, vehicular movement, wastewater and waste handling. The project operations will be carried out in a systematic manner as to minimize any disturbance of Ecological and biodiversity of the area Development of a planation with varied variety of trees and shrubs would have a positive impact.

Socio-Economic Environment - The improvement in the social condition of the surrounding will be observed soon after the implementation of the integrated municipal waste-processing complex.

- Improvement in the social condition through Employment
- Improvement in the state of living standards of the waste-pickers and their family.

Social acceptance of the MSW management facility will be the major issue because of aesthetic sense and foul smell in surrounding areas. But the project proponent will take care of these issues and implement adequate mitigation measures to maintain the aesthetic sense of the area.

11.13 SITE SELECTION AND ALTERNATIVE SITE ANALYSIS

One of the major constraints in identifying sanitary landfill site was its availability in near vicinity of project city as otherwise proposing a site far away from the city would increase the Operation and Maintenance cost for the improved MSW management system. Kotdwar Nagar Nigam has identified 3 alternative sites including the proposed site at Kanchanpuri. The selection of landfill site was carried out based upon various selection criteriaas per the MSW manual and finally the site at Kanchanpuri was selected. The reason behind selecting the Site at Kanchanpuri, Haldukhatta Malankham, Kotdwar as against their alternative sites are given below:

- ✓ River located at a safe distance of 480 m from the Kanchanpuri site;
- ✓ No public park is located nearby;
- ✓ Proximity and availability of access from Haridwar road;
- ✓ No vehicular access road available at present for SIDCUL site;
- \checkmark Site near Khoh River is located very near to the river and in the flood plain.
- ✓ Kanchanpuri site has been already transferred by the Forest Dept. to the Nagar Nigam and duly approved by the Govt. of Uttarakhand and MoEF&CC, Dehradun RO.

11.14 ENVIRONMENTAL MONITORING PLAN

Arrangements will be made for regular site inspections by in house audit team and the independent engineer. Regular risk assessments of the operational procedure will be under taken to continue safe and efficient operations. An environmental monitoring plan is suggested to monitor environmental parameters during designing phase, construction phase and operation phase of the project.

OPERATION MONITORING FOR LANDFILL

Regular monitoring of the various components of the physical environment is planned during the operational period of the facility. It is proposed to undertake the following monitoring as a part of the normal operations of the facility.

- ✓ Leachatequantityandquality.
- ✓ Surfacewaterqualitybothupanddown-streamofthefacilityforimportantparameters.
- ✓ Groundwaterqualityinsurroundingareasofthefacilityandinnearbyvillagecommonwatersupplybore s.
- ✓ AmbientAirqualitywithinandimmediatelysurroundingareasofthesite.
- ✓ Stabilityoffinalcover

PUBLIC HEALTH MONITORING

A two-stage health-monitoring program is proposed.

- ✓ Monitor the health of workers within the project site to identify adverse health effects, and
- ✓ By organizing health camps on a regular basis.

POST CLOSURE MONITORING

Post-closure monitoring of the landfill will be done primarily as a compliance requirement in addition to social responsibility. The frequency of monitoring may be varied from time to time depending on changing circumstances. There is a need for the post-closure monitoring of air quality, noise or visual effects during the post closure period however this need will be reviewed periodically and should any aspects warrant further monitoring they will be included in the program

11.15 DISASTER MANAGEMENT PLAN

The main occupational hazard likely to occur can be fire, gaseous discharges and noise. Fire protection systems will be provided and approval will be obtained.

To prevent disaster due to fire, oil spillage, electrocution and other accidents following preventive measures shall be adopted.

- ✓ Provision of adequate access way for movement of equipment and personnel shall be kept.
- ✓ Minimum two no. of gates for escape during disaster shall be provided.
- ✓ Adequate fire fighting system as per approval obtained from the Fire Department.

ANTICIPATED NATURAL DISASTERS

Floods: The area is not prone to floods but however cloudbursts may cause floods & flashflood near the proposed site. Precautionary measures will be taken and in disaster management it will be considered to avoid the impending effects on the workers at the site if the disaster occurs. **Earthquake**: The area falls in seismic zone IV [as per IS 1893 (Part-I): 2002]. **Land slide**: The area lies in low to moderate landslide zone.

11.16 ENVIRONMENT MANAGEMENT PLAN

For the effective and consistent functioning of the project, an Environmental Management Cell (EMC) will be established for the project. The Environmental Management Plan (EMP) is required to ensure a sustainable development of the plant area and the surrounding areas of the plant. Total estimated capital investment for the proposed facility is 1369.951 lakh INR. The environmental management plan capital cost has been allocated as INR 62.11. lakh and annual recurring expenditure during the stage of operation is estimated as INR 10.44 lakhs.

11.17 GREEN BELT DEVELOPMENT

An area of approx. 1965 sqm [33.5%] has been earmarked for development of greenbelt along the boundary, roads, and in open places available inside the facility. As planned, a 3 - 5 m wide green belt with approx. 600 trees shall be developed around the plant boundary which will consist of hardy, locally available plant species.

11.18 OCCUPATIONAL SAFETY AND HEALTH MANAGEMENT

Safe working environment is essential for proper operation of the landfill site and due safety in work would be taken by all concerned. Measures will be followed to cover safety and health aspects within the landfill to prevent and reduce accidents and occupational diseases among workers. The following points recommended on safety aspects will be implemented by the authorities:

- Providing workers with appropriate protective clothing, gloves, respiratory face masks and slipresistant shoes for waste transport workers and hard-soled safety shoes for all workers.
- The workplace shall be equipped with fire detectors, alarm systems and fire-fighting equipment. The equipment shall be periodically inspected and maintained in good working condition.
- Providing adequate personnel facilities, including washing areas and areas to change clothes before and after work.
- > All the employees shall be required to undergo a medical check-up before joining the facility.
- First aid facilities shall be made available at the facility.

11.19 PROJECT BENEFITS

The contribution of the proposed project on local social infrastructure is expected to be significant. This Project will provide a significant amount of direct and indirect employment opportunities to the local people. From the proposed project the major benefits, include improving the degraded environment by establishing an Integrated Solid Waste Management Facilities. Also, a number of recyclable materials, for example paper, glass, plastic, rubber, ferrous and non-ferrous metals present in the MSW are suitable for recovery and reuse which will be beneficial for environment by conserving resources. This will also improve ecomic condition of rag pickers and recycling units.

11.20 CONCLUSION

The EIA study has made an overall assessment of the potential environmental impacts likely to arise from the proposed Integrated Solid waste Management Facility. All possible environment aspects have been adequately assessed and necessary control measures have been formulated to meet statutory requirements. Thus implementing this project will not have any appreciable negative impacts.

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