ENVIRONMENTAL IMPACT ASSESSMENT
AND
ENVIRONMENTAL MANAGEMENT PLAN
FOR
ENVIRONMENTAL CLERANCE
OF
Bailadila Iron Ore Deposit-4

"Bailadila Iron Ore Deposit-4 Mine (M.L. Area = 646.596 Ha) with a production capacity of 7.0 MTPA ROM Iron ore and 6.41 MTPA Waste Excavation (Total Excavation 13.41 MTPA) along with 2000 TPH Crushing plant inside mining lease area located in Bailadila reserve forest, Tehsil Bade Bacheli, District South Bastar Dantewada, State Chhattisgarh of M/s. NMDC – CMDC Limited (NCL)."

Is Interlinked With

"Screening Cum Beneficiation Plant (750 TPH of 4 lines each) along with 2200 TPH Downhill Conveyor and Loading Facilities in 100.077 Ha. Forest area and 22.4658 ha. Revenue land(Govt., Private and Bade Jhad Ke Jungle) located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village; Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh of M/s. NMDC-CMDC Limited (NCL)."

ToR of Non Coal Mining : F. No.- IA-J-11015/104/2021-IA-II(NCM) dated 11.03.2022 and

ToR of Mineral Beneficiation: F. No. IA-J-11011/23/2022-IA-II(IND-I) dated 21.02.2022

Date of Public Hearing : 12.09.2023

Baseline Data Collection Period: 1st March-2022 to 31st May-2022

NMDC – CMDC LIMITED

Greens Villey City, Housing Board Colony, Boriyakala, Raipur, Chhattisgarh—492 015, Phone No. 0771– 2971919

Prepared by :

ecoMen

Ecomen Laboratories Pvt. Ltd.,

Accredited by QCI/NABET Certificate No. **NABET/EIA/2023/RA 0203 (Rev 01)**, valid till March 22, 2025

(An approved Laboratory from NABL Certificate No.TC-7587 & MoEF&CC)

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NMDC-CMDC LIMITED

(A Subsidiary of NMDC Ltd.)

Regd. Off : Greens Villey City, Housing Board Colony, Boriyakala,
Sejbahar, Raipur 492015 (C.G.) Tel: 0771-2971919, Fax : 0771-2971920

NCL

CIN : U13100CT2008GOI020711

E-mail : ceonmdccmdc@gmail.com

Ref. No. NCL/HO/Dep-4/Env/2024/1424 **Date: 23.01.2024**

UNDERTAKING BY PROJECT PROPONENT

I, Padmanabh Naik, Chief Executive Officer of M/s NMDC - CMDC Ltd., hereby give this undertaking to the effect that the conditions laid down in the Terms of Reference (TORs) issued by Ministry of Environment, Forest & Climate Change (MoEF&CC), GoI, vide Letter no. IA-J-11015/104/2021-IA-II (NCM), dated 11/03/22 and Letter no. IA-J-11011/23/2022-IA-II (IND-I), dated 21/02/22 for "Bailadila Iron Ore Deposit-4 Mine (M.L. area 646.596 Ha) with a production capacity of 7.00 MTPA ROM Iron Ore and 6.41 MTPA Waste Excavation (Total Excavation 13.41 MTPA) along with 2000 TPH Crushing plant inside lease area" and "Screening Cum Beneficiation Plant (750 TPH of 4 lines each) along with 2200 TPH Downhill Conveyor and Loading Facilities in 122.5428 Ha area located at outside the Mining Lease area of Bailadila Iron Ore Project, Deposit-4" at village Bhansi, Tehsil Bade Bacheli, District - South Bastar, Dantewada, Chhattisgarh for NMDC - CMDC Ltd. have been complied with and presented in the EIA / EMP report.

It may be noted that as per one of the conditions of the TOR Letter no: IA-J-11011/23/2022-IA-II (IND-I), dated 21/02/22, scheme of dry disposal of Iron Ore Tailings has been incorporated in the Screening Cum Beneficiation Plant and because of this the area required for Screening Cum Beneficiation Plant is decreased from 195.537 Ha (Forest area of 100.077 Ha and 95.46 Ha of revenue land) to 122.5428 Ha (Forest area of 100.077 Ha. and 22.4658 Ha. comprising of Govt. revenue land, Private revenue land & revenue forest land – Bade Jha Ke Jungle).

The information and data submitted is factually correct and M/s NMDC - CMDC Ltd. owns the contents of the report.

Place: Raipur
Date: 23/01/2024

P. Naik 23/1/24

(Padmanabh Naik)
Chief Executive Officer
NMDC – CMDC Ltd.

ECOMEN LABORATORIES PVT. LTD.
Second Floor Hall, House No. B-1/8, Sector-H, Aliganj, Lucknow - 226 024
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E-mail: contactus@ecomen.in, Website: www.ecomen.in, CIN - U74210UP1989PTC010601,GSTIN : 09AAACE6076H1ZI
An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi

Date:23.01.2024

UNDERTAKING BY CONSULTANT

We hereby certify that the contents (Information & Data) given in the ""Bailadila Iron Ore Deposit-4 Mine (M.L. Area = 646.596 Ha) with a production capacity of 7.0 MTPA ROM Iron ore and 6.41 MTPA Waste Excavation (Total Excavation 13.41 MTPA) along with 2000 TPH Crushing plant inside mining lease area located in Bailadila reserve forest, Tehsil Bade Bacheli, District South Bastar Dantewada, State Chhattisgarh of M/s. NMDC – CMDC Limited (NCL)."

Is Interlinked With

"Screening Cum Beneficiation Plant (750 TPH of 4 lines each) along with 2200 TPH Downhill Conveyor and Loading Facilities in 100.077 Ha. Forest area and 22.4658 ha. Revenue land(Govt., Private and Bade Jhad Ke Jungle) located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village; Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh of M/s. NMDC-CMDC Limited (NCL)." are correct & Based on the information provided by Project Proponent.

***for* Ecomen Laboratories Pvt. Ltd.**

(B. P. Pandey)
Chairman & CEO

DISCLOSURE OF CONSULTANT

Declaration by Experts contributing to the EIA/EMP of "Bailadila Iron Ore Deposit-4 Mine (M.L. Area = 646.596 Ha) with a production capacity of 7.0 MTPA ROM Iron ore and 6.41 MTPA Waste Excavation (Total Excavation 13.41 MTPA) along with 2000 TPH Crushing plant inside mining lease area located in Bailadila reserve forest, Tehsil Bade Bacheli, District South Bastar Dantewada, State Chhattisgarh of M/s. NMDC – CMDC Limited (NCL)."

Is Interlinked With

"Screening Cum Beneficiation Plant (750 TPH of 4 lines each) along with 2200 TPH Downhill Conveyor and Loading Facilities in 100.077 Ha. Forest area and 22.4658 ha. Revenue land(Govt., Private and Bade Jhad Ke Jungle) located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village; Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh of M/s. NMDC-CMDC Limited (NCL)."

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

EIA coordinator: Dr Binay Prakash Pandey

Signature:  **Date:** 17.01.2024

Period of involvement: February, 2022-January, 2024

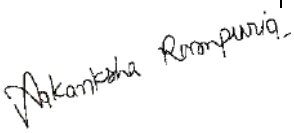
Contact information: Ecomen Laboratories Pvt. Ltd.,

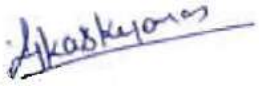
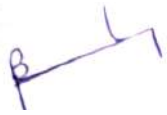
B – 1/8, 2nd Floor, Sector-H, Aliganj,

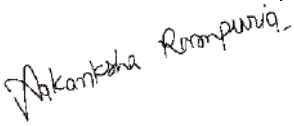
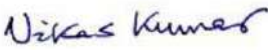
Lucknow – 226024, Uttar Pradesh, India

Mob. No.- 9335947470

Functional area experts:

S. No.	Functional areas	Name of the expert/s	Involvement (Period and task**)	Signature and date
1	AP*	Dr. Shailendra Kumar Singh	February, 2022-June, 2023 Identification of Locations, interpretation of data wrt to standard, statistical analysis compilation etc.	
		Mr Abhishek Singh		
		Mr Manish Shukla		
2	WP*	Ms. Akansha Rampuria	February, 2022-June, 2023 Identification of Locations, interpretation of data wrt to standard, Compilation of report	
		Mr Rajneesh		
3	SHW*	Mr. B. P. Pandey	February, 2022-June, 2023 Identification of waste generation management & mitigation measures etc.	
		Mr. Rajneesh		
		Ms. Anuradha Srivastava (T.M.)		

4	SE	Mr. Vikas Jaiswal	February, 2022-June, 2023 Group discussion, designing of questionnaire, data analysis and interpretation	
5	EB*	Dr. Umendra Sharma, IFS(Retd)	February, 2022-June, 2023 Conducted ecological survey, assessment of impacts, prepared report and compilation etc.	
		Dr. Ashish K Mishra (Assisted to FAE)		
6	HG*	Mr. B. P. Pandey	February, 2022-June, 2023 Hydrogeology of the study area including status, water level of ground water of the area & possibility of recharge rain water harvesting etc.	
		Mr. Aman Dixit		
7	GEO*	Mr. B. P. Pandey	February, 2022-June, 2023 Geological features & formations, topography & Lithology of the 10 km radius area and lease area	
		Mr. Aman Dixit		
8	SC*	Ms. Reena Tripathi	February, 2022-May, 2023 Identification of	

		Mr. Abhishek Singh (T.M.)	Locations, interpretation of data report quality, Compilation of report	
9	AQ*	Ms. Akansha Rampuria	February, 2022-June, 2023 Prediction of GLC by using AERMOD model etc.	
		Mr. Rajneesh		
10	NV	Dr Vikas Kumar	February, 2022-June, 2023 Identification of locations, Data Interpretation (Leq), Compilations of report including impact assessment, vibration & impact etc.	
		Dr. M. K. Jain	November, 2023 to January, 2024 Identification of locations, Data Interpretation (Leq), Compilations of report including impact assessment, vibration & impact etc.	
11	LU*	Dr. Umendra Sharma IFS(Retd)	February, 2022-June, 2023 Developing the Land	

		Mr. Anshuman Singh (T M)	use/ land cover of the study area by using remote sensing data.	
12	RH*	Mr. B. P. Pandey	February, 2022-June, 2023 Identification of Hazards, Hazardous substance. Preparation of on-site emergency plan etc.	
		Ms. Anuradha Srivastava		

*One TM against each FAE may be shown

**Please attach additional sheet if required

Date and Sign of EIA Coordinator:

Name: Dr. Binay Prakash Pandey

Signature:  **Date:** 17.01.2024

Date and Sign of Head of ACO / authorised person:

Name: B. P. Pandey 

Designation: CEO **Signature:** **Date:** 17.01.2024

Name of the EIA consultant organization: Ecomen Laboratories Pvt. Ltd.,
B – 1/8, 2nd Floor, Sector-H, Aliganj,
Lucknow–226024, Uttar Pradesh, India

NABET Certificate No. & Issue Date: NABET/EIA/2023/RA 0203 dated 20.04.2021

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EXECUTIVE SUMMARY

1.1 Introduction

NMDC-CMDC Ltd. (NCL) was incorporated on 1st July 2006 between NMDC and CMDC Ltd. as a Joint Venture Company. It is proposed to produce ROM Iron ore of 7.0 MTPA and waste excavation of 6.41 MTPA (Total Excavation 13.41 MTPA) in ML Area 646.596 Ha along with 2000 TPH Crushing plant inside mining lease area along with Screening Cum Beneficiation Plant (750 TPH of 4 lines each), 2200 TPH Downhill Conveyor and Loading Facilities in 100.077 Ha. forest area and 22.4658 Ha. revenue land (Govt., Private and Bade Jhad ke Jungle) located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village: Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh by M/s NMDC-CMDC Limited (NCL). The Bade Bacheli is very well connected by SH/NH road and rail.

MoEF&CC vide its office memorandum J-11013/41/2006-IA. II(I) dated 24th December 2010 has issued procedure to be adopted henceforth for consideration of integrated and interlinked projects.
The two interlinked projects are as under:

"Bailadila Iron Ore Deposit-4 Mine (M.L. Area 646.596 Ha) with a production capacity of 7.0 MTPA ROM Iron ore and 6.41 MTPA Waste Excavation (Total Excavation 13.41 MTPA) along with 2000 TPH Crushing plant inside mining lease area located in Bailadila reserve forest, Tehsil Bade Bacheli, District South Bastar Dantewada, State Chhattisgarh of M/s. NMDC – CMDC Limited (NCL)" falls under the Schedule "Mining of Minerals Open Cast Mining -1 (a)" of Category-'A' as per Environmental Impact Assessment (EIA) Notification SO 1533, of 14-09-2006 and its subsequent amendment.

is interlinked with

"Screening Cum Beneficiation Plant (750 TPH of 4 lines each) along with 2200 TPH Downhill Conveyor and Loading Facilities in 100.077 Ha. forest area and 22.4658 Ha. revenue land (Govt., Private and Bade Jhad ke Jungle) located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village; Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh of M/s. NMDC-CMDC Limited (NCL)" falls under the Schedule "Mineral Beneficiation - (2b)" of Category-'A' as per Environmental Impact Assessment (EIA) Notification SO 1533, of 14-09-2006 and its subsequent amendment.
ToR for Bailadila Iron Ore Deposit-4 Mine and Screening cum Beneficiation Plant outside the mining lease of Deposit-4 were issued by MoEF&CC vide order No. IA-J-11015/104/2021-IA-II(NCM) dated 11.03.2022 and IA-J-11011/23/2022-IA-II(IND-I) dated 21.02.2022 respectively.

Single Public consultation will be held based on the EIA report thus prepared for both components as per the provision of EIA notification 2006.

Ministry of Mines, GoI on 30.09.2019 has granted its prior approval for reservation of Bailadila Iron Ore Deposit-4 (Total Area 646.596 Ha), in favour of NMDC-CMDC

Ltd. for the purpose of Prospecting and Mining of Iron Ore. Further, Ministry of Mines, GoI on 18.02.2021 has issued amendment for the coordinates mentioned in the earlier issued Gazette Notification for reservation of Bailadila Iron Ore Deposit-4.

Mineral Resource Department (MRD), Government of Chhattisgarh (GoCG) on 26.06.2021 has issued a Letter of Intent (LOI) for grant of Mining Lease for the said area of Bailadila Iron Ore Deposit-4 for a period of five years.

Subsequently, MRD, GoCG on 07.08.2021 has issued an amendment in the Letter of Intent (LOI) prescribing the requirement of approved Mining Plan.

Further, MRD, GoCG on 04.05.2022 has issued an amendment in the Letter of Intent (LOI) mentioning period of the mining lease as 50 years.

The total mining lease area earmarked for Bailadila Iron Ore Deposit-4 is 646.596 Ha. Total mining lease area is forest land. To develop Screening cum Beneficiation Plant along with 2200 TPH Downhill Conveyor and Loading facilities an area of 100.077 Ha. forest area and 22.4658 Ha. revenue land (Govt., Private and Bade Jhad ke Jungle) has been identified. Application for diversion of the Forest Land has been submitted vide proposal no. FP/CG/MIN/146694/2021 dated 04.10.2021 for total area of 682.2722 Ha. (570.10 Ha inside mining lease, 100.077 Ha outside mining lease in the reserve forest and 12.0952 Ha Bade Jhad ke Jungle). An area of 76.496 Ha demarcated as Tree Fern Area inside the mining lease is not included in the forest diversion proposal.

The Mining Plan was approved from IBM vide letter no. Dantewada/Fe/Khanij-1292/2021/-Raipur, dated 24-09-2021.

1.2 Project Description

The Bailadila Deposit-4 Mining Lease area is located near village Bacheli/Bhansi, Tehsil Bade Bacheli, District Dantewada, State Chhattisgarh. It is located at Bailadila range of hills trending N-S direction. The Deposit-4 is approachable by kutcha road from Bhansi or from Deposit-5 of the NMDC Ltd. Bhansi is very well connected by SH road from Kirandul to Geedam. Bacheli is nearest town. Dantewada is district headquarters. Bailadila Iron Ore Deposit-4 having lease area of 646. 596 Ha is located in the Topo Sheet No. E44J2 between longitude 81°12'02.90192"E to 81°13'07.02661"E and between latitude 18°41'26.17920"N to18°43'38.52758"N.

Based on ToR issued by MoEF&CC, GoI (EAC IND-I) vide Letter No. IA-J-11011/23/2022-IA-II(IND-I) dtd. 21/02/2022 NMDC-CMDC Ltd has incorporated the technology for the Dry Disposal of the Tailings (Hydraulic filter-based technology) in the beneficiation process of the Bailadila Iron Ore Deposit-4 Project.

The ML area extended over on area of 646.596 ha in the Forest Land with iron ore production capacity of 7.0 MTPA. However, out of the 646.596 Ha Forest Land, proposal for forest land diversion is moved only for an area of 570.1 Ha. Remaining Forest area, within the Mining Lease area will not be diverted for the Mining Purposes. Further, an area of 100.077 Ha. forest area and 22.4658 Ha. revenue

land (Govt., Private and Bade Jhad ke Jungle) outside the Mining Lease will also be required for the development of Screening cum beneficiation plant, Loading plant & railway siding, stockpiles, water settling/recirculation ponds and offices etc.

Deposit No. 4 is situated in the North of Deposit No. 5 and South of Deposit No. 3 in the western ridge of the Bailadila reserve forest. The ore body occurs as northern continuation of north block of Deposit No.5, separated from Deposit No.5 by a narrow parting of about 150 mts of poor grade lateritic ore. On the northern side, Deposit No.4 is separated from Deposit No.3 by a parting of un-enriched banded hematite-quartzite.

Initially the mine will be developed for 1195600 Tonnes per annum in the first year and later on 2.0 MTPA of ROM production from second to fifth year. Thereafter the capacity of the mine will be gradually augmented to 7.0 MTPA of ROM.

Deposit-4 mine has been designed for operation as fully mechanized opencast mine using shovel-dumper combination and various processes are - drilling, blasting, excavation, quality control, ore processing (crushing with 2000 TPH) & transportation of ore through Downhill conveyor and waste disposal. However, during the 1st five years of Mining operation various processes like drilling, blasting, excavation, quality control, ore processing (crushing & screening with 400 TPH mobile crushing and screening units), loading of finished products and waste disposal etc. are planned with smaller mining machineries.

Waste (Shale and Banded Hematite Quartzite) will be dumped in the Waste Dump outside the ultimate pit limit.

The deposit will be exploited by deploying shovel-dumper combination. The deep-hole drilling and blasting technique will be adopted for rock fragmentation.
In the initial five years of mining when the mine production capacity would be limited to 2 MTPA, it is proposed to deploy smaller equipment for mine working. During initial five years, drilling would be carried out using 150 mm diameter drill machine whereas ore production and waste removal will be done by 3.2 cum bucket excavator with 25 T capacity dumpers. After five years, when mine capacity will be upgraded to 7 MTPA, it is proposed to replace smaller equipment with higher capacity equipment. From 6th year onwards, drilling would be carried out using 250 mm dia. drill machine whereas ore production and waste removal will be done by 8.0 cum bucket excavator (derated from 10 cum bucket excavator) with 100 T dumpers.

The capacity of the mine shall be augmented in the continuously increasing manner from the sixth year of the operation of the mine and the mine shall attain its full rated capacity of 7.0 MTPA of capacity in the 9th year of operation.

Screening cum Beneficiation Plant will be 750 TPH of 4 lines each along with 2200 TPH Downhill Conveyor System and Loading Facilities in 122.5428 Ha. area outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village: Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh.

Proposed new Screening Plant @EL 580m consists of 4 Nos. screening lines having 4 Nos. of double deck vibrating screens of design capacity of 750 TPH (primary screens) and 4 Nos. Secondary Vibrating Screens of 550 TPH capacity.

The screening plant covers open stockpile, a four-line screening plant & tertiary crushing plant, wet circuit system, conveyor system, electrical sub-station, electrical building / control room, office & stores buildings, maintenance sheds, canteen & rest rooms, sprinkler water & dry fog system pump houses, raw water reservoirs, recirculation water tank & pumping systems, dry tailings disposal system etc.

Deposit-4 will be developed for production of 7.0 MTPA Iron ore by producing 5.5 MTPA & 1.5 MTPA in dry mode and wet mode respectively. During the monsoon season, dry screening of ore in secondary screen will be difficult due to binding of screen deck by high moisture sticky iron ore. Also, jamming of the connecting chutes hamper the total production. Sometimes operation of screening plant even for 08 hours in a day with rated capacity is very difficult due to above mentioned problems. To overcome this problem, it is envisaged to incorporate Wet Screening facility in Secondary Screens during monsoon season.

In the process of wet classification, the adhered fine particles on coarse ore as well as natural & generated ultrafine particles of Iron, silica and alumina are being reported as slimes and in this Fe grade is generally below 60% Fe. These slimes will be dry stacked for blending with high grade fines.

The crushed iron ore (-150mm) will be feed to the screening cum beneficiation plant situated outside the mining lease and same will be transported to screening cum beneficiation plant through the downhill conveyor belt from the crushing plant situated inside the mining lease of Deposit-4. During initial five-year period, when plant and railway siding will be under construction, iron ore produced will be transported to the customers through road. Though, after initial five years period when loading plant/railway siding of Deposit-4 will be constructed and commissioned, iron ore will be transported through rail, however, this will further depend on completion of the work of doubling of KK rail line and connection of Rawghat to Jagdalpur through rail. In view of this, 20% of total project capacity may be transported through road in foreseeable future beyond the initial five years period.

The salient features of Bailadila Iron Ore Deposit-4 are given in **Table – 1.1.**

TABLE- 1.1

Salient Features of Bailadila Iron Ore Project Deposit-4		
Sl. No.	**Description**	**Particulars**
1	Mining Lease Area	646.596 Ha.
2	Infrastructure Area Outside the Mining Lease of Bailadila Deposit-4.	122.5428 Ha. (100.077 Ha. forest area and 22.4658 Ha. revenue land (Govt., Private and Bade Jhad ke Jungle))
3	Type of mine	Open Cast Mine

4	Method of Mining	Fully Mechanized open cast method
5	Reserves	109.01 MT
6	Expected life of mine	21 Years
7	Ore to Waste ratio	1:0.625
8	Waste Excavation (Maximum)	6.41 MTPA (Estimated by mine scheduling software MineSched)
9	Rated Capacity	7.00 MTPA
10	Average no. of working days / Number of Shifts / Working Hours for Mine	268 / 3 Shifts / 8 Hrs.
11	Bench height & width	12 m height & Minimum bench width during operation phase: 30 m
12	Top and Bottom Bench	1200 mRL and 996 mRL
13	Present Working Benches	Mining Operation Not yet commenced
14	Waste (Till life of mine)	68.173 MT
15	Ultimate pit slope	Less than 45 degrees.
16	Downhill Conveyor System	2200 TPH of approx. length 7.5 KM
17	Screening Plant with Beneficiation Facilities	4 lines of 750 TPH
18	Tertiary Crushing	2 lines of 800 TPH
19	Loading and Stacking Facilities	3000 TPH Loading Facilities with Lump Stockpile of 3.2 LT and Fine Ore Stockpile 2.3 LT
20	Average no. of working days / Number of Shifts / Working Hours for Screening cum Beneficiation Plant	365/ 3 Shifts / 8 Hrs.
21	Power requirement & sources	Power requirement: 6 MVA, Sources: Chhattisgarh State Power Distribution Company Limited.
22	Water Requirement	Mining Lease Area-4250 KLD Beneficiation Plant-1250 KLD (Dry Screening for 8 months) and 8,630 KLD (Wet Screening for 4 months of monsoon period). Considering the future requirements including the proposed township, Water requirement is envisaged to be around 20,000 Cu.m per day at the peak rated capacity which will be met from the source of existing Sankani Nalla and Nerli Nalla (Sankani Nadi).
23	Total Project Cost (For entire Bailadila Iron Ore Deposit-4 including ancillary facilities located outside the Mining Lease Area)	Rs. 4091.33 Crores (approx.) (Approx. Rs. 1156.163 Crores inside ML area and approx. Rs. 2935.167 Crores outside ML area)
		(Source: Mine Planning-NMDC-CMDC Limited)

1.3 Description of the Environment

The study area is core zone (Mining lease area of 646.596 Ha and Screening cum Beneficiation Plant area of 122.5428 Ha) and buffer zone (a 10-km radius area around the ML and screening cum beneficiation plant). The baseline environmental data for preparation of EIA/EMP report for Bailadila Iron Ore Deposit-4 & Screening cum Beneficiation Plant was carried out for 3 months i.e., from 1st March-2022 to 31st May-2022 representing Pre-Monsoon season

1.3.1 Land Use

The land use pattern of the study area for Bailadila Iron ore mine Deposit-4 indicates that 31.64% of the area is under dense forest land and the remaining area is accounted for by Mining Area, Rocky/Barren Area, Waterbodies, Streams, settlements etc. The land use pattern of the study area for screening cum beneficiation plant indicates that 44.15% of the area is under dense forest land and the remaining area is accounted for by Mining Area, Rocky/Barren Area, Waterbodies, Streams, and Settlements etc.

1.3.2 Soil Quality

Six soil samples were collected from mining lease area, screening cum beneficiation plant area, agriculture areas, forest areas, etc., and analysed for various physico-chemical and organic parameters. It is found that the pH of soil is normal ranging 6.66-7.21, average nitrogen (N) values were in medium to high range (56.90-132.5 kg/ha), average potassium (K) value is also in the range of low to high (80.50-130.4 kg/ha). The average phosphorus (P) values were found to be medium (11.10-17.10 kg/ha) range.

1.3.3 Climatology and Meteorology

Meteorological data was recorded hourly for three months. Calm condition prevailed over 12.40 % of the time of the study period. The first predominant wind direction was from South-West to North-East over approx. 5.5 % of the time in which speed of 0.30 to 3.0 m/s was recorded and second predominant wind direction was from North-West to South-East over approx. 5.0 % of the time in which speed of 0.3 to 3.0 m/s was recorded. Maximum & minimum temperature recorded were 39.19^{0}C & 18.44^{0}C respectively.

1.3.4 Ambient Air Quality

The ambient air quality monitoring was carried out during the study period at fourteen locations, covering twelve for mining & allied activities (core & buffer zone) and eleven for screening cum beneficiation plant core & buffer zone) at different locations representing upwind, cross wind, and downwind directions. Out of 12 locations considering core & buffer zone of mining lease area, the maximum Respirable Particulate Matter (PM_{10}) was found to be 71.50 µg/m^3 at Akashnagar and 71.40 µg/m^3 at Padapur followed by 67.53 µg/m^3 at ML area. The particulate and gaseous pollutants are found well within the National Ambient Air Quality standards 2009.

1.3.5 Water Quality

Total 8 ground water sampling locations were selected for Mining lease area and 7 sampling locations for Screening cum Beneficiation Plant area. In which 7 locations are common for each other in both 10 Km map. Total 8 surface water locations selected for surface water study in which 6 sampling locations selected for Mining lease area and 6 sampling locations for Screening cum Beneficiation Plant area (in which 4 locations are common for each other at 8 locations in both 10 Km map). All the samples were found well within the prescribed limits. The result of ground water shows that all the parameters are well within the acceptable limit of IS: 10500. The analysis result of surface water shows that all the parameters are well within the prescribed limit of IS: 2296 (Class C) i.e., for surface water quality.

1.3.6 Ambient Noise Levels

Total 8 sampling locations selected for Mining lease area (One in core zone, 7 in buffer zone) and 8 sampling locations for Screening cum Beneficiation Plant area (One in core zone, 7 in buffer zone). In which 3 locations are common for each other in both 10 Km map. The noise levels at all locations were found well within the limits of Ambient Air Quality Standards w.r.t. Noise.

1.3.7 Flora & Fauna

There is no biosphere reserve, national park, tiger reserve, elephant reserve, wildlife sanctuary, or bird sanctuary within the study area. Two reserve forests fall in study area. (i) Bijapur Reserve Forest (ii) Bailadila Reserve Forest. Majority of the landscape in the Mining Lease area is characteristic of having dense forest with patches of degraded natural landscape. Mining lease area are dominated by Terminalia tomentosa, Syzygium cumini, Acacia catechu, Cassia fistula.

The forest vegetation provides habitation for faunal species such as birds, butterflies, moths, rodents, hares, reptiles, and lizards. The forests not only provide habitation but also provide nesting and grazing for herbivores.

There is a presence of seven Schedule–1 species reported in the Dantewada Forest Division namely Sloth Bear, Indian Pangolin, Panther, Python, Bengal Monitor Lizard, Bastar Hill Myna and Common Peafowl. Wildlife conservation & management plan has been approved by Chief Wildlife Warden vide Order No./V.PRA/Prabandha-637/253 Nava Raipur, dated 25.09.2023. The fund allocated for Wild Life conservation and management plan is Rs. 1931.732/- Lacs. Biodiversity Conservation Plan and Soil, Water & Moisture Conservation for tree fern area has been prepared and approved by Biodiversity Board of Chhattisgarh vide order no./Jai.V.Bo/17 Raipur dated 21.08.2023. The fund allocated for Biodiversity Conservation Plan and Soil, Water & Moisture Conservation for tree fern area is Rs. 3107.733/- Lacs.

1.3.8 Social Environment

As per census 2011 data, the study area consists of about 27 villages, with 14554 households and 59684 population. The sex ratio in the study area is 969. 10.74% of the population is from Scheduled Castes (SC) and 47.38% comes from Scheduled Tribes (ST). Overall, the data on social stratification reveals that the SC and ST population is more than 58.12%. The literacy rate is 56.56%. NMDC-CMDC Ltd. will support to education in the nearby villages under CSR funds.

1.4 Anticipated Environmental Impacts

Mining being a site-specific activity, excavation is bound to be done at a place where minerals actually exist. Opencast mining operations with crushing and screening activities result in air pollution in the form of particulate and gaseous pollutants. Adequate mitigation measures will be implemented to control air pollution. The impact due to proposed Bailadila Iron Ore Deposit-4 project has been predicted using AERMOD with digital elevation model option.

Emission sources considered include transportation activity. 3D terrain modelling has been done. The modelling results indicate that the maximum incremental Ground Level Concentrations (GLC) of PM_{10}, $PM_{2.5}$, NO_2 & SO_2 with controlled measures will be about 18$\mu g/m^3$, 8.46$\mu g/m^3$, 11.4$\mu g/m^3$ & 7.58$\mu g/m^3$ respectively. The overall resultant concentrations (GLC's + baseline) were found well within the NAAQ 2009 standards.

The water will be mainly required for dust suppression in mining areas and ore processing plants. Two Effluent Treatment Plant of 10 KL capacity each will be put into operation for treatment of suspended solids and oil & grease generated due to the washing of HEMM. A 200 KLD STP will be installed within screening plant to treat domestic waste water. The mining operations will be conducted at the hilltop which is at a higher level than the groundwater level. The groundwater level is at 730 MRL and will not be intersected during mining operations.

R&R issues are involved for proposed screening cum beneficiation plant. About 21 Nos. families will be affected in the revenue land / forest revenue land area of the project. These families will be compensated, resettled and rehabilitated socially, culturally and economically as per extant provisions of the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act–2013 (LARR Act-2013) and rules thereof. Guidelines given in the Ideal Rehabilitation Policy 2007 of State of Chhattisgarh will also be followed. Publication of Pre-liminary notification under section-11 of the LARR Act-2013 has been made in the Gazette of Chhattisgarh on 08.09.2023.

1.5 Mitigation Measures

Drilling Operations

When the blast holes will be drilled, the cuttings from the holes will be flushed out of the holes by passing the compressed air through drill rods and the cuttings will be allowed to fall outside the collar of the blast hole by means of blowers. The dust thus generated during drilling will be suppressed and allowed to settle in the form

of a cone near the collar of the blast hole itself by use of water during drilling so that the air will not be polluted by the blast hole drilling. During drilling operation sharp bits will be used and wet drilling system will be practiced.

Blasting

The air gets polluted during blasting operations will be in the form of chemical gasses produced during the explosion and dust generated during blasting. However, in the mine the number of holes blasted during any blast event will not exceed a maximum of 30/40 holes per blast and on an average about 20 per blast, thus the gases generated during explosion will not likely to contribute much to the air pollution. As such no ill effects will be there due to chemical gases produced during the explosion and dust generated during the blast either on vegetation or on the residents of the nearby township or residential houses. Optimal use of explosives, controlled blasting techniques with the use of NONEL (Non-Electric Detonators), optimization of initiation systems will be adopted. Regular water sprinkling before and after the blasting in the surrounding area of the blasting face will be adopted.

Excavation in Ore and Waste

During ore or waste excavation, hauling of ore/waste, feeding of ROM in crusher and dumping of waste in waste dump yard during dry months, some dust will be generated. Blasted ore and waste will be reclaimed from blasted muck pile by shovels and same will be transported from mine face to the crushing plant/waste dump by 100 tonnes capacity dumpers. To lessen the generation of dust during excavation, the excavators will have inbuilt mechanism of air-conditioned cabin to protect the operator from fugitive dust and water will be sprayed on the blasted muck pile. Also, main mine haul roads where dumper will ply, will also be sprayed with water through 28 KL capacity water sprinklers (four nos.) during dry seasons. Thus, there will be negligible dust generation during excavation and haulage of ore and waste.

Crushing Operation

Fugitive dust will be generated in the crushing plant during dry months when the ROM ore will be crushed in the crushers and will be carried to the primary surge pile through conveyer. In order to ensure effective dust suppression, water will be sprayed in the form of a mist in the crusher. Since crushing will be done by the equipment which will be housed in an enclosure, there will be no threat of air pollution to the surrounding areas due to the crushing plant as the GI sheet enclosure premises. The atomized water sprinklers aided with compressed air will be installed at the point of ore dumping platform at Deposit-4 crushing plant for effective dust suppression.

Down Hill conveyor Operation

Crushed ore from the crusher will be transported through a system of closed conveyor belts to screening cum beneficiation plant for further processing. This system will be developed in order to control the dust generation during transportation of ore from one place to another. The conveyor system will be

stretched from crushing plant to screening plant covering a distance of around 8.7 km. It will be ensured that conveyor system will work efficiently and therefore able to control dust emission.

1. Dry fog dust suppression system (DSS) will be installed at Primary Crusher and Secondary Crusher area and in Downhill conveyor system.
2. The locations where DSS will be installed along with nozzles are dumper platform, all screen levels, conveyor transfer chutes, intermediate stockpiles, screening plant, loading plant etc.

Screening and Loading Operation

The screening plant will be housed in a huge GI sheet enclosure, which will act as a good shield for the prevention of dust particles escaping out of the plant building. Fixed water sprinklers in the loading plant area will be used. All the HEMMs and other vehicles will be maintained in good condition so as to keep the exhaust emissions well within the limits. All project vehicles will undergo Pollution under Control tests to assess their emissions. Maintenance of vehicles will be carried out to keep emission levels under control.

Control Measures at Mineral Processing Plants

- Water will be sprinkled on the ore before crushing. The atomised water sprinkler aided with compressed air at the point of ore dumping platform will be installed at crushing plant;
- Water sprinklers along with compressed air forming mist will be installed at all transfer points in the mineral processing plant to suppress the dust at Deposit-4;
- All the conveyor belts will be covered and will be equipped with telescoping chutes at transfer points to reduce the vertical fall of ore material;
- The vehicles will be maintained properly and exhaust emission will be checked regularly;
- Speed restrictions will be imposed on the HEMMs and light vehicles to minimize the dust generation in mining and mineral processing plant areas;
- In the Loading plant area, lump ore & fine ore reclaimers will be provided with dust suppression arrangement. The mist water will be sprayed while reclaiming the ore from stockpile for loading into railway wagons through wagon loading system.

Water Pollution & Control:

Garland drains will be constructed at the side & toe of waste dumps. Buttress walls will be constructed at the toe of the active waste dumps to arrest the silt material flowing with water during rainy season. Coir matting and afforestation will be carried out at the dump slope. Two Effluent Treatment Plant of 10 KL capacity each will be put into operation for treatment of suspended solids and oil & grease generated due to the washing of HEMM in ML and other machineries at Screening Plant. A 200 KLD STP will be installed within Screening Plant to treated domestic waste water.

Noise & Vibration Control and Management

Deep hole blasting will be restricted to day time hours only; Proper and timely maintenance of mining machinery; Noise levels will be controlled by using optimum explosive charge per delay and milli second delay detonators and proper stemming to prevent blow out of holes; Speed of moving dumpers and other vehicles running in the mine will be limited to moderate Speed (25 km/hr) to prevent undue noise as per DGMS circulars enforcing safety standards; Provision of user-friendly soft type ear muffs/ear plugs to workers in noise prone area; Proper blast design; Avoiding excess confinement of charges; Proper stemming of holes will be carried out etc.

Waste Management:

There is negligible top soil. Lateritic material, shale and banded iron formations (BIF) analyzing less than 45 % Fe has been considered as waste. Waste (Shale and Banded Hematite Quartzite) will be dumped in the Waste Dump outside ultimate pit limit. Waste will be backfilled in the North Block after extracting all the Ores and associated waste materials of the Deposit during the life of the Mine. Total mineable waste in the Bailadila Deposit-4 is 68.17 MT. The overall stripping ratio of deposit is 1:0.63. The maximum waste excavation of 6414000 Tonnes will be done during the 16^{th} Year of operations.

Overburden Dump Management:

Efforts will be made to stabilize active dumps. The overburdens will be dumped as per the specifications of IBM and MoEF&CC stipulated conditions and the slope of the dump will be maintained at not more than 28^0. For stabilizing the dumps, engineering structures will be made, followed by biological measures, to achieve faster restoration. The combinations of grasses, herbs, shrubs, creepers and tree species shall be used in restoration process. Depending upon stability and age, the plantation will be done either by seed broadcasting, hydro-seeding or planting of seedlings. In addition to seed broadcasting and planting of seedlings, planting of suitable herbs and shrubs shall be done on the slopes by making holes in geo-textile coir mat.

Benches and trenches will be made to make the slopes of OB dumps gentle, followed by seed broadcasting and planting of seedlings of shrubs, namely *Clerodendrum viscosum, Helicteres isora, Indigofera cassioides etc. trees species like Aegle marmelos, Alangium salvifolium, Albizia lebbeck, Albizia procera, Annona squamosa, Anogeissus latifolia, Cassia fistula, Dalbergia sissoo etc.* Root *stock/slips of grasses, namely, Bothriochloapertusa, Cymbopogonflexuosus, C. martini, C.nardus, Cynodondactylon, Dactylocteniumaegyptum, Dichanthiumannulatum, Eleusineindica, Heteropogoncontortus*, etc.

Green-belt development Programme

In order to minimise the impact of mining on Environmental component outside the mining lease area, green belt zone will be established in Safety Zone inside the mining lease area. The green belt will act as a barrier to trap the suspended dust particles and also suppress air pollutants. The area proposed for green belt development includes the area under safety zone all along the mine lease

boundary. Out of 8.488 ha. of Safety zone area, it is proposed for 3.058 Ha all along the mine lease boundary will be planted with native species at a rate of 2500 plants per hectare in the 1st year (1.248 Ha.) and second year (1.81 Ha.). Rest 5.43 Ha of Safety zone area will be planted @ 1000 plants per ha. of 1.81 Ha. each year in the successive 3rd year, 4th year and 5th year. Plantation in the Dump No.-1 is proposed in the 3rd year of 1.672 Ha.@ 1500 plants per Ha. Gap plantation in the remaining area is proposed @ 1000 plants per ha. of a total area of 48.38 Ha. in the 2nd year (12.08 Ha.), 3rd Year (12.08 Ha.), 4th Year (12.08 Ha.), and 5th Year (12.08 Ha.). It is proposed for plantation of 62000 saplings in the 1st five years for a total area of 58.48 Ha.

Green area at the infrastructural facilities outside mining lease will be 400575 m^2 (33% of the total area of outside mining lease) and afforestation/gap plantation will be done as 2500 trees per hectare i.e., a total of 100144 trees for afforestation/gap plantation.

1.6 Environmental Monitoring Program

Regular environmental monitoring of ambient air, meteorology, water quality, ambient noise, soil quality, etc. will be carried out by MoEF&CC/CPCB recognised laboratories in different seasons of the year. Vibration monitoring studies will be conducted by reputed agency and in-house by using seismograph. Ground water levels and quality will also be monitored in four seasons of the year. The monitoring data will be submitted on the Parivesh Portal of MoEF&CC along with six monthly environmental progress reports. Two continuous ambient air quality monitoring stations will be installed for continuous recording of PM_{10}, $PM_{2.5}$, SO_2, NO_2 & CO on a continuous basis.

1.7 Additional Studies

A single Public Hearing has been held on 12.09.2023 at N.M.D,C. I.T.I. Complex, Bhansi, District-South Bastar Dantewada (C.G) for the two interlinked projects namely "Bailadila Iron Ore Deposit-4 Mine (M.L. Area = 646.596 Ha) with a production capacity of 7.0 MTPA ROM Iron ore and 6.41 MTPA Waste Excavation (Total Excavation 13.41 MTPA) along with 2000 TPH Crushing plant inside mining lease area located in Bailadila reserve forest, Tehsil Bade Bacheli, District South Bastar Dantewada, State Chhattisgarh of M/s. NMDC – CMDC Limited (NCL)."
&
"Screening Cum Beneficiation Plant (750 TPH of 4 lines each) along with 2200 TPH Downhill Conveyor and Loading Facilities in 122.5428 Ha area located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village; Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh of M/s. NMDC-CMDC Limited (NCL)."
The advertisement of the Public Hearing was given by Chhattisgarh Environment Conservation Board in National and local Newspapers "Hindustan Times" (English) & "Haribhoomi" (Hindi) on 12.08.2023.

The total cost of activities / schemes planned in response to the public demand during public hearing is Rs. 4000 lakhs, which will be spent over three Financial Years (FY).

The complete mining and screening cum beneficiation operations will be carried out under the management, control, and directives of a qualified manager. Moreover, mining and screening cum beneficiation supervisory staff will be imparted basic, refresher, first aid, and frontline supervisory statutory training from time to time. A Disaster Management Plan (DMP) will be in place which will ensure the safety of life, protection of the environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of the DMP, it will be widely circulated and personnel training through rehearsals or mock drills will be conducted. Training exercises will also be held to ensure that all personnel will be familiar with their responsibilities and that communication links will functioning effectively.

The Occupational Health Centre will be established and the annual budget will be Rs. 56.27 lakhs. The initial and periodic medical examinations will be carried out as per the provisions laid out in the Occupational Safety and Health and Working Conditions Code, 2020.

1.8 Project Benefits

Bailadila Iron Ore Deposit-4 project will provide economic benefits to employees, the local population in the project's vicinity, and the government in the form of royalty (15% of IBM's average sale value), District Mineral Fund (30% of royalty), National Mineral Exploration Trust (2% of royalty), and additional premium (22.5% of IBM's average sale value).

The direct employment will be 700, out of which 315 will be for mining lease area and 385 will be for screening cum beneficiation plant. Indirect employment including contractual employment will be about 1400. Total population expected to be benefited from the proposed mining lease and screening cum beneficiation plant will be around 10500. Indirect employment will be generated through handling of material, transport, banks, schools, restaurant, shops, petty trade etc., which will improve social & economic standing of the people in the locality. Further people will also get opportunity to engage themselves and earn by rendering various services to the community which will help, in improving social & economic condition of the local people.

Company will undertake peripheral developmental activities by implementing welfare measures in surrounding area. For this purpose, Company will spend around minimum 2 % of the average net profits of the company during the three immediately preceding financial years for CSR activities.

1.9 Environment Management Plan

The monitoring programme will serve as an indicator for taking suitable mitigative measures in time to safeguard the environment. The EMP includes waste dump

management; construction of engineering structures for surface water management; afforestation; dust suppression on haul roads; biological reclamation; etc.

NMDC-CMDC Ltd. has planned an amount of Rs. 91.21 crores under capital cost for the implementation of the Environmental Management Plan and the recurring cost per annum is about Rs. 5.21 crores.

1.10 Conclusions

The Bailadila Iron Ore Deposit-4 project will meet the increasing demand for iron ore for domestic steel plants, pellet plants, etc. and contribute to the national and state exchequer in the form of royalty, district mineral fund, national mineral exploration fund, additional premium, and statutory taxes. NMDC-CMDC Ltd. will implement EMP measures and social welfare measures for the development of the area.

TOR CONDITIONS ISSUED BY MOEF&CC AND ITS COMPLIANCE

I. Terms of Reference on 14/01/2022 for Non-Coal Mining (Proposal No: IA/CG/MIN/251288/2022, File No: IA-J-11015/104/2021-IA-II(NCM)) for Mining Lease of Deposit-4.

A. SPECIFIC CONDITIONS OF TOR

Sl. No.	TOR Point	Compliance Status
i.	The Project Proponent should install the continuous ambient air quality monitoring stations in such numbers as per the scientific study and in consultation with CPCB.	Predominant wind direction is from SW to NE. There is a proposal of installing two nos. of CAAQMS (one in upwind & other in downwind direction) in consultation with CECB. Apart from these stations a CAAQMS is already installed at adjacent mine namely Bailadila Iron ore Deposit-5 which lies in the upwind direction of the mining lease. Discussed in **Table 10.2** of **Chapter-10**.
ii.	The Project Proponent needs to carry out the cumulative impact assessment by considering all the mining activity of the adjoining mines, crusher and beneficiation plant in the study area and should indicate the capacity of the each mine considered for predication of air quality modeling. The control case and worst-case scenario needs to be demonstrated with controlling factor and GLCs values for all the pollutants needs to be clearly mentioned. The input parameters used for the modeling also needs to be submitted.	Cumulative Impact Assessment is done for all operating mines in the study area i.e., Deposit-5, Depost-10, Deposit-14, Deposit-14 NMZ, Deposit-11, GLCs are estimated for both Worst case and control case. Details are given under **Section 4.1.5.1** of **Chapter-4**.
iii.	The Project Proponent should prepare the EMP considering the scenario of pollution to be generated for normative and peak total excavation for assessing air and noise pollution by considering all the mining activity.	The EMP measures considering the scenario of pollution for normative and peak production for air and noise pollution is given under **Section 4.2.5.11 & 4.2.6** of **Chapter-4.**
iv.	The Project Proponent needs to submit the restoration plan for waste dumps to be located in the forest land. PP should also submit the map demarcating the mineralized and non-mineralized zone in the forest land and non-forest land in the mine lease area.	Restoration plan for waste dump is enclosed as **Plate No. 4.10** of **Chapter-4**. Map demarcating the mineralized and non-mineralized zone in the forest land and non-forest land in the mine lease area is attached as **Plate No. 2.7** of **Chapter-2**.
v.	The Project Proponent needs to carry out the Public Hearing as per provisions of EIA Notification, 2006. PP should also submit the time bound action plan on concerns of the public through proper separate budget for	A single Public Hearing held on 12.09.2023 at N.M.D,C. I.T.I. Complex, Bhansi, District-South Bastar Dantewada (C.G) for the two interlinked projects namely "Bailadila Iron Ore Deposit-4 Mine (M.L. Area =

	the concerns of the local people in terms of health care facilities for COVID, betterment of schools nearby and to facilitate the online education system by providing Wi-Fi connectivity, smart classrooms and desktops/tablets, infrastructure, and environment protection.	646.596 Ha) with a production capacity of 7.0 MTPA ROM Iron ore and 6.41 MTPA Waste Excavation (Total Excavation 13.41 MTPA) along with 2000 TPH Crushing plant inside mining lease area located in Bailadila reserve forest, Tehsil Bade Bacheli, District South Bastar Dantewada, State Chhattisgarh of M/s. NMDC – CMDC Limited (NCL)." & "Screening Cum Beneficiation Plant (750 TPH of 4 lines each) along with 2200 TPH Downhill Conveyor and Loading Facilities in 122.5428 Ha area located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village; Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh of M/s. NMDC-CMDC Limited (NCL)." The advertisement of the Public Hearing was given by Chhattisgarh Environment Conservation Board in National and local Newspapers "Hindustan Times" (English) & "Haribhoomi" (Hindi) on 12.08.2023. The total cost of activities / schemes planned in response to public demand during public hearing is **Rs. 4000 lakhs**, which will be spent over three Financial Years (FY). Public hearing issues along with time bound action plan and budget is given under **Section-7.1** of **Chapter-7.**
vi.	The Project Proponent should submit the detailed plantation/greenbelt plan in tabular format (year wise for entire life of mine) with proper capital and recurring cost. PP shall undertake the adequate plantation with the seedling of 10ft height with at least 90% survival rate and the peripheral plantation shall be completed within 6 months from the start of mining operations. The causalities of each year shall be replaced every year with new saplings and such number of saplings shall not be counted in the number of saplings proposed to plant in that year. PP shall undertake the progressive bench plantation up to HFL for eco restoration of water bodies. Undertaking in this regard needs to be submitted by the PP.	**Proposed Safety Zone & Gap Plantation – Five Year Plan Period:** Safety zone & gap plantation proposed to be undertaken during first five years of mining plan period within the mining lease areas by planting 62000 saplings with an estimated expenditure of Rs. 1.85 Crs as given under **Section 4.2.12.1, Table 4.20 (year wise proposed plantation for first five years)** of **Chapter-4.** **Reclamation of Mined out areas, waste dumps, utility service area & area under environmental protection etc:** The proposed reclamation & rehabilitation will be undertaken as given in **Table 4.16**. The measures include technical and

		biological reclamation of mined out areas, plantation with native species on dumps and mined out benches. The part of mine pit shall be restored as a water reservoir and remaining part will be backfilled. An undertaking for the progressive bench plantation up to HFL for eco restoration of water bodies is enclosed **Annexure 4.1**.
vii.	The Project Proponent needs to submit the certificate obtained from Forest Department regarding tree fern area not to be diverted at the time of appraisal of EC.	Already forest diversion application is registered excluding the tree fern area of 76.496 Ha. Registration letter Dated 13.06.2022 from APCCF (LM), Chhattisgarh is enclosed as **Annexure 1.8**.
viii.	The Project Proponent needs to submit the certified EC compliance report of adjacent mines for Deposit 5 & Deposit 10 at the time of appraisal of EC.	The Certified EC Compliance Report & subsequent closure report on the observed points for Deposit-5 and Deposit-10 were obtained from the Regional Office, MoEF&CC vide letter no. 3-20/2008(ENV)/723 dated 20.05.2022 and letter no. 3-23/2011 (Env)/1356 dated 12.04.2023 respectively (attached as **Enclosure-I & II**).

B. Standard TOR for Non-Coal Mining Project: Mining Lease of Deposit-4

Sl. No	**TOR Point**	**Compliance Status**
1	Year-wise production details since 1993-94 should be given, clearly stating the highest production achieved in any one year prior to 1993-94. It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to1994. The production details should be duly authenticated by Department of Mines & Geology, State Government.	**Not Applicable**
2	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	Mineral Resource Department (MRD), Government of Chhattisgarh (GoCG) on 26.06.2021 vide letter F 2-20/2005/12 has issued a Letter of Intent (LOI) for grant of Mining Lease. (Attached as **Annexure-1.5**).
3	All documents including approved mine plan,	All documents are compatible and

	EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.	are in the name of the NMDC-CMDC Ltd. All the documents including approved mine plan and EIA are compatible with one another.
4	All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	All corner coordinates of the mine lease areas superimposed on the topo sheet are given in **Plate No. 1.2** of **Chapter-1**. Satellite imagery giving land use land cover with interpreted map of 10 km radius is enclosed as **Plate No. 3.7 & 3.8**. There is no national park, wildlife sanctuary, biosphere reserve, elephant reserve, elephant corridor, tiger reserve, sanctuary, habitat for migratory birds, archaeological site, defence installation or airport within 10 km of the ML area
5	Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.	A study area of a 10 km radius around the Deposit-4 mining lease area are provided on the Survey of India Toposheet on a 1:50,000 scale. Details of Geology and Surface Geological plans of Deposit-4 Mining lease areas are enclosed attached as **Plate No. 2.7**. Topography of lease areas along with contours and other surface features are shown in surface plans attached as **Plate No. 2.3**.
6	Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.	Deposit-4 Mining Lease is part of Bailadila Reserved Forest, Dantewada Forest Division, Chhattisgarh. Application for diversion of the Forest Land has been submitted vide proposal no. FP/CG/MIN/146694/2021 dated 04.10.2021 for total area of 682.2722 Ha. (570.10 Ha inside mining lease, 100.077 Ha outside mining lease in the reserve forest and 12.0952 Ha Bade Jhad ke Jungle). An area of 76.496 Ha demarcated as Tree Fern Area inside the mining lease is not included in the forest diversion proposal.

		Acknowledgement is enclosed as **Annexure-1.8 & Annexure-1.9**). Process of land acquisition of the revenue land has been initiated.
7	It should be clearly stated whether the proponent Company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/violation of the environmental or forest norms/ conditions? The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large, may also be detailed in the proposed safeguard measures in each case should also be provided.	NMDC-CMDC Limited (NCL) has formulated environmental policy at corporate level and taken the approval of the Board for the same, with commitment to protect the environment while operating projects. NCL will put its sincere efforts to control the pollution and comply all the statutory standards. The corporate environmental policy of NCL is formulated in English and Hindi language and attached as **Annexure 10.1 & 10.2** respectively.
8	Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.	As the project is a green field project, so there are no existing dumps & pits, however every suitable engineering measures will be adopted in due course of time based on the scientific studies conducted by institutes like Central Institute of Mining and Fuel Research (CIMFR) and National Institute of Rock Mechanics (NIRM) etc. Details of the same will be provided in the six-monthly compliance report.
9	The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc. should be for the life of the mine / lease period.	The study area considered is 10 km zone from mining lease boundaries of Deposit-4 mining lease. Waste generation data is provided for plan period and life of the mine, same is 3.747 million tonnes & 68.17 million tonnes respectively and details are given under **Section 2.6.4 & 2.6.5** of **Chapter-2**.
10	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife	Land use pattern of the study area of 10 km has been assessed through

	sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given	Remote Sensing & GIS methodology. Details are given under **Section 3.11** of **Chapter-3** and enclosed as **Plate No. 3.7 & 3.8**. Land use of the mine lease area giving details of existing, operational and post operational phases are given under **Section 4.1.2** of **Chapter-4**.
11	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given.	**Not Applicable**
12	A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.	Application for diversion of the Forest Land has been submitted vide proposal no. FP/CG/MIN/146694/2021 dated 04.10.2021. References are enclosed as **Annexure-1.8 & Annexure-1.9**
13	Status of forestry clearance for the broken-up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	Application for diversion of the Forest Land has been submitted vide proposal no. FP/CG/MIN/146694/2021 dated 04.10.2021 for total area of 682.2722 Ha. (570.10 Ha inside mining lease, 100.077 Ha outside mining lease in the reserve forest and 12.0952 Ha Bade Jhad ke Jungle). An area of 76.496 Ha demarcated as Tree Fern Area inside the mining lease is not included in the forest diversion proposal. References are enclosed as **Annexure-1.8 & Annexure-1.9**).
14	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be	Request letter for grant of FRA certificate in respect of Bailadila Iron Ore Deposit-4 has already been submitted to the O/o the District

	indicated.	Collector, South Bastar Dantewada. FRA certificate will be submitted in due course of time.
15	The vegetation in the RF / PF areas in the study area, with necessary details, should be given.	The details of the vegetation occurring in the mining lease area (RF) is given under **Section 3.10** of **Chapter-3**.
16	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.	Wildlife conservation & management plan has been approved by Chief Wildlife Warden vide Order No./V.PRA/Prabandha-637/253 Nava Raipur, dated 25.09.2023 (refer **Annexure-4.3**). The fund allocated for Wild Life conservation and management plan is **Rs. 1931.732/- Lacs.** The details of the fund allocated for Wild Life conservation and management plan are given under **Section 4.2.12.7** & **Table 4.26** of **Chapter-4.**
17	Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/Elephant Reserves/ (existing as well as proposed), if any, within 10 km of the mine lease should be clearly indicated, supported by a location map duly authenticated by Chief Wildlife Warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished.	There are no National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Tiger / Elephant Reserves within 10 km radius of mining lease of Deposit-4.
18	A detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest	Detailed biological study carried out. Schedule-I fauna in the study area reported in Dantewada Forest Division are provided. Biodiversity Conservation Plan and Soil, Water & Moisture Conservation for tree fern area has been prepared and approved by Biodiversity Board of Chhattisgarh vide order no./Jai.V.Bo/17 Raipur dated 21.08.2023 (refer **Annexure-4.4**). The fund allocated for Biodiversity Conservation Plan and Soil, Water &

	and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	Moisture Conservation for tree fern area is **Rs. 3107.733/- Lacs.** The details of the fund allocated for Wild Life conservation and management plan are given under **Section 4.2.12.7** & **Table 4.27** of **Chapter-4.**
19	Proximity to Areas declared as "Critically Polluted" or the Project areas likely to come under the "Aravali Range", (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Dept. Should be secured and furnished to the effect that the proposed mining activities could be considered.	Not applicable. The project is not located in Critically Polluted area or on Aravali range.
20	Similarly, for coastal Projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL. HTL, CRZ area, location of the mine lease w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).	Not applicable. The project is not located in CRZ zone.
21	R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs /STs and other weakers of the society in the study area, a need-based sample survey, family-wise, should be undertaken to assess their requirements, and action programs prepared and submitted accordingly, integrating the sectoral programs of line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.	Not Applicable.
22	One season (non-monsoon) [i.e., March - May (Summer Season); October - December (post monsoon season); December - February (winter season)] primary baseline data on	The study area comprises of core zone (Mining Lease area) and buffer zone covering an area of 10 km radius from the boundary of core

	ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-wise in the EIA and EMP Report. Site-specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downwind direction and location of sensitive receptors. There should be at least one monitoring station within 500 m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.	zone. The baseline environmental monitoring studies were carried in study area during summer season 2022, covering the months of March, April and May. The various environmental parameters monitored are ambient air quality, water quality, ambient noise levels, soil quality, ecology, land use, demographic & socio-economic conditions. Details are provided in different sections of Chapter-3.
23	Air quality modeling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modelling should be provided. The air quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.	Air quality modelling is carried out for incremental estimation of ground level due to mining operations and transportation activity. AERMOD has been employed. The details of emissions considered for modelling studies are provided. Isopleths showing the incremental ground level concentrations of PM_{10}, $PM_{2.5}$, SO_2, and NOx are given under **Section 4.1.5.1, Plate No. 4.3 to Plate No. 4.8** of **Chapter-4**.
24	The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	The total water requirement inside the mining lease will be 4250 KLD and sourced from Sankani Nalla and Nerli Nalla (Sankani Nadi). Details are given under **Section 2.11.1** of **Chapter-2**. A detailed water balance is furnished in under **Section 4.2.7, Figure No. 4.3 & Figure No. 4.4** of **chapter-4**.
25	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.	Application for drawl of water has already been submitted to the Water Resource Department, Chhattisgarh (attached as **Annexure 2.1**).
26	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	The rain water (surface run off) will be properly guided through garland drains to the lower most mining benches. Rain water will be allowed to settle to remove suspended solids. Provisions for check dams/bunds in

		the water streams and toe walls below the waste dumps will be made. 5 nos. of rain water harvesting pits have been planned in screening cum beneficiation plant area.
27	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.	Toe walls and contour trenches will be constructed at the bottom of waste dumps to arrest the silt load and reduce the impact on the water quality. Further details are given under **Section 4.2.7** of **Chapter-4**.
28	Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect groundwater table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report inter-alia, shall include details of the aquifers present and impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of ground water should also be obtained and copy furnished.	The ultimate pit limit will be 996 mRL in the ML area. The groundwater table exists at 730 mRL, which clearly shows that the mine work will not intersect the ground water table. The cross section showing the ultimate pit depth are given as **Plate No. 4.9**.
29	Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the hydrology should be.	Galli nala is passing in the eastern direction of the Bailadila Iron Ore Deposit-4 inside the mining lease area through the non-diverted forest land of 76.496 Ha. of tree fern area. This area will be treated as conservation zone for tree fern and will not be impacted with mining activities.
30	Information on site elevation, working depth, groundwater table etc. Should be provided both in AMSL and BGL. A schematic diagram may also be provided for the same.	Bailadila Iron Ore Deposit-4 is situated on the western limb of Bailadila Hills range at an elevation of 1200 AMSL. Entire mining lease area is hilly. The few cross sections showing ultimate pit are depicted as **Plate No. 2.8(A)** & **Plate No. 2.8(B).**
31	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on	Addressed under Specific TOR- VI.

	commencement of the Project. Phase-wise plan of plantation and compensatory afforestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and native species and the species which are tolerant to pollution.	
32	Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.	Details are discussed under **Section4.2.5.8** & **4.2.5.9** of **Chapter-4**.
33	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Rest Shelters will be provided for employees to take rest during rest hours at mining field offices, service center area and processing plant areas. Other facilities like first aid rooms, canteen, drinking water, toilets will also be provided as per requirement and statutory provisions. Details are given under **Section 2.11.4** of **Chapter-2**.
34	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.	Conceptual afforestation and reclamation plan is provided as **Plate No. 4.10** of **Chapter-4**. The reclamation of mined out areas will be undertaken at the end of life of mine after obtaining approval of IBM for Final Mine Closure Plan. The Biological reclamation of the mined-out areas at conceptual stage would be as follows: On the completed benches, shrubs like Agave and local shrubs will be planted. Recommended grasses will

		be grown on the slopes by hydro-mulching. Shrubs and native species of trees will be planted or seeds will be sown adding some soil. A water body is also planned in the mined-out pit of the South block of the Deposit-4, this will attract terrestrial fauna and avifauna.
35	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	List of notifiable diseases applicable to the Iron Ore mining operations are Silicosis and Noise induced hearing loss (exposure to high noise levels) as per 3rd Schedule of the Occupational Safety, Health and Working Conditions Code, 2020 No. 37 Of 2020 dated 28th September, 2020. Every year 20% of the total work force will be covered under periodic medical examination. Details are given under **Section 4.2.15** of **Chapter-4**.
36	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	The mining and allied operations will be confined to the mining lease area, as population will be far away from the mining site, thus, there will be no health implications on Public. In general, the common and seasonal diseases observed in the study are Dysentery, Malaria, Cold and fever, Jaundice. To improve the health conditions of the surrounding populace provisions will be made out of the CSR funds of the project. Details of the CSR fund allocation is given under **Section 8.3** of **Chapter-8.**
37	Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	CSR activities as undertaken by NMDC Ltd. in nearby iron ore mining projects will be emulated to provide necessary facilities to the local populace. The activities which will be undertaken by NMDC-CMDC Ltd. towards CSR could be broadly classified as: • Education • Roads and Buildings • Health and hygene • Drinking water; and • Infrastructure. Details of the CSR fund allocation is given under **Section 8.3** of

		Chapter-8.
38	Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Detailed environmental management plan to mitigate the environmental impacts is provided in under Section 4.2 of Chapter-4. Further details of provisioning of funds are provided at **Section 10.7 & Table 10.2** of **Chapter-10**.
39	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project.	A single Public Hearing held on 12.09.2023 at N.M.D,C. I.T.I. Complex, Bhansi, District-South Bastar Dantewada (C.G) for the two interlinked projects namely "Bailadila Iron Ore Deposit-4 Mine (M.L. Area = 646.596 Ha) with a production capacity of 7.0 MTPA ROM Iron ore and 6.41 MTPA Waste Excavation (Total Excavation 13.41 MTPA) along with 2000 TPH Crushing plant inside mining lease area located in Bailadila reserve forest, Tehsil Bade Bacheli, District South Bastar Dantewada, State Chhattisgarh of M/s. NMDC – CMDC Limited (NCL)." & "Screening Cum Beneficiation Plant (750 TPH of 4 lines each) along with 2200 TPH Downhill Conveyor and Loading Facilities in 122.5428 Ha area located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village; Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh of M/s. NMDC-CMDC Limited (NCL)." The advertisement of the Public Hearing was given by Chhattisgarh Environment Conservation Board in National and local Newspapers "Hindustan Times" (English) & "Haribhoomi" (Hindi) on 12.08.2023. The total cost of activities / schemes planned in response to public demand during public hearing is **Rs. 4000 lakhs**, which will be spent over three Financial Years (FY). Public hearing issues along with time bound action plan and budget is given under **Section-7.1** of **Chapter-7.**
40	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project	Not Applicable

	should be given	
41	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	The estimated project cost is Rs. 4091.33 Crores (approx.) (Approx. Rs. 1156.163 Crores inside ML area and approx. Rs. 2935.167 Crores outside ML area). NMDC-CMDC Ltd has budgeted an amount of Rs. 91.21 Crores under capital cost for implementation of Environmental Management Plan and recurring cost per annum is about 5.21 crores. Details is given under **Section 10.7 & Table 10.2** of **Chapter-10**.
42	A Disaster Management Plan shall be prepared and included in the EIA/EMP Report.	Disaster management plan detailing the measures for handling various emergency scenarios are provided under **Section 7.3** of **Chapter-7**.
43	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	Benefits of the Project is discussed in Chapter-8.
44	Activity-wise time-bound action plan on the issues raised and commitment made during public hearing to be submitted as part of the final EMP Report in compliance of the Ministry's OM F.No.22-65/2017-IA.11I dated 30th September, 2020.	The total cost of activities / schemes planned in response to public demand during public hearing is **Rs. 4000 lakhs**, which will be spent over three Financial Years (FY). Public hearing issues along with time bound action plan and budget is given under **Section-7.1** of **Chapter-7.**
45		
a	All documents to be properly referenced with index and continuous page numbering.	Noted & complied
b	Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.	Noted & complied
c	Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project.	Noted & complied
d	Where the documents provided are in a language other than English, an English translation should be provided.	Noted & complied

e	The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted	Noted
f	While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF vide O.M. No. J-11013/41/2006-IA.II (I) dated 4th August, 2009, which are available on the website of this Ministry, should be followed.	Noted & complied
g	Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation.	Noted & complied
h	As per the circular no. J-11011/618/2010-IA. II (I) dated 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Not Applicable
i	The EIA report should also include	
	Surface plan of the area indicating contours of main topographic features, drainage and mining area,	Noted & complied
	Geological maps and sections and	Noted & complied
	Sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	Noted & complied

II. Terms of Reference on 21/02/2022 for Mineral Beneficiation (Proposal No: IA/CG/IND/251437/2022, File No: IA-J-11011/23/2022-IA-II(IND-I)) for Screening cum Beneficiation plant outside the Mining Lease of Deposit-4.

A)	**GENERIC TERMS OF REFERENCE (ToR) IN RESPECT OF INDUSTRY SECTOR**	
Sl. No.	**Condition**	**Compliance**
1.	**Executive Summary**	Enclosed
2.	**Introduction**	
i.	Details of the EIA Consultant including NABET accreditation	**Ecomen Laboratories Pvt. Ltd.** **Address:** B – 1/8, 2nd Floor, Sector-H, Aliganj, Lucknow – 226024, Uttar Pradesh, India. **Mobile No.:** 9335947470 **Landline No.:** 5222761885 **E-mail Id:** contactus@ecomen.in **Accreditation No.:** NABET/EIA/2023/RA 0203 dated 20.04.2021 NABET Certificate is Attached.
ii.	Information about the project proponent	NMDC-CMDC Ltd. (NCL) was incorporated on 1st July 2006 between NMDC and CMDC Ltd. as a Joint Venture Company having its registered office at Green Villey City, Housing Board Colony, Post Sejbahar, NH-30, Raipur, Chhauisgarh – 492015.
iii.	Importance and benefits of the project	As per National Steel Policy-2017, Government of India has an ambitious plan for increasing the domestic steel production from present capacity of around 115 MTPA to 300 MTPA by FY 2030. This will necessitate production of 400-450 million tonnes of iron ore annually. The direct employment will be 700 for mining lease area (315 nos.) and screening cum beneficiation plant (385 nos.). Indirect employment including contractual employment will be about 1400. Total population

		expected to be benefited from the proposed mining lease and screening cum beneficiation plant will be around 10500. Indirect employment will be generated through handling of material, transport, banks, schools, restaurant, shops, petty trade etc., which will improve social & economic standing of the people in the locality. NMDC-CMDC Ltd. will undertake peripheral developmental activities by implementing welfare measures in surrounding area. For this purpose, Company will spend around minimum 2 % of the average net profits of the company during the three immediately preceding financial years for CSR activities.
3.	**Project Description**	
i.	Cost of project and time of completion.	Cost of the project is approx. Rs. 4091.33 Crores (Approx. Rs. 1156.163 Crores inside ML area and approx. Rs. 2935.167 Crores outside ML area). The first five years of the mining operations is considered as construction phase of the project and all ore dressing facilities, like Crushing plant, downhill conveyor will be installed during construction period of this project inside the Mining Lease. However, connected infrastructures like Screening Plan, Loading Plant and Admin building etc. will be constructed outside the Mining Lease Area during the 1st five years. Start of construction of the project will be commenced once all the statutory clearances will be obtained. Production will be commenced immediately after getting all regulatory clearances with smaller capacity equipment and in-pit crushing / screening

		system as detailed earlier. Details are discussed under **Section 2.13** of **Chapter-2**.
ii.	Products with capacities for the proposed project.	Product is Iron Ore with capacity of 7 MTPA of ROM.
iii.	If expansion project, detail s of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.	Not Applicable.
iv.	List of raw materials required and their source along with mode of transportation.	During the production of iron ore in the mining lease, usable grade iron ore as well as sub grade ore shall be produced. The crushed iron ore (-150mm) will be feed to the screening cum beneficiation plant situated outside the mining lease and same will be transported to screening cum beneficiation plant through the downhill conveyor belt from the crushing plant situated inside the mining lease of Deposit-4. During initial five-year period, when plant and railway siding will be under construction, iron ore produced will be transported to the customers through road. Though, after initial five years period when loading plant/railway siding of Deposit-4 will be constructed and commissioned, iron ore will be transported through rail, however, this will further depend on completion of the work of doubling of KK rail line and connection of Rawghat to Jagdalpur through rail. In view of this, 20% of total project capacity may be transported through road in foreseeable future beyond the initial five years period. Steps proposed to be taken to protect the ore from getting air borne are discussed under **Section 4.2.5.7** of **Chapter-4**.
v.	Other chemicals and materials required	Not Applicable

	with quantities and storage capacities.	
vi.	Details of Emission, effluents, hazardous waste generation and their management.	There will be no generation of Emission and effluents. Used oil generated will be sent to authorized vendor.
vii.	Requirement of water, power, with source of supply. Status of approval, water balance diagram, man-power requirement (regular and contract).	The total water requirement inside the mining lease will be 4250 KLD. The total water requirement for screening cum beneficiation facility (outside the mining lease of Bailadila Iron Ore Deposit-4) at full rated capacity is 8630 KLD (approx.) and 5500 KLD in wet and dry operations respectively. Thus, maximum water requirement will be 12880 KLD (Mining operation-4250 KLD + Wet screening operations -8630 KLD). Permission for withdrawal of water from Sankani Nalla and Nerli Nalla (Sankani Nadi) will be obtained from Water Resource Department, GoCG. NCL has submitted application for obtaining water permission for 20,000 KLD (considering entire Bailadila Deposit-4 project with peak rated capacity and future requirements including separate township) with Water Resource Department, GoCG. (attached as **Annexure 2.1**). Water balance is discussed under **Section 4.2.7** of **Chapter-4** and **Figure No. 4.3** & **4.4**. It is proposed to take electrical power from CSPDCL which is the main source for electrical power in Chhattisgarh, through their substation at Kirandul at 33KV through suitable overhead lines. CSPDCL is supplying power at 33 KV to other Bailadila projects and same voltage grade is proposed to Deposit-4, Bailadila also. Power is required for mines, Crushing Plant, Secondary Crushing Plant, Tertiary Crushing Plant, Screening Plant, Stacking, Reclaiming, Loading plant, Service Centre and

		Township. Based on the various loads involved, it is estimated that Maximum demand requirement shall be approx. 6 MVA to meet the 7 MTPA production. For electricity proper application will be initiated in due course of time when project will get started. The direct employment will be 700 for mining lease area (315 nos.) and screening cum beneficiation plant (385 nos.). Indirect employment including contractual employment will be about 1400. Total population expected to be benefited from the proposed mining lease and screening cum beneficiation plant will be around 10500.
viii.	The project proponent shall furnish the requisite documents from the competent authority in support of drawl of ground water and surface water and supply of electricity.	Application for drawl of water has already been submitted to the WRD GoCG, (attached as **Annexure 2.1**). For electricity proper application will be initiated in due course of time when project will get started.
ix.	Process description along with major equipment and machineries, process flow sheet (Quantitative) from raw materials to products to be provided.	Proposed new Screening Plant @EL 580m consists of 4 Nos. screening lines having 4 Nos. of double deck vibrating screens of design capacity of 750 TPH (primary screens) and 4 Nos. Secondary Vibrating Screens of 550 TPH capacity. Detailed process description with process sheet is discussed under **Section 2.9.3** of **Chapter-2.** Major Equipments are discussed in **Table 2.12** & **2.13** under **Section 2.7** of **Chapter-2.**
x.	Hazard identification and detail, of proposed safety systems.	Details are discussed under **Section 7.2 & 7.3** of **Chapter-7**.
xi.	Expansion/modernization proposals:	Not Applicable
	a. Copy of all the Environmental	

	Clearance(s) including Amendments thereto obtained for the project from MoEF&CC/SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment, Forest and Climate Change as per circular dated 30th May, 2012 on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In addition, status of compliance of Consent to Operate for the ongoing/existing operation of the project from SPCS/PCC shall be attached with the EIA-EMP report.	
	b. In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification 2006 shall be provided. Copies of Consent to Establish/No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCS shall be submitted. Further, compliance report to the conditions of consents from the SPCS shall be submitted.	
4.	**Site Details**	
i.	Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site. whether other sites were considered.	Screening Cum Beneficiation Plant (750 TPH of 4 lines each) along with 2200 TPH Downhill Conveyor and Loading Facilities in 122.5428 Ha. is located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village; Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh. Three alternative sites for Screening cum Beneficiation Plant were considered. Details of Analysis of Alternative Sites for Screening cum Beneficiation Plant

		is discussed under **Section 5.2** of **Chapter-5**.
ii.	A toposheet of the study area of radius of 10km and site location on 1:50.000/1:25,000 scale on an A3/A2 sheet. (Including all eco-sensitive areas and environmentally sensitive places)	Enclosed as **Plate No. 2.5** of **Chapter-2.**
iii.	Co-ordinates (lat-long) of all four corners of the site.	Co-ordinates (lat-long) is given in **Plate No. 1.2** of **Chapter-1**.
iv.	Google map-Earth downloaded of the project site.	Google Earth map is enclosed as **Plate No. 1.3** of **Chapter-1.**
v.	Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, green belt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of industrial Area indicating location of unit within the Industrial area/Estate.	Enclosed as **Plate No. 2.1** & **2.2** of **Chapter-2.**
vi.	Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.	**Figure No. 2.1** of **Chapter-2.**
vii.	Land use break-up of total land of the project site (identified and acquired), government/private - agricultural, forest, wasteland, water bodies, settlements, etc shall be included. (Not required for industrial area)	Land use break-up of total land of the project site is given in **Table 2.1B** of **Chapter-2.**
viii.	A list of major industries with name and type within study area (10km radius) shall be incorporated. Land use details of the study area.	A list of major industries is given under **Section 2.14** & **Plate No. 2.11** of **Chapter-2.** Land use details of the study area is given in **Table 3.40** under **Section 3.11.2.4** of **Chapter-3**.
ix.	Geological features and Geo-hydro logical/status of the study area shall be included.	The Bailadila Iron Ore Deposit 4 is a part of Bailadila Group of rocks of Archaean- Proterozoic age of Bastar Craton. It consists of mainly the banded iron formation (BIF), associated ferruginous shales and phyllite overlies unconformably the Bengpal group. Apart from these major rock types, volcanic tuffs and quartzites are also present in and around the mine lease area. Metabasaltic

		traps with tuffs and cherts underlie the above suite of rocks (i.e. Bengpal Series). The basal metabasaltic lavas and dolerite intrusions are encountered along the eastern foothills of the range. Details are discussed under **Section 2.5** of **Chapter-2.**
x.	Details of Drainage of the project upto 5km radius of study area. If the site is within 1km 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. (Mega green field projects)	The drainage plan of study area is attached as **Plate No.2.6** of **Chapter-2.**
xi.	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.	Land acquisition process is already under progress. Publication of preliminary notification as per Section-11 of the LARR Act 2013 has been made in the Gazette of the Chhattisgarh on 08.09.2023. (attached as **Annexure-1.11**).
xii.	R&R details in respect of land in line with state Government policy.	About 21 Nos. of families will be affected in the revenue land / Forest revenue land / Forest Pattas in the reserve forest area of the project. These families will be compensated, resettled and rehabilitated socially, culturally and economically as per extant provisions of the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act – 2013 and rules thereof. Guidelines given in the Ideal Rehabilitation Policy 2007 of State of Chhattisgarh will also be followed. Details are discussed under **Section 7.5** of **Chapter-7**.
5.	**Forest and wildlife related issues (if applicable):**	
i.	Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest	Application for diversion of the Forest Land has been submitted vide proposal no.

	Department. (If applicable).	FP/CG/MIN/146694/2021 dated 04.10.2021 for total area of 682.2722 Ha. (570.10 Ha inside mining lease, 100.077 Ha outside mining lease in the reserve forest and 12.0952 Ha Bade Jhad ke Jungle). An area of 76.496 Ha demarcated as Tree Fern Area inside the mining lease is not included in the forest diversion proposal (references are enclosed as **Annexure-1.8 & Annexure-1.9**).
ii.	Land use map based on High resolution satellite imagery (GPS) of the proposed site delineating the forest land (in case of projects involving forest land more than 40 ha).	Land use details of the study area is given in **Table 3.40** under **Section 3.11.2.4** of **Chapter-3**. Land use map based on High resolution satellite imagery (GPS) is attached as **Plate No. 3.9** & **3.10** of **Chapter-3**.
iii.	Status of Application submitted for obtaining the stage-I forestry clearance along with latest status shall be submitted.	Application for diversion of the Forest Land has been submitted vide proposal no. FP/CG/MIN/146694/2021 dated 04.10.2021 for total area of 682.2722 Ha. (570.10 Ha inside mining lease, 100.077 Ha outside mining lease in the reserve forest and 12.0952 Ha Bade Jhad ke Jungle). An area of 76.496 Ha demarcated as Tree Fern Area inside the mining lease is not included in the forest diversion proposal (references are enclosed as **Annexure-1.8 & Annexure-1.9**).
iv.	The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wild life Warden showing these features vis-a.-vis the project location and the recommendations or comments of the Chief Wildlife Warden-thereon.	Not Applicable
v.	Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for	Wildlife conservation & management plan has been approved by Chief Wildlife Warden

	conservation of Schedule I fauna, if any exists in the study area.	vide Order No./V.PRA/Prabandha-637/253 Nava Raipur, dated 25.09.2023 (refer **Annexure-4.3**). The fund allocated for Wild Life conservation and management plan is **Rs. 1931.732/- Lacs.** The details of the fund allocated for Wild Life conservation and management plan are given under **Section 4.2.12.7** & **Table 4.26** of **Chapter-4.**
vi.	Copy of application submitted for clearance under the Wildlife (Protect ion) Act, 1972, to the Standing Committee of the National Board for Wildlife.	Not Applicable
6.	**Environmental Status**	
i.	Determination of atmospheric inversion level at the project site and site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direct ion and rainfall.	Discussed under **Section 3.5.1** of **Chapter-3**.
ii.	AAQ data (except monsoon) at 8 locations for PM10, PM2.5, S02, NOx, CO and other parameters relevant to the project shall be collected. The monitoring stat ions shall be based CPCB guidelines and take into account the pre-dominant wind direction, population zone and sensitive receptors including reserved forests.	AAQ data has been collected summer season (March 2022 to May 2022). Details are discussed under **Section 3.5.2** of **Chapter-3**.
iii.	Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQQM Notification of Nov. 2009 along with - min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an annexure to the EIA Report.	Attached as **Annexure 3.1(A)-3.1(N)**.
iv.	Surface water quality of nearby River (60m upstream and downstream) and other surface drains at eight locations.is per CPCB/MoEF&CC guidelines.	Details are attached as **Annexure 3.2 (B)** & **3.2 (C).**
v.	Whether the site falls near to polluted stretch of river identified by the CPCB/MoEF&CC.	Site does not fall near to polluted stretch of river identified by the CPCB/MoEF&CC.
vi.	Ground water monitoring at minimum at 8 locations shall be included.	Details are attached as **Annexure 3.2 (A).**
vii.	Noise levels monitoring at 8 locations within the study area.	Details are discussed under **Section 3.5.5** of **Chapter-3**.
viii.	Soil Characteristic as per CPCB guidelines.	Details are discussed under

		Section 3.5.7 of **Chapter-3**.
ix.	Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.	Details are discussed under **Section 3.5.6** of **Chapter-3**.
x.	Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.	Details are discussed under **Section 3.7** of **Chapter-3**.
xi.	Socio-economic status of the study area.	Details are discussed under **Section 3.6** of **Chapter-3**.
7.	**Impact Assessment and Environment Management Plan**	
i.	Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modelling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be well assessed. Details of the model used and the input data used for modeling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby. Sensitive receptors, if any.	Cumulative Impact Assessment is done for both Worst case and control case. Details are given under **Section 4.1.5.1** of **Chapter-4**.
ii.	Water Quality modelling - in case. if the effluent is proposed to be discharged in to the local drain. then Water Quality Modelling study should be conducted for the drain water taking into consideration the upstream and downstream quality of water of the drain.	Not Applicable
iii.	Impact of the transport of the raw materials and end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or conveyor-cum-rail transport shall be examined.	Details are discussed under **Section 4.2.5.8** of **Chapter-4**.
iv.	A note on treatment of wastewater from different plant operations, extent recycled	A scheme for dry disposal of iron

	and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E (P) Rules.	ore in the beneficiation plant has been conceptualised (hydraulic pressure filter technology) in which there will be no waste water/effluent generation.
v.	Details of stack emission and action plan for control of emissions to meet standards.	There will be no process stack.
vi.	Measures for fugitive emission control	Details are discussed under **Section 4.2.5** of **Chapter-4.**
vii.	Details of hazardous waste generation and their storage, utilization and disposal. Copies of MOU regarding utilization of so lid and hazardous waste shall also be included. EMP shall include the concept of waste-minimization, recycle/reuse/recover techniques, Energy conservation, and natural resource conservation.	Used oil generated will be sent to authorized vendor.
viii.	Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.	Not Applicable
ix.	Action plan for the green belt development plan in 33 % area i.e., land with not less than 2500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.	Green area at the infrastructural facilities outside mining lease will be 400575 m^2 (33% of the total area of outside mining lease) and afforestation/gap plantation will be done as 2500 trees per hectare i.e. a total of 100144 trees for afforestation/gap plantation. The work will be undertaken through Chhattisgarh Rajya Van Vikas Nigam. Details are discussed under **Section 4.2.5** of **Chapter-4** and **Plate No. 2.1** & **2.2.**
x.	Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the rooftops and storm water drains to recharge the ground water and also to use for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.	The rain water (surface run off) will be properly guided through garland drains to the lower most mining benches. Rain water will be allowed to settle to remove suspended solids. Provisions for check dams/bunds in the water streams and toe walls below the waste dumps will be made. 5 nos. of rain water harvesting pits have been planned in screening cum

		beneficiation plant area. Details are discussed under **Section 4.2.9** of **Chapter-4** and **Plate No. 2.1**.
xi.	Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.	NMDC-CMDC Ltd. has budgeted an amount of Rs. 91.21 crores under capital cost for the implementation of the Environmental Management Plan and the recurring cost per annum is about Rs. 5.21 crores. Details are discussed under **Section 10.7** of **Chapter-10**.
xii.	Action plan for post-project environmental monitoring shall be submitted.	Discussed in different Sections of **Chapter-6**.
xiii.	Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.	Details are discussed under **Section 7.3** of **Chapter-7**.
8.	**Occupational health**	
i.	Details of existing Occupational & Safety Hazards. What are the exposure levels of above-mentioned hazards and whether they are within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them with in PEL so that health of the workers can be preserved.	List of notifiable diseases applicable to the Iron Ore mining operations are Silicosis and Noise induced hearing loss (exposure to high noise levels) as per 3rd Schedule of the Occupational Safety, Health and Working Conditions Code, 2020 No. 37 Of 2020 dated 28th September, 2020. Every year 20% of the total work force will be covered under periodic medical examination. Details are given under **Section 4.2.15** of **Chapter-4**.
ii.	Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre-designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre-placement and periodical examinations give the details of the same. Details regarding last month analysed data of abovementioned parameters as per age, sex, duration of exposure and department wise.	Every year 20% of the total work force will be covered under periodic medical examination. Details are given under **Section 4.2.15** of **Chapter-4**.
iii.	Annual report of health status of workers	Annual report of health status of

	with special reference to Occupational Health and Safety.	workers with special reference to Occupational Health and Safety will be prepared after implementation of the project.
iv.	Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers.	Details are given under **Section 4.2.15** of **Chapter-4**.
9.	**Corporate Environment Policy**	
i.	Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.	NMDC-CMDC Limited (NCL) has formulated an environmental policy at corporate level (same has been approved by its Board), with commitment to protect the environment while operating projects. NCL will put its sincere efforts to control the pollution and comply all the statutory standards. The draft corporate environmental policy of NCL is formulated in English and Hindi language and attached as **Annexure 10.1** & **10.2** respectively.
ii.	Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement/ deviation / violation of the environmental or forest norms/ conditions? If so, it may be detailed in the EIA.	Yes, corporate environmental policy of NCL is formulated in English and Hindi language and attached as **Annexure 10.1** & **10.2** respectively.
iii.	What is the hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.	Details are provided as **Figure 10.1** of **Chapter-10**.
iv.	Does the company have system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the company and /or shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report	Yes, corporate environmental policy of NCL is formulated in English and Hindi language and attached as **Annexure 10.1** & **10.2** respectively.
10.	Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase.	All the infrastructure facilities such as 'restrooms, washrooms, canteen, provision of potable water etc. will be provided to all the workers as well as truck drivers during construction & operation phase.

11.	To address the Public Hearing issues, provisions contained. under Ministry's Office Memorandum vide F.No. 22-65/2017-IA. III dated 30/09/2020 shall be complied.	The total cost of activities / schemes planned in response to public demand during public hearing is **Rs. 4000 lakhs**, which will be spent over three Financial Years (FY). Public hearing issues along with time bound action plan and budget is given under **Section-7.1** of **Chapter-7.**
12.	Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protect ion) Act, 1986 or re levant Sections of Air and Water Acts? If so. details thereof and compliance/ATR to the notice(s) and present status of the case.	No litigation is pending against the project and/or any direction/order passed by any Court of Law against the project
13.	A tabular chart with index for points wise compliance of above ToRs.	Noted and complied.
14.	The ToRs prescribed shall be valid for a period of three years for submission of the EIAEMP reports along with Public Hearing Proceedings (wherever stipulated).	Noted.
B)	**ADDITIONAL ToRS FOR BENEFICIATION PLANT**	
1.	Complete process flow diagram describing each unit, its processes and operations, along with material and energy inputs & outputs (material and energy balance).	Details in respect of dry and wet screening/beneficiation of iron ore along with process flow diagram, equipment specification, mass balance are discussed under **Section 2.9.3** of **Chapter-2**. Water balance is discussed under **Section 4.2.7** of **Chapter-4** and **Figure No. 4.3** & **4.4**.
2.	Details regarding pollution control measures to be adopted in the mineral handling area, loading and unloading areas including all transfer points shall be submitted.	Dry fog dust suppression system (DSS) will be installed at all transfer points in the conveyor belt gallery and plant area. Mist water canon will also be provided for dust suppression at stockpiles of the loading plant. The secondary stockpile before the screening plant will be covered one. Details are discussed under **Section**

		4.2.5.7 of **Chapter-4**.
3.	The Project proponent shall submit action plan for conditioning of the ore with water to mitigate fugitive dust emission, without affecting flow of ore in the ore processing and handling areas.	During the dry operation of the Plant, approx. 1000 KLD water will be used for dust suppression in the Plant. As only Primary Screen with double deck will be used and down the line process will be closed down, sized Iron Ore (product of primary screen and tertiary crusher) treated with water (for dust suppression purpose) will move to Lump Ore / Fine Ore Conveyor Belt i.e. movement of the ore will be in limited areas during the dry season operations. Water spraying for dust suppression will be just enough to stop the iron ore becoming air borne at transfer points. There will not be any effect on flow the ore in the plant area during dry season. However, during wet screening process, there may be chances of biding of iron ore particles in the screen openings and chutes. This may create flowability issue during wet screening process, to remove this, specially made chutes with special liners, screens with special cloths and water absorbent polymer will be used. Details of the same is discussed under **Section 2.9.3.3** of **Chapter-2**.
4.	Treatment details regarding effluent generated from the ore beneficiation plant and the mode of transportation of tailing slurry shall be submitted.	A scheme of dry disposal of tailings using horizontal belt filters and hydraulic pressure filters has been incorporated in the beneficiation scheme of the project. This scheme will enable the project to use the water optimally and there will be zero discharge of slime out of the ore processing and handling areas. Details of the same is discussed under **Section 2.9.3.1** of **Chapter-2.**

5.	Separate chapter on design of the tailing/slime pond by considering the rainfall in the area, proximity of the tai ling/slime pond to the nearby water bodies and safety etc., shall be submitted.	Not applicable as a scheme of dry disposal of iron ore tailings has been envisaged removing requirement of tailing dam thereof.
6.	Action plan for regular monitoring of ground water level and quality in and around the project area of beneficiation plant and tailing/slime pond shall be submitted by establishing a network of existing wells and constructing new piezometers.	Regular monitoring of ground water level and quality in and around the project area of beneficiation plant will be done. Details are discussed under **Sections 6.2** & **6.3** of **Chapter-6**.
7.	Details regarding establishment of garland drain around the tailing/slime pond and the quantity of decanted water to be re-circulated from the tailing/slime pond shall be submitted along with complete water balance.	Not applicable as a scheme of dry disposal of iron ore tailings has been envisaged removing requirement of tailing dam thereof.
8.	Technology to be adopted for maximum recovery of ore in order to reduce slurry discharge and to increase the life of the tailing/slime pond shall be submitted.	As per the scheme of dry disposal of iron ore tailings, maximum recovery of ore will be done and the dry tailings cakes will be stored in a stockpile and used water will be recycled in the beneficiation process. Details of the same is discussed under **Section 2.9.3.1** of **Chapter-2.**
C)	**Specific ToRs**	
i.	Project proponent shall collect fresh one season Ambient Air Quality (AAQ) data based on meteorology and topography of the area.	A fresh one season Ambient Air Quality (AAQ) data based on meteorology and topography of the area has been collected from 1st March, 2022 to 31st May, 2022. Details are discussed under different Sections of Chapter-3.
ii.	A scheme for Dry disposal of Iron Ore Beneficiation Plant (IOBP) tailings after dewatering shall be submitted.	A scheme of dry disposal of iron ore tailings in form of cakes through horizontal belt filter/pressure filter has been incorporated in the beneficiation scheme of Bailadila iron ore deposit-4. Details are discussed under **Section 2.9.3.1** of **Chapter-2**.
iii.	Cumulative impact assessment shall be carried out for iron ore mines and	Cumulative Impact Assessment is done for both Worst case and

	beneficiation plant.	control case. Details are given under **Section 4.1.5.1** of **Chapter-4**.
iv.	Detail regarding no. of trees to be cut, girth & height, age and species of the trees shall be provided in the EIA/EMP report.	Approx. 21696 trees will be cut in outside mining lease area (screening cum beneficiation plant). Details of trees to be cut with girth class wise are attached as **Annexure 4.2.**
v.	R&R shall be implemented as per Land Acquisition, Rehabilitation and Resettlement (LARR) Act 2013. The details shall be furnished in EIA report.	Application for diversion of 12.0952 Ha of Revenue Forest Land (Bade Jhad ke Jungle) is included in the Forest Diversion Proposal for Forest Land falling in the Bailadila Reserve Forest. Application for allotment of Government Revenue Land has been filed with the District Collector – South Bastar, Dantewada. Application for acquisition of Private Revenue Land, as per provisions of the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act – 2013 (LARR Act 2013), is also under process with the revenue department of the District – South Bastar, Dantewada. Publication of preliminary notification as per Section-11 of the LARR Act 2013 has been made in the Gazette of the Chhattisgarh on 08.09.2023. (attached as **Annexure-1.11**). About 21 Nos. of families will be affected in the revenue land / Forest revenue land / Forest Pattas in the reserve forest area of the project. These families will be compensated, resettled and rehabilitated socially, culturally and economically as per extant provisions of the Right to Fair Compensation and Transparency in

		Land Acquisition, Rehabilitation and Resettlement Act – 2013 and rules thereof. Guidelines given in the Ideal Rehabilitation Policy 2007 of State of Chhattisgarh will also be followed. Details are discussed under **Section 7.5** of **Chapter-7**.
vi.	Status of Forest Clearance for the diversion of 100.07 ha of forest land shall be submitted.	Application for diversion of 100.077 Ha of forest land and 12.0952 Ha (revenue forest land-Bade Jhad ke Jungle) is already submitted on the Parivesh Portal and same has been registered (attached as **Annexure 1.8** & **1.9**). Activities for forest clearance are under process.
vii.	Details regarding downhill pipe conveyor, Right of Way for the conveyor and the noise control measures to be adopted in the conveyor route shall be submitted.	The downhill conveyor system will be open belt conveyor with closed/covered conveyor gallery and all the measures for mitigation of noise will be adopted such as use of rubber rollers, regular maintenance of the conveyor structure, truss structure, rollers, brakes etc. The complete length of downhill conveyor will be passing through the forest land for which diversion application has been filed and same is under process. Details are discussed under **Section 2.9.2** of **Chapter-2** and **Plate No. 2.1** & **2.2**.
viii.	Action plan to limit the particulate matter emission from all the stacks be low 30 mg/Nm^3 shall be furnished.	Not Applicable
ix.	Action plan for fugitive emission control in the plant premises shall be provided.	Details are discussed under **Section 4.2.5** of **Chapter-4.**
x.	Action plan for green belt development in 33% of total area with tree density of 2500 plants per ha shall be submitted. This shall include 20 m green belt development inside the project area towards the Bhansi Village located al distance of 250 meter from the project site.	Green area at the infrastructural facilities outside mining lease will be 400575 m^2 (33% of the total area of outside mining lease) and afforestation/gap plantation will be done as 2500 trees per hectare i.e. a total of 100144 trees for

		afforestation/gap plantation. The work will be undertaken through Chhattisgarh Rajya Van Vikas Nigam. Details are discussed under **Section 4.2.5** of **Chapter-4** and **Plate No. 2.1** & **2.2.**
xi.	Action plan for rain water harvesting shall be submitted.	There will be provision of five rain water harvesting pits at the beneficiation plant. Details are discussed under **Section 4.2.9** of **Chapter-4.**
xii.	Action plan for the stock piles with impervious floor, provision of garland drains and catch pits to trap run off material shall be submitted.	The floor of the stockpiles in the plant area will be made impervious by use of geopolymer binders or laying of clay. In market, there are various manufactures which are providing specially formulated liquids (polymer binder) to replace use of concreting in surface laying. These liquids are environment friendly. Further garland drains throughout the outer boundary of the stockpiles will be made and water of the garland drains will be channelized in the catch pits to trap the run off iron ore.
xiii.	Action plan for developing connecting and internal road in terms of MSA as per IRC guidelines shall be submitted.	Internal roads in the plant area will be utilised by light vehicles, utility trucks and small capacity tippers for man/ material transfer. Internal roads in the plant area will be of sufficient width and adequate load bearing capacity. All internal roads will be tarred, giving proper slope to direct the rainwater. Also shoulder drains will be constructed and pavements will also be constructed.
xiv.	Details of flora and fauna existing in the study area shall duly be authenticated by the concerned DFO of the area. In case of existence of any endangered species and schedule I fauna, authenticated conservation plan shall be submitted.	Wildlife conservation & management plan has been approved by Chief Wildlife Warden vide Order No./V.PRA/Prabandha-637/253 Nava Raipur, dated 25.09.2023 (refer **Annexure-**

		4.3). The fund allocated for Wild Life conservation and management plan is **Rs. 1931.732/- Lacs.** The details of the fund allocated for Wild Life conservation and management plan are given under **Section 4.2.12.7** & **Table 4.26** of **Chapter-4.** Detailed biological study carried out. Schedule-I fauna in the study area reported in Dantewada Forest Division are provided. Biodiversity Conservation Plan and Soil, Water & Moisture Conservation for tree fern area has been prepared and approved by Biodiversity Board of Chhattisgarh vide order no./Jai.V.Bo/17 Raipur dated 21.08.2023 (refer **Annexure-4.4**). The fund allocated for Biodiversity Conservation Plan and Soil, Water & Moisture Conservation for tree fern area is **Rs. 3107.733/- Lacs.** The details of the fund allocated for Wild Life conservation and management plan are given under **Section 4.2.12.7** & **Table 4.27** of **Chapter-4.**

CHAPTER-1
INTRODUCTION

1.1 Purpose of the Report

NMDC-CMDC Ltd. (NCL) was incorporated on 1st July 2006 between NMDC and CMDC Ltd. as a Joint Venture Company having it's registered office at Green Villey City, Housing Board Colony, Boriyakala, Raipur, Chhattisgarh - 492 015. The objective of NCL is to develop, explore, raise and sell Iron Ore and any other minerals from the deposits allocated by GoI.

As per National Steel Policy-2017, Government of India has an ambitious plan for increasing the domestic steel production from present capacity of around 115 MTPA to 300 MTPA in next 10 to 15 years. This will necessitate production of 400-450 million tonnes of iron ore annually. Low per capita steel consumption in the country at approx. 77 kg vis-a-vis the world average of 233 kg also indicates the huge growth potential for the Indian steel industry. In view of the ambitious targets set by National Steel Policy, steel producers like Tata Steel, JSW Steel, JSPL etc. are already ramping up their steel production capacities. NMDC being India's largest iron ore producer has to take lead in ensuring high production to avoid iron ore imports leading to loss of precious foreign exchange.

To achieve the targets set by National Steel Policy-2017, Ministry of Steel, GoI has asked NMDC Ltd. to increase its Iron Ore Production capacities. Accordingly, NMDC has targeted to achieve Iron Ore production of 84 MTPA by 2025 and 100 MTPA by 2030. To achieve this, NMDC plans to opening up of green field projects and enhance capacity expansion of brown field projects. One of project identified under green field is Bailadila Iron Ore Deposit-4 of M/s NMDC-CMDC Limited (NCL) which is located north of Deposit-5 on the western flank of the Bailadila range of hills, lying at a distance of about 135 kms towards south-west of Jagdalpur in the state of Chhattisgarh.

It is proposed to produce ROM Iron ore of 7.0 MTPA and waste excavation of 6.41 MTPA (Total Excavation 13.41 MTPA) in ML Area 646.596 Ha along with 2000 TPH Crushing plant inside mining lease area located in Bailadila reserve forest, Tehsil Bade Bacheli, District South Bastar Dantewada, State Chhattisgarh along with Screening Cum Beneficiation Plant (750 TPH of 4 lines each), 2200 TPH Downhill Conveyor and Loading Facilities in 100.077 Ha. Forest area and 22.4658 ha. Revenue land(Govt., Private and Bade Jhad Ke Jungle) area located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village: Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh by M/s NMDC-CMDC Limited (NCL).

In pursuance of Government of India policy vide Environment (Protection) Act, 1986, new projects or expansion of any existing plant necessitates statutory prior environmental clearance in accordance with the objectives of National Environmental Policy as approved by the Union Cabinet on 18th May, 2006 and

MoEF&CC EIA Notification dated 14.09.2006, by preparing Environmental Impact Assessment (EIA) report.

MoEF&CC vide its office memorandum J-11013/41/2006-IA. II(I) dated 24th December 2010 has issued procedure to be adopted henceforth for consideration of integrated and interlinked projects.

The two interlinked projects are as under:

"Bailadila Iron Ore Deposit-4 Mine (M.L. Area = 646.596 Ha) with a production capacity of 7.0 MTPA ROM Iron ore and 6.41 MTPA Waste Excavation (Total Excavation 13.41 MTPA) along with 2000 TPH Crushing plant inside mining lease area located in Bailadila reserve forest, Tehsil Bade Bacheli, District South Bastar Dantewada, State Chhattisgarh of M/s. NMDC – CMDC Limited (NCL)."

Is Interlinked With

"Screening Cum Beneficiation Plant (750 TPH of 4 lines each) along with 2200 TPH Downhill Conveyor and Loading Facilities in 100.077 Ha. Forest area and 22.4658 ha. Revenue land (Govt., Private and Bade Jhad Ke Jungle) area located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village; Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh of M/s. NMDC-CMDC Limited (NCL)."

After obtaining TOR from respective EACs, NCL shall prepare a common EIA report with baseline environmental data for one full season and also covering the both the TOR conditions comprehensively and entire project as a whole.

Single Public consultation shall be held based on the EIA report thus prepared for both components as per the provision of EIA notification 2006.

After, Public consultation will be held, the proposal for Environmental Clearance shall be uploaded in Parivesh portal of MoEF&CC simultaneously in both sectors viz Non-Coal Mining and Industry-1.

The respective EACs will consider the above two specific proposals based on the common EIA report. After review of the above proposals by respective EACs and their recommendations made, the Environment Clearance will be issued by both the sectors of MoEF&CC, GOI simultaneously.

Hence, NCL Ltd has engaged EIA consultant M/s. Ecomen Laboratories (P) Ltd., Lucknow (Accredited by QCI/NABET) for preparation of EIA/EMP report for Bailadila Iron Ore Deposit-4 with fresh base line data for a total excavation of 13.41 MTPA (7 MTPA ROM and 6.41MTPA waste excavation) in mining lease area of 646.596 Ha along with Screening Cum Beneficiation Plant (750 TPH of 4 lines each) with 2200 TPH Downhill Conveyor and Loading Facilities in 122.5428 Ha area located at outside the Mining Lease area of Bailadila Iron Ore Deposit-4.

Form-1 and PFRs were uploaded in the Parivesh portal of MoEF&CC for obtaining Terms of Reference on 14/01/2022 for both the proposals i.e. non coal mining **(Proposal No: IA/CG/MIN/251288/2022, File No: IA-J-11015/104/2021-IA-II(NCM))** for Mining Lease of Deposit-4 and Industrial Projects-I sector

(Proposal No: IA/CG/IND/251437/2022, File No: IA-J-11011/23/2022-IA-II(IND-I)) for Screening cum Beneficiation plant outside the Mining Lease of Deposit-4.

The EAC meeting for Bailadila Iron Ore Deposit-4 Mine was held on 17th February 2022 and ToR was issued vide No. IA-J-11015/104/2021-IA-II(NCM) dated 11.03.2022 (enclosed as **Annexure-1.1**).

The EAC meeting for Screening cum Beneficiation Plant outside the mining lease of Deposit-4 was held on 10th February 2022 and ToR was issued vide F. No. IA-J-11011/23/2022-IA-II(IND-I) dated 21.02.2022 (enclosed as **Annexure-1.2**).

Based on the stipulated ToR conditions, the project proponent has incorporated the scheme of dry disposal of iron ore tailings in the beneficiation process of Bailadila Iron Ore Deposit-4. Because of this, requirement of slurry pipeline and tailing dam thereof has been done away, resulting in requirement of a lesser area of 122.5428 Ha outside the mining lease area against the initial requirement of 195.537 Ha.

Baseline monitoring study was conducted during March' 2022 to May' 2022 in core and buffer zone of Bailadila Deposit-4 Mine and Beneficiation Plant. The EIA/EMP report is prepared based on the Terms of Reference for obtaining environmental clearance for the proposed projects.

Single Public Hearing was conducted on 12.09.2023 at Village-Bhansi, Tehsil-Bade Bacheli, District-South Bastar Dantewada, Chhattisgarh based on the EIA report prepared for both components as per the provision of EIA notification 2006.

1.2 Identification of Project & Project Proponent

1.2.1 Identification of Project

Ministry of Mines, GoI on 30.09.2019 has granted its prior approval for reservation of Bailadila Iron Ore Deposit-4 (Total Area 646.596 Ha), in favour of NMDC-CMDC Ltd. (NCL) for the purpose of Prospecting and Mining of Iron Ore (enclosed as **Annexure-1.3**). Further, Ministry of Mines, GoI on 18.02.2021 has issued amendment for the revised coordinates in the earlier issued Gazette Notification for reservation of Bailadila Iron Ore Deposit-4 (enclosed as **Annexure-1.4**).

Mineral Resource Department (MRD), Government of Chhattisgarh (GoCG) on 26.06.2021 has issued a Letter of Intent (LOI) for grant of Mining Lease for the said area of Bailadila Iron Ore Deposit-4 for a period of five years (enclosed as **Annexure-1.5**).

Subsequently, MRD, GoCG on 07.08.2021 has issued an amendment in the Letter of Intent (LOI) prescribing the requirement of approved Mining Plan (enclosed as **Annexure-1.6**).

Further, MRD, GoCG on 04.05.2022 has issued an amendment in the Letter of Intent (LOI) mentioning period of the mining lease as 50 years (enclosed as **Annexure-1.7**).

The total mining lease area earmarked for Bailadila Iron Ore Deposit-4 is 646.596 Ha. Total mining lease area is forest land. To develop Screening Cum Beneficiation

Plant along with 2200 TPH Downhill Conveyor and Loading facilities an area of 100.077 Ha. Forest area and 22.4658 ha. Revenue land (Govt., Private and Bade Jhad Ke Jungle) has been identified. Application for diversion of the Forest Land has been submitted vide proposal no. FP/CG/MIN/146694/2021 dated 04.10.2021 for total area of 682.2722 Ha. (570.10 Ha inside mining lease, 100.077 Ha outside mining lease in the reserve forest and 12.0952 Ha Bade Jhad ke Jungle). An area of 76.496 Ha demarcated as Tree Fern Area inside the mining lease is not included in the forest diversion proposal (references are enclosed as **Annexure-1.8 & Annexure-1.9**). Process of land acquisition of the revenue land has been initiated and preliminary notification as per section 11 of the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR Act 2013) for the same has been published in the Gazzette of Chhattisgarh on 08.09.2023 (attached as **Annexure-1.11**).

1.2.2 Project Proponent

NMDC-CMDC Ltd. was incorporated based on the Memorandum of Understanding dated 1st July 2006 and the Shareholders & Joint Venture Agreement signed on 27th March 2007 by and between NMDC Ltd. and CMDC Ltd. The ratio of equity holding of NMDC Ltd. and CMDC Ltd. in the Company is 51 percent and 49 percent respectively. NMDC Ltd. is a Government of India Enterprise under Ministry of Steel incorporated on November 15, 1958 is engaged in the activities of exploration, developing and exploiting mineral resources of the country other than oil, natural gas and atomic minerals. NMDC is the largest producer of Iron ore in the country sharing about 17% of the country's production. NMDC developed number of iron ore mines in the remote areas of the country and has contributed significantly to the country's growth through mining of valuable minerals like iron ore and diamonds. All projects of NMDC are accredited with Integrated Management System (IMS) along with Social Accountability Standards SA 8000:2014. In the field of environment management and social awareness, NMDC has received various prestigious awards.

1.3 Brief Description of Nature, Size, and Location of the Project

Nature of the Project

Bailadila Iron Ore Deposit-4 is a big and homogeneous iron ore deposit having 129.40 MT (Million Tonnes) of Insitu Resource and Reserve of 109.01 MT with average grade of Fe 64.80%.

NMDC-CMDC Ltd. proposes to develop and operate the Bailadila Iron Ore Deposit-4 located in the stateof Chhattisgarh through Departmental mining/Mine Developer cum Operator (MDO).

If MDO will be appointed by NCL then the MDO shall at its own cost and expenses procure, finance for, and undertake the design, engineering, procurement, construction and operation of the mine for excavation, processing and delivery of Iron Ore.

In the first five years of mining plan period, mine developmental activities along with haul road preparation, approach to waste dump etc. are proposed. The annual excavation capacity of the mine shall be 2.0 MTPA in the first five years of operation.

The capacity of the mine shall be augmented in the continuously increasing manner from the sixth year of the operation of the mine and the mine shall attain its full rated capacity of 7.0 MTPA of capacity in the 9th year of operation. The deposit will be exploited by deploying shovel-dumper combination. The deep- hole drilling and blasting technique will be adopted for rock fragmentation.

During the first five years, all necessary infrastructure facilities, such as crushing and screening facilities, downhill long-distance conveyors, railway sidings, etc. will be established and hence there would be a cap of 2.0 MTPA on production capacity during this period.

Size of the Project:

Deposit-4 is situated in the North of Deposit No.5 and South of Deposit No.3 in the western ridge of the Bailadila Iron Ore range. The ore body occurs as northern continuation of north block of Deposit No.5, separated from Deposit No.5 by a narrow parting of about 150 mts of poor grade lateritic ore. On the northern side, Deposit No.4 is separated from Deposit No.3 by a parting of un-enriched banded hematite-quartzite.

The ore body is divided into north and south blocks which are separated by unenriched BHQ. The deposit is bounded by a deep valley on western side and Galli nalla on eastern side. The eastern flank of the deposit is mostly covered by poor grade laterites. Small cliffs composed of hard massive ore occur on the western side of the deposit. Western boundary is often marked by sharp contact against the BHQ.

The deposit has a general synclinal structure. The ore body is however, disturbed by several faults which are oblique and transverse in nature. The ore body is also characterized by cross folding, because of which the width of the ore body at places is wider and narrower.

Initially the mine will be developed for 1195600 Tonnes per annum in the first year and later on 2.0 MTPA of ROM production from second to fifth year. Thereafter the capacity of the mine will be gradually augmented to 7.0 MTPA of ROM.

Bailadila deposit-4 will be worked as a fully mechanized mine. Deposit-4 has been designed for operation as fully mechanized opencast mines using shovel-dumper combination and various processes are - drilling, blasting, excavation, quality control, ore processing (crushing & screening), loading of finished products and waste disposal. Waste (Shale and Banded Hematite Quartzite) will be dumped in the Waste Dump outside ultimate pit limit. It is a big and homogeneous iron ore deposit having 129.40 MT (Million Tonnes) of Resource and Reserve of 109.01 MT with average grade of Fe 64.8 %. The production capacity of Deposit-4 will be @7 MTPA Iron Ore ROM production. Accordingly, the life of the Mine would be 21 years.

Screening cum Beneficiation Plant shall be having 750 TPH of 4 lines each along with 2200 TPH Downhill Conveyor with Loading Facilities in 122.5428 Ha area located outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village: Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh. The screening cum beneficiation plant and loading plant covers a four-line screening

plant, tertiary crushing plant, wet circuit system with provision for dry disposal of tailings, conveyor system, open stockpiles for dried tailings' cake, finished product, electrical sub-station, electrical building / control room, office & stores buildings, maintenance sheds, canteen & rest rooms, sprinkler water & dry fog system pump houses, raw water reservoirs, recirculation water tank & pumping systems, water settling/recirculation ponds etc.

Location of the Project

Bailadila Iron Ore Deposit-4 Mine having lease area of 646.596 Ha is located in the Topo sheet no. E44J2 between longitude 81°12'02.90192"E to 81°13'07.02661"E and between latitude 18°41'26.17920"N to18°43'38.52758"N.

Screening Cum Beneficiation Plant (750 TPH of 4 lines each) Bailadila Iron Ore Deposit-4 is located in the Topo sheet no. 65F/1 (E44J1), 65F/2 (E44J2), 65F/5 (E44J5) and 65F/6 (E44J6) between longitude 81°13'02.16001"E to 81°17'34.68820"E and between latitude 18°43'38.19000"N to 18°46'40.65043"N at Village-Bhansi, Tehsil/Taluka- Bade Bacheli, District-South Bastar Dantewada, State-Chhattisgarh.

Genera location, specific Location map and google map of Bailadila Iron Ore Deposit-4 Mine and Screening cum Beneficiation Plant outside the mining lease of Deposit-4 with coordinates are given in **Plate No.-1.1, 1.2 & 1.3** respectively**.**

1.4 Importance to the Country, Region

As per National Steel Policy–2017, Government of India has an ambitious plan for increasing the domesticsteel production from present capacity of around 115 MTPA to 300 MTPA by FY 2030. This will necessitate production of 400-450 million tonnes of iron ore annually. Low per capita steel consumption in the country at approx. 77 kg vis-a-vis the world average of 233 kg also indicates the huge growth potential for the Indian steel industry. Further, the Government's ambitious plan of developing 100 smart cities and housing for all will result in a huge demand of steel.

In view of the ambitious targets set by National Steel Policy, steel producers are ramping up their capacities, thus, there will be sufficient demand of domestic iron ore produced.

The **"Make in India"** initiative is expected to witness significant investments in Construction, Infrastructure, Automobile, Shipbuilding and Power sectors, which will stimulate steel demand. Hence, efforts will be made to pass on such benefit to the domestic steel producers. Use of cost efficient and competitive 'Indian Made steel' will pave the way for infrastructure development and construction activities in the country. Under the National Steel Policy 2017, it is expected that at the current rate of GDP growth, the steel demand will grow threefold to reach a demand of 230 MT by 2030-31.

Taking into consideration the above factors, it is anticipated that the demand of quality Iron Ore will be high in future. As the average grade of total Mineral Resource is +64% for Bailadila Iron Ore Deposit-4 which is much above the standard requirement of buyers in domestic market, selling of final product of proposed mine should not be any issue.

In view of the difficulties being faced by the domestic Sponge Iron Units and Steel Plants present in the State of Chhattisgarh and to fulfill their demand of Iron Ore, Bailadila Iron Ore Deposit-4 has been reserved in favour of the JVC named as NMDC-CMDC Limited (NCL).

Demand of iron ore has surged to excessive levels not only in Chhattisgarh but also throughout the country. In foreseeable future, no decline is visible in the iron ore demand.

India is an emerging economy with a growing middle-class section. Growth of this section is increasing demand for consumer durables and capital good. The automotive sector and construction industry are also growing. As per Union Budget 2019-20, government's push to infrastructure sector will increase the demand for steel. Strong long-term demand from the steel industry is expected to further boost the iron ore industry.

Booming construction, automobiles and packaging industries are expected to lend substantial support to the metals and mining sector. NMDC is bullish on the growth prospects of India's steel industry with its competitive advantages and the impetus being given by the government to the steel sector.

1.5 Brief History of the Project

Bailadila Iron Ore Deposit-4 of M/s NMDC-CMDC Limited (NCL) is a green field project which is located north of Deposit-5 on the western flank of the Bailadila range of hills, lying at a distance of about 135 kms towards south-west of Jagdalpur in the state Chhattisgarh.

It is proposed to produce ROM Iron ore of 7.0 MTPA and waste excavation of 6.41 MTPA (Maximum). Ministry of Mines, GOI on 30.09.2019 has granted its prior approval for reservation of Bailadila Iron Ore Deposit-4 (Total Area 646.596 Ha), in favour of NMDC-CMDC Ltd. (NCL) for the purpose of Prospecting and Mining of Iron Ore.

Further, Mineral Resource Department, Government of Chhattisgarh on 26.06.2021 has issued a Letter of Intent (LOI) for grant of Mining Lease for the said area of Bailadila Iron Ore Deposit-4.

The total lease area of Bailadila Iron Ore Deposit-4 Mine is earmarked to 646.596 Ha comprising of Forest land of 646.596 Ha, out of which 76.496 Ha area is demarcated for conservation of Tree Fern and the same is excluded from the forest diversion proposal of the project. Total area outside the Mining Lease of Deposit-4 earmarked for Screening cum Beneficiation Plant along with Downhill Conveyor and Loading Facilities is 122.5428 Ha (100.077 Ha outside mining lease in the reserve forest, 12.0952 Ha Bade Jhad ke Jungle in revenue forest, 6.9585 Ha private revenue land, 1.0101 Ha Government revenue land and 2.402 Ha railway land).

1.5.1 Details of Mining Lease

Ministry of Mines, GoI on 30.09.2019 has reserved Bailadila Iron Ore Deposit-4 (Total Area 646.596 Ha.), in favour of NMDC-CMDC Ltd. (NCL) for the purpose of Prospecting and Mining of Iron Ore under section 17A of MMDR Act-1957. Ministry of

Mines, GoI, New Delhi vide G.S.R.119(E) dt 18.02.2021 has issued amendment in the earlier notification no. G.S.R. 697(E) for the revised coordinates of Deposit-4.

Further, Mineral Resource Department (MRD), Government of Chhattisgarh (GoCG) on 26.06.2021 has issued a Letter of Intent (LOI) for grant of Mining Lease for the said area of Bailadila Iron Ore Deposit-4, prescribing the requirement of Environmental Clearance and Forest Clearance.

Subsequently, MRD, GoCG on 07.08.2021 has issued an amendment in the Letter of Intent (LOI) prescribing the requirement of approved Mining Plan.

Further, MRD, GoCG on 04.05.2022 has issued an amendment in the Letter of Intent (LOI) mentioning period of the mining lease as 50 years.

After obtaining Mining Plan approval, Environmental Clearance & Forest Clearance, Grant Order will be issued by GoCG for signing the lease deed.

1.5.2 Mining Plan

The Mining Plan was approved from IBM vide letter no. Dantewada/Fe/Khanij-1292/2021/-Raipur dated 24-09-2021. The mining plan approval letter issued by IBM; Ministry of Mines, Raipur along with approved Mining Plan is enclosed as **Annexure-1.10**

1.5.3 Environmental Clearance

Form -1 and PFR was uploaded in Parivesh portal of MoEF&CC for obtaining Terms of Reference on 14/01/2022 for both proposals i.e. non coal mining **(Proposal No: IA/CG/MIN/251288/2022, File No: IA-J-11015/104/2021-IA-II(NCM))** for the Mining Lease of Deposit-4 and Industrial Projects-I sector **(Proposal No: IA/CG/IND/251437/2022, File No: IA-J-11011/23/2022-IA-II(IND-I))** for the Beneficiation plant outside the Mining Lease of Deposit-4.

The EAC meeting for Bailadila Iron Ore Deposit-4 Mine was held on 17th February 2022 and TOR was issued vide No. IA-J-11015/104/2021-IA-II(NCM) dated 11.03.2022.

The EAC meeting for Beneficiation Plant outside the Mining Lease of Deposit-4 mine was held on 10th February 2022 and TOR issued vide F. No. IA-J-11011/23/2022-IA-II(IND-I) dated 21.02.2022.

1.5.4 Air and Water consents

The consent to operate for discharge of effluents under Water (Prevention and Control of Pollution) Act 1974 and emission under Air (Prevention and Control of Pollution) Act 1981 will be obtained after grant of Environmental clearance.

1.5.5 Forest Clearance

The application for Stage 1 Forest Clearance has been submitted vide proposal No. FP/CG/MIN/146694/2021 dated 04/10/2021.

Forest clearance is under process for a total area of 570.10 Ha inside the mining lease of Bailadila Iron Ore Deposit-4, 100.077 Ha outside the mining lease in Bailadila reserve forest and 12.0952 Ha of Bade Jhad ke Jungle for the Mining operation, Waste dumping, Infrastructures like Crushing Plant, Downhill Conveyor,

Screening cum Beneficiation Plant including system for dry disposal of tailings, Loading Plant, various stockpiles, Offices, Service Centre, Explosive Magazine, Security Barrack, Water Pipeline, Power line etc. during the life of the mine.

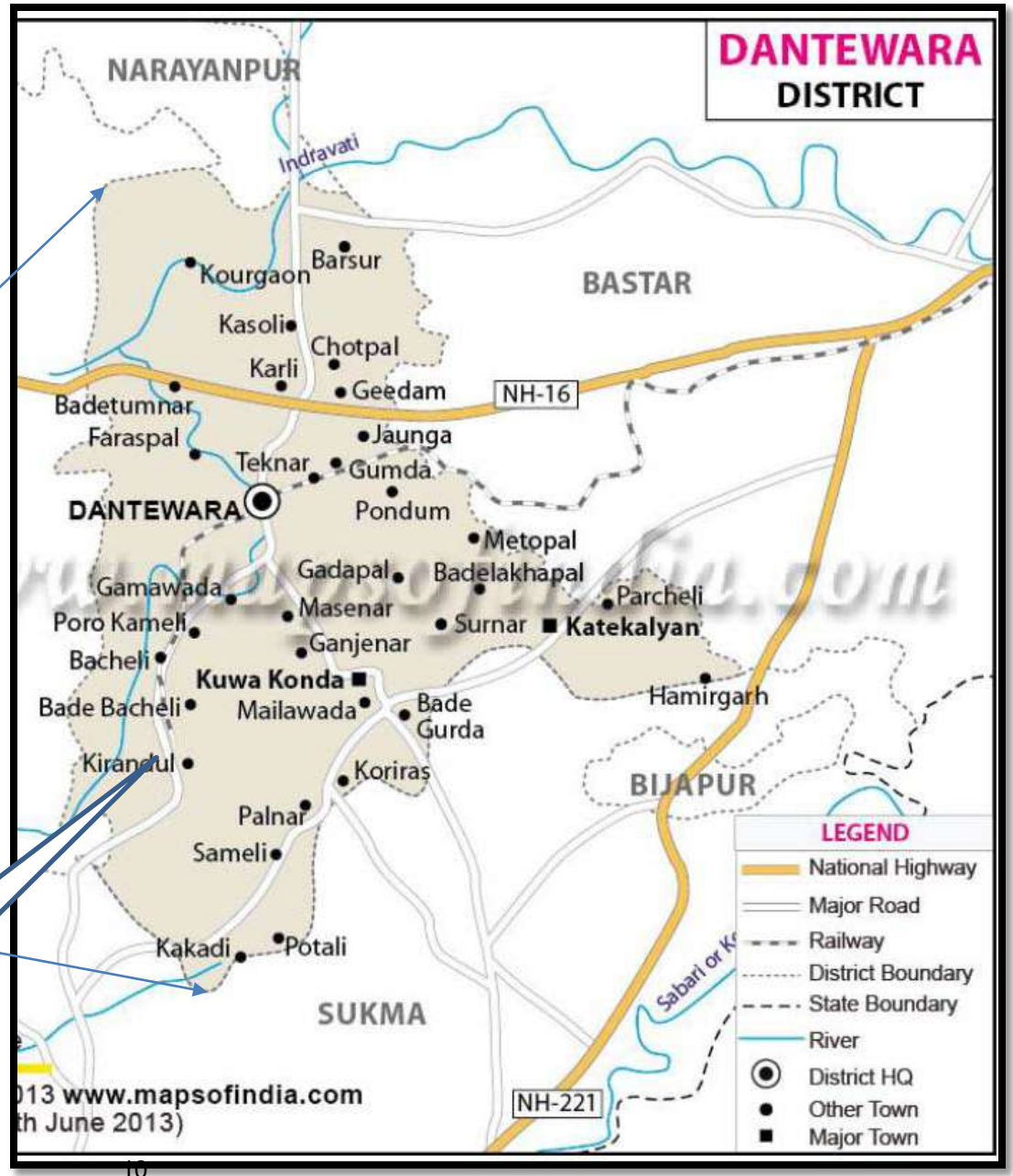
1.6 Scope of the Study

The core zone in the study area comprises of the mining lease area (646.596 ha) for Bailadila Iron Ore Deposit-4 and 122.5428 Ha Screening cum Beneficiation Plant (750 TPH of 4 lines each) along with Downhill Conveyor and Loading Facilities. Buffer zone covers the area within 10 km radial distance from the mining lease boundary for Bailadila Iron Ore Deposit-4 and 10 km radial distance from the Screening cum Beneficiation Plant boundary (outside the mining lease area).

The scope of study broadly includes:

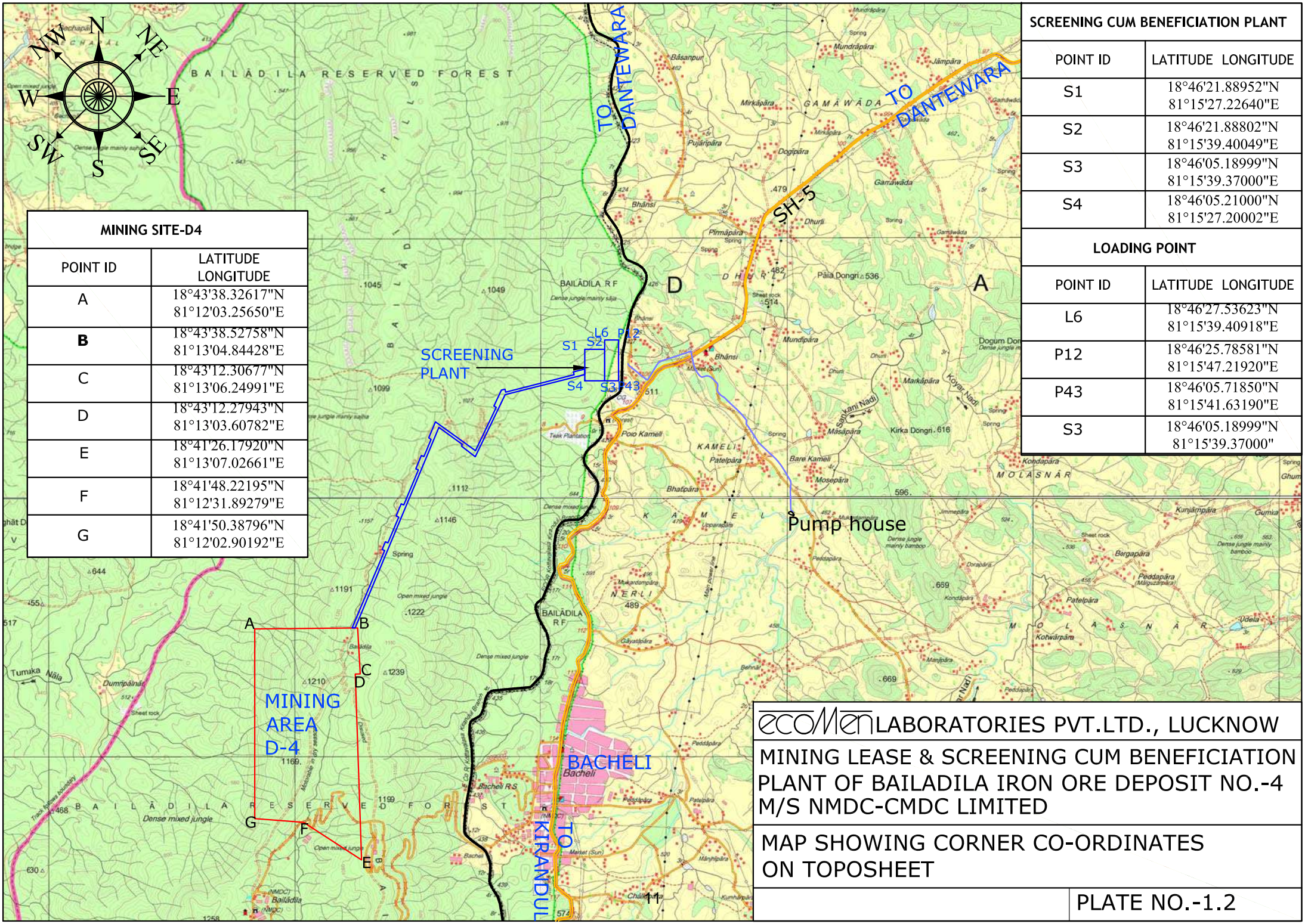
- Collection of data relevant to the study area and literature review
- Undertaking environmental monitoring, so as to establish the current environmental status of the study area
- Identification of various existing pollution loads due to various activities;
- Evaluation of the impacts on various environmental attributes in the study area by using scientifically developed and widely accepted environmental impact assessment methodologies;
- Documentation of the environment management plan (EMP), outlining the measures required to improve the environmental quality; and
- Identification of the critical environmental attributes required to be monitored
- The literature includes review of documents such as Mining Plan etc.

PROJECT LOCATION MAP OF MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4



PROJECT SITE

PLATE NO.-1.1



MINING SITE-D4	
POINT ID	LATITUDE LONGITUDE
A	18°43'38.32617"N 81°12'03.25650"E
B	18°43'38.52758"N 81°13'04.84428"E
C	18°43'12.30677"N 81°13'06.24991"E
D	18°43'12.27943"N 81°13'03.60782"E
E	18°41'26.17920"N 81°13'07.02661"E
F	18°41'48.22195"N 81°12'31.89279"E
G	18°41'50.38796"N 81°12'02.90192"E

SCREENING CUM BENEFICIATION PLANT	
POINT ID	LATITUDE LONGITUDE
S1	18°46'21.88952"N 81°15'27.22640"E
S2	18°46'21.88802"N 81°15'39.40049"E
S3	18°46'05.18999"N 81°15'39.37000"E
S4	18°46'05.21000"N 81°15'27.20002"E
LOADING POINT	
POINT ID	LATITUDE LONGITUDE
L6	18°46'27.53623"N 81°15'39.40918"E
P12	18°46'25.78581"N 81°15'47.21920"E
P43	18°46'05.71850"N 81°15'41.63190"E
S3	18°46'05.18999"N 81°15'39.37000"

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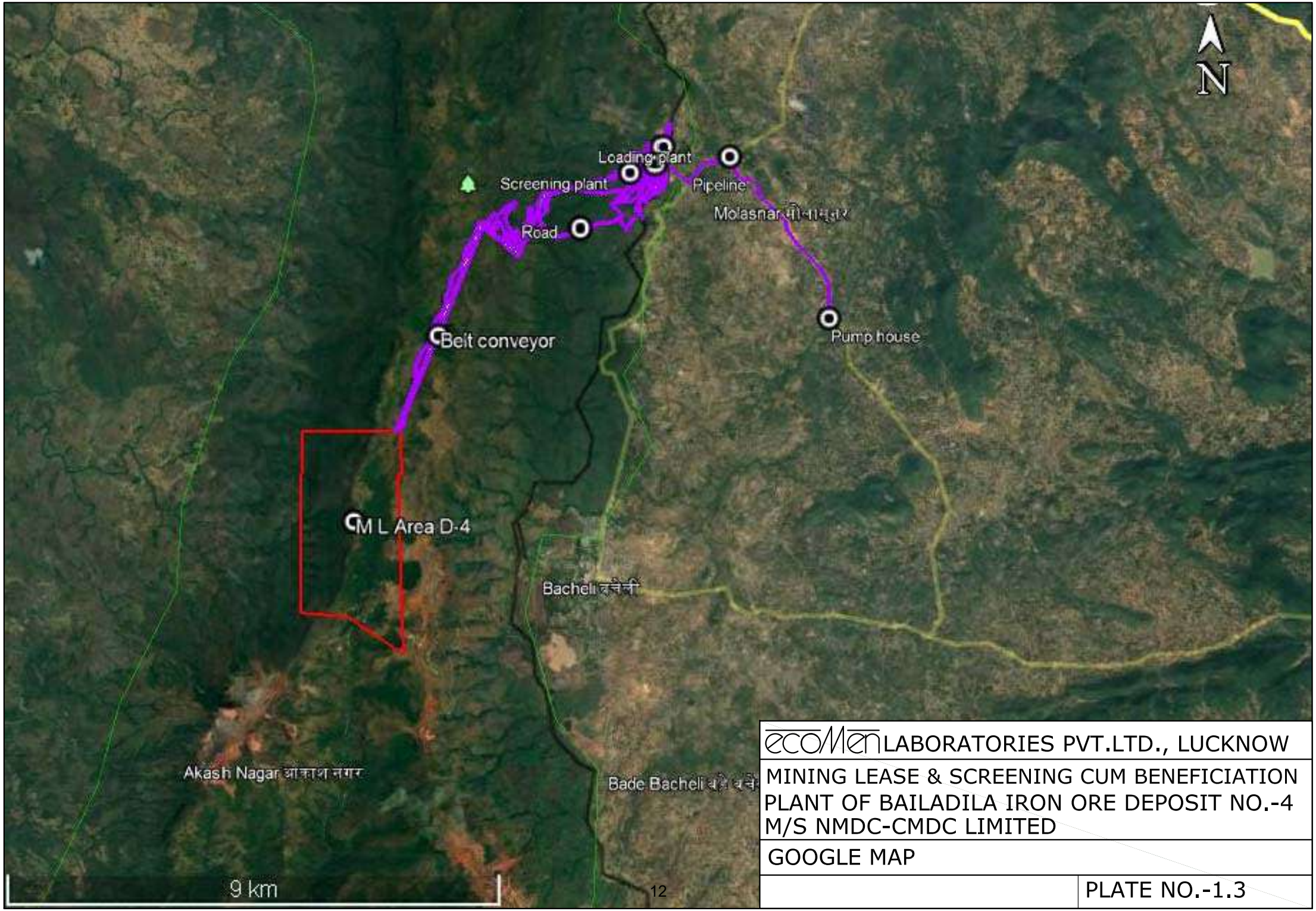
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4 M/S NMDC-CMDC LIMITED

MAP SHOWING CORNER CO-ORDINATES ON TOPOSHEET

PLATE NO.-1.2



ecoMen LABORATORIES PVT.LTD., LUCKNOW	
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4 M/S NMDC-CMDC LIMITED	
GOOGLE MAP	
	PLATE NO.-1.3

CHAPTER -2

PROJECT DESCRIPTION

2.0 Introduction

This chapter deals with the details of the lease, geology of the mining lease area, valuation of the deposit, estimation of the iron ore reserves, method of mining, mining machinery, screening cum beneficiation plant, downhill conveyor, loading, waste generation, production of iron ore etc.

2.1 Type of the Project

The proposed mining lease area is situated near Village Bacheli/Bhansi, Tehsil – Bade Bacheli with Screening and Loading facilities at Bhansi, South Bastar Dantewada district, Chhattisgarh. The proposed project is a fully mechanized opencast mine with associated Screening cum Beneficiation facilities having 7.0 MTPA capacity. Conventional mining system with shovel dumper combination will be adopted. The sequence of the operations will be development of mine benches, drilling, blasting, excavation, loading, crushing, screening/beneficiation, stacking and transportation.

2.2 Need for the Project

As per National Steel Policy-2017, Government of India has an ambitious plan for increasing the domestic steel production from present capacity of around 115 MTPA to 300 MTPA by FY 2030. This will necessitate production of 400-450 million tonnes of iron ore annually. Low per capita steel consumption in the country at approx.77 kg vis-a-vis the world average of 233 kg also indicates the huge growth potential for the Indian steel industry. Further, the Government's ambitious plan of developing 100 smart cities and housing for all by 2022 will result in a huge demand of steel.

In view of the ambitious targets set by National Steel Policy, steel producers are ramping up their capacities and with the possibility of lifting of ban on the export of iron ore from Chhattisgarh, there will be sufficient demand of domestic iron ore produced. The **"Make in India"** initiative is expected to witness significant investments in Construction, Infrastructure, Automobile, Shipbuilding and Power sectors, which will stimulate steel demand. Hence, efforts will be made to pass on such benefit to the domestic steel producers. Use of cost efficient and competitive 'Indian Made steel' will pave the way for infrastructure development and construction activities in the country. Under the National Steel Policy 2017, It is expected that at the current rate of GDP growth, the steel demand will grow threefold to reach a demand of 230 MT by 2030-31.
Taking into consideration of above factors, it is anticipated that the demand of quality Iron Ore will be high in future. As the average grade of total Mineral Resource is +64% for Bailadila Iron Ore Deposit-4 which is much above the standard requirement of buyers in domestic market, selling of final product of proposed mine should not be any issue.

In view of the difficulties being faced by the Domestic Sponge Iron Units and Steel Plants present in the State of Chhattisgarh and to fulfill their demand of Iron Ore, State Government of Chhattisgarh has recommended for the reservation of Bailadila Iron Ore Deposit-4 in favour of the Joint Venture Company formed between NMDC Ltd. (A Central Govt. PSU) CMDC Ltd. (A State Govt. PSU). Accordingly, agreeing with the need of the project, Ministry of Mines, Govt. of India has reserved the Bailadila Iron Ore Deposit-4 in favour of the JV Company i.e. NMDC-CMDC Limited (NCL).

2.3 Location

The Bailadila Deposit-4 Mining Lease area is located near village Bacheli/Bhansi, Tehsil Bade Bacheli, District Dantewada, State Chhattisgarh. It is located at Bailadila range of hills trending N-S direction. The Deposit-4 is approachable by kutcha road from Bhansi or from Deposit-5 of the NMDC Ltd. Bhansi is very well connected by SH road from Kirandul to Geedam. Bacheli is nearest town. Dantewada is district headquarters. The general and specific location map of Bailadila Iron Ore Deposit-4 is given in **Plate No.-1.1 and Plate No-1.2** in SOI topo sheet. Bailadila Iron Ore Deposit-4 having lease area of 646. 596 Ha is located in the **Topo Sheet No.** E44J2 between longitude 81°12'02.90192"E to 81°13'07.02661"E and between latitude 18°41'26.17920"N to18°43'38.52758"N. Longitude & latitude of boundary pillars of mining lease are as below:

Pillar No.	Pillar Longitude	Pillar Latitude
A	81°12'03.25650"E	18°43'38.32617"N
B	81°13'04.84428"E	18°43'38.52758"N
C	81°13'06.24991"E	18°43'12.30677"N
D	81°13'03.60782"E	18°43'12.27943"N
E	81°13'07.02661"E	18°41'26.17920"N
F	81°12'31.89279"E	18°41'48.22195"N
G	81°12'02.90192"E	18°41'50.38796"N

Based on ToR issued by MoEF&CC, GoI (EAC IND-I) vide Letter No. IA-J-11011/23/2022-IA-II(IND-I) dtd. 21/02/2022 NMDC-CMDC Ltd has incorporated Dry Disposal Tailing System (Hydraulic filter-based technology) in the beneficiation process of the Bailadila Iron Ore Deposit-4 Project. Due to incorporation of this technology in the process, there is change in the land requirement and the revised land requirement is as given in **Table 2.1B**. The 122.5428 ha area (initially in ToR application area was 195.537 Ha) outside the Mining Lease of Deposit-4 is located in the topo sheet no. E44J1, E44J2, E44J5 between longitude 81°13'02.16001"E to 81°17'34.68820"E and between latitude 18°43'38.19000"N to 18°46'40.65043"N. The location map of proposed ancillary facilities such as Screening cum Beneficiation Plant is given in **Plate No.-1.2** on SOI topo map. Project site photographs is given in **Figure 2.1**.

Figure 2.1: Project Site Photographs

Loading Plant Area

Mine Lease Area

Railway Siding Area

Screening Plant area

2.4 Details of Mine Operations

2.4.1 Size or Magnitude of Operation

The ML area extended over on area of 646.596 ha in the Forest Land with iron ore production capacity of 7.0 MTPA. However, out of the 646.596 Ha Forest Land, proposal for land diversion is moved only for an area of 570.1 Ha. Remaining Forest area, within the Mining Lease area will not be diverted for the Mining Purposes. Further, an area of 100.077 Ha. Forest area and 22.4658 ha. Revenue land (Govt., Private and Bade Jhad Ke Jungle) outside the Mining Lease will also be required for the development of Screening cum beneficiation plant, Loading plant & railway siding, stockpiles, water settling/recirculation ponds and offices etc.

Deposit No.4 is situated in the North of Deposit No.5 and South of Deposit No.3 in the western ridge. The ore body occurs as northern continuation of north block of Deposit No.5, separated from Deposit No.5 by a narrow parting of about 150 mts of poor grade lateritic ore. On the northern side, Deposit No.4 is separated from Deposit No.3 by a parting of un-enriched banded hematite-quartzite.

Initially the mine will be developed for 1195600 Tonnes per annum in the first year and later on 2.0 MTPA of ROM production from second to fifth year. Thereafter the capacity of the mine will be gradually augmented to 7.0 MTPA of ROM.

Bailadila deposit-4 will be worked as a fully mechanized mine. Deposit-4 has been designed for operation as fully mechanized opencast mine using shovel-dumper combination and various processes are - drilling, blasting, excavation, quality control, ore processing (crushing with 2000 TPH) & transportation of ore through Downhill conveyor and waste disposal. However, during the 1st five years of Mining operation various processes like drilling, blasting, excavation, quality control, ore

processing (crushing & screening with 400 TPH mobile crushing and screening units), loading of finished products and waste disposal etc. are planned with smaller mining machineries.

Waste (Shale and Banded Hematite Quartzite) will be dumped in the Waste Dump outside ultimate pit limit.

The deposit will be exploited by deploying shovel-dumper combination. The deep-hole drilling and blasting technique will be adopted for rock fragmentation.

In the initial five years of mining when the mine production capacity would be limited to 2 MTPA, it is proposed to deploy smaller equipment for mine working. During initial five years, drilling would be carried out using 150 mm diameter drill machine whereas ore production and waste removal will be done by 3.2 cum bucket excavator with 25 T capacity dumpers. After five years, when mine capacity will be upgraded to 7 MTPA, it is proposed to replace smaller equipment with higher capacity equipment. From 6th year onwards, drilling would be carried out using 250 mm dia. drill machine whereas ore production and waste removal will be done by 8.0 cum bucket excavator (derated from 10 cum bucket excavator) with 100 T dumpers.

The capacity of the mine shall be augmented in the continuously increasing manner from the sixth year of the operation of the mine and the mine shall attain its full rated capacity of 7.0 MTPA of capacity in the 9th year of operation.

Screening cum Beneficiation Plant will be 750 TPH of 4 lines each along with 2200 TPH Downhill Conveyor System and Loading Facilities in 122.5428 Ha. area outside the Mining Lease area of Bailadila Iron Ore Deposit-4 at Village: Bhansi, Tehsil: Bade Bacheli, District South Bastar Dantewada, Chhattisgarh. A detailed engineering layout and greenbelt plan of screening plant cum beneficiation plant are attached as **Plate No. 2.1 & 2.2** respectively.

2.4.2 Details of Land Use in ML Area and outside the ML Area

The mining lease of Deposit-4 falls under Bailadila Reserve Forest. The western slope is characterized by natural forest growth. The central portion is almost barren with exposures of iron ore, laterite capping etc. The lower slopes of Galli nalla have shrubs, ferns and medium high trees. The classification of the land use pattern is given in the following tables -

TABLE-2.1A

DETAILS OF PROPOSED LAND USE PATTERN IN ML AREA (FOREST AREA)

Sl. No.	Land Use	Area (Ha)
1	Area under Mining (In-situ)	94.1100
2	Area under Mining (Float Ore)	70.5200

3	Overburden/Waste Dumping	74.0700
4	Infrastructure (Crushing Plant, Workshop, Administrative Building, Roads etc.)	65.9000
5	Explosive Magazine Area	15.3700
6	**Tree-Fern Area (Non-diverted)**	**76.4960**
7	Green belt- Safety Zone along the ML Boundary	08.4880
8	Area under Environmental Protection, improvement and EMP Works	241.6420
	Total	**646.5960**

TABLE-2.1B
DETAILS OF PROPOSED LAND USE PATTERN OUTSIDE ML AREA (FOREST, REVENUE LAND and REVENUE FOREST LAND - BADE JHAD KE JUNGLE)

Sl. No.	Description	Area (Ha)				
		Forest	Revenue Forest Land (Bade Jhad ke Jungle)	Pvt. Revenue Land	Govt. Revenue Land	Railway Land
1	Major part of Downhill conveyor system including overhead electrical line & water pipeline	43.0000	-	-	-	-
2	Screening Plant including all allied facilities	18.2810	-	-	-	-
3	Loading Plant including all allied facilities	10.2390	6.4106	3.2936	0.1107	-
4	Railway siding	1.0410	5.1193	3.6594	0.3055	2.4020

Sl. No.	Description	Area (Ha)				
		Forest	Revenue Forest Land (Bade Jhad ke Jungle)	Pvt. Revenue Land	Govt. Revenue Land	Railway Land
5	Existing roads widening / strengthening for two-way traffic and new approach roads to all the plants & transfer houses	27.5160	-	-	-	
6	Pump House	-	0.4000	-	-	-
7	Pipe line	-	0.1653	0.0055	0.5939	-
	Total	**100.0770**	**12.0952**	**6.9585**	**1.0101**	**2.4020**

2.4.3 Salient Features of the Project

Salient Features of Bailadila Iron Ore Project Deposit-4		
S. No.	**Description**	**Particulars**
1	Mining Lease Area	646.596 Ha.
2	Infrastructure Area Outside the Mining Lease of Bailadila Deposit-4.	122.5428 Ha. (100.077 Ha. Forest area and 22.4658 ha. Revenue land(Govt., Private and Bade Jhad Ke Jungle)
3	Type of mine	Open Cast Mine
4	Method of Mining	Fully Mechanized open cast method
5	Reserves	109.01 MT
6	Expected life of mine	21 Years
7	Ore to Waste ratio	1:0.625
8	Waste Excavation (Maximum)	6.41 MTPA (Estimated by mine scheduling

		software MineSched)
9	Rated Capacity	7.00 MTPA
10	Average no. of working days/ Number of Shifts / Working Hours for Mine	268 / 3 Shifts / 8 Hrs.
11	Bench height & width	12 m height & Minimum bench width during operation phase: 30 m
12	Top and Bottom Bench	1200 mRL and 996 mRL
13	Present Working Benches	Mining Operation Not yet commenced
14	Waste (Till life of mine)	68.173 MT
15	Ultimate pit slope	Less than 45 degrees.
16	Downhill Conveyor System	2200 TPH of approx. length 8.7 KM
17	Screening Plant with Beneficiation Facilities	4 lines of 750 TPH
18	Tertiary Crushing	2 lines of 800 TPH
19	Loading and Stacking Facilities	3000 TPH Loading Facilities with Lump Stockpile of 3.2 LT and Fine Ore Stockpile 2.3 LT
20	Average no. of working days / Number of Shifts / Working Hours for Screening cum Beneficiation Plant	365/ 3 Shifts / 8 Hrs.
21	Power requirement & sources	Power requirement: 6 MVA, Sources: Chhattisgarh State Power Distribution Company Limited.
22	Water Requirement	Mining Lease Area-4250 KLD Beneficiation Plant-1250 KLD (Dry Screening for 8 months) and 8,630 KLD (Wet Screening for 4 months of monsoon period). Considering the future requirements including the proposed township, Water

		requirement is envisaged to be around 20,000 Cu.m per day at the peak rated capacity which will be met from the source of existing Sankani Nalla and Nerli Nalla (Sankani Nadi).
23	Total Project Cost (For entire Bailadila Iron Ore Deposit-4 including ancillary facilities located outside the Mining Lease Area)	Rs. 4091.33 Crores (approx.) (Approx. Rs. 1156.163 Crores inside ML area and approx. Rs. 2935.167 Crores outside ML area)
(**Source:** Mine Planning-NMDC-CMDC Limited)		

2.4.4 Mine Layout

The main designing considerations in the Pit layout are given below:

- To design an economical production of required iron ore quality for the life of mine;
- To minimize transportation distance for iron ore and overburden; and
- To minimize adverse effects on environment.

2.4.5 Topography

Bailadila Iron Ore Deposit No. 4 is situated on the north of Deposit-5 and in the south of Deposit-3 in the western ridge of the Bailadila Iron ore range. The deposit is characterized by rugged and undulating topography.

The highest elevation is 1210 m above MSL and the lowest elevation is about 1020 m above MSL. The ore body has a general NNE-SSW trend with steep easterly slope and forms a gentle slope towards west.

The mining lease of Deposit- 4 falls in the Bailadila reserve forest area. The Bailadila forest is fairly widespread and dense in nature. The hill tops however show a different picture of barren nature due to rocky out crops, duricrusts and lateralization having scanty soil cover to support dense vegetation. Scrubs, grasses and stunted trees wherever possible characterize the hilltops.

The location of screening plant is situated on the hillock at 580 MRL and the loading plant is situated at 520 MRL. Vegetation of the buffer zone is close to Class-5A (Southern Tropical Dry Deciduous type) and at certain patches it represents Class-5B (Northern Tropical Dry Deciduous type), according to Champion & Seth. Surface plan of the mine lease is shown in **Plate No. 2.3**. The surface plan of the area along with proposed infrastructure is shown in **Plate No. 2.4**.

There is no national park, biosphere reserve, elephant reserve, elephant corridor, tiger reserve, sanctuary, habitat for migratory birds, archaeological site, defense installation or airport within 10 km of the periphery of core zone shown in the plan as **Plate No. 2.5.**

2.4.6 Drainage

The eastern and western ridges of Bailadila become closer between the Deposit-4 of western ridge and Depoist-8 of eastern ridge separated by shallow saddle. This happens to be the divide point for the drainage direction. The stream flowing towards south is called Galli Nalla and the one flowing towards north is Sankani nalla. Near to Deposit-4 these streams are in the form of "seeps". The regular flow starts much downstream on both sides. There is no perennial stream on the western slope of the deposit within the core zone. However, the slope ultimately drains to the streams which join and flow to the north and then west with the name of Mari Nadi. It is however, several kilometers away from the core zone.

During the time of exploratory drilling, no water table has been encountered. Ground water of confined and permanent nature may be expected only at much lower levels since the hills have got abrupt relief over 600 meters from the plains.

Buffer Zone: The important streams are Malinger Nadi flowing South West of Deposit-14, Kirandul or Koyar Nadi, south east of Deposit -14, stream from Deposit-11B, Bacheli Nalla, Galli Nalla and Sankani Nalla. The villagers use water from these nallas for their irrigation and drinking purposes.

The course of the present natural drainage system in the Bailadila iron ore mines complex will not be affected due to the present and future mining, crushing, screening, beneficiation operations.

The drainage plan of buffer zone is shown in **Plate No.2.6.**

2.5 Geology

2.5.1 Regional Geological Setting

The Bailadila Iron Ore Deposits occur in two parallel ridges in the Bailadila range of hills stretching north-south. Altogether, fourteen deposits have been located in these two ridges. The Bailadila iron ore series is considered to be equivalent to iron ore series of Jharkhand and Orissa. The Bailadila Iron Ore Deposit 4 is a part of Bailadila Group of rocks of Archaean- Proterozoic age of Bastar Craton. It consists of mainly the banded iron formation (BIF), associated ferruginous shales and phyllite overlies unconformably the Bengpal group. Apart from these major rock types, volcanic tuffs and quartzites are also present in and around the mine lease area. Metabasaltic traps with tuffs and cherts underlie the above suite of rocks (i.e. Bengpal Series). The basal metabasaltic lavas and dolerite intrusions are encountered along the eastern foothills of the range.

The Bailadila sequence forms a northerly plunging synclinorium (Crookshank, 1963; Ramakrishnan, 1990). According to Chatterjee (1970), the NNE plunging overturned folds in Bailadila sequence are a result of horizontal shear concomitant with flexural slip folding.

In earlier stratigraphic schemes given by Crookshank (1963) and Bandyopadhyay and Hishikar (1977), the Bailadila Group starts with feldspathicquartzites, the

latter, concordantly overlie the metabasalt – metapelite of the Bengpal Group (Ramakrishnan, 1990).

A three-tier classification of Bailadila Group is proposed by Khan and Bhattacharya (1993). Khan and Bhattacharya (1993) have incorporated the hitherto mentioned metabasalt – metapelite in the Bailadila Group, naming it as Bhansi Formation.

The lithostratigraphic sequence of Bailadila Group, South Bastar, Dantewada is detailed as follows:

Stratigraphic Group	Subgroup	Formation	Member	Lithology
BAILADILA GROUP	Upper Subgroup	Kailash Nagar Iron Formation		Banded Hematite quartzite, banded magnetite quartzite, pockets of massive, laminated ores and blue dust.
		Loa Formation	Akash Nagar Shale	Thinly laminated, soft, ferruginous shales
			Galli-Nala Conglomerate	Polymictic, unsorted, matrix supported conglomerates, Matrix variable in composition from silty tuffaceous to sandy ferruginous.
	.....Local Unconformity.....			
	Middle Subgroup	East Ridge Shale Formation		Interlaminated ferruginous tuffaceous shales and bedded cherts. Rarely carbonaceous shales/slates. Banded ferruginous cherts towards the top.
		Bacheli Meta-siliciclastic Formation		Thick to thin, graded cross bedded wackes /arenites with interbedded shaly layers, becoming common upwards
	.....Local Unconformity.....			
	Lower Subgroup	Bhansi Formation		Chlorite, micaceous phyllites with or without andalusite porphyroblasts. Metabasalts occasionally containing amygdales.
	.....Angular Unconformity.....			
	Basement: Quartz- Chlorite Schists, Recrystalized Quartzites, Magnetite Quartzites of Bengpal (Sukma)			

2.5.2 Local Geology (Geology of Deposit)

Deposit No.4 is situated in the North of Deposit No.5 and South of Deposit No.3 in the western ridge. The ore body occurs as northern continuation of north block of Deposit No.5, separated from Deposit No.5 by a narrow parting of about 150 mtrs of poor grade lateritic ore. On the northern side, Deposit No.4 is separated from Deposit No.3 by a parting of un-enriched banded hematite-quartzite.

The ore body is divided into north and south blocks which are separated by unenriched BHQ. The deposit is bounded by a deep valley on western side and galli nalla on eastern side. The eastern flank of the deposit is mostly covered by poor grade laterites. Small cliffs composed of hard massive ore occur on the western side of the deposit. Western boundary is often marked by sharp contact against the BHQ.

The deposit has a general synclinal structure. The ore body is however, disturbed by several faults which are oblique and transverse in nature. The ore body is also characterized by cross folding, because of which the width of the ore body at places is wider and narrower.

2.5.3 General Description of the Deposit/Ore Body

On the basis of detailed geological exploration in Dep. 4, the following local stratigraphic sequence has been established:

Soil cover and laterite	Bailadila Group
Iron Ore	
Banded Iron formation	
Ferruginous shales/ slates, tuff and cherts	
White quartzite and Conglomerates	

The ore body has a lenticular shaped surface appearance. The deposit has a strike length of 3,500 m and width varies from 80 m to 250 m. The average width of the ore body is 150 m. Detailed exploration has established the ore body up to a maximum depth of 130 m. The average depth of bore hole is around 75 m. The average thickness of Ore body is 62 m.

The major rock types of this area are banded iron formation (BIF), ferruginous shales, phyllites, tuffs and quartzites. However, detailed geological mapping, drilling and ore dressing studies have revealed various ore types in Deposit-4. Physical and Chemical variations in different ore types were observed with regard to degree of surface oxidation, hardness, compactness, granularity, sandy and flaky nature etc. Based on above characteristics ore has been broadly grouped into eight dominant types.

- Type- 1: Steel grey hematite
- Type- 2: Blue grey / Blue hematite

- Type- 3: Laminated hematite
- Type- 4: Lateritic / Limonitic Ore
- Type- 5: Blue dust / Flaky ore
- Type: 8: Float Ore
- Type- 9: Transition Zone ore
- Type-10: Sub-Grade ore

For ore type classification, the following cut-off criteria have been adopted.

- Cut -off % Ore Types
- Fe- 45 % All ore types
- SiO_2- up to 7 % Blue dust (Type-5)
- SiO_2- 7 % to 12 % Transition zone ore (Type-9)
- SiO_2 > 12% For Subgrade Ore (Type -10)

Lateritic material, shale and banded iron formations (BIF) analyzing less than 45 % Fe has been considered as waste. As per IBM notification on threshold value for Hematitic Ore, the Sub-grade ore analyzing 45 % - 55% Fe is included in the Ore Category.

The threshold value is as published by IBM for Hematitic Iron Ore. Geological Plan of the deposit-4 is enclosed as **Plate No. 2.7** and Geological cross sections is enclosed as **Plate No. 2.8 (A&B)**.

2.5.4 Physical & Metallurgical properties of Ore

The detail chemical analysis as well as determination of metallurgical characteristics were conducted at NMDC R&D Laboratory, Hyderabad which is accredited by NABL.

The details of Ore dressing Tests, Physical Properties and grade of different ore types are as follows in **Table 2.2**:

TABLE 2.2
PHYSICAL & METALLURGICAL PROPERTIES OF DIFFERENT ORE TYPES

Ore Type/ Descriptions	1 Steel grey	2 Blue grey	3 Laminated	4 Lateritic	5 Blue dust	9 Transition Zone	10 Sub-Grade
Lump recy% -40mm to +10mm(dry)	84.2	81.7	47.4	58.1	-	-	-
Fines recy (%) -10mm to +6mm	5.0	5.1	10.3	7.9	-	-	-
Fines recy (%) -6mm to +65mesh	8.8	10.5	31.3	25.5	-	-	-

Bulk density of ROM crushed to -40mm size	2.54	2.2	2.26	2.2	-	-	-
Specific gravity	4.2	4.0	3.5	3.5	3.4	-	-
Tumbler Index% (+6.3mm)	88.6	73.7	70.0	63.6	-	-	-
Shatter Index%	91.5	90.5	85.0	92.0	-	-	-
Fe%	66.86	66.34	64.95	56.59	66.14	60.89	51.77
SiO2%	1.69	1.70	2.72	2.27	3.57	10.57	17.20
Al2O3%	1.33	1.22	2.50	7.10	1.06	1.40	4.80

2.5.5 Details of the Prospecting / Exploration already carried out

The detailed exploration of Deposit-4 had been carried out by M/s. NMDC Ltd during 1972-74. During the period 81 boreholes were drilled with total meterage of 6085.654 m. It is a big and homogeneous iron ore deposit having 129.40 MT (Million Tonnes) of In-situ Resource and Reserve of 109.01 MT with average grade of Fe 64.80 %. The ore body has a lenticular shaped surface appearance. The deposit has a strike length of 3,500 m and width varies from 80 m to 250 m. The average width of the ore body is 150 m. Detailed exploration has established the ore body up to a maximum depth of 130 m. The average depth of bore hole is around 75 m. The average thickness of Ore body is 62 m.

Around 28 Million Tonnes of undefined material likely to be encountered, has not been considered in the excavation of Ore/Waste. The same will be taken into account after further exploration during Mining Operation throughout life of the Mine.

The details of exploration work carried out at Bailadila Deposit-4 are given below in **Table 2.3**.

TABLE 2.3
DETAILS OF EXPLORATION FROM INCEPTION TILL DATE

S. No.	Nature of Exploration	Deposit -4
1.	Geological Mapping	2.2 sq km
2.	Total Boreholes drilled	81 Nos.
3.	Total meterage drilled	6085.65 M
4.	Pitting (no.s)	115

(**Source:** Approved Mining Plan by IBM)

The proposed drilling programme at Bailadila Deposit-4 ML area is given in **Table 2.4**.

TABLE 2.4
DRILLING PROPOSED DURING THE PERIOD FROM 1ST YEAR TO 5TH YEAR

A. Drilling Proposal at Mineralized Area (Core Drilling)

Sl. No	Year	In forest area				In Non- forest				Total bore-hole	Total Mtr
		No. of bore-holes	Total mtr	Type of borehole	Grid interval	No. of bore-holes	Total mtr	Type of bore-hole	Grid interval		
1	Year1	18	1800	vertical/ Angular	62.5m x 62.5m	NIL	NIL	NIL	NIL	18	1800
2	Year2	18	1800		62.5m x 62.5m	NIL	NIL	NIL	NIL	18	1800
3	Year3	18	1800		62.5m x 62.5m	NIL	NIL	NIL	NIL	18	1800
4	Year4	14	1400		62.5m x 62.5m	NIL	NIL	NIL	NIL	14	1400
5	Year5	12	1200		62.5m x 62.5m	NIL	NIL	NIL	NIL	12	1200
Sub Total (A)										**80**	**8000**

B. Drilling Proposal at Waste Dumping Area (DTH/Non-Core Drilling)

Sl. No	Year	In forest area				In Non- Forest				To tal bore-hole	Total Mtr
		No. of bore-holes	Total mtr	Type of borehole	Grid interval	No. of bore-holes	Total mtr	Type of bore-hole	Grid interval		
1	Year1	4	120	Vertical	375 m x 250 m	NIL	NIL	NIL	NIL	4	120
2	Year2	4	120		375 m x 250 m	NIL	NIL	NIL	NIL	4	120
3	Year3	4	120		375 m x 275 m	NIL	NIL	NIL	NIL	4	120
4	Year4	4	120		250 m x 250 m	NIL	NIL	NIL	NIL	4	120
5	Year5	4	120		250 m x 250 m	NIL	NIL	NIL	NIL	4	120
Sub Total (B)										**20**	**600**

2.5.6 *Total Reserve and Resource of Deposit-4 as per UNFC Categorization*

Estimated Mineable Reserves as on date is shown in **Table 2.5**

TABLE 2.5
BALANCE RESERVE AS ON DATE

A)	**Total Mineral Reserve Estimated in the area**	**UNFC Code**	**Quantity in Million tonnes**	**Grade**		
				Fe%	**SiO_2%**	**Al_2O_3**
	Proved Mineral Reserve 111	111				
	Probable mineral Reserve 121	121	71.78	64.65	3.01	2.03
	Probable mineral Reserve 122 (Insitu)	122	28.95	65.04	-	-
	Probable mineral Reserve 122 (Float Ore)	122	8.28	65.30	-	-
B)	**Total Remaining Resources**					
	Feasibility mineral Resource	211	-	-	-	-
	Prefeasibility mineral resource (Insitu)	221	8.04	-	-	-
	Prefeasibility mineral resource (Insitu)	222	0.82	-	-	-
	Measured mineral resource	331	-	-	-	-
	Indicated mineral resource (Float Ore)	332	0.59	-	-	-
	Inferred mineral resource (Insitu)	333	10.94	-	-	-
	Reconnaissance mineral resource	334	-	-	-	-
Grand Total (A + B)		**(In MT)**	**129.40**	**64.69**	**-**	**-**

(**Source:** Approved Mining Plan by IBM/PFR of the Project)

2.5.7 Recovery and Grade

The following end products are produced to meet the requirement of various customers:

Product	Size
Lump	(-) 150 (+) 10 mm
Calibrated Lump Ore (CLO)	(-) 40 (+) 10 mm
Baila Sized Ore	(-) 20 (+) 10 mm
Fines	(-) 10 mm

The expected recovery of lumps & fines is 36% & 64% respectively during dry process and 35% & 61% respectively during wet process.

The expected grade of lumps and fines is about 65% Fe.

2.5.8 Waste

Lateritic material, shale and banded iron formations (BIF) analyzing less than 45 % Fe has been considered as waste. Waste (Shale and Banded Hematite Quartzite) will be dumped in the Waste Dump outside ultimate pit limit. Remaining amount of Waste will be backfilled in the North Block after extracting all the Ores and associated waste materials of the Deposit during the life of the Mine. Total mineable waste in the Bailadila Deposit-4 is 68.17 MT. The overall stripping ratio of deposit is 1:0.63. The maximum waste excavation of 6414000 Tonnes will be done during the 16th Year of operations.

The year wise generation of overburden/waste for this mining plan period are given in **Table 2.6 and Table 2.7.**

TABLE-2.6

YEAR WISE DUMP DETAILS

Sl. No.	Year	Dump Id	Type of Dump	Proposed Area (ha)	Height (m)	Total Dump Quantity (m^3)	New Dump Location
1	Year 1	D1	Waste	1.69	20	72339	Northing-2069730 to 2069450 & Easting-522341 to 522456
2	Year 1	D2	Waste	20.07	150	636316	Northing -2070536 to 2069913 & Easting-521581 to 522111
3	Year 2	D2	Waste	20.07	150	164147	Northing -2070536 to 2069913 & Easting-521581 to 522111
4	Year 3	D2	Waste	20.07	150	107614	Northing -2070536 to 2069913 & Easting-521581 to 522111
5	Year 4	D2	Waste	20.07	150	299885	Northing -2070536 to 2069913 & Easting-

							521581 to 522111
6	Year 5	D2	Waste	20.07	150	164666	Northing -2070536 to 2069913 & Easting-521581 to 522111

TABLE-2.7

EXCAVATION SCHEDULING DURING THE FIRST FIVE YEAR OF THE BAILADILA IRON ORE DEPOSIT-4

Period	Production (Ore) in Tonnes	Production (Waste) in Tonnes
1	1195600	1791000
2	2000000	436000
3	2000000	287000
4	2000000	806000
5	2000000	427000

2.6 Details of Exploitation

2.6.1 Method of Mining

Bailadila Iron Ore Deposit 4 will be developed as a fully mechanized opencast mine having operations involving Drilling, Blasting, Excavation, Quality Control, Hauling and Ore Processing, loading of finished products and handling of wastes by adopting the proven mining technology i.e., Shovel- Dumper combination.
Waste (Shale and Banded Hematite Quartzite) will be dumped in the Waste Dump outside ultimate pit limit. Remaining amount of Waste will be backfilled in the North Block after extracting all the Ores and associated waste materials of the Deposit during the life of the Mine.

It is proposed to keep bench height of 12 m and Minimum bench width during operation phase will be 30 m.

For initial five years of mining operations, shovels of 3.2 cum capacity will be deployed and after commissioning of the project, i.e., from sixth year onwards, when mine capacity will be upgraded to 7 MTPA, it is proposed to replace smaller equipment with higher capacity equipment. From 6^{th} year onwards, drilling would be carried out using 250mm diameter drill machine whereas ore production and waste removal will be done by 8.0cum bucket excavator (derated from 10cum bucket excavator) with 100T dumpers. Bench height of 12m will be technically compatible to maximum digging heights of both the categories of excavators. Such a height would provide adequate potential for production with deep-hole blasting and economize the cost of drilling and blasting with requisite burden and spacing of holes.

Two working/ production shifts of 8 hours each are proposed for the first 5 years of mining operation. After five years of mining operation, when mine capacity will be enhanced to 7 MTPA in phased manner, it is proposed to work in 3 shifts of 8 hours each with timings as 06.00 hrs. – 14.00 hrs. (1st shift), 14.00 hrs. -22.00 hrs. (2nd Shift) and 22.00 hrs. – 06.00 hrs. (3rd Shift). Some of the employees will work in general shift, the timing is 08.00 hrs. to 17.00 hrs.

Illumination will be provided in the mine with the help of tower lights, and lightings are provided all along the main mine road. Regular water sprinkling will be done on haulage roads by 28,000 Ltrs. capacity Water Sprinklers for dust suppression.

Spot levels are proposed to be taken periodically for finding floor level of the benches and leveling will be done regularly by dozing and grading to maintain respective RLs of the bench floor as the face advances. VHF Walkie - talkie sets will be provided to all the Executives are engaged in production, maintenance and repairs for better co-ordination. VHF sets is proposed to be provided in all the shovels, Drill Machines, control rooms for proper communication and timely action for repairs, breakdowns etc.

Shift In-charges having First Class / Second Class Mines Managers' Certificate holders supported by Assistants with 2nd class Mines Managers or Foreman Certificate holders shall look after safety aspects in the mines. All the officers, supervisors and workmen working in the mines or plant will be provided with safety helmets, safety shoes, ear-muffs, hand gloves, safety goggles etc. Raincoats, gumboots, water bottles, cloth (Gumcha) and torch / cells are also proposed to be provided to all the employees. The surface plan showing all features of mine is enclosed as **Plate No. 2.3.**

2.6.2 Mine Development

An existing road from Bhansi to the deposit will be utilized for the development of the deposit. In the first five years of mining plan period, mine developmental activities along with haul road preparation, approach to waste dump etc. are proposed. The annual excavation capacity of the mine shall be 2.0 MTPA in the first five year of operation. During the first five years, all necessary infrastructure facilities, such as crushing plant (inside mining lease) and downhill conveyor (inside & outside the mining lease), and all ancillary facilities planned at outside ML area will be established and hence there would be a cap of 2.0 MTPA on production capacity.

The capacity of the mine shall be augmented in the continuously increasing manner from the sixth year of the operation of the mine and the mine shall attain its full rated capacity of 7.0 MTPA of capacity in the 9th year of operation. The deposit will be exploited by deploying shovel-dumper combination. The deep-hole drilling and blasting technique will be adopted for rock fragmentation.

2.6.3 Total Excavation up to Lease Period (year-wise development plans)

The total excavation consists of ROM Iron Ore Production and waste excavation. The details of the proposed ROM production and waste excavation from Deposit-4

is given in **Table 2.8**.

TABLE 2.8
PROPOSED ROM PRODUCTION

Production Scheduling During the Life of the Mine of Bailadila Iron Ore Deposit-4			
Period	**Production (Ore) In Tonnes**	**Production (Waste) In Tonnes**	**Total excavation In Tonnes**
1	1195600	1791000	2986600
2	2000000	436000	2436000
3	2000000	287000	2287000
4	2000000	806000	2806000
5	2000000	427000	2427000
6	3500000	2588000	6088000
7	4900000	2703000	7603000
8	6300000	4052000	10352000
9	7000000	4351000	11351000
10	7000000	3744000	10744000
11	7000000	4171000	11171000
12	7000000	4465000	11465000
13	7000000	3290000	10290000
14	7000000	6262000	13262000
15	7000000	2872000	9872000
16	**7000000**	**6414000**	**13414000**
17	7000000	3544000	10544000
18	7000000	4039000	11039000
19	7000000	4330000	11330000
20	7000000	4302000	11302000
21	1114400	3299000	4413400
Grand Total	**109010000**	**68173000**	**177183000**

(**Source:** Approved Mining Plan by IBM, PFR of Deposit-4)

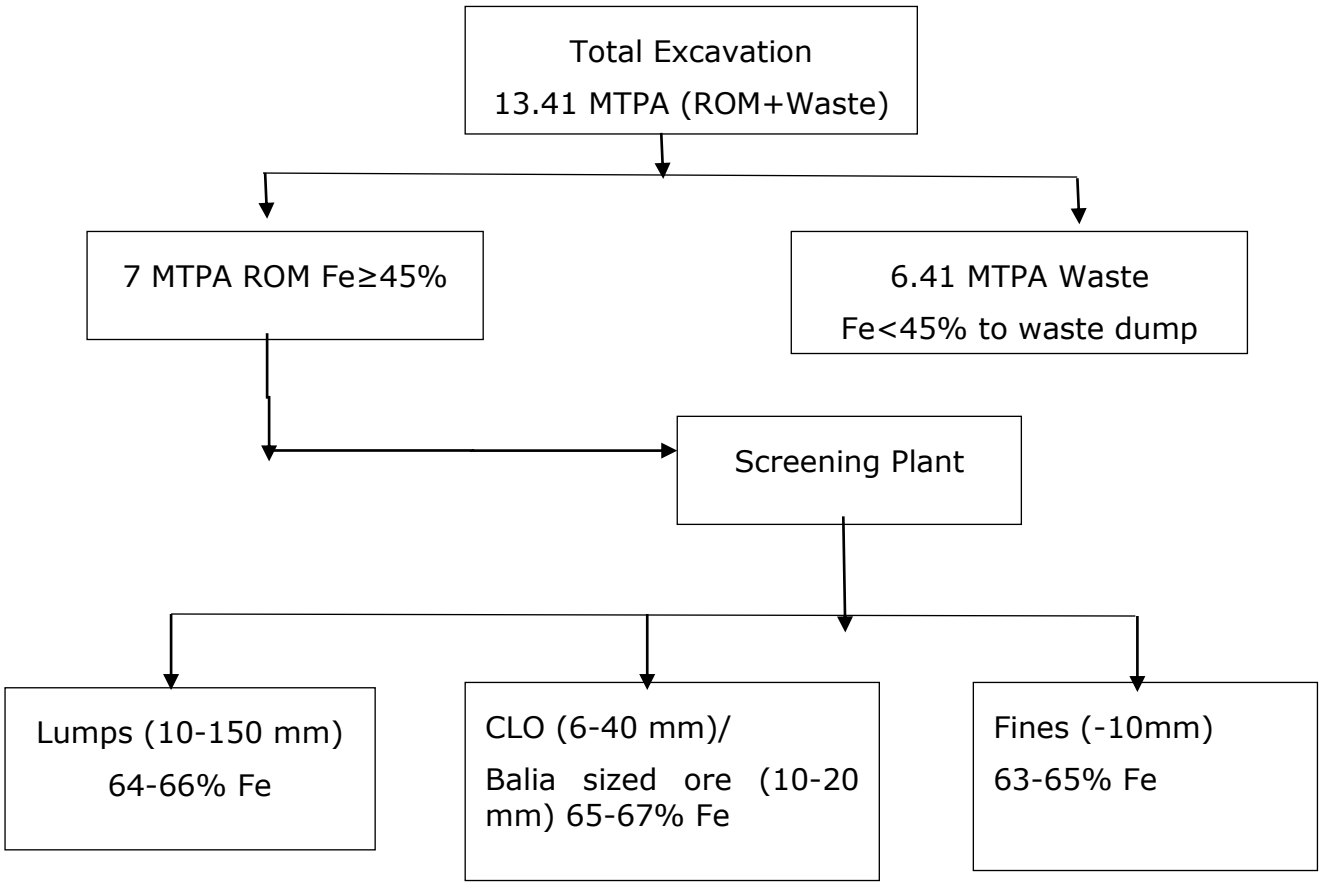
Year Wise Material Handling						
Year	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**
(A) Total ROM quantity (t)	1195600	2000000	2000000	2000000	2000000	9195600
(B) Saleable ore from ROM (t)	1195600	2000000	2000000	2000000	2000000	9195600
(C) Proposed Dump Handling Quantity (t)	0	0	0	0	0	0
(D) Saleable Ore recovered from	0	0	0	0	0	0

dump workings (t)						
(E) Total Saleable Ore (t) (=B+D)	1195600	2000000	2000000	2000000	2000000	9195600
(F) Total Quantity Handled (t) (=A+C)	1195600	2000000	2000000	2000000	2000000	9195600

The maximum total excavation proposed from the Deposit 4 ML is 13.41 MTPA (7 MTPA ROM + 6.41MTPA waste). The material balance flow sheet is given in **Figure No. 2.2.**

FIGURE No. 2.2

Material Balance Sheet for production of 7 MTPA ROM Iron Ore (13.41 MTPA Excavation) of Dep-4 ML of NMDC-CMDC



Note: Lumps, CLO/Sized ore & Fines will be sold to the different parties.

2.6.4 Waste Generation during mining plan period (1st – 5th Year)

A total of 3.747 MT of waste shall be generated during plan period as given in **Table 2.9.**

TABLE 2.9.

Year Wise waste Handling during Plan period	
OB/Waste handling proposal (1st Year) CUM	708655 Cum.
OB/Waste handling proposal (2nd Year) CUM	164147Cum.
OB/Waste handling proposal (3rd Year) CUM	107614Cum.
OB/Waste handling proposal (4th Year) CUM	299885Cum.
OB/Waste handling proposal (5th year) CUM	164666Cum.

2.6.5 Waste generation till life of the Mine

The waste mainly consists of BHQ and shale. The quantity of generation of waste will be 68.17 million tonnes during life of mine. However, around 28 Million Tonnes of undefined material has not been considered in the excavation of Ore/Waste. The same will be taken into account after further exploration on starting of Mining Operation. There is no mineral reject generation as all the +45% to 55% Fe material produced will be blended with high grade ore and offered to the customers.

2.6.6 Life of the Mine

Life of the mine is 21 years. Reserves are 109.01 ML.

2.6.7 Ultimate pit limit

Ultimate Pit Limit (UPL) is designed in SURPAC with the help of Most Economic Pit Shells generated through WHITTLE, which is used as input for MINESCHED, which in turn helps in better planning and management of extraction of ore.

The ultimate pit limit of Bailadila Deposit-4 is spread over an area of 94.11 Ha. Haul road of clear width of 20 m will be developed having a gradient of not less than 1 in 16. The top and lowest bench of the ultimate pit limit will be 1200 MRL and 996 MRL respectively. Two pits will be formed at the end of the life of the mine of Bailadila Deposit-4 mine. The pit formed between CS-45 to CS-58 would be backfilled by the waste rock generated during the normal mining operation. An area of 20.04 Ha will be covered by water body. The final pit slope angle of the ultimate pit will be 45^0. Back filling will be done only after ascertaining the absence of mineral in the proposed area.

2.6.8 Final Slope of the Faces

The ultimate width of the benches in the finishing stage could be reduced to 12m under provision of Mines Act. However, it would be maintained at 12m equivalent to the height of the benches so as to maintain an ultimate pit slope of 45^0. All the working faces of the mine is being terminated in the competent rock, the slope failure problem is not envisaged. However, the final ore and waste rock faces will be maintained at the slope angle of 80^0 and 75^0 respectively.

2.6.9 Waste Dumping

The waste generated will be dumped in the proposed waste dumps, located towards the north-western side of the lease. The area demarcated for the waste dumps will be 74.07 Ha. The waste dump for this mining plan period will be located at non-mineralized north-western flank of the deposit and will be outside of the pit limit.

Waste dumping sites have been chosen using following criteria.

- Less density of vegetation &
- Closed valley wherever possible.
- Non-mineralized zone (By surface mapping / Exploratory drilling)

Care is also taken to see that no waste be dumped within the pit limit unless ore body thins out or become too narrow to work.

Suitable number of check dams, buttress walls and trench at toe of waste-dumps shall be constructed to prevent water pollution. Drainage in mine area shall be checked before the on-set of monsoon.

Number of check dams and check bunds will be constructed on water course. 5 nos. check dams and 9 nos. check bunds are proposed. Every year before onset of the monsoon de-silting of Check dam & Check bunds will be done to arrest the overflow of the silt. Regular water sampling is proposed to be carried out every year during winter period, pre-monsoon period, monsoon period and post monsoon period. Two waste dumps envisaged in the mine will be protected using toe wall, buttress wall at the bottom of the waste dumps. At suitable places geo-textile will be used for waste dump stabilization. Garland drains will be made to channelize the surface run off into the series of check dams / bunds. It is proposed to prepare channels beside haul roads for controlled passage of rain water wash offs.

2.6.9.1 Ultimate Spread and height of the dump

There shall be Five nos. of waste dumps around the ultimate pit limit area. The final spread of the dumps will be 74.07 Ha. The maximum height of the waste dump will be 150 m and will have a gentle slope of 38° to conform the angle of repose of the waste rock. These waste dumps will be stabilized by planting trees and making terraces and parapet walls at the toe of the dumps. Waste shall be hauled by dumpers and disposed in Waste Dump nos. 1, 2, 3, 4, 5, which are outside Ultimate Pit Limit. Each of the dump has been planned in stages so as to attain maximum stability.

TABLE -2.10
DUMP CAPACITY OF VARIOUS WASTE DUMPS

Dump No	Northing	Easting	Area (Ha)	Capacity in Tonnes	Top RL	BottomRL	Period of Closure
D1	2069730 to 2069450	522341 to 522456	1.69	183018	1040	1020	1st year of Operation
D2	2070536 to 2069913	521581 to 522111	20.07	10163066	1055	905	8th year of Operation
D3	2069292 to 2068636	521507 to 522008	21.13	8332718	1055	905	10th year of Operation
D4	2068577 to 2067876	521428 to 521858	18.5	10637546	1050	930	12th year of Operation
D5	2067849 to 2067443	521278 to 521749	12.68	6813569	1045	955	14th year of Operation
		Sum Total	**74.07**	**36129917**			

2.6.9.2 Waste Dump Management

The overburdens will be maintained as per the specifications of IBM and MoEF&CC stipulated conditions and the slope of the dump will be maintained at not more than the angle of repose. Detailed measures for waste dump management of various dumps are discussed in **Chapter-4**. Dump Plan & Dump Section at the end of the Vth year are enclosed as **Plate No. 2.9 & 2.10** respectively.

2.6.9.3 Engineering Measures for Waste Dumps

i) **Toe Wall:** It is proposed at the toe of the dump to protect the material from erosion. Also, it is provided with weep holes at 1x1m grid points on its body to facilitate seepage of water. The RR stone masonry cement sand mortar toe wall of a height of 3.0 m are proposed for the waste dumps in the lease area, while, RR dry toe wall of a height of 2.0m is proposed.

ii) **Garland Drains (Catch Water Drains):** The GDs are proposed 1-2 m below the toe wall to collect the discharging runoff water at the toe of dump and to carry it safely to SST tanks followed by natural water courses. It should have 2.0 m top width, 1.0 m bottom width and 1.0 m depth.

iii) **Geo-textile/ Coir mat:** It is proposed to protect the dump slopes from erosion/runoff by employing geo textile/coir matting after terracing their slope to approximate height.

2.7 Extent of Mechanization

2.7.1 Details of Mining Equipment

Drilling

It is proposed to deploy 150 mm dia rotary percussive drills along with crawler drills of 100 mm dia for mine development and bench preparation of mines during 1st five years of operation.

Afterwards the blast hole drilling shall be done by 250 mm dia rotary drills to achieve the ultimate target of the mine, i.e., 7.0 MTPA of Iron Ore ROM production. In the addition of the above-mentioned drills, crawler drills of 100 mm dia are proposed to be deployed to drill with the toes, uneven bench floors and cliff remnants.

Broad Blasting Parameters

Burden and Spacing

Normally 3 to 4 row blasting patterns are adopted to minimize ground vibration, noise and fly rock control. The diameter of holes are 150 mm and the depth of holes on an average is 14.5 m (including that of sub grade drilling of 1.2 meter for bench height variations etc.). The average burden is 4 to 5 meters and the average spacing is 5 to 6 m.

Charge per hole and No. of Holes

Charge per hole is around average of 140 kg for 150 mm dia hole & around average of 400 kg for 250 mm dia hole in ore and waste. Blasting is conducted as and when required. In one round of blast 100 to 150 holes are fired.

Charge per delay

Ground vibrations are not likely to affect the structures in the vicinity of mine lease area. While the core area has no structures, the structure adjacent to the mine area will be of concrete structures like workshop, office, store etc. These structures will not be affected by the ground vibrations as they will be away from the nearest face of the mine and being of good construction quality.

The impacts are also minimized by choosing proper detonating system, optimizing total explosive charge and charge/delay.

TABLE 2.11

Sl. No.	Criteria	Bench Height(12m)	Bench Height(12m)
1	Drill Hole Dia. (in mm)	150	250
2	Blast Hole Depth (including Sub Grade Drilling & for collapsing of holes)	13.2	13.2

3	Avg. Burden (in mtrs.)	3.5	5
4	Avg. Spacing (in mtrs.)	4.5	6
5	Avg. Stemming (in mtrs.)	5	5
6	Charge per Hole (in kgs)	140	300
7	Charge per Delay (in kgs.)	600	1000
8	Method of Initiation	**Bottom Initiation**	**Bottom Initiation**
9	Sequence of Blasting	Multi Row Blasting Method	Multi Row Blasting Method
10	Type of Explosive	Site mixed bulk explosives, supplied by Orica, KEL, NFCL and others suitable parties if any are proposed to be used for primary blasting whereas 83mm slurry explosive cartridges would be used for secondary blasting. The initiation system for the blasting would be done using Non-electric (NONEL) detonator.	Site mixed bulk explosives, supplied by Orica, KEL, NFCL and others suitable parties if any are proposed to be used for primary blasting whereas 83mm slurry explosive cartridges would be used for secondary blasting. The initiation system for the blasting would be done using Non-electric (NONEL) detonator.
11	Powder Factor (Ton/Kg)	4-5	4-5
12	Secondary Blasting	83mm slurry explosive cartridges would be used for secondary blasting.	83mm slurry explosive cartridges would be used for secondary blasting.

Method of initiation

Non-electric Bottom initiation will be adopted to reduce noise and ground vibration by using suitable initiation methods. Through the use of modern bottom initiation techniques, in-hole delay sequencing will be adopted. It will further control the ground vibrations and the possibility of air blast will become negligible. Sequence of blasting, the first row will be blasted in the beginning and subsequent rows will be blasted after giving proper delay. The rows will be blasted in multi row blasting method. Conventional slurry explosives will be used

for column charge in the cartridge form and Site Mixed Emulsion (SME) explosives. Conventional D-cord and shock tubes will be used for trunk line.

Powder Factor

A powder factor of 4-5 ton/kg for ore and waste excavation is proposed to be obtained from the blasting.

Secondary Blasting

Secondary Blasting will be done only for blasting of toes, and ledges. Secondary drilling will be done by 100 mm dia. crawler drills and subsequently blasting is done by controlled charging. However, blasting of boulders will be minimized keeping in view the vibration and noise hazards. For handling the boulders rock breaker will be introduced.

Storage of Explosive / Explosive Magazine

Charging of blast holes will be carried out with bulk explosive on contract with SME/SMS plant operators. However, a separate Magazine of 15 Tonnes capacity will be planned at a suitable location, preferably for storing detonators and other blasting accessories.

Slurry explosives required for secondary blasting are also planned to be stored in the same premises. During the development period of Mining, portable magazines are proposed to be installed at the safest location inside the Mining Lease of Bailadila Iron Ore Deposit-4.

Excavation / Loading

By adopting the various drilling and blasting parameters, optimum fragmentation of the ore can be achieved and easily handled by the mobile equipment's and crusher at the crushing plant.

The study of geological data reveals that the quality of ore is quite uniform. However, to ensure consistency of feed to the plant, the mining faces shall be, as far as possible aligned across the strike of the deposit.

Taking into account the size of the equipment's turning radius and the minimum distance for the power control units and space required for drills, the minimum operating width of the bench required would be kept at 30m for the first five years of mining plan period.

The ultimate width of the benches in the finishing stage could be reduced below 12m under provision of Mines Act. However, it would be maintained at 12m equivalent to the height of the benches so as to maintain an ultimate pit slope of 45^0.

Haul road will be prepared to connect 1200 MRL i.e., proposed top bench to 1105 MRL i.e., proposed dumper platform location. It is also proposed to have two-way traffic at main mine haul road. To enhance the safety standards on the haul road, according to recent DGMS (Tech) Circular no-9 dated 2.12.2008, the width of the main mine haul road shall not be less than 3 times the maximum width of the widest machinery plying on it plus 5 mtrs. After completion of construction phase, i.e., first five years, 100 T dumpers are proposed to be deployed; the clear width of

the haul road shall not be less than 23 m. The gradient of the main mine haul road will not be steeper than 1 in 16. The gradient of the ramps will not be steeper than 1 in 10.

It is proposed to deploy smaller equipment for mine working during initial five years. Ore production and waste removal will be done by 3.2 cum bucket excavator. After five years, when mine capacity will be upgraded to 7 MTPA, it is proposed to replace smaller equipment with higher capacity equipment. From 6th year onwards, ore production and waste removal will be done by 8.0cum bucket excavator (derated from 10cum bucket excavator).

In the initial five years 4.0. cum Front-end loaders will be used for loading purposes including final products. After five years 8.0. cum of Front-end loader will be used for loading purposes including final products. Final product at loading plant will be loaded by Rapid Wagon Loading System (RWLS).

For the first five years of start of mining operations, the haulage of blasted ore from mining faces to the mobile ore dressing plant will be done by means of conventional off high way heavy duty dumpers having a payload capacity of 25 T. The same capacity truck will be used for waste transportation to Waste dump.

The products, i.e., CLO (-40+10 mm) & Fines (-10 mm) generated at mine head by mobile ore dressing plant installed temporarily during the first mining plan period will be transported to loading plant proposed to be located near Bhansi Railway Station for onward dispatch to the Iron ore buyers.

After completion of this five-year of mining operation, off high way heavy duty dumpers having a payload capacity of 100 T are proposed in view of targeted rate of mine capacity of 7.0 MTPA to haul the ROM from mine benches to the proposed crushing plant at 1105 MRL. The crushed ore will be transported to the railway siding by means of downhill conveyor system.

Haulage

For the first five years of start of mining operations, the haulage of blasted ore from mining faces to the mobile ore dressing plant will be done by means of conventional off high way heavy duty dumpers having a payload capacity of 25 T. The same capacity truck will be used for waste transportation to Waste dump.

The products, i.e., CLO (-40+10 mm) & Fines (-10 mm) generated at mine head by mobile ore dressing plant installed temporarily during this mining plan period will be transported to loading plant proposed to be located near Bhansi Railway Station for onward dispatch to the Iron ore buyers.

After completion of this five-year of mining operation, off high way heavy duty dumpers having a payload capacity of 100T are proposed in view of targeted rate of mine capacity of 7.0 MTPA to haul the ROM from mine benches to the proposed crushing plant at 1105 MRL. The crushed ore will be transported to the railway siding by means of downhill conveyor system.

List of Mining Equipment for first five years of mining operation (2 MTPA) are given in **Table 2.12.**

Table 2.12

S.no	Equipment Description	Capacity	Requirement
1	Blast hole drills (Multi pass)	150 mm dia	3
2	Crawler drills	100 mm dia	2
3	Diesel-hydraulic Shovel/Back-hoe	3.2 cum	6
4	Dumpers	25 T	18+71 (Highway Truck for Ore Transportation from mine benches to Ore dressing plant=18 and Highway Truck for Ore Dispatch from Ore dressing plant to Railway Siding=71)
5	Front end loaders	4 cum	2
6	Crawler dozer	410 HP	2
7	Motor grader	280 HP	1
8	Water sprinkler	28 KL	2

List of Mining Equipment after five years of mining operation (7 MTPA) are given in **Table 2.13.**

TABLE 2.13

Sl. No.	Equipment Description	Capacity	Requirement
1	Blast hole drills	250 mm dia	4
2	High pressure all hydraulic crawler drills	100 mm dia	2
3	Shovels (Electric)	8.0 cum	6
4	Dumpers	100 T	18
5	Front end loaders	14 cum	2
6	Crawler dozer	410 HP	4
7	Wheel Dozer	496 HP	1
8	Motor grader	280 HP	2
9	Water sprinkler	28 KL	4
10	Mobile crane	30 T	2
11	Mobile crane	12 T	2
12	Fuel bowser	6 KL	2
13	Service Trucks	-	4
14	Explosive Van	1	3
15	Fire Engines	1	2
16	Lubrication Van	1	2
17	Jeeps	4	12
18	Car	1	2
19	Ambulance with Ventilator	1	3

2.8 Progressive Mine Closure Plan

The total area put to use for the first five-year mining plan period will be 130.927 Ha. At the end of the first five-year period area under mining will be 19.889 Ha and area used for waste dumping will be 15.599 Ha. In this mining plan period, a road will be developed from 1105 MRL to 1200 MRL to connect the mine with Crushing Plant. The excavated material will be dumped at the Waste Dump No-1. The break-up of areas in the mining lease for calculation of financial assurance is given in **Table-2.14**.

TABLE-2.14
CONSOLIDATED VIEW OF FINANCIAL ASSURANCE

Sl. No.	**Particular**	**Area put to use at Start of Year** (Ha) **(A)***	**Additional Requirement** (Ha) **(B)***	**Total** (Ha) **(C = A + B)**
1.	Area under Mining	0	19.889	19.889
2.	Topsoil stacking	0	0	0
3.	Overburden/Waste Dumping	0	15.599	15.599
4.	Mineral Storage	0	1	1
5.	Infrastructure (Workshop, Administrative Building etc.)	5.318	45.892	51.21
6.	Roads	9.123	9.988	19.111
7.	Railways	0	0	0
8.	Effluent Treatment Plant	0	0.1	0.1
9.	Mineral Separation Plant	0	0.16	0.16
10.	Township Area	0	0	0
11.	Explosive Magazine Area	0	15.37	15.37
12.	Others to Specify (Green belt-Safety zone Area)	0	8.488	8.488
Total		**14.441**	**116.486**	**130.927**

During the first five years' plan period total 18,651 running meters of outer / inner fencing, 1125 meters of retaining wall below the waste dumps, 1140 meters of garland drains have been planned. During the first five years' plan period plantation details are given in **Table-2.15.**

TABLE 2.15

YEAR WISE PLANTATION PROPOSAL

Sr. No.	Year	Green Belt Location (s)	Area Proposed to be Covered (Ha)	Number of Plants Proposed	Expected Survival Rate (%)	Estimated Expenditure (INR)
1	Year 1	Safety Zone	1.248	3000	85	312000
2	Year 2	Safety Zone	1.81	4500	85	497750
3	Year 2	Gap Plantation	12.08	11500	85	3322000
4	Year 3	Safety Zone (Gap Plantation)	1.81	2000	85	547525
5	Year 3	Dump Plantation at Dump-1	1.672	2500	85	505780
6	Year 3	Gap Plantation	12.08	11500	85	3654200
7	Year 4	Safety Zone (Gap Plantation)	1.81	2000	85	602277.5
8	Year 4	Gap Plantation (Other than safety zone)	12.08	11500	85	4019620
9	Year 5	Safety Zone (Gap Plantation)	1.81	2000	85	662505
10	Year 5	Gap Plantation (Other than safety zone)	12.08	11500	85	4421582

2.9 Ore Processing

During the 1st five years of Mining operations, mobile ore dressing plant will be installed at the mine site for production of CLO/Lump (-40+10mm size & -20mm +10mm) & Fines (-10 mm). Once the OCSL (Ore Crushing Screening and Loading) facilities are installed, the ore will be processed through OCSL plant only.

The ROM produced from the first year itself in course of all the developmental activities will be crushed and screened at the mine head itself by installing a mobile ore dressing plant. The products, i.e. Lump/CLO and fines will be transported to loading plant proposed to be located near Bhansi Railway Station for onward dispatch to different plants of Chhattisgarh as well as different States.

The first five years of the mining operations is considered as construction phase of the project and all ore dressing facilities, like crushing plant, downhill conveyor, screening plant, tertiary crushing plant & loading plant will be installed during construction period of this project.

Once, these facilities are installed, ROM ore, (-) 1,200 mm, from the mine shall be fed to the crushing plant with the help of dumpers. The crushed ore of (-) 350mm after being passed through the metal detector is fed to a scalping screen for separation of (-) 150mm size material. The oversize (+150mm) from the scalping screen will pass through secondary cone crusher and reduce to (-) 150mm size.

During the first five years of mining operations, only dry process will be adopted. There will not be any generation of sub-grade middlings and rejects. ROM excavated from the pit will be directly fed to the in-pit ore dressing plant. Hence, quantity of the ROM excavation and feed to the plant will be same. Since, dry process is proposed to be adopted during first five years of the plan period, product grade will be same as feed grade of the plant.

2.9.1 Crushing Plant

The Plant is planned at hilltop within the mine lease boundary. The elevation of the dumper platform level is kept at EL (+) 1105 m, so that most of dumper platform & Crushing Plant building are in cutting zone.

The location is selected at the center of the mine (outside of ultimate pit boundary), so that the lead distance from both sides of the mine is equidistance. Further, to match with contours / topography and to avoid encroaching into fern area (thick vegetation) & nearby galli nallah, the primary crushing plant has been kept near to Ultimate Pit Boundary (65 m).

Single line primary crushing plant (@2000 TPH) with gyratory crusher and single line of secondary crushing (@1200 TPH) have been envisaged to crush down (-) 1200 mm size ROM boulders to (-) 150 mm size lumps. A covered primary stockpile (PSP) of suitable capacity at EL 1094m is planned.

Rest shelters, office room of suitable sizes for operational & running maintenance staff near dumper platform level including all amenities such as drinking water, wash rooms, electricals etc. are also considered.

2.9.2 Downhill Conveyor System

To connect Primary Stockpile at hilltop and Screening Plant at foothill, various options of downhill conveyor system have been worked out balancing between earth cutting, trestle heights, conveyor inclination, approach roads etc., Out of various options studied, the option with 4 conveyors having total length of approx. 8.7 km (DHC1 – 5.1 km, DHC2 – 0.8 km, DHC3 – 1.2 km & DHC4 – 1.6 km) appears to be a feasible option.

The downhill conveyors corridor has been considered to be 45 m in width (25 m on the right-hand side and 20 m on the left-hand side in the direction of the conveyor belt travel) for planning conveyors, transfer houses, belt laying area,

electrical sub-station, control rooms, maintenance/storage sheds, fire water system, dust suppression system etc., including installation of overhead electrical transmission lines and water pipelines.

Thus, Downhill conveyors of length approximately 8.7 km (total four conveyors) @ 2200 TPH design capacity, majorly following the ground profile and towards Bhansi complete with state of art electrics, controls and braking system is envisaged.

2.9.3 Screening Plant (Dry and Wet Processes)

The screening plant at EL 580m corridor covers open stockpile, a four-line screening plant & tertiary crushing plant, wet circuit system, conveyor system, electrical sub-station, electrical building / control room, office & stores buildings, maintenance sheds, canteen & rest rooms, sprinkler water & dry fog system pump houses, raw water reservoirs, recirculation water tank & pumping systems, tailings disposal system etc.

Proposed new Screening Plant @EL 580m consists of 4 Nos. screening lines having 4 Nos. of double deck vibrating screens of design capacity of 750 TPH (primary screens) and 4 Nos. Secondary Vibrating Screens of 550 TPH capacity.

Deposit-4 will be developed for production of 7.0 MTPA Iron ore by producing 5.5 MTPA & 1.5 MTPA in dry mode and wet mode respectively. During the monsoon season, dry screening of ore in secondary screen will be difficult due to binding of screen deck by high moisture sticky iron ore. Also, jamming of the connecting chutes hamper the total production. Sometimes operation of screening plant even for 08 hours in a day with rated capacity is very difficult due to above mentioned problems. To overcome this problem, it is envisaged to incorporate Wet Screening facility in Secondary Screens during monsoon season.

In the process of wet classification, the adhered fine particles on coarse ore as well as natural & generated ultrafine particles of Iron, silica and alumina are being reported as slimes and Fe grade is generally below 60% Fe. These slimes will be dry stacked for blending with high grade fines.

2.9.3.1 Dry Screening System

Primary crushing and secondary crushing capacities are designed for 2000 TPH and 1200 TPH respectively to crush the material from 1200 mm to minus 150 mm. Downhill conveyor capacity is designed for handling 2200 TPH.

Screening plant is designed for four lines by considering three lines for operation and one line for standby mode to cope up with the unexpected breakdowns / maintenance works. Each line is designed with primary vibrating screen having design capacity of 750 TPH and rated capacity of 670 TPH, secondary vibrating screen is having design capacity of 550 TPH and rated capacity of 450 TPH are considered to handle the eight months dry operation of 5.5 MTPA (Dry operation layout is shown as **Figure 2.3**).

During the operation of dry and wet circuits, Primary Vibrating Screen's oversize fraction (+) 40 mm is crushed to (-) 40 mm in close circuit with tertiary crusher. Thus produced (-) 40 mm (Natural and generated) will be feed stock for secondary screen.

The secondary screens shall have 10mm screen panels and rest of 6 mm and 3 mm screen panels are taken out during the dry operation for avoiding clogging of these screen panels and to maintain better flowability. The screened products -40+10 mm size is designated as Calibrated Lump Ore (CLO) having grade of 67.08% Fe and minus 10 mm fines is having grade of 64.97% Fe.

Vibrating Screens

The primary screens will be double deck type suitable for the following conditions:

(a) Material to be handled : Iron ore
(b) Design/rated capacity : 750 TPH / 670 TPH
(c) Bulk density : 2.2 to 2.8 T/m^3
(d) Moisture content : 5 to 6% average
(e) Separation size : +40 mm and (-) 40 mm
(f) Separation efficiency required: 95%
(g) Sieve analysis of ROM (input material)

Size fraction	
+150 mm	<2%
+40 to (-) 150 mm	45% average
(-) 10 mm	64% average
(-)3.00 mm	56.4% average
+3.00 to (-)10 mm	8.4%

The secondary screens will be wet triple deck type suitable for the following duty conditions:

(a) Material to be handled : Iron ore
(b) Design/rated capacity : 550 TPH / 450 TPH
(c) Bulk density : 2.2 T/m^3
(d) Moisture content : 5 to 6% average
(e) Separation size : 10.0 mm, 6.0 mm and 3.0 mm
(f) Separation efficiency required : 95%

The secondary screens will work as wet screen during monsoon and dry screen during all other seasons. The screens should have provision of insertion and removal of the second and third deck. During monsoon, the second deck and the third deck will be inserted for separation of (-)3.00 mm slurry (due to wet

screening). For all other seasons, a solid deck will be inserted in place of the second and third deck. So, only one deck will be working for separation of 40 mm and 10 mm, i.e. material sizes will be +10 to (-) 40 mm and (-) 10 mm. The water spraying over the decks during monsoon should be uniform. Wet screening should be achieved over full area of the deck. The water pressure should be sufficient to wash the material thoroughly and also prevent jamming of the deck plates.

Cone Crusher

The crushers must be suitable for the following duty conditions:

(a)	Material to be handled	:	Iron ore
(b)	Design capacity	:	750 TPH
(c)	Bulk density	:	2.2 T/m^3
(d)	Material size	:	+40 mm and (-) 150 mm
(e)	Output material size required	:	(-) 40 mm

For production of 5.5 million tons iron ore with the dry circuit operation (Eight months), 2000 TPH feed rate is considered. Accordingly mass balance is prepared @2000TPH given as **Figure 2.4**.

Figure 2.3: Dry operation layout

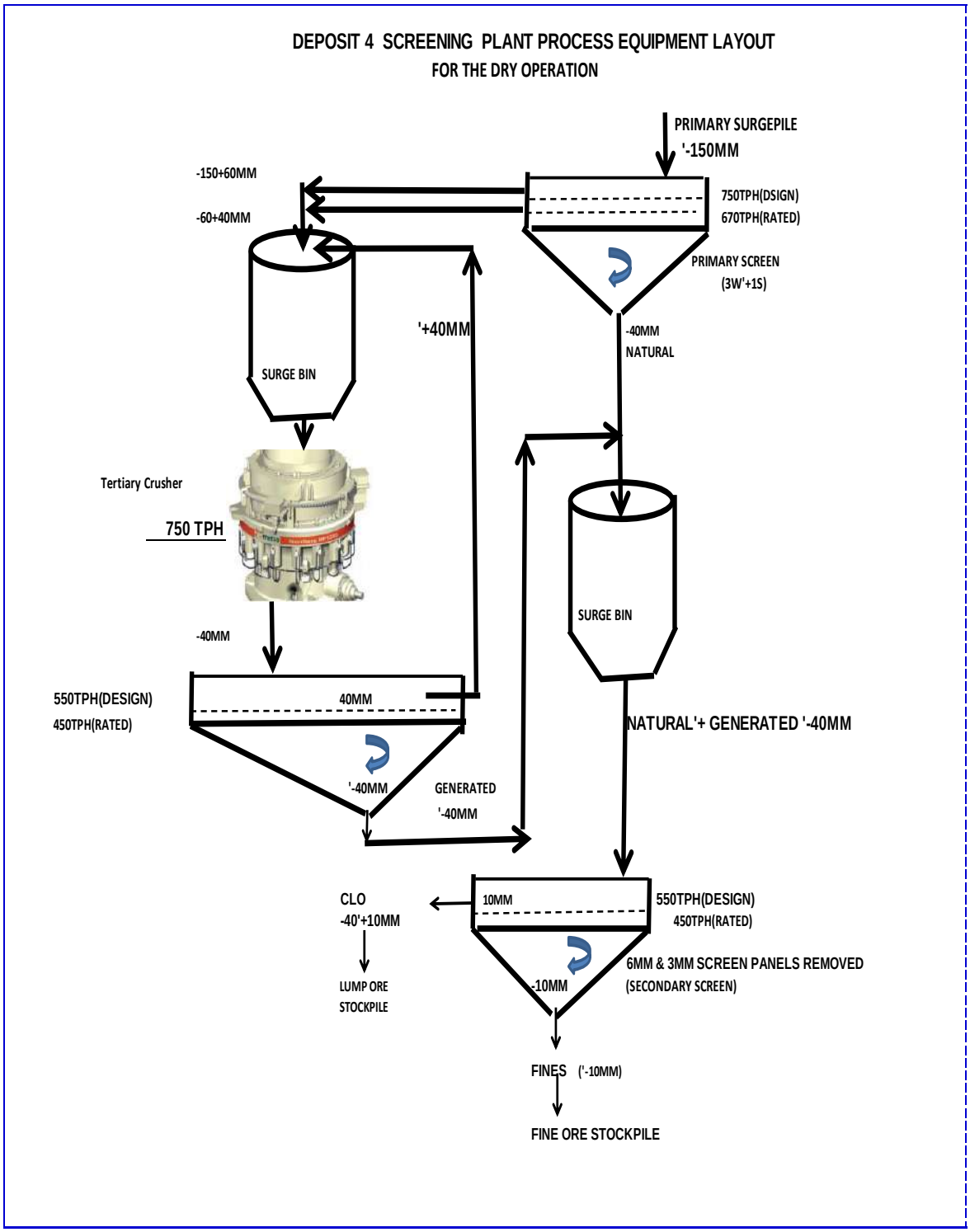
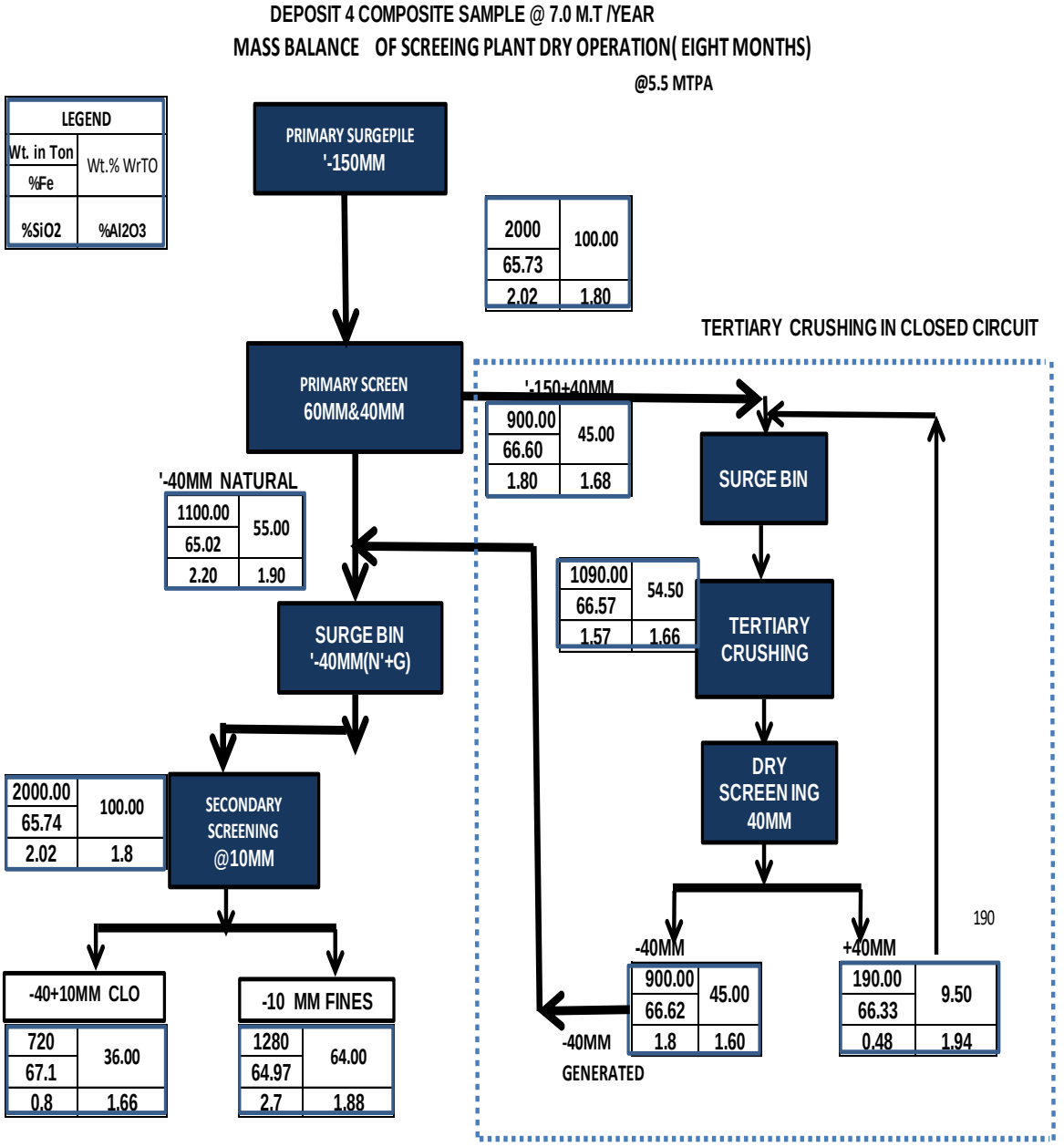


Figure 2.4: Mass Balance for Dry Operation



PRODUCT	Wt in TONS	Wt%
-40+10mm(CLO)	720.00	36.00
-10.00mm(Fines)	1280.00	64.00
Total	2000.00	100.00

2.9.3.2 Wet Screening System

The plant & equipment for the wet screening system shall be designed and sized based on the following basic parameters including physical characteristics of raw materials and products to be handled.

Annual operating days : 100 (During Monsoon)

No. of shifts per day : Three (3) Shifts of eight (8) hours Per shift

Design Capacity : 1528 TPH (Dry Solids)

Rated Capacity : 1350 TPH (Dry Solids)

Iron Ore from Secondary Surge Bunker shall be fed to double Deck Primary Vibrating Screens. Primary Vibrating Screen's oversize fraction (+) 40 mm is crushed to (-) 40 mm in close circuit with tertiary crusher. Thus produced (-) 40 mm (Natural and generated) will be feed stock for secondary screen. In monsoon season for wet screening, iron ore from Secondary Screens shall be fed to the wet circuit. The bottom deck of these Secondary triple deck screens shall be replaced by solid P.U. deck during dry season. Wet circuit system consists of spiral classifiers and associated equipment like clusters of hydro-cyclones, de-watering screens, slurry pumps and Hi-Rate thickener, filtration equipment (**pressure filters/ belt filters**) etc., for maximum recovery of water & to convert tailings slurry into cake form for easy handling.

Downstream equipment (spiral classifier, hydro cyclone, dewatering screen, tailings thickener and pressure filter) are planned in wet operation along with secondary screens to achieve the production targets as well as handling the generated slimes (-0.040 mm). To meet the prevailing environmental conditions, scheme (**Figure 2.5**) for operation of wet circuit has been prepared and same has been used for preparing mass balance and water balance. Layout of screening plant wet circuit has been given at **Figure 2.5**.

During wet screening operation, the fine Iron ore slurry (-3.00 mm size fraction) obtained from the secondary screen shall be fed to spiral classifiers through launders by gravity to cut the size fraction at 0.15 mm and obtain classifier sand (Cl. Sand) -3.00 + 0.15 mm and classifier over flow (Cl. O/F) -0.15 mm.

Classifier sand is combined with de slimed cyclone under flow and same will be passed through high frequency dewatering screen for reducing the moisture content of -3.00 + 0.15 fines as screen over size.

Classifier overflow, which is collected in Hydro Cyclone Feed sump is pumped to bank of Hydro Cyclones for de-sliming of minus 40 microns.

The Hydro Cyclone underflow shall be fed to the same set of High Frequency Screens along-with underflow from spiral classifiers. The dewatered Iron Ore Fines from the Hi Frequency Screen shall be transported through Belt Conveyor to fines Stock Yard.

Hydro Cyclone over flow (Slimes 0.040 mm) is dewatered through thickener and pressure filter.

The Underflow collected in the High Frequency Screen Catch Pan shall gravitate to a tank from where the same shall be pumped to a Concentrate Thickener. The Concentrate from the Thickener Underflow shall be pumped to a Horizontal Belt Filter / pressure filter. The dewatered concentrate from the Horizontal Belt Filter / pressure filter shall be transported to the fine ore stock yard through Belt Conveyor. The Underflow collected in the Horizontal Belt Filter / pressure filter catch pan shall be pumped back to the Concentrate Thickener.

The Hydro Cyclone overflow shall flow by gravity to Tailing Thickener. Suitable polyelectrolyte flocculent / lime shall be added into the thickener to enhance the settling process. The clarified water collected as Tailing Thickener Overflow shall be pumped back to the system along with makeup water.

The underflow slurry from Tailing Thickeners shall be pumped to Hydraulic Pressure Filters via Pulp Mixing Tank for dewatering Thickener underflow. The dewatered fines (cakes) shall be transported to the low-grade dump yard through belt conveyor / trucks. The filtered water shall be pumped back to the tailing thickener.

From the wet circuit operation of secondary screens and above-mentioned downstream equipment, saleable Calibrated Lump Ore (-40+10 mm) having grade of 67% Fe and fines (-10 + 0.40mm) having grade of 65% Fe are produced along with dry slimes (-0.040 mm) having grade of 51.0 % Fe which can be blended with high grade fines / stack for future use.

From the above considered scheme (@1350TPH), conceptual mass & water balances are prepared and shown as **Figure 2.6** & **Figure 2.7** respectively.

Wet circuit system consists spiral classifiers and associated equipment like clusters of hydro-cyclones, de-watering screens, slurry pumps and Hi-Rate thickener, filtration equipment (pressure filters/ belt filters etc) for max recovery of water & to convert tailings slurry into cake form for easy handling.

Broad Specifications of Major Equipment

Secondary Screen (Qty – 3 Working +1 Standby)

Duty Parameters (Each Screen) –

Design Capacity	: 550 TPH
Rated Capacity	: 440 TPH
Separation at	
- Top Deck	: 10 mm
- Middle deck	: 6 mm
- Bottom deck	: 3 mm
Approx size distribution	

+ 40 mm	: 8.01%
+ 10 – 40 mm	: 36.54%
- 10 + 3.15 mm	: 12.91%
- 3.15 mm	: 42.54%
Required Screening Efficiency	: 95%

The linear motion triple screen having top deck with woven wire mesh of HCHT wire and bottom two decks are PU decks with 6 mm. sq. and 3.00 x 15 mm rectangular opening respectively. During dry screening operation, second deck and the third decks having 6.00 mm and 3.00 mm aperture respectively will be removed and the – 10.00 mm fraction shall be transported by a belt conveyor.

Spiral Classifier (Qty – 3 Working +1 Standby)

Duty Parameters (each classifier)

-	Design Capacity	: 275 TPH
-	Rated Capacity	: 255TPH
Spiral		: Triple pitch with performed flights, replaceable White Cast Iron wearing shoes with counter sunk bolts and submerged anti friction lower bearing.
Spiral speed		: 5 to 6 RPM
Shaft		: Heavy duty tubular seamless pipe
Short Arms		: Cast steel
Lifting device type		: Motorized Hydraulic to provide a lift of approx. 1050 mm
Tank		: Full flared tank with supported by a rigid substructure with adjustable side weirs
Drive		: Drive complete with planetary gear box with hydraulic motor (approximate 30 KW)
Slope		: 3.5 in 12
Material of construction		
Spiral		: Steel IS 2062 106 Grade B
Wear Shoes		: White cast Iron

Bank of Hydro Cyclone (Qty – 2 Nos.)

Each bank of Hydro cyclone shall be suitable for the following duty conditions:

Material	:	Iron Ore fines
Particle size	:	< 0.15mm
Solids sp. Gravity	:	4.85
Solids flow rate	:	170 TPH
Water flow rate	:	925 m^3/hr
Cyclone Overflow	:	Solids – 28TPH Water - 1158Cum / hr
Cyclone underflow	:	Solids – 165 TPH Water – 140 Cum / hr.
Cyclone diameter	:	250 mm

The classifying cyclones shall be polyurethane or alumina (92%) ceramic lined suitable for high abrasion. This includes feed distributor with pressure gauges and knife gate valves, overflow, underflow chambers suitably lined with polyurethane or high alumina (92%) ceramic.

High Frequency Screen (Qty – 3 Nos)

High Frequency Screens is considered to dewater minus 0.20 mm Iron Ore fines received as underflow from Spiral Classifiers & Bank of Hydro Cyclones. The dewatered iron ore fines from the High Frequency Screen is discharge to a fine ore conveyor. Effluent from the Screen will report to the concentrate thickener.

Model	:	Reverse Incline
Speed	:	1200 to 1500 rpm
Throw	:	5 mm
Deck Surface	:	Polyurethane, ¼ mm, slotted openings
Feed	:	275 TPH (Design), 250 TPH (Rated) Water 116 m^3/Hr (Design), 97 m^3/Hr (Rated))
Efficiency of Screen	:	Maximum product moisture 10% Maximum solids in the underflow 6%

Hi-Rate Thickener (Qty – 2 Nos. for Tailings and 1 No. for Concentrate)

Duty Parameters for Tailing Thickener (each thickener)

Feed to Thickener	:	Iron Ore Fines Slurry containing 55.5 TPH dry solids and 2315 cum / hr water.
Rise Rate	:	2.4 metre per hour per sq. mtr area
Torque ratings of Thickener Drive	:	Trip Torque - 638820 Nm Continuous running Torque – 415234 Nm Peak Torque – 830467 Nm
Thickener underflow	:	50% solids
Thickener overflow	:	Maximum solids in overflow water 100 ppm with flocculation and lime dozing
Thickener diameter	:	38 Mtr.

Duty Parameters for Concentrate Thickener

Feed to Thickener	:	Iron Ore Fines Slurry containing 45 TPH dry solids and 600 cum / hr water.
Rise Rate	:	3.5 metre per hour per sq. mtr area
Torque ratings of Thickener Drive	:	Trip Torque - 106175 Nm Continuous running Torque – 69014 Nm Peak Torque – 138028 Nm
Thickener underflow	:	50% solids
Thickener overflow	:	Maximum solids in overflow water 100 ppm with flocculation and lime dozing
Thickener diameter	:	15 Mtr

Horizontal Belt Filter (Qty - 1 Working + 1 Standby)

Duty Parameters

Feed to Filter	Solids - 75 TPH (Design), 62 TPH (Rated)

Water -75 m^3/Hr (Design), 62 m^3/Hr (Rated)

Chemical analysis Fe +62%.

Approx. filtration area 126 sq. m

The HBF shall complete with heavy duty frame, carrier belt, filter cloth, vacuum box, spillage grader, head and tail pulley, feed dam roller, cloth rollers, belt roller, flap dams, discharge chute spray pipe with nozzles, cloth tracking system safety guards, vacuum hoses, filtrate manifold, moisture trap, vacuum pump, air blower, compressor, gearbox and drive motor.

Hydraulic Pressure Filter (Qty. - 2 Working + 1 Standby)

Duty Parameters (each filter)

Feed to Filter Solids - 30 TPH (Design), 25 TPH (Rated)

Water - 32 m^3/Hr (Design), 27 m^3/Hr (Rated)

Desired output moisture 10 to 11%

Approximate Size 1500 mm x 1500 mm

Filter Area 357 sq. m

Particle size 0.040 mm

Cake thickness 32 mm

Motor for Hydraulic System 11 KW, 4 Pole.

Operating pressure 7 and 15 bar

The above sizes / specifications are indicative and may vary depending upon availability of the same with the manufactures.

Slurry Pumps Specifications & duty conditions for slurry duty centrifugal pumps:

Pumps description	**Slurry Flow rate, M^3/Hr**	**Slurry Head, M**	**Water Head, M**	**Type of Solids**	**Solid Sp. Gr.**	**Slurry Sp. Gr.**	**Max. Particle size, mm**	**Type Horizontal / Vertical**	**No. of**
Spiral Classifier Feed Pump	750	10	10.8	Iron Ore Fines	4.85	1.31	3.15	Horizontal	3

Hydro Cyclone Feed Pump	1000	30	30.4	Iron Ore Fines	4.85	1.19	0.150	Horizontal	2
Thickener Underflow pump	112	15	15.5	Iron Ore Fines	4.85	1.91	0.150	Horizontal	3
Thickener Overflow pump	1850	38.5	38.6	Traces	-	1.01	Microns	Horizontal	3
Spillage Sump Pump	60	20	21.7	Iron Ore Fines	4.84	1.5	5.0	Vertical	1

Process Water Requirement

From the submitted conceptual flow sheet of water balance the required makeup water is 465.83 Cu.M/hr and total make up water requirement for one day operation of screening cum beneficiation plant is 8630.00 Cu.Mtr.

Slurry/Tailings Disposal in dry mode

The slimes obtained from the hydro cyclone under flow and over flow would be partially dewatered in a dewatering screen & concentrate thickener and tailing thickener respectively. Final dewatering of concentrate and tailing thickeners underflows (50-60% solids) passed through horizontal belt filter / pressure filters. These thickeners and filters (HBF & pressure filter) would be located inside the plant boundary.

HBF / Pressure Filter cake having moisture content of 10 % would be transported high grade fines storage area.

Pressure Filter cake having moisture content of 15 % would be transported to low grade fines storage area.

Wet circuit will be well instrumented and controlled through local control panel as well as through central control center. In order to have better supervision, operation and control of the proposed system, microprocessor based programmable logic controller (PLC) has been envisaged.

It may be noted here that in place of disposal of iron ore tailings through conventionally adopted system of slurry pipeline and tailing dam, a scheme of dry disposal of iron ore tailings in form of cakes through horizontal belt filter/pressure filter has been incorporated in the beneficiation scheme of Bailadila iron ore deposit-4. It will be first time that iron ore of Bailadila range will be treated through such scheme on such a large scale. Success of introduction of horizontal belt filter

and pressure filter will depend on multiple factors of which mineralogy of the iron ore of Deposit-4 will be of the utmost important. In case of failure of envisaged scheme of dry disposal of iron ore tailings (**Figure 2.8**) in form of cakes, option of disposing such tailings through conventional system of slurry pipeline and tailing dam may be explored in future. For which approx. 35 Ha. land may be required. However, before adopting any change in process of Bailadila iron ore Deposit-4, necessary statutory clearances will be obtained.

Figure 2.5: Wet Circuit Layout of Screening Plant

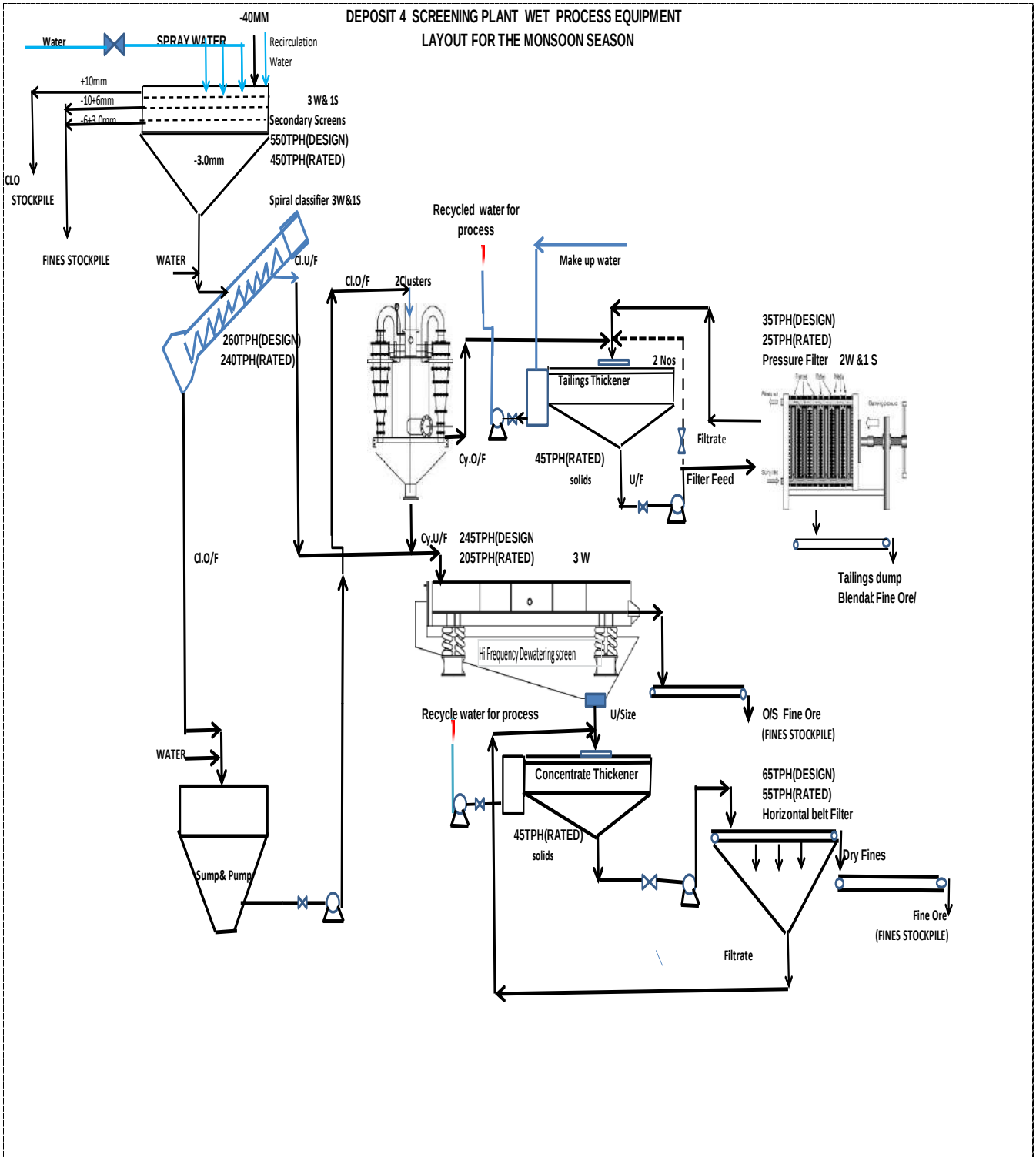


Figure 2.6: Wet Circuit Mass Balance

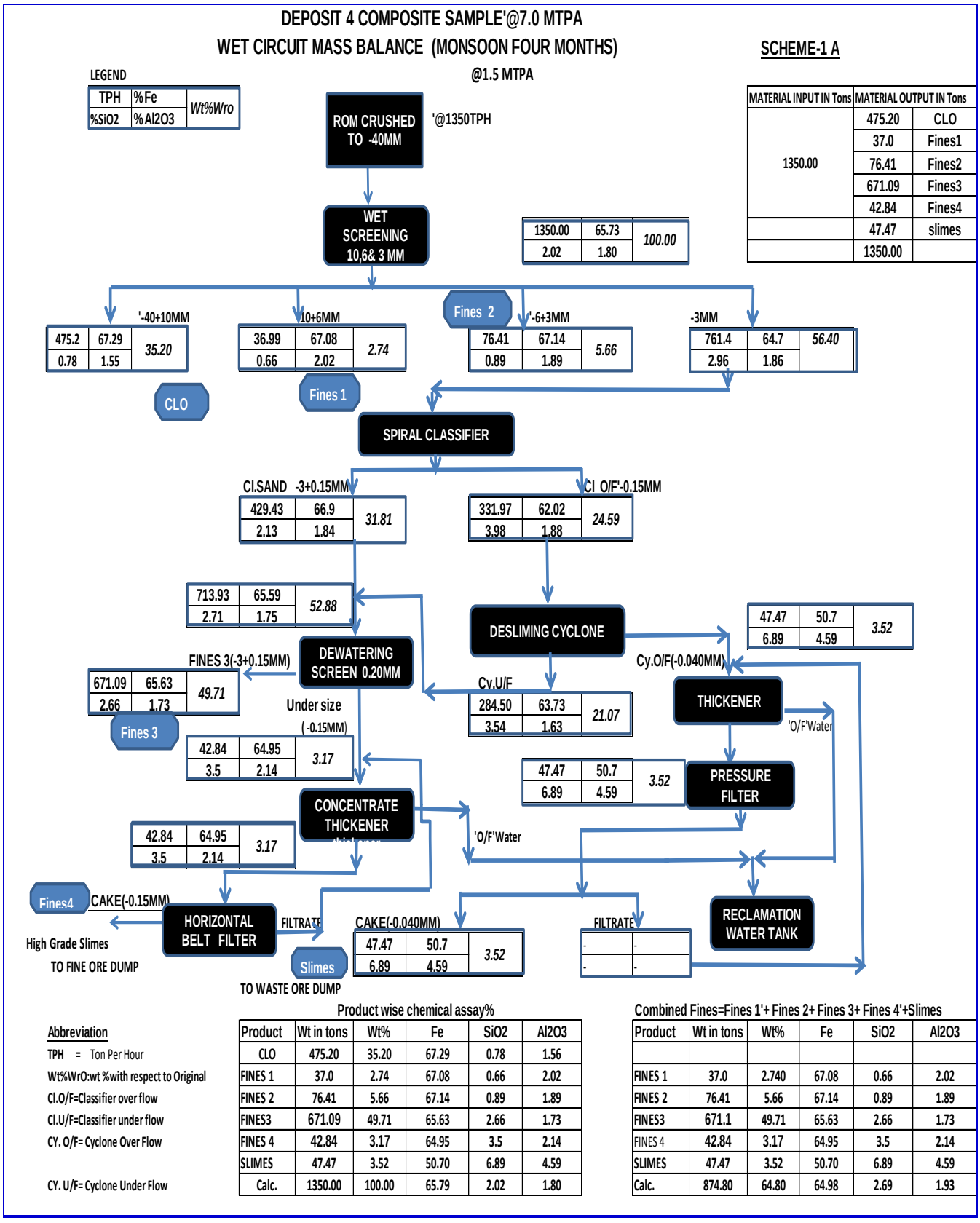


Figure 2.7: Wet Circuit Water Balance

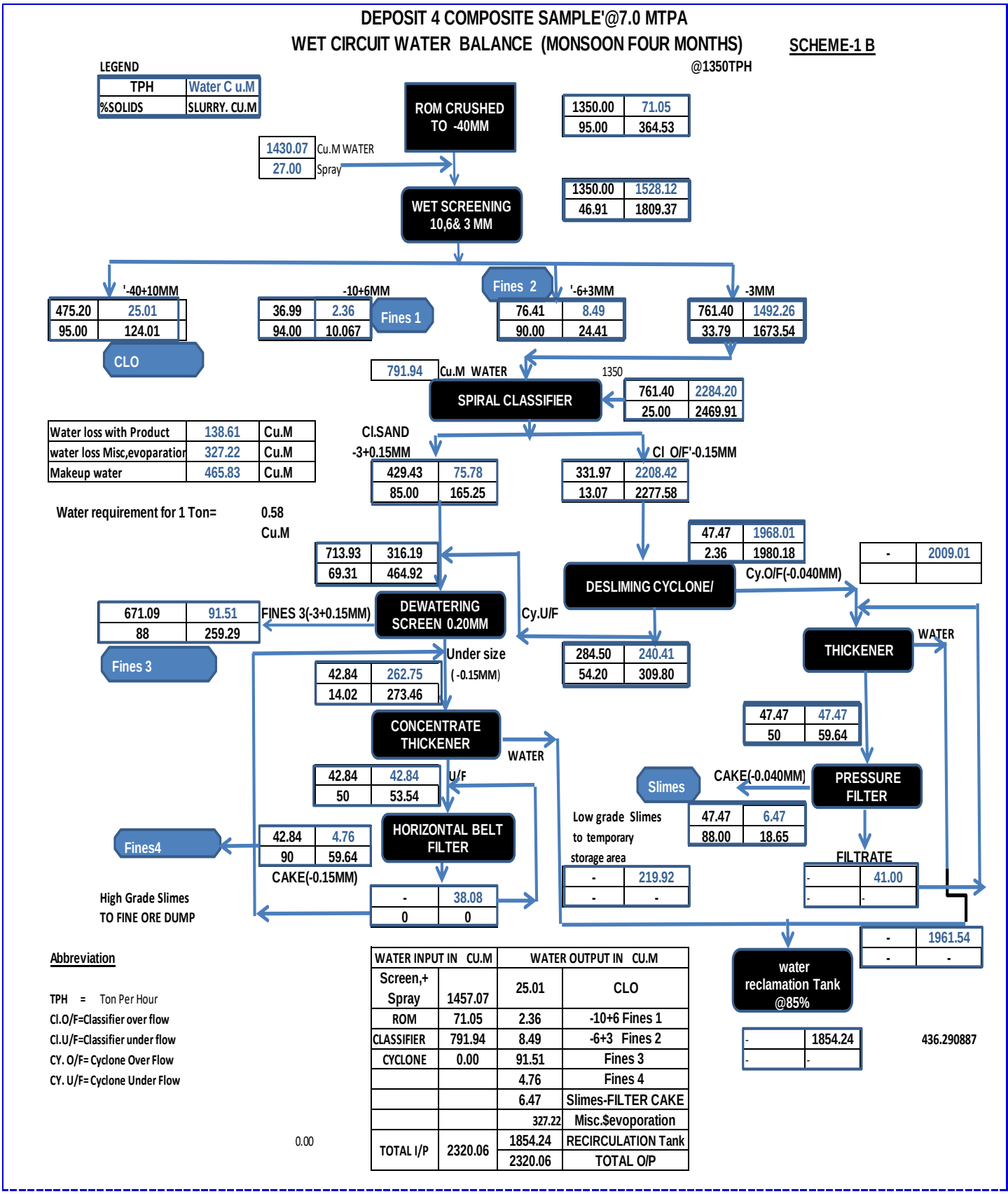
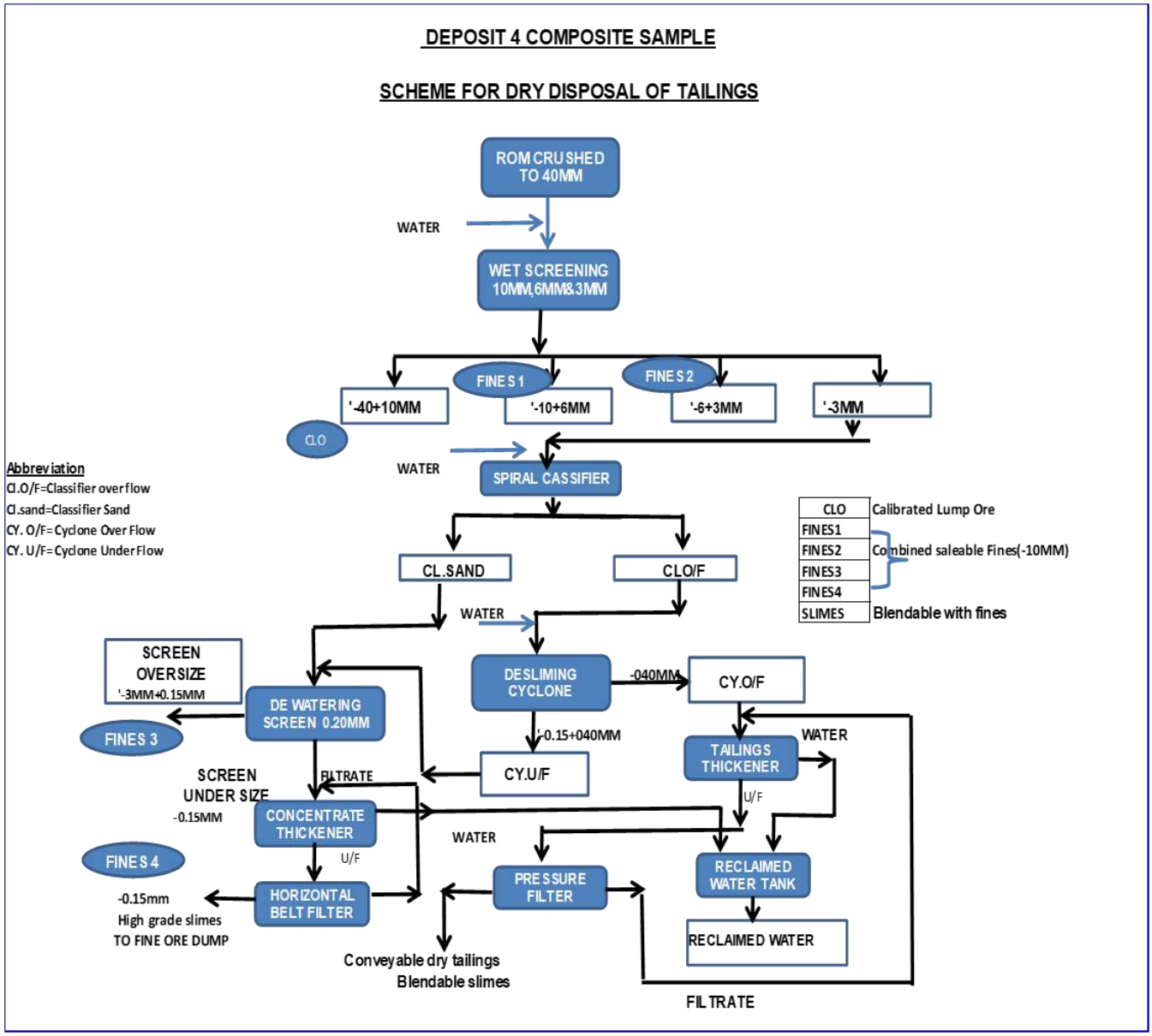


Figure 2.8: Scheme for Dry Disposal of Tailings



2.9.3.3 Action plan to improve the flowability of Iron ore in the Ore processing and handling areas

During the dry operation of the Plant, approx. 1000 KLD water will be used for dust suppression in the Plant. As only Primary Screen with double deck will be used and down the line process will be closed down, sized Iron Ore (product of primary screen and tertiary crusher) treated with water (for dust suppression purpose) will move to Lump Ore / Fine Ore Conveyor Belt i.e. movement of the ore will be in limited areas during the dry season operations. Water spraying for dust suppression will be just enough to stop the iron ore becoming air borne at transfer points. There will not be any effect on flow the ore in the plant area during dry season. However, during wet screening process, there may be chances of biding of iron ore particles in the screen openings and chutes. This may create flowability

issue during wet screening process, to remove this, specially made chutes with special liners, screens with special cloths and water absorbent polymer will be used. Apart from these measures, air blaster and spring loaded scrappers will also be used at chutes and screens.

2.9.3.4 Loading Plant and Railway Siding

In the loading plant area, 4 nos. of product stockpiles (EL. 532m) and facilities for stacking, reclaiming, loading and rail transport are planned. There shall be a common loading arrangement for both lump & fines through flood loading system. The loading plant also includes ancillary buildings, sub-stations, ROB etc. Stockpile have been designed to accommodate approx. 3.2 LT of iron ore lump and approx. 2.3 LT of iron ore fines at a time.

There shall be separate loading lines for both lump & fines and loading arrangement shall preferably be through flood loading system for in-motion loading of wagons. Possibility of direct and swapping of loading systems as per requirement shall also be considered.

The iron ore fines and CLO as obtained from the screening system will be conveyed by means of belt conveyor systems suitably sized and will be stacked in respective bays by means of stacker-cum-reclaimers.

Each stacker-cum-reclaimer will be used for building up stock piles and for reclaiming the same from the yard as and when required.

Stacker-cum-Reclaimer will also be provided with suitable by-pass facility to transfer the material to yard conveyor itself in order to have provision of direct feeding loading bunkers. Also, if there is a breakdown of stacker cum reclaimers, a suitable conveying arrangement is kept for stacking of material on to the stockpile.

2 no. flood loading systems have been proposed for loading fines and CLO.

There will be loading bin on railway track, complete with all accessories and other loading equipment like load cell mounted weigh hopper, motorised sector gate and hydraulic loading chute.

The wagon loading will be done through flood loading system at an approximate rate of one wagon per minute on an average (indicative). The loading will be controlled from control room located at the first floor just above the wagon level. The rate of loading will be around 3000 TPH matching the variation of creep speed of locomotive. To ensure a better loading and weighing accuracy there will be a separate online wagon weighing system.

In order to have better supervision, operation and control of the proposed Rapid Loading Systems, microprocessor based programmable logic controller (PLC) has been envisaged. The PLC will have the facilities for remote monitoring and sequential control, including local operation of individual equipment, audio visual fault annunciation, normal status display, signalling, data logging, data display and

printing etc. with sufficient capability of management reporting from a control desk located at silo control room.

Main Hill Top Road and other connecting Roads

Roads have been planned to approach Crushing Plant, Screening Plant, Loading Plant, conveyor and transfer houses. In most of the areas, existing 'kaccha' road of 4 m width is planned to be widened & strengthened to facilitate two-way traffic. New roads are also planned to avoid hairpin bend for safety and area required for roads is about 28 Ha (approx.). To cross over from existing railway line towards plant side, ROBs have been planned at two locations near loading plant.

2.9.4 Raw Material Required: Estimated Quantity, Likely Source, Marketing Area of Final Products, Mode of Transport of Raw Material & Finished Product

During the production of iron ore in the mining lease, usable grade iron ore as well as sub grade ore shall be produced. The crushed iron ore (-150mm) will be feed to the screening cum beneficiation plant situated outside the mining lease and same will be transported to screening cum beneficiation plant through the downhill conveyor belt from the crushing plant situated inside the mining lease of Deposit-4. During initial five-year period, when plant and railway siding will be under construction, iron ore produced will be transported to the customers through road. Though, after initial five years period when loading plant/railway siding of Deposit-4 will be constructed and commissioned, iron ore will be transported through rail, however, this will further depend on completion of the work of doubling of KK rail line and connection of Rawghat to Jagdalpur through rail. In view of this, 20% of total project capacity may be transported through road in foreseeable future beyond the initial five years period.

2.10 Mineral Use

The products will be used as raw material for steel plants, pig iron plants, sponge iron plants and pellet plants of the country.

2.11 Resource Requirement

2.11.1 Water Requirement

The total water requirement inside the mining lease will be 4250 KLD. The total water requirement for screening cum beneficiation facility (outside the mining lease of Bailadila Iron Ore Deposit-4) at full rated capacity is 8630 KLD (approx.) and 5500 KLD in wet and dry operations respectively. Thus, maximum water requirement will be 12880 KLD (Mining operation-4250 KLD + Wet screening operations -8630 KLD). Permission for withdrawal of water from Sankani Nalla and Nerli Nalla (Sankani Nadi) will be obtained from Water Resource Department, GoCG. NCL has submitted application for obtaining water permission for 20,000 KLD (considering entire Bailadila Deposit-4 project with peak rated capacity and future requirements including separate township) with Water Resource Department, GoCG.(attached as **Annexure 2.1**).

Details of water requirement is given below:

Mining operations		
Sl. No.	**Description**	**Requirement (in KLD)**
1.	Dust suppression on haul roads	2000
2.	Dust suppression at Crushing Plant	1000
3.	For Domestic purpose	50
4.	For plantation	1000
5.	Miscellaneous	200
	Total	**4250**

Screening cum Beneficiation Plant Operations		
Dry screening operations		
Sl. No.	**Description**	**Requirement (in KLD)**
1.	For domestic purpose	50
2.	Dust suppression at downhill conveyor system, screening plant & loading plant	1000
3.	Miscellaneous	200
	Total (A)	**1250**
Wet screening operations		
1.	For domestic purpose	50
2.	Dust suppression at downhill conveyor system, screening plant & loading plant	8380
3.	Miscellaneous	200
	Total (B)	**8630**

For the initial period of 5 years, the water requirement is 1000 KLD. This includes water for sprinkling, gardening purposes and service center purposes.

The water will be consumed for following purposes:

- Wet drilling operations
- Water sprinkling on haul roads inside the mining lease and transportation roads
- Mist/fog spray at crushing plant
- At service centre, hilltop
- Mines office, and canteen
- Green belt development
- Miscellaneous construction activities

Two perennial water sources are identified in the area viz. (a) Sankani nallah at EL. (+) 1025.00 at Hill- top and (b) Nerli nallah (Sankani Nadi) at EL. (+) 450.00 at Foot-Hill. Other near-by source of water in the area is the discharge of Sankani nalla (to which other streams are merged) near Shatdhar junction between Dantewada and Bhansi.

Sankani Nallah: The downstream water from Sankani nallah can be one source of water for Dep. 4 operations both at Hill-Top and at Screening Plant partly. This water can be tapped by providing pick- up weir on downstream side of nallah and distributed by pumping to Mines, both Primary and Secondary Crushing plants, Service Centre, Fire suppression system for downhill conveyor and other infrastructures at Hill-Top of Dep. 4. Also, the water from this source can be supplied to Screening Plant operations (partly) by gravity. Accordingly, water storage reservoirs of sufficient capacities with Filter house shall be constructed at Hill-Top and near Screening Plant area.

Nerli Nallah (Sankani Nadi): This nallah is 4 Kms approx. away from Bhansi. The water from this nallah can be tapped by providing pick-up weir on downstream side of nallah and distributed by pumping to Screening Plant (partly), Loading Plant, Administration building and other infrastructures at Bhansi.

At hilltop, water is required for sprinkling on haul roads and feeder roads, mist spray at crushing plant, service center, auto shop, greenbelt development and domestic purposes in mine.

As already outlined above, Screening Plant area requires considerable quantity of water during monsoon season. Therefore, it is necessary to draw a part of water from Sankani nallah above. Accordingly, Sankani nallah shall be the source for both mining and plant operations at Hill-Top and operations at Screening Plant partly. The positive pump head is 100m approx. (EL. 1125 - EL. 1025 = 100m approx.) from Sankani pump house to reservoirs at Hill-Top. The length of pipe line from proposed pump house at Sankani nallah to reservoirs at Hill-Top and at Screening Plant is 6.50 Kms and 5.00 Kms approx. respectively. The pump house shall have two pumps with one spare one (2W+1S).

The Nerli nallah (Sankani Nadi) shall be the source for balance operations at Screening Plant, full operations at Loading plant, Township, Administrative building, Guest house, Hospitals, Commercial establishments and other infrastructures at Foot-Hill. The positive pump head is 250m approx. (EL. 700 - EL. 450 = 250m approx.) from Nerli pump house to reservoirs at Screening plant, 100m approx. (EL. 550 - EL. 450 = 100m approx.) at Loading plant area, 20m approx. (EL. 470 - EL. 450 = 20m approx.) at Township area. The length of pipe line from proposed pump house at Nerli nallah (Sankani Nadi) to reservoirs at Screening Plant, at Loading plant and at Township is 10.00 Kms, 7.00 Kms and 4.00 Kms approx. respectively. The pump house shall have two pumps with one spare one for supply to Screening Plant (2W+1S) and one pump with one spare one for supply to Township (1W+1S). The water for Loading plant shall be drawn from reservoirs at Screening Plant by gravity.

Accordingly, water requirement for Screening Plant shall be met from both Sankani Nallah and Nerli nallah (Sankani Nadi).

As the Bailadila region is hilly in terrain and average rainfall is more than 110mm, therefore, rain water harvesting techniques can be implemented in the selected areas of foot-hill region or artificial reservoirs can be made for storing rain water

would prove useful and beneficial in the long run. Other-wise, this rain water goes waste down the hilly area.

Suitable water storage facilities of required capacities for both raw and filtered water at Hill-Top, Screening Plant, Loading Plant, Township areas etc., are to be provided along with pumping, control and conveying systems.

2.11.2 Power Requirement

It is proposed to take electrical power from CSPDCL which is the main source for electrical power in Chhattisgarh, through their substation at Kirandul at 33KV through suitable overhead lines. CSPDCL is supplying power at 33 KV to other Bailadila projects and same voltage grade is proposed to Deposit-4, Bailadila also. Power is required for mines, Crushing Plant, Secondary Crushing Plant, Tertiary Crushing Plant, Screening Plant, Stacking, Reclaiming, Loading plant, Service Centre and Township. Based on the various loads involved, it is estimated that Maximum demand requirement shall be approx. 6 MVA to meet the 7 MTPA production.

It is proposed to have one 33 KV substation at Hill - Top to meet the nearby loads of mines, Crushing Plant, Secondary Crushing Plant, Tertiary Crushing Plant, Service Centre etc., The supply voltage to these load centers can be at 6.6KV. The Main Receiving Sub Station (MRSS) of 33 KV is proposed at foot hill to meet the loads of remaining sections i.e., Screening Plant, Stacking, Reclaiming, Loading Plant, Water pumping, Township etc., 6.6 KV supply can be considered for these load centers and 33KV can be considered for providing supply to the township area. The hill-top substation will be fed at 33 KV from this substation. The substations will have PLC & SCADA systems which can be interlinked on fiber optic / wireless network. Automatic Power Factor Control (APFC) systems are also to be envisaged at major load centers including the substations. AC Variable Frequency Drives for Down Hill conveyor motors are envisaged. LT motors of minimum IE2 energy efficiency are to be considered.

Project is proposed to take a temporary connection at 11KV for about 500KVA demand for construction power from CSPDCL. An OH line is to be constructed from CSPDCL to Deposit-4. Suitable rating of two Nos. 11KV/415V transformers with associated electrics is envisaged for making the temporary power supply available at foot hill and hill top. The internal OH lines for distribution of 11KV/415V power are also envisaged. It is also proposed to have two nos. of DG sets (2500 kVA Capacity of each DG set) for meeting the emergencies during construction and after construction as power back-up. The fuel requirement of HSD will be 892 L/hr.

2.11.3 Manpower Requirement, Management & Supervisory Personnel

Manpower of Bailadila Iron Ore Deposit-4 is estimated for the standalone project of 7.0 MTPA of ROM production where all the OCSL and other infrastructural facilities will be exclusively for Bailadila Iron Ore Deposit-4 only.

It is estimated that 700 persons would be employed for this project during its production stage (from sixth year onwards). However, during the construction

stage (during first five years of operation), part of this strength would be positioned in phases to ensure smooth implementation of mine development/construction, erection, commissioning and stabilizing the production processes.

Project will generate direct and indirect employment during operations. The employment is either permanent or contractual in nature. Most of the semi-skilled and un-skilled labours shall be employed on contractual works such as plantation, civil constructions, plant maintenance, nursery maintenance etc. The location of Bailadila Iron Ore Deposit-4 will help to improve the financial earnings of the surrounding population by way of petty trade and employment opportunities. The projects will encourage for setting up of various utility services and petty trade benefiting large number of people around the mining areas of Bailadila Iron Ore Deposit-4.

Many local people will be encouraged to take-up the works in NMDC for township maintenance, miscellaneous works, supply of material, transportation works for which, workforce from surrounding villages will be hired. Thereby, resulting secondary employment generation through various firms and means.

The details of the manpower for 7 MTPA production at Bailadila Iron Ore Deposit-4, are given below:

Sl. No.	**Description**	**No.**
1	Highly Skilled	282
2	Skilled	127
3	Semi- Skilled	123
4	Un- Skilled	168
	Total	**700**

2.11.4 Site Services

The Bailadila Iron Ore Deposit-4 is proposed to be developed as a Joint Venture project between NMDC and CMDC. Therefore, all the required facilities for mining operations, plant process and loading operations including offices and township are to be provided separately.

The total number of employees including security personnels likely to be posted in the project is about 700.

Service Centre

For repair, maintenance and servicing of mining and other heavy earth-moving equipments, a service centre shall be constructed at Hill top (EL. (+) 1075.00) preferably as close to mines as possible. Water storage facilities including Filter

house at EL. (+) 1125 shall be constructed for distribution of both raw water and filter water for plant activities and for drinking.

The Service Centre shall constitute mainly the following buildings/shops:

a) Main work shop and Field work shop

b) Hill top stores including P.O.L.

c) Servicing facilities, Dumper hard stand,

d) Time office, rest shelters, Fire station,

e) Effluent treatment plant along with an incinerator etc.,

These buildings shall be constructed in Structural steel frame work with RCC foundations. The buildings shall be covered with Pre-Coated Coloured Galvalume sheets. For sun light shade inside the buildings, FRP translucent sheets (approx. 15% area) shall be provided in cladding only.

The total layout shall be in levelled area and shall be provided with chain-link fencing and proper drainage arrangements. Both raw and filtered water supply shall be provided at all shops/buildings.

Substation including switch yard, Mines office, Canteen buildings shall be constructed in RCC near Service Centre and Mines at EL. (+) 1075.00. Both Raw and filtered water facilities, drainage, sanitary and sewerage arrangements shall be provided. Suitable black-top approach roads in gradient 1 in 25 shall be provided to all buildings/shops along with drains and outlets.

Canteen

A good quality canteen will be constructed at the mine office of Deposit-4 to cater the needs of persons employed in mine and ancillary activities. Mobile canteen vans will be provided to carry and supply refreshment to the workmen at their work sites.

Rest Shelter and Latrines

Adequate numbers of rest shelters and Latrines as per norms will be provided at Mining Office, Service Centre area etc.

First Aid Station

A 50-bedded hospital along with an occupation health centre having basic infrastructural facilities will be provided. Since the works in mining area will continue round the clock, first aid shelter will be provided as per the statute to take care of emergent needs to impact first aid to the injured. First Aid Centres will be maintained at each important work sites.

Mine Vocational Training Centre

A full-fledged vocational training centre is planned at/near the main administrative building of Deposit-4. The VT Centre will be located at the foot-hill of the deposit.

Administration Office, Central Stores, Chemical Lab., Main Substation Building:

For above, a plain area involving minimum earth work at a convenient place near Bhansi Railway Station (close to proposed loading plant) is selected. All these buildings shall be constructed in RCC as permanent structures. Suitable cross-drainage works and earthwork protection works shall be constructed. Basic amenities such as water supply, sanitary arrangements including sewerage systems with septic tank and soak pits shall be provided.

2.12 Assessment of new & untested technology for the risk of the technological failure

There is no such new & untested technology for the risk of technological failure. However, following shall be practiced.

Guided channel of dump slope: During rainy season, surface runoff creates rain cut in the dump slope. To prevent such rain cut, guided channels will be made to guide surface runoff through particular channels.

Coir matting: Coir matting is the strip of mat made up of coir. It is used to cover loose dump surface. It helps to prevent washing of dump soil from dump surface. After one or two years these coir mats are destroyed but the dump soil remains stable.

Rock breaker to avoid secondary blasting: Rock breaker is a type of mechanical hammer for breaking of rock fitted with excavator. It is used for loosening and breaking of rocks instead of blasting. As a result, there will be no throw of rock or no vibration due to blasting.

2.13 Proposed Time Schedule and Approval for Implementation

The first five years of the mining operations is considered as construction phase of the project and all ore dressing facilities, like Crushing plant, downhill conveyor will be installed during construction period of this project inside the Mining Lease. However, connected infrastructures like Screening Plan, Loading Plant and Admin building etc. will be constructed outside the Mining Lease Area during the 1st five years. Start of construction of the project will be commenced once all the statutory clearances will be obtained. Production will be commenced immediately after getting all regulatory clearances with smaller capacity equipment and in-pit crushing / screening system as detailed earlier.

The total project envisages setting up of new crushing plant, downhill conveyor system, Screening / beneficiation Plant, Loading Plant and administrative offices etc. and same is proposed to be executed largely on LSTK basis though EPCM consultant considering design, engineering, procurement ,supply ,fabrication, construction, erection, testing, commissioning and performance guarantee tests and includes mainly 8 packages i.e. package-1 (Earthwork for main/external roads, construction of roads), package-2 (laying of water pipe line, filter plant etc.) package-3 (crushing plant, primary stockpile etc.), package-4 (Service Centre, Mining Office, Canteen, Hilltop Store, Valley Store, Admin buildings etc.), package-5 (Hilltop and Valley Sub-Stations, laying of HT Lines), package-6 (downhill conveyor systems), package-7 (Screening Plant, Dry tailing disposal plant etc.) and

package-8 (loading plant and dispatch system), based on requirement of ore crushing, screening & conveying including all aspects of mechanical, civil, structural, electrical, controls etc.

Following are the various activities in Project implementation & execution:

- Finalization of DPR
- Due Diligence by Financial Institution
- Approval of DPR
- Environment & Forest clearances
- Appointment of agency for soil investigation
- Soil Investigation & submission of report
- Appointment of EPCM Consultant
- Arrangement of construction power and water (enabling works)
- Invitation of bids and order placement on suppliers & contractors
- Major equipment procurement
- Plant construction through various contractor(s)
- Trial Runs & Commissioning.
- PG test

By initiating advance action for some of the activities, considering some are parallel actions and based on minimum time period required for certain activities like appointment of EPCM consultant, supply of long lead item such as gyratory & cone crushers etc., the project shall be completed in all respects as per the following time schedule.

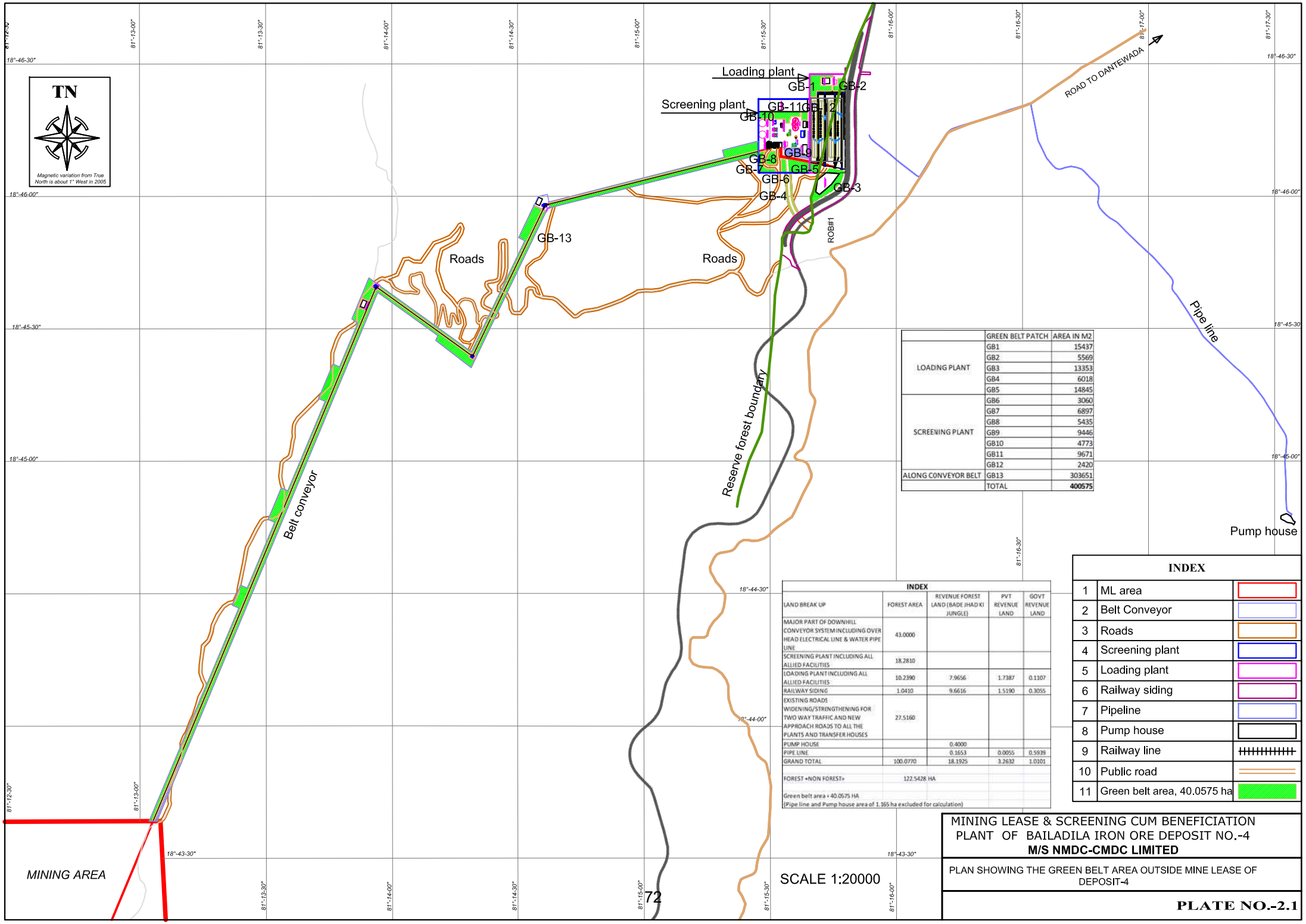
The project shall be constructed & no-load trial runs shall be conducted within 45 months from the date of appointment of EPCM Consultant. The project integrated commissioning shall be done within 3 months after no-load trial runs and followed by PG TESTS to complete within 3 months.

Sl. No.	Activity	Months
1.	Finalization of DPR, Due Diligence by Financial Institution and approval of DPR	12
2.	Appointment of EPCM Consultant	3
3.	Engineering, preparation of tender Documents, floating of tender enquiries for plant construction, receipt of offers, evaluation, price recommendations by EPCM Consultant.	11
4.	Award of work to LSTK Contractors ((by this date all statutory clearances must be in place including tree felling permission)	1
5.	Design, engineering, supply, construction & No-load trial runs by contractors	33
6.	Project integrated commissioning	3
7.	Conducting PG Tests	3

2.14 List of major industries with name and type within study area (10 km radius)

1. Bailadila Iron Ore Mine, Deposit-5 & Deposit-10, Bacheli Complex (Iron Ore Mining Complex of NMDC Ltd.)
2. Bailadila Iron Ore Mine, Deposit-14, Deposit-14NMZ & 11ML, Kirandul Complex (Iron Ore Mining Complex of NMDC Ltd.)
3. Bailadila Iron Ore Mine, Deposit-13 of NMDC-CMDC Ltd. (Non-operational)
4. Beneficiation and Slurry Pipeline Plant of AM/NS India at Kirandul

A map showing location of surrounding mines of Deposit-4 is enclosed as **Plate No. 2.11.**



	GREEN BELT PATCH	AREA IN M2
LOADING PLANT	GB1	15437
	GB2	5569
	GB3	13353
	GB4	6018
	GB5	14845
SCREENING PLANT	GB6	3060
	GB7	6897
	GB8	5435
	GB9	9446
	GB10	4773
	GB11	9671
	GB12	2420
ALONG CONVEYOR BELT	GB13	303651
	TOTAL	**400575**

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LAND BREAK UP	FOREST AREA	REVENUE FOREST LAND (BADE JHADKI JUNGLE)	PVT REVENUE LAND	GOVT REVENUE LAND
MAJOR PART OF DOWNHILL CONVEYOR SYSTEM INCLUDING OVER HEAD ELECTRICAL LINE & WATER PIPE LINE	43.0000			
SCREENING PLANT INCLUDING ALL ALLIED FACILITIES	18.2810			
LOADING PLANT INCLUDING ALL ALLIED FACILITIES	10.2390	7.9656	1.7387	0.1107
RAILWAY SIDING	1.0410	9.6616	1.5190	0.3055
EXISTING ROADS WIDENING/STRENGTHENING FOR TWO WAY TRAFFIC AND NEW APPROACH ROADS TO ALL THE PLANTS AND TRANSFER HOUSES	27.5160			
PUMP HOUSE		0.4000		
PIPE LINE		0.1653	0.0055	0.5939
GRAND TOTAL	100.0770	18.1925	3.2632	1.0101

FOREST +NON FOREST= 122.5428 HA

Green belt area = 40.0575 HA
(Pipe line and Pump house area of 1.165 ha excluded for calculation)

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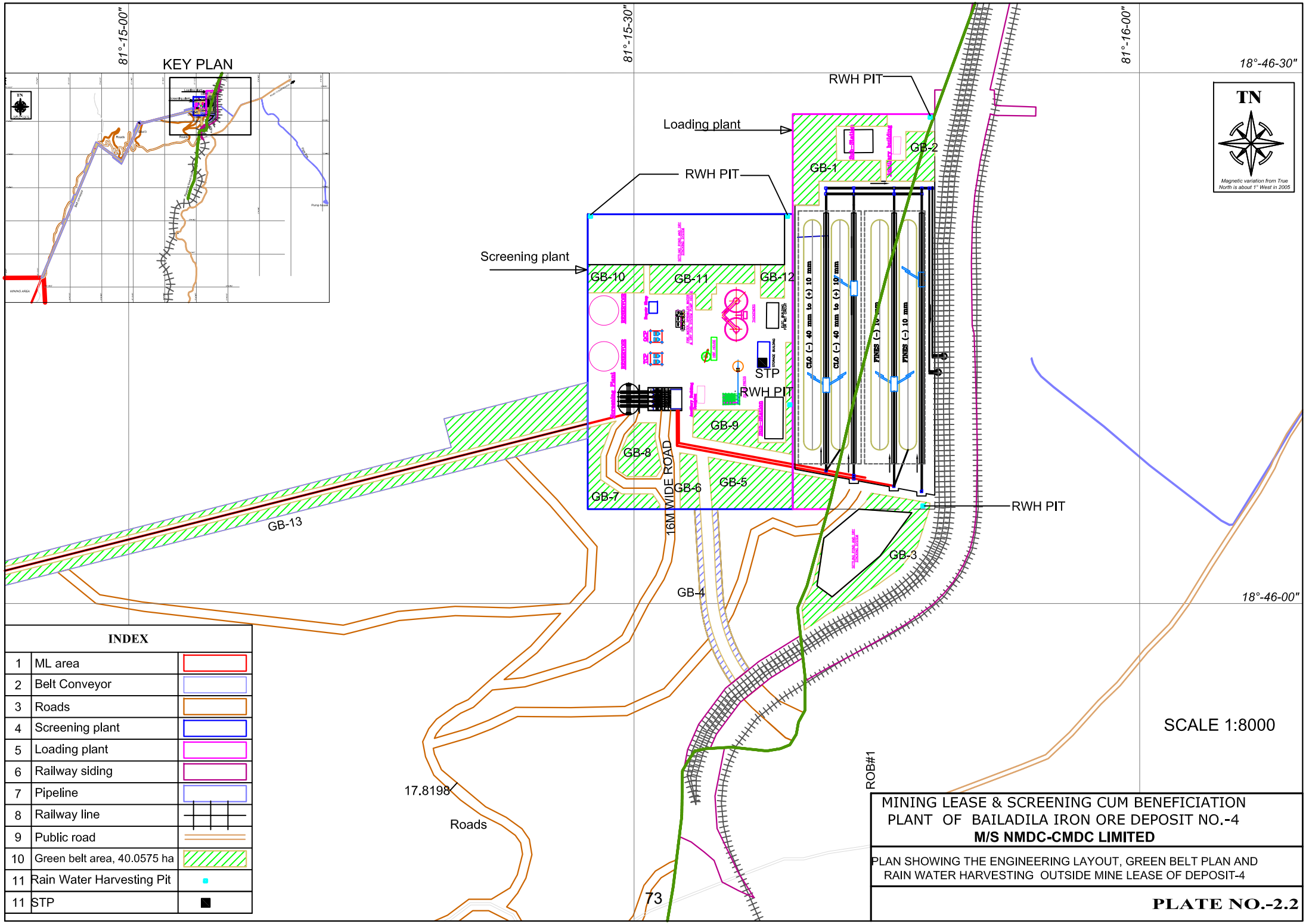
1	ML area	
2	Belt Conveyor	
3	Roads	
4	Screening plant	
5	Loading plant	
6	Railway siding	
7	Pipeline	
8	Pump house	
9	Railway line	
10	Public road	
11	Green belt area, 40.0575 ha	

SCALE 1:20000

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

PLAN SHOWING THE GREEN BELT AREA OUTSIDE MINE LEASE OF DEPOSIT-4

PLATE NO.-2.1



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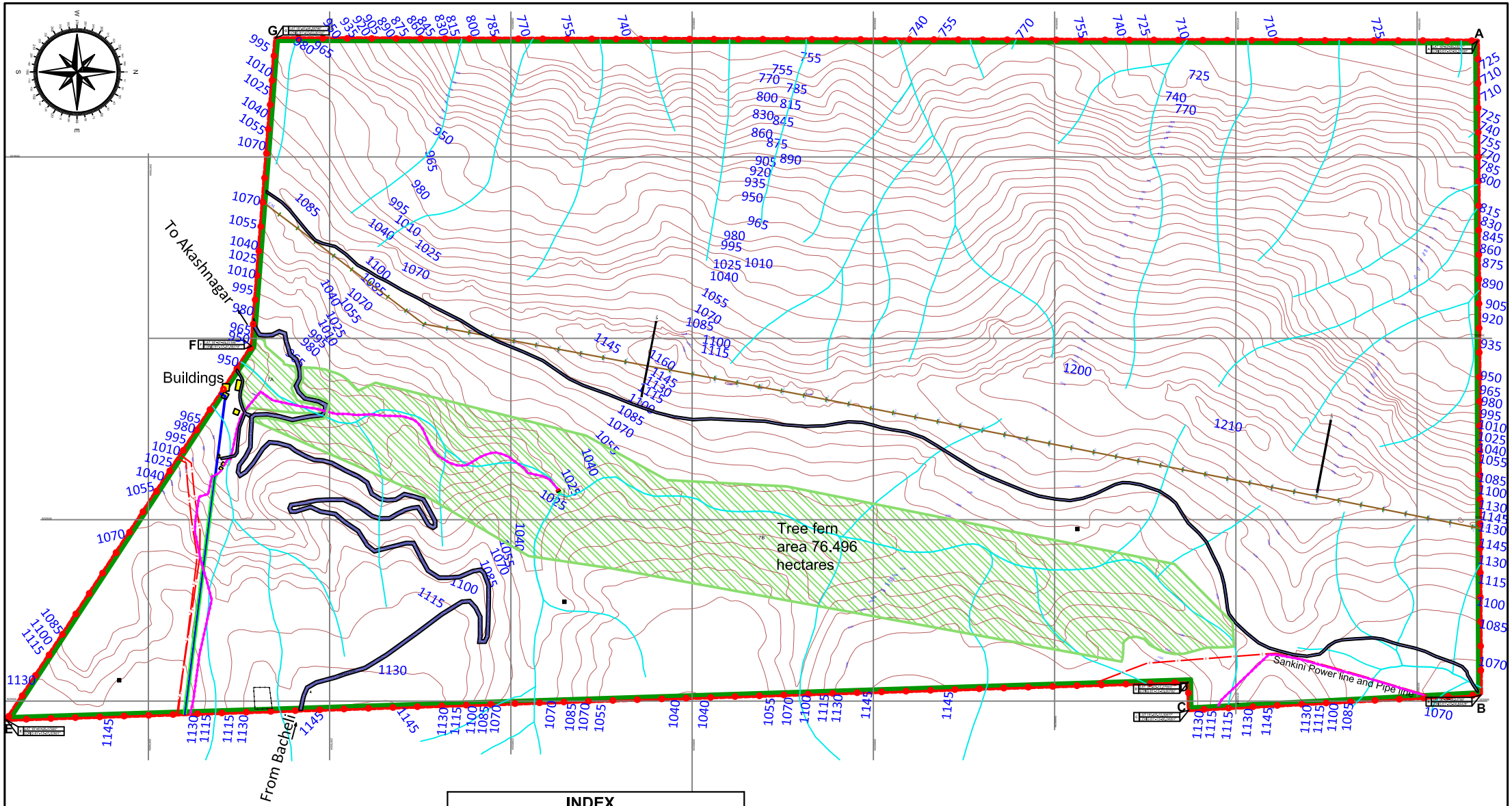
1	ML area	
2	Belt Conveyor	
3	Roads	
4	Screening plant	
5	Loading plant	
6	Railway siding	
7	Pipeline	
8	Railway line	
9	Public road	
10	Green belt area, 40.0575 ha	
11	Rain Water Harvesting Pit	
11	STP	

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

M/S NMDC-CMDC LIMITED

PLAN SHOWING THE ENGINEERING LAYOUT, GREEN BELT PLAN AND RAIN WATER HARVESTING OUTSIDE MINE LEASE OF DEPOSIT-4

PLATE NO.-2.2



ML CO ORDINATES(WGS84 DATUM) OF DEPOSIT-4		
PILLAR	LONGITUDE	LATITUDE
A	81° 12' 03.25650"	18° 43' 38.32617"
B	81° 13' 04.84428"	18° 43' 38.52758"
C	81° 13' 06.24991"	18° 43' 12.30677"
D	81° 13' 03.60782"	18° 43' 12.27943"
E	81° 13' 07.02661"	18° 41' 26.17920"
F	81° 12' 31.89279"	18° 41' 48.22195"
G	81° 12' 02.90192"	18° 41' 50.38796"

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ML boundary	
Nalah	
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Tree fern area	

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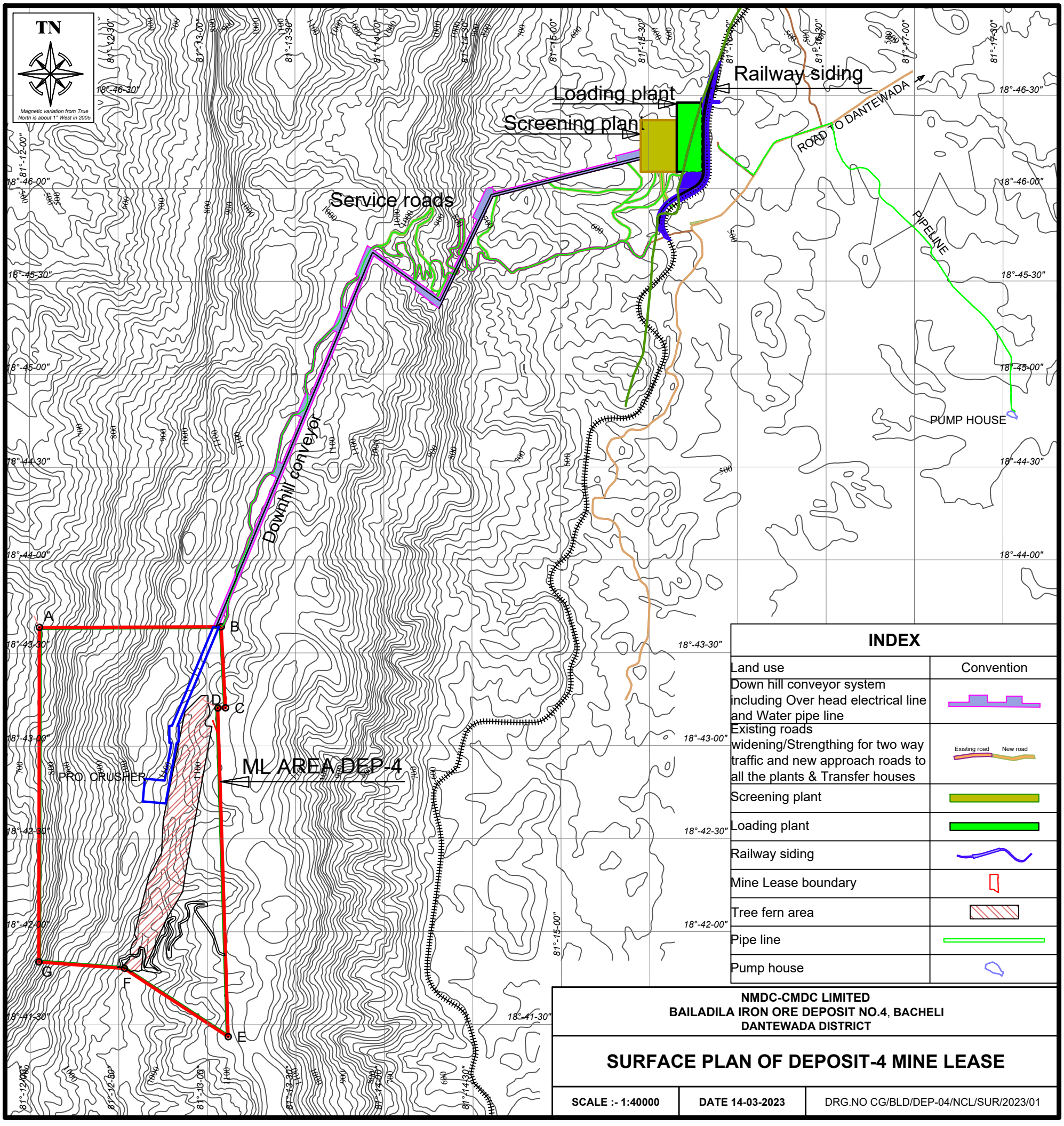
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

SURFACE PLAN OF LEASE AREA

PLATE NO.-2.3



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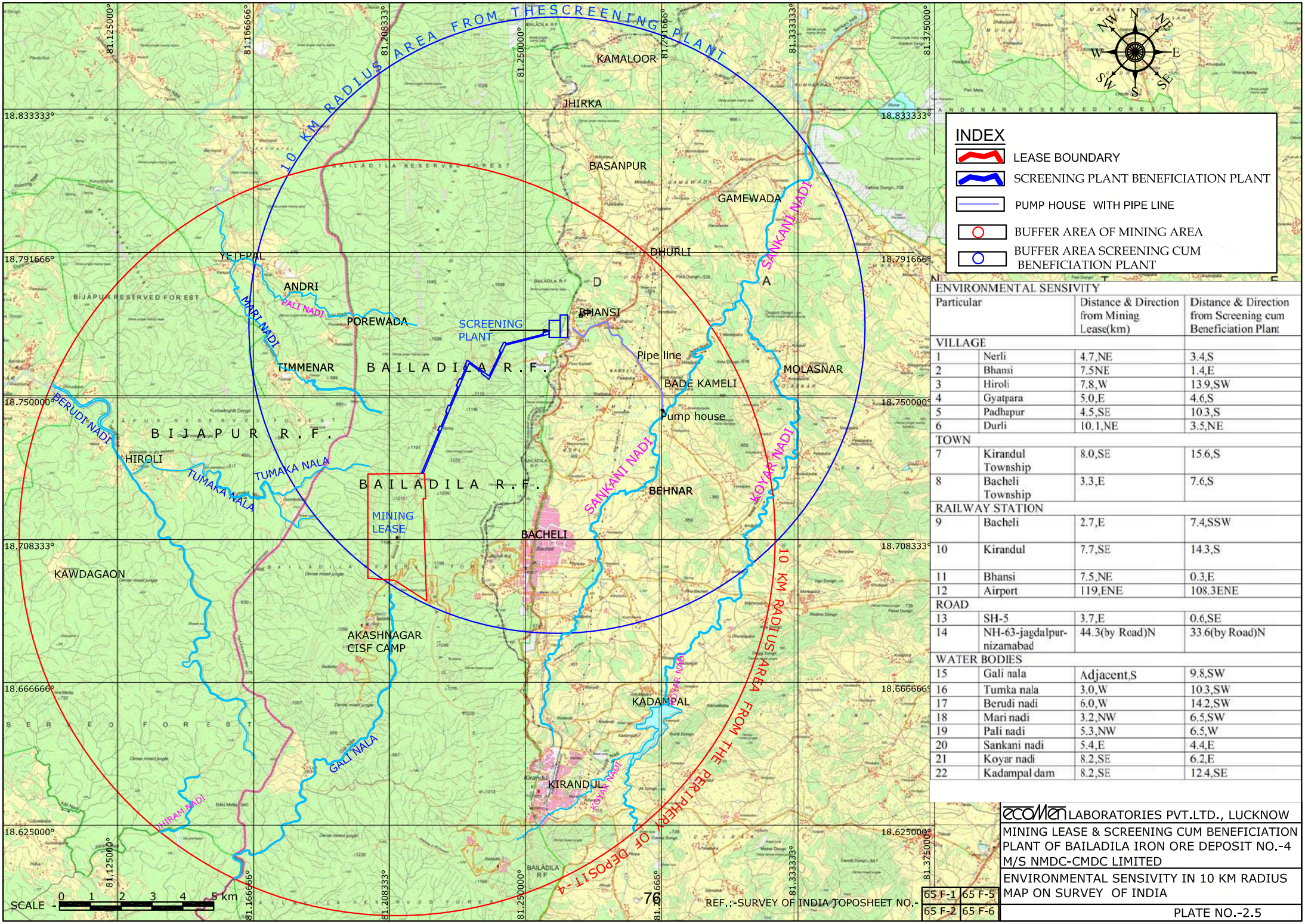
Land use	Convention
Down hill conveyor system including Over head electrical line and Water pipe line	
Existing roads widening/Strengthing for two way traffic and new approach roads to all the plants & Transfer houses	Existing road / New road
Screening plant	
Loading plant	
Railway siding	
Mine Lease boundary	
Tree fern area	
Pipe line	
Pump house	

NMDC-CMDC LIMITED
BAILADILA IRON ORE DEPOSIT NO.4, BACHELI
DANTEWADA DISTRICT

SURFACE PLAN OF DEPOSIT-4 MINE LEASE

SCALE :- 1:40000	DATE 14-03-2023	DRG.NO CG/BLD/DEP-04/NCL/SUR/2023/01

PLATE NO.-2.4



ENVIRONMENTAL SENSIVITY

Particular		Distance & Direction from Mining Lease(km)	Distance & Direction from Screening cum Beneficiation Plant
VILLAGE			
1	Nerli	4.7,NE	3.4,S
2	Bhansi	7.5NE	1.4,E
3	Hiroli	7.8,W	13.9,SW
4	Gyatpara	5.0,E	4.6,S
5	Padhapur	4.5,SE	10.3,S
6	Durli	10.1,NE	3.5,NE
TOWN			
7	Kirandul Township	8.0,SE	15.6,S
8	Bacheli Township	3.3,E	7.6,S
RAILWAY STATION			
9	Bacheli	2.7,E	7.4,SSW
10	Kirandul	7.7,SE	14.3,S
11	Bhansi	7.5,NE	0.3,E
12	Airport	119,ENE	108.3ENE
ROAD			
13	SH-5	3.7,E	0.6,SE
14	NH-63-jagdalpur-nizamabad	44.3(by Road)N	33.6(by Road)N
WATER BODIES			
15	Gali nala	Adjacent,S	9.8,SW
16	Tumka nala	3.0,W	10.3,SW
17	Berudi nadi	6.0,W	14.2,SW
18	Mari nadi	3.2,NW	6.5,SW
19	Pali nadi	5.3,NW	6.5,W
20	Sankani nadi	5.4,E	4.4,E
21	Koyar nadi	8.2,SE	6.2,E
22	Kadampal dam	8.2,SE	12.4,SE

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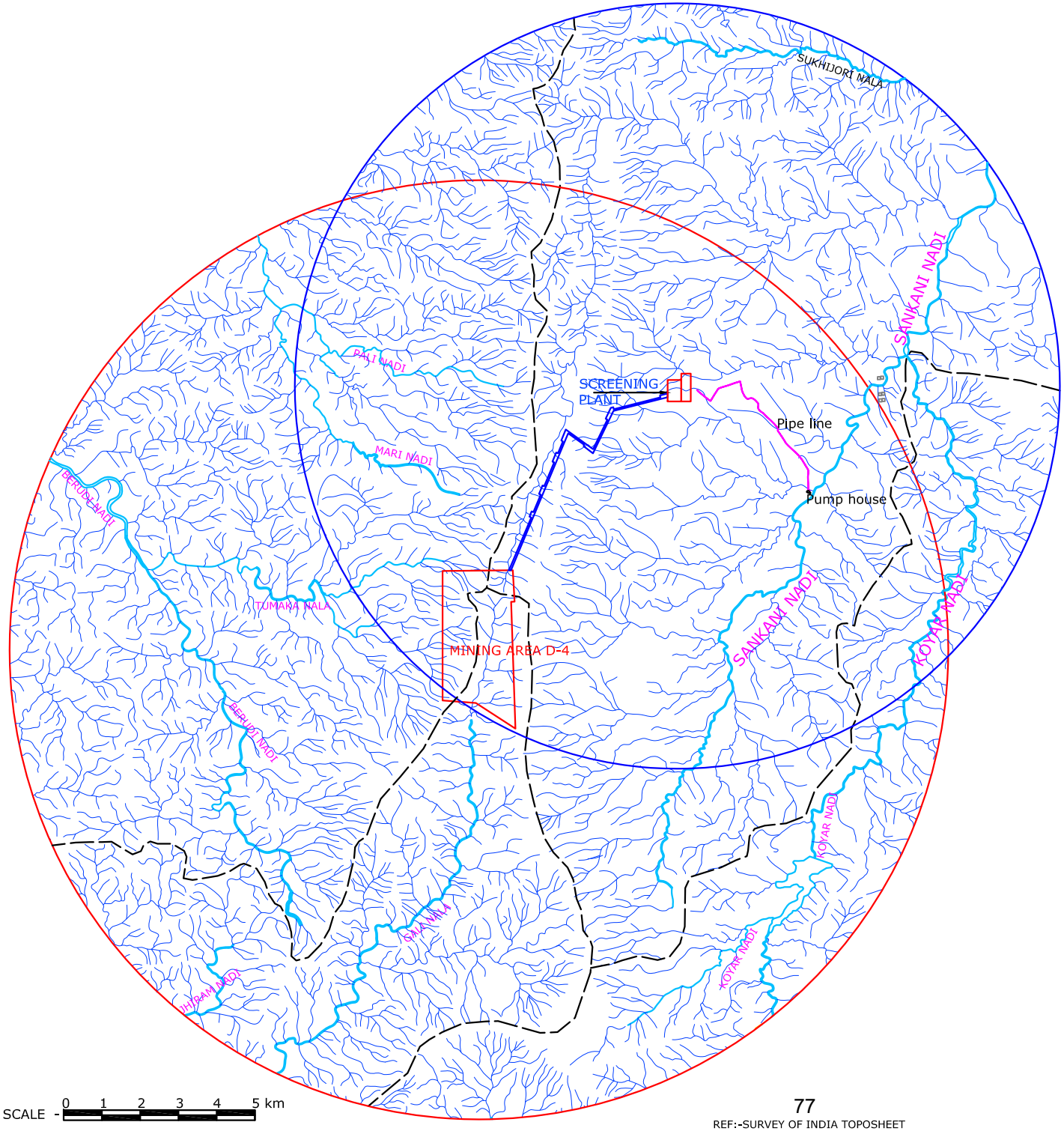
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4 M/S NMDC-CMDC LIMITED

ENVIRONMENTAL SENSIVITY IN 10 KM RADIUS MAP ON SURVEY OF INDIA

PLATE NO.-2.5



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- BUFFER OF MINING AREA D-4
- BUFFER OF SCREENING PLANT
- LEASE BOUNDARY
- PUMP HOUSE WITH PIPE LINE
- RIVER / NALLA
- WATER DIVIDE

SCALE - 0 1 2 3 4 5 km

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REF:-SURVEY OF INDIA TOPOSHEET

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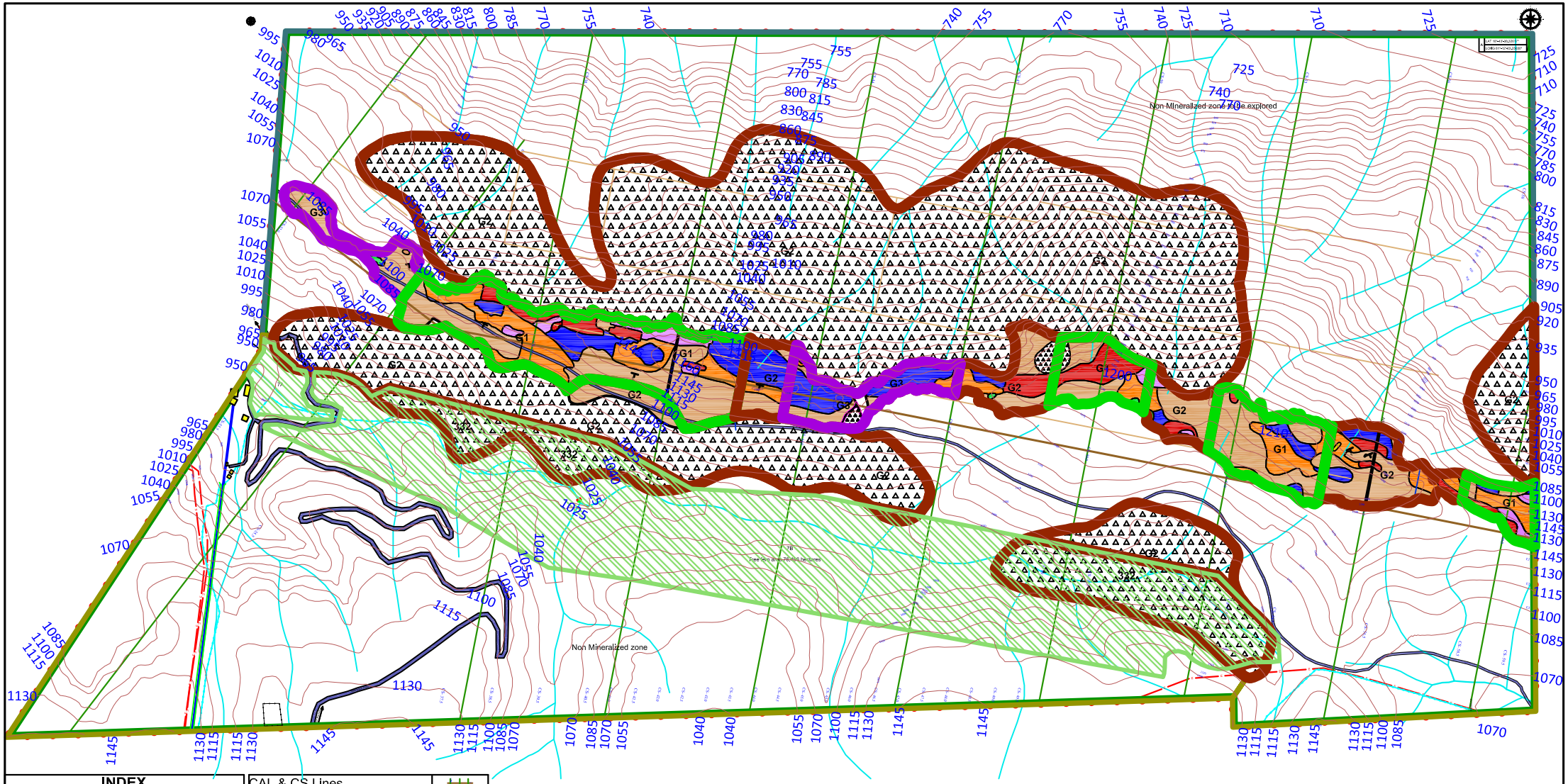
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

DRAINAGE MAP IN BUFFER ZONE

PLATE NO.-2.6



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BHJ/BHQ	
Shale	
Float ore	
Transition ore	
Sub grade ore	
Existing Bore hole ID	
Exploratory Pits	
Ore zone boundary	

CAL & CS Lines	
Dip/Strike	
G1 level of exploration	
G2 level of exploration	
G3 level of exploration	
Non mineralized zone	
Non mineralized to be explored	

Yearwise Exploratory Drilling Programme

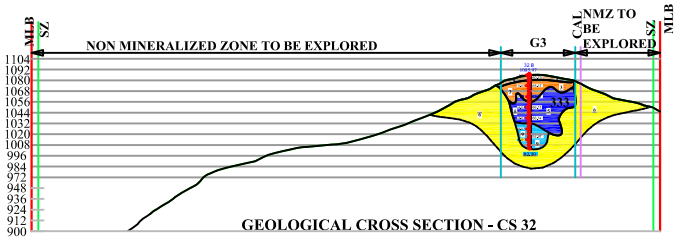
YEAR	CORE	METERAGE	DTH	METERAGE	TOTAL BH	TOTAL METERAGE
1st Year	18	1800	4	120	22	1920
2nd Year	18	1800	4	120	22	1920
3rd Year	18	1800	4	120	22	1920
4th Year	14	1400	4	120	18	1520
5th Year	12	1200	4	120	16	1320
TOTAL	80	8000	20	600	100	8600

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

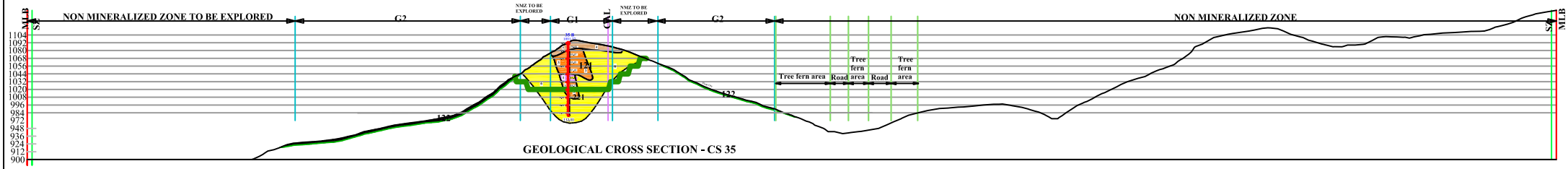
M/S NMDC-CMDC LIMITED

GEOLOGICAL PLAN OF LEASE AREA

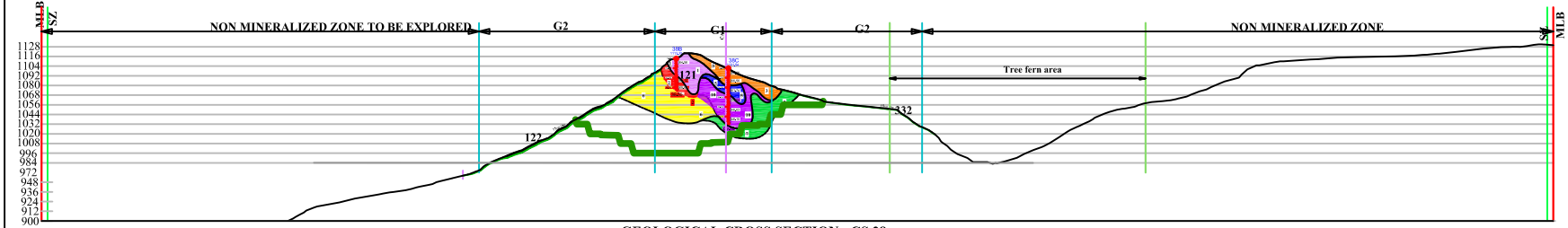
PLATE NO.-2.7



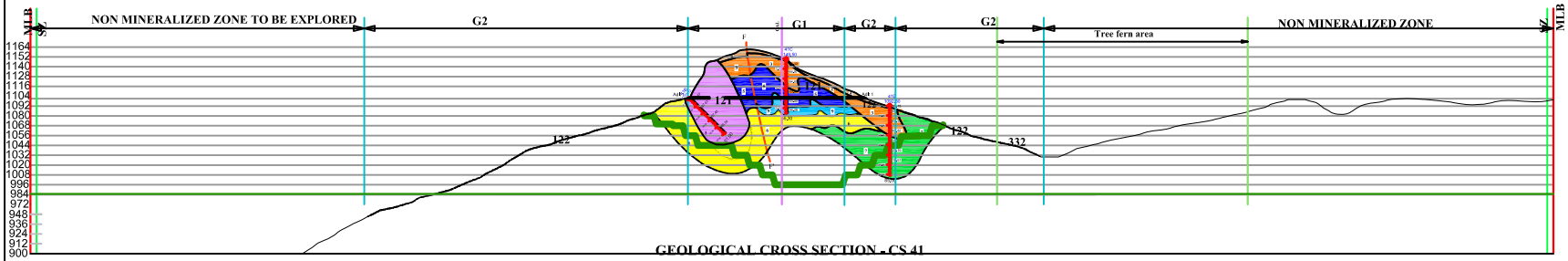
GEOLOGICAL CROSS SECTION - CS 32



GEOLOGICAL CROSS SECTION - CS 35



GEOLOGICAL CROSS SECTION - CS 38



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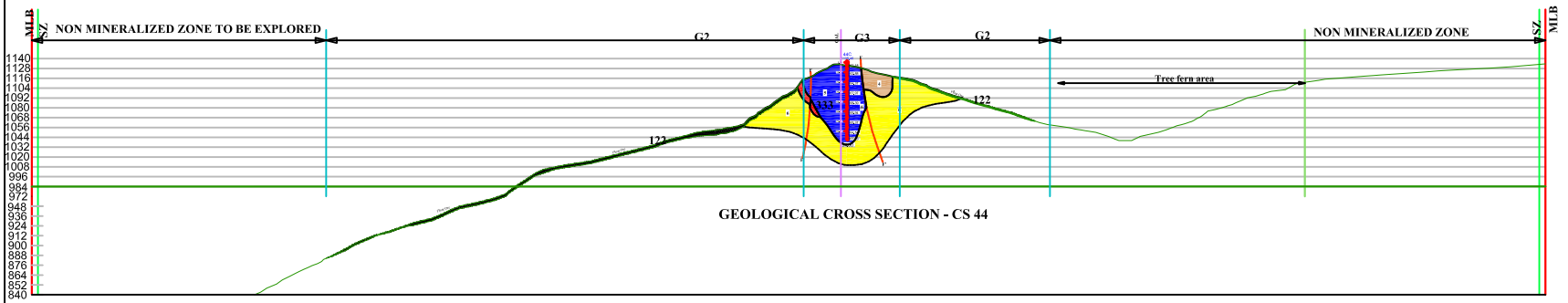


GEOLOGICAL CROSS SECTION - CS 44

INDEX

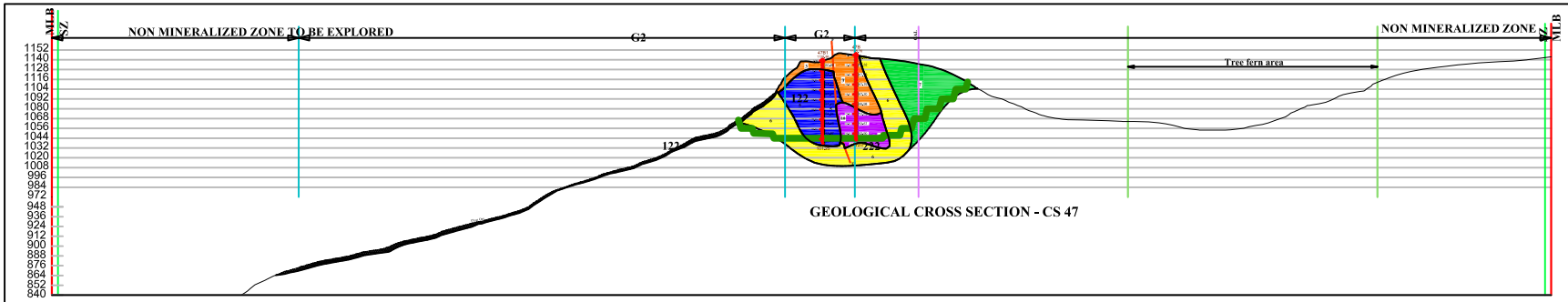
Steel Grey Hematite		Transition ore		
Blue Grey Hematite		Sub grade ore		
Laminated Hematite		Bore hole ID		
Lateritic/Limonitic ore		Mining lease		
Blue dust/Flaky ore		Safety zone line		
BHJ/BHQ		UPL		
Shale		UNFC		121 / 221 / 332
Float ore		Exploratory level G1,G2, Non mineralized etc		G1 G2

SCALE 1:2000

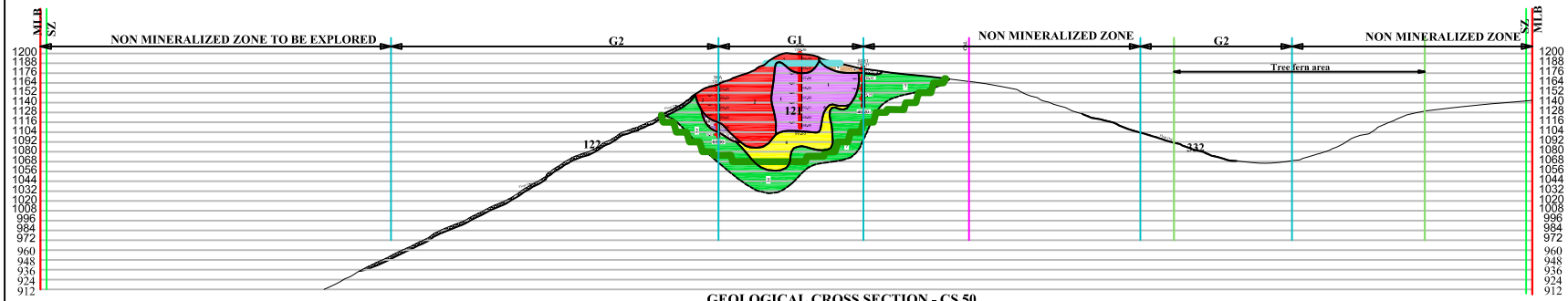
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

GEOLOGICAL SECTION OF LEASE AREA

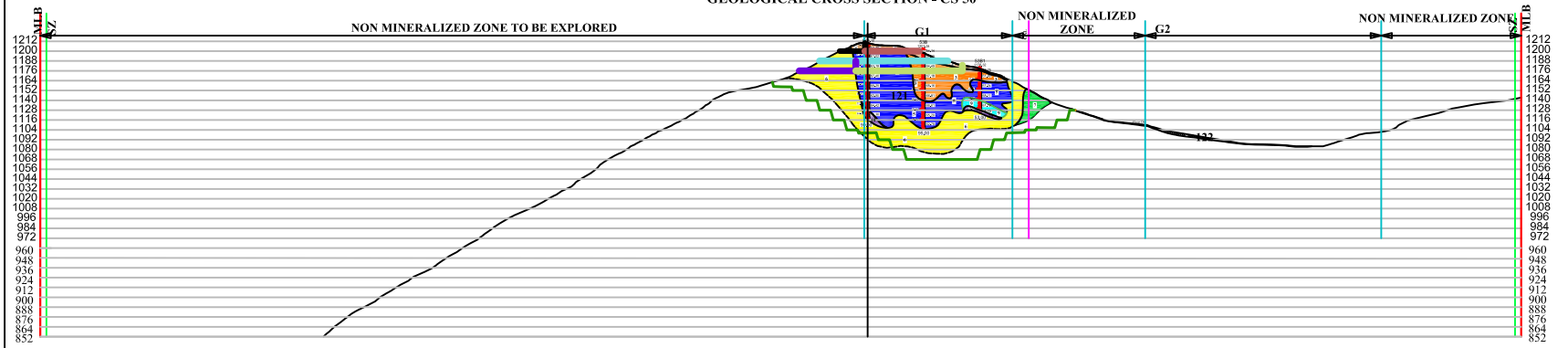
PLATE NO.-2.8(A)



GEOLOGICAL CROSS SECTION - CS 47

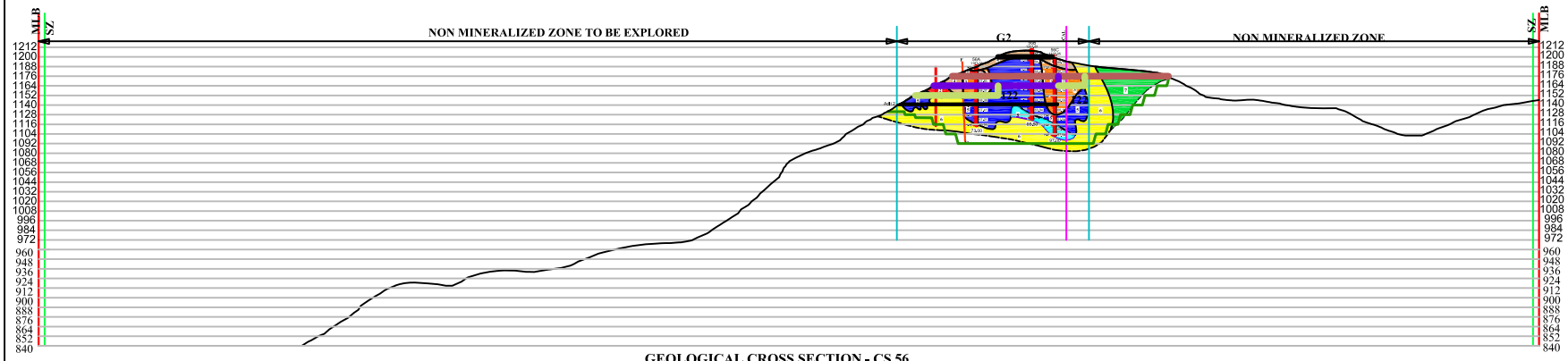


GEOLOGICAL CROSS SECTION - CS 50



GEOLOGICAL CROSS SECTION - CS 53

INDEX			
Steel Grey Hematite		Transition ore	
Blue Grey Hematite		Sub grade ore	
Laminated Hematite		Bore hole ID	
Lateritic/Limonitic ore		Mining lease	
Blue dust/Flaky ore		Safety zone line	
BHJ/BHQ		JPL	
Shale		JNFC	121 / 221 / 332
Float ore		Exploratory level G1,G2. Non mineralized etc	G1 G2

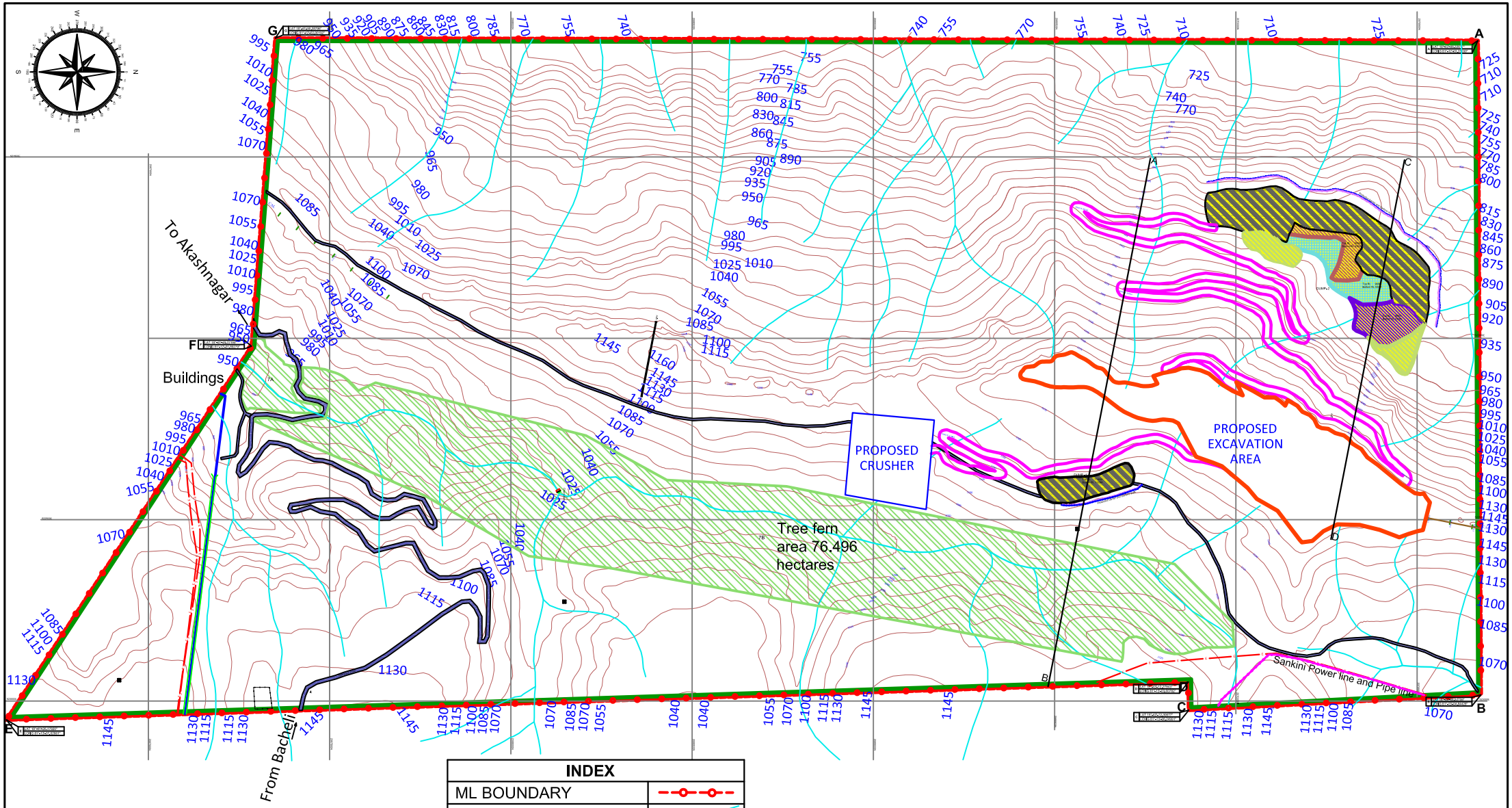


GEOLOGICAL CROSS SECTION - CS 56

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

GEOLOGICAL SECTION OF LEASE AREA

PLATE NO.-2.8(B)



PROPOSED DUMP POSITION	
1ST YEAR	
2ND YEAR (INCLUDES 1ST YEAR)	
3RD YEAR (INCLUDES 2ND YEAR)	
4TH YEAR (INCLUDES 3RD YEAR)	
5TH YEAR (INCLUDES 4TH YEAR)	

INDEX	
ML BOUNDARY	
NALAH	
CONTOURS	
HAUL ROAD	
DUMP	
ROAD WAYS	
EXCAVATION AREA	
PROTECTIVE BARRIER	
GARLAND DRAIN	
TREE FERN AREA	

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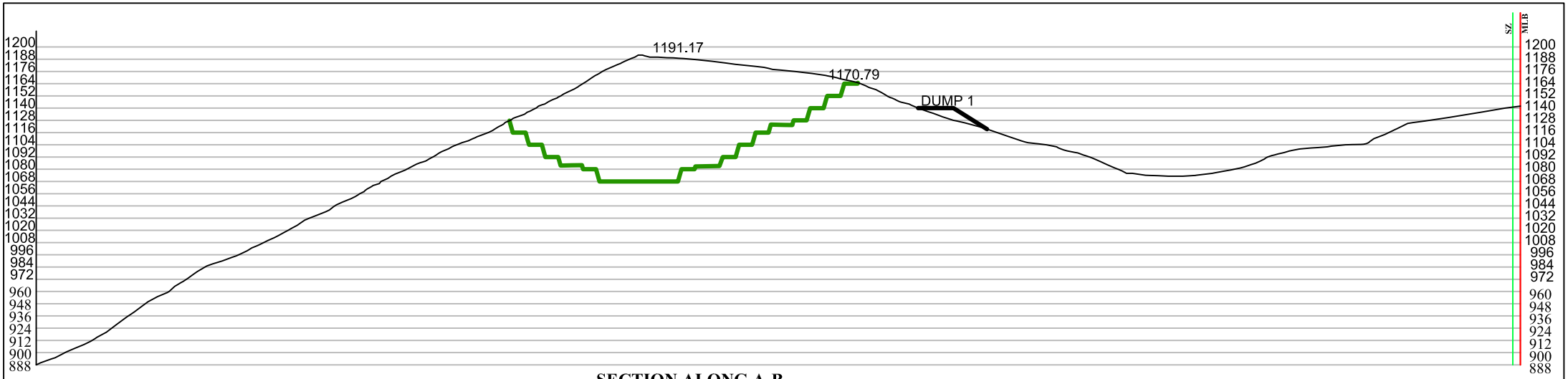
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

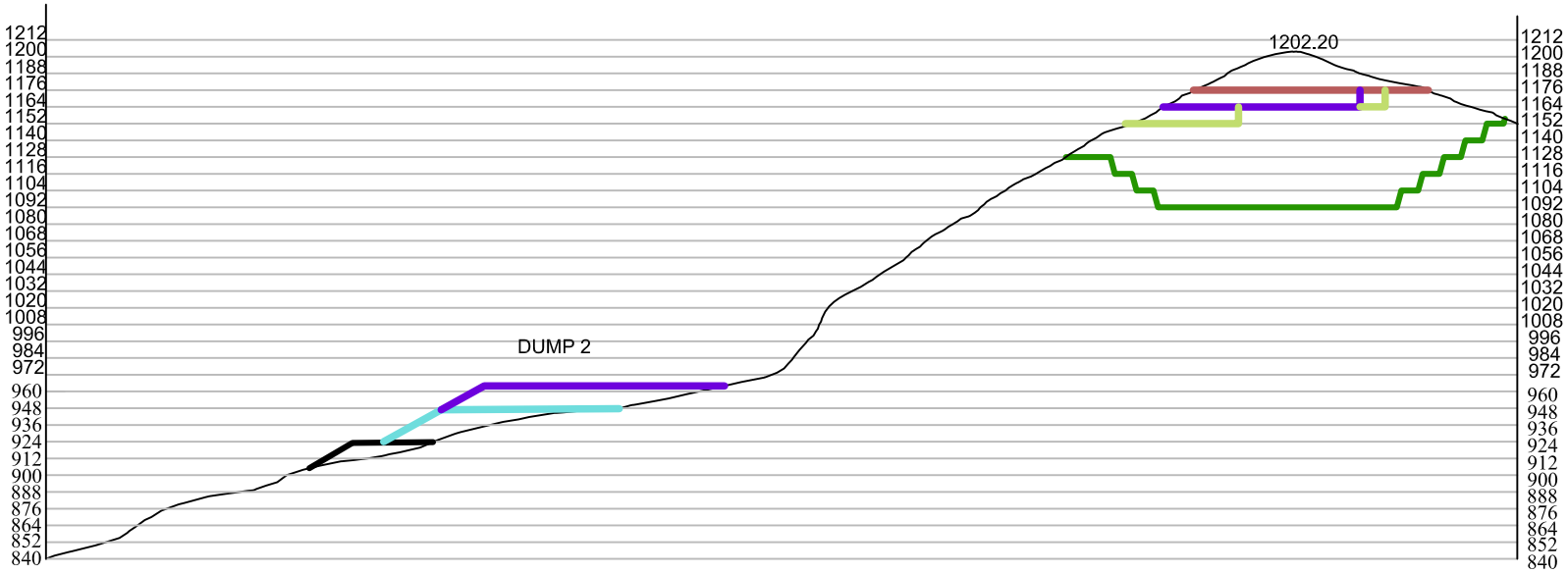
M/S NMDC-CMDC LIMITED

DUMP PLAN END OF THE VTH YEAR

PLATE NO.-2.9



SECTION ALONG A-B



SECTION ALONG C-D

Index	
Mining lease	
Safety zone line	
UPL	

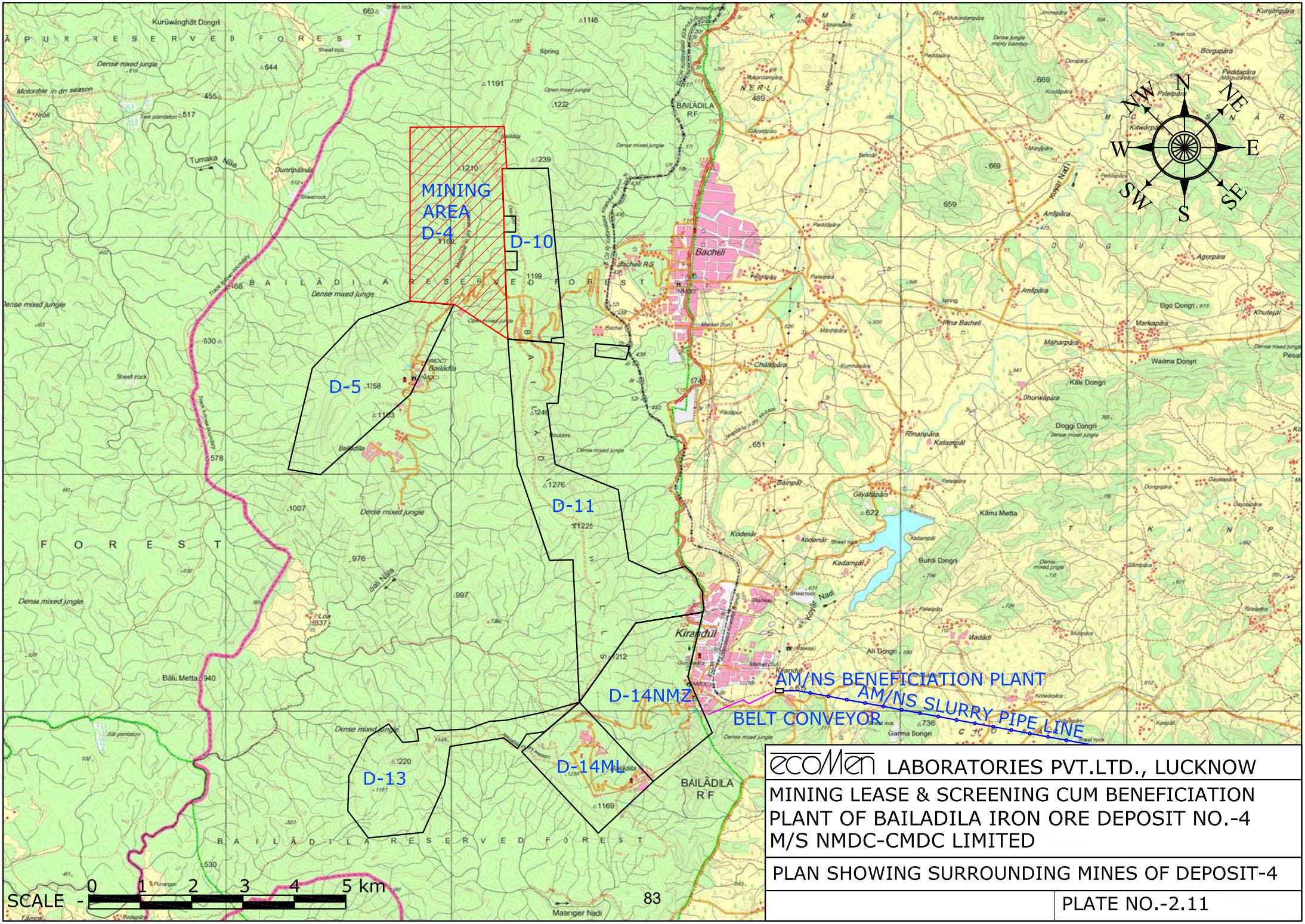
INDEX	
Face/Dump position at the end of	Line colour
First year	
Second year	
Third year	
Fourth year	
Fifth year	

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

M/S NMDC-CMDC LIMITED

DUMP SECTION END OF THE VTH YEAR

PLATE NO.-2.10



ecoMen LABORATORIES PVT.LTD., LUCKNOW

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

PLAN SHOWING SURROUNDING MINES OF DEPOSIT-4

PLATE NO.-2.11

CHAPTER – 3

DESCRIPTION OF THE ENVIRONMENT

3.1 Study Description

This chapter illustrates the description of the existing environmental status of the study area with reference to the prominent environmental attributes. The existing environmental setting is considered to adjudge the baseline conditions which are described with respect to climate, atmospheric conditions, ambient air quality, ambient noise levels, water quality, soil quality, ecology, socio-economic profile, land use etc. Mining lease (ML) and screening cum beneficiation plant are located in forest area under Dantewada Forest Division. The ML and beneficiation plant is surrounded by Bailadila reserve forest and Bijapur reserve forest.

The study area is core zone (Mining lease area of 646.596 Ha and Screening cum Beneficiation Plant area of 122.5428 Ha) and buffer zone (a 10-km radius area around the ML and screening cum beneficiation plant). The various environmental attributes have been monitored in the core and buffer zone area.

3.1.0 Study Period

The baseline environmental data for preparation of EIA/EMP report for Bailadila Iron Ore Deposit-4 & Screening cum Beneficiation Plant was carried out for 3 months i.e. from 1st March-2022 to 31st May-2022 representing Pre-Monsoon season for above environmental parameters. The secondary data was also collected from various government, semi-government agencies like Forest department, CGWB, IMD etc.

3.1.1 Study Components

The attributes such as meteorology, ambient air quality, water quality, noise level etc. were studied and the details of monitoring such as location, frequency etc. are given below in **Table 3.1**.

TABLE 3.1
SHOWING ATTRIBUTES AND STUDY PARAMETERS

S. No.	Attribute	Parameters	Remark
1	Meteorology	Wind Speed and Direction, Temperature, Relative Humidity & Rainfall	Hourly recording at project site
2	Ambient air quality	PM_{10}, $PM_{2.5}$, SO_2, NO_2 and CO	**In Mining lease area** 12 locations (One in core zone area and 11 locations in buffer zone) and for **Screening cum Beneficiation Plant** 11 locations (One in core zone area and 10 locations in buffer zone). In which 9 locations of ML buffer zone and Screening cum Beneficiation Plant buffer zone are common for each other in both 10 Km map for Bailadila Iron Ore Deposit-4. One season 24 hourly sampling twice a week for PM_{10}, $PM_{2.5}$, SO_2 and NO_2 and rest of parameters (O_3, NH_3, CO, BaP, Benzene, As, Ni and Pb) were monitored once in a month.
3	Water quality	Physical, Chemical and Bacteriological Parameters as per APHA and IS standards	**Ground water** Total 8 sampling locations selected for **Mining lease area** and 7 sampling locations for **Screening cum Beneficiation Plant** area. In which 7 locations are common for each other in both 10 Km map. **Surface Water** Total 8 locations selected for surface water study in which 6 sampling locations selected for Mining lease area and 6 sampling locations for Screening cum Beneficiation Plant area (in which 4 locations are common for each other at 8

			locations in both 10 Km map).
4	Noise levels	Noise levels in dB(A) SPL, Leq(A), L_{day}, L_{night}	Total 8 sampling locations selected for **Mining lease area** (One in core zone, 7 in buffer zone) and 8 sampling locations for **Screening cum Beneficiation Plant** area (One in core zone, 7 in buffer zone). In which 3 locations are common for each other in both 10 Km map.
5	Soil characteristics	Soil profile, characteristics, soil type and texture, NKP value etc.	Total 7 sampling locations selected for **Mining lease area** (One in core zone 6 in buffer zone) and 7 sampling locations for **Screening cum Beneficiation Plant** area (One in core zone, 6 in buffer zone). Buffer zone locations are common for each other in both 10 Km map.
6	Socio-economic Aspects	Socio-economic characteristics	Primary data based on Limited survey and secondary data from Census-2011 (Common Villages studied for Primary data survey in **Mining lease & Screening cum Beneficiation Plant**)
7	Ecology	Existing terrestrial flora and fauna	Through field visit and secondary data Core zone Ecology & biodiversity assessment of **Mining lease & Screening cum Beneficiation Plant** have been done separately. Buffer zone study is common for each other
8	Land use	Land use for different categories.	Through Satellite Imagery.

3.2.0 General Climatic Condition (Secondary data)

The data collected during the monitoring period (1st March-2022 to 31st May-2022) is primary information for the baseline study and air quality prediction models.

Meteorological parameter's historical data used as secondary information in identifying the general climatic nature of the region.

Bailadila region enjoys mild summer and winter is not severe. The maximum temperature in summer rises up to 40^0C between May and June whereas minimum temperature in winter drops to 10^0C. The area receives heavy rains during monsoon from June to October. Weather during rainy season is stormy accompanied by gales and the hilltops are covered with thick clouds and dense fog, which reduces visibility. (Source: IMD Jagdalpur)

The description of the meteorology of the study area is given below:

a) Temperature

The South Bastar Dantewada district experiences a wide seasonal temperature variation and daily temperature variation. The maximum temperature goes up to 40^0C during summer in the month of May and the minimum temperature goes down to 10^0C during winter in the month of December and January (All recorded temperatures are monthly average of daily maximum and minimum)

Source: http://cgwb.gov.in/District_Profile/Chhatisgarh/Dantewada.pdf

b) Rainfall

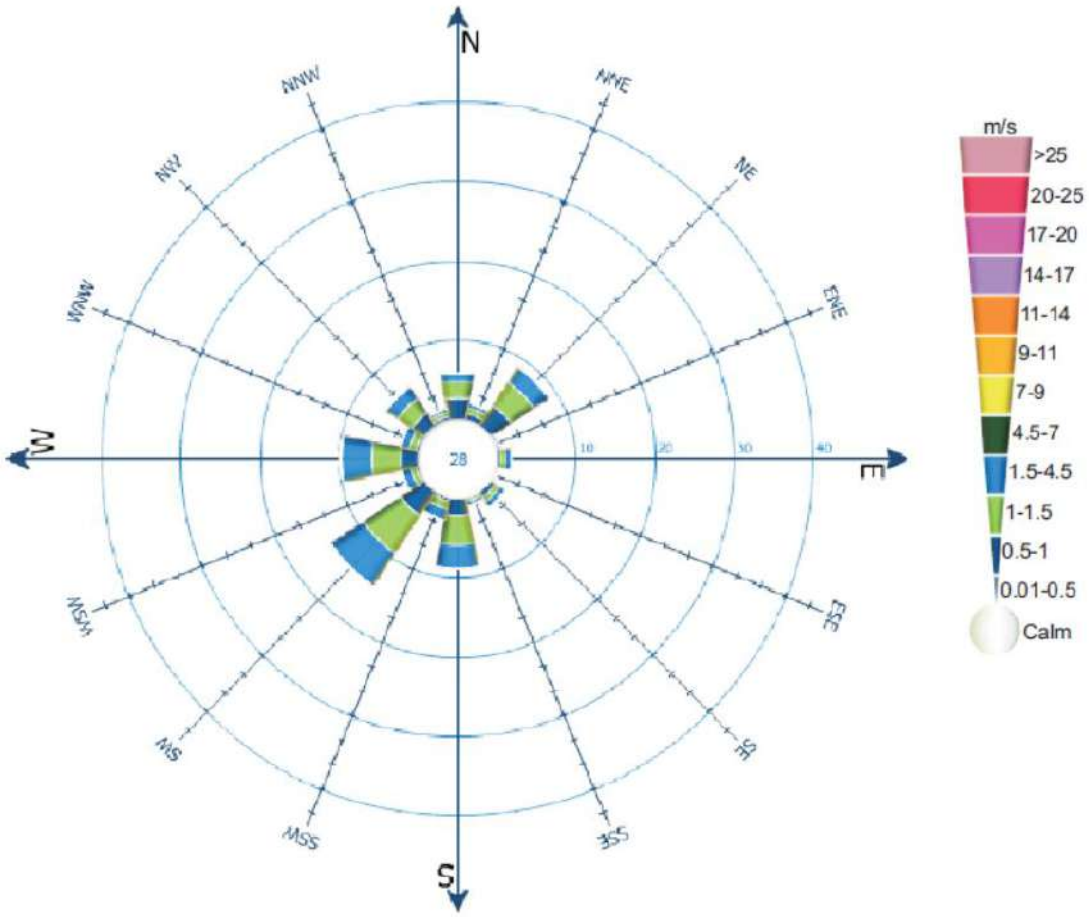
The average annual rainfall in Bailadila district is 1250 mm. The South-west monsoon lasts from July to September and the area gets about 85% of the annual rainfall during this period. October to December also experience the rains.

Source: http://cgwb.gov.in/District_Profile/Chhatisgarh/Dantewada.pdf

c) Wind

Data from the nearby IMD Station, Jagdalpur which is at a distance of 124 km has been obtained. The annual predominant wind directions are SW to NE (16.2%). Average speed is 1.5m/s to 4.5m/s as shown in **Figure 3.1**.

Figure 3.1: Annual Wind Rose of IMD Station, Jagdalpur



3.3 Selection of sampling stations

Details about the selection of sampling locations is given below. The sampling procedures and data analysis is given in subsequent sections.

3.3.1 Micro-meteorological station

The meteorological data like temperature, humidity, wind speed, wind direction, cloud cover and rainfall were recorded at site. Wind speed and direction recorder, thermometer, hygrometer and rain gauge were used. The micro meteorology station for deposit-4 was kept at mine site office of adjacent Deposit-5 mine.

3.3.2 Ambient Air Quality Locations

The most predominant wind direction during the study period was SW to NE over 16.2% of the time. The ambient air quality monitoring locations were selected to represent the whole study area Mining lease & Screening cum Beneficiation Plant independently and keeping in view the predominant downwind direction and location of sensitive receptors. One location within core zone and one location at 500 m in the predominant downwind direction have been also selected for Mining lease &

Screening cum Beneficiation Plant both. Considering the above, the following 12 ambient air quality monitoring locations selected for Mining lease area whereas 11 locations for Screening cum Beneficiation Plant **(Table 3.2)** have been selected for monitoring of ambient air quality parameters as per CPCB notification of 2009. The plan showing location of AAQ monitoring locations in Mining lease & Screening cum Beneficiation Plant alongwith metrological sampling station is given in **Plate No. 3.1**. Photographs of ambient air monitoring is shown in **Figure 3.2**.

TABLE 3.2
AMBIENT AIR QUALITY MONITORING LOCATIONS

Sl. No.	Name of Location	Distance, Direction from ML Area (in km)	Distance, Direction from Benificiation Plant (in km)	GPS Coordinate	Remarks
core zone					
AM1	Within lease area	-,-	7.5, SW	18°42'0.79"N 81°12'43.72"E	ML area
AB1	Proposed Screening plant	7.5 NE	-,-	18°46'24.35"N 81°15'32.68"E	Screening plant
Buffer Zone specific					
AM2	Akash Nagar CISF Camp	1.4, SW	10.9, SW	18°40'18.11"N 81°11'45.55"E	Upwind for Mine & Proposed screening plant both
AM3	Padapur	4.1, SE	10.1, S	18°40'34.90"N 81°15'22.25"E	Crosswind Mine & Proposed screening plant both
AB2	Pujaripara	10.7 NE	3.8, NE	18°48'10.37"N 81°17'6.32"E	Downwind for Mine & Proposed screening plant both
Buffer Zone Common					
AMB1	Within 500m downwind direction from lease area	0.5, NE	5.5, SW	18°43'52.57"N 81°13'11.08"E	Downwind for Mine & Upwind for Proposed screening plant
AMB2	Timmenar	4.5, NW	9.0, SW	18°45'27.65"N	Crosswind Mine & Proposed

				81°10'20.56"E	screening plant both
AMB3	Near proposed conveyor alignment	3.5, NE	2.9, SW	18°45'25.86"N 81°13'58.03"E	Downwind for Mine & Upwind for Proposed screening plant
AMB4	Within 500M Downwind Direction from Beneficiation Plant	7.5, NE	0.5, NE	18°46'41.96"N 81°15'57.19"E	Downwind for Mine & Proposed screening plant both
AMB5	Near Kanya Ashram, Dhurli	10.0, NE	3.2, NE	18°47'24.57"N 81°17'10.02"E	Downwind for Mine & Proposed screening plant both
AMB6	Bhansi	7.5, NE	1.5, E	18°46'15.02"N 81°16'29.28"E	Downwind for Mine & crosswind for Proposed screening plant
AMB7	Porokameli	6.2, NE	1.0, SE	18°45'38.35"N 81°15'50.46"E	Downwind for Mine & Crosswind for Proposed screening plant
AMB8	Nerli	4.7, NE	3.7, S	18°44'3.56"N 81°15'44.15"E	Crosswind Mine & Proposed screening plant both
AMB9	Bacheli	2.3, E	7.2, SSW	18°42'19.16"N 81°14'29.03"E	Crosswind Mine & Proposed screening plant both

Note- AM: For Mining lease 10 km, AB: For Screening cum Beneficiation Plant 10 km, AMB: Common sampling stations in Mining lease & Screening cum Beneficiation Plant 10 km

Figure 3.2: Photographs showing Ambient Air Monitoring

Padapur

Bacheli

Nerli

Porokameli

3.3.3 Water Quality Locations

The Total water samples were collected from 16 locations out of this 8 are surface water location and 8 are ground water locations for buffer zone of Mining lease area whereas 7 locations for Screening cum Beneficiation Plant separately in 10 km study area. The details of the sampling locations are given in **Table 3.3** below and shown in **Plate No. 3.2.** Photographs of water sampling is shown in **Figure 3.3**.

Table. 3.3
Water Sampling Locations

Specific Ground water locations for Mining lease					
GWM1	Padapur	4.3, SE	10.1, S	18°40'32.36"N 81°15'25.35"E	Bore well.
Common Ground water locations for Mining lease and Screening cum Beneficiation Plant					
GWMB1	Bacheli	4.3, E	7.4, S	18°42'11.89"N 81°14'53.28"E	Bore well.
GWMB2	Nerli	4.8, NE	3.5, S	18°44'2.89"N 81°15'46.45"E	Bore well.
GWMB3	Porokameli	5.8, NE	1.2, S	18°45'20.63"N 81°15'49.75"E	Bore well.
GWMB4	Bhansi	8.0, NE	1.9, E	18°46'17.82"N 81°16'30.25"E	Bore well.
GWMB5	Dhurli	10.0, NE	3.8, NE	18°47'27.40"N 81°17'14.56"E	Bore well.
GWMB6	Badekameli	8.8, NE	4.0, SE	18°45'14.93"N 81°17'42.90"E	Bore well.
GWMB7	Behnar	7.1, E	5.9, SE	18°43'17.75"N 81°17'10.58"E	Bore well.

Sl. No.	**Name of Location**	**Distance, Direction from ML Area (in km)**	**Distance, Direction from Benificiation Plant (in km)**	**GPS Coordinate**	**Remarks**
Specific Surface water locations for Mining lease & Screening Cum Beneficiation Plant					
SWM1	Gali Nala	0.6, S	10.1, SW	18°41'26.85"N 81°12'34.62"E	It flows in between Eastern & Western ridge of

					Bailadila range on the Southern direction of Deposit-4. It carries surface runoff from Bailadila range and joins Talperu Nadi.
SWM2	Berudi Nadi	7.8, W	14.4, SW	18°43'39.02"N 81° 7'45.04"E	It originates in Western direction of ML and flows north-west and ultimately joins Indravati River.
SWB1	Confluence Point of Sankani & Koyar River	11.7, NE	6.0, E	18°46'40.83"N 81°18'59.01"E	It receives major inflow from catchment area of Bailadila in the eastern direction and flows towards North East and joins Dankini river at Dantewada.
SWB2	Jharalawa Nala Near Gamewada	17.7NE	7.0	18°48'45.80"N 81°18'44.30"E	--
Common Surface water locations for Mining lease & Screening cum Beneficiation Plant					
SWMB1	Nala Near Central Workshop, Bacheli	4.2, E	6.0, S	18°42'22.00"N 81°15'26.12"E	It receives inflow from nearby tributaries and flows towards North and joins Sankani River
SWMB2	Nerli Ghati Nala Near CRPF CAMP-230	4.4, NE	2.5, S	18°44'39.80"N 81°15'22.90"E	
SWMB3	Nerli Dam Discharge D/S of DAM	5.5, NE	2.7, SE	18°44'41.84"N 81°16'00.42"E	

SWMB4	Sankani Nadi	8.6, NE	4.3, SE	18°44'49.04"N 81°17'42.40"E	It originates in SSE direction and flows towards North and ultimately joins Koyar Nadi.

Note: GWMB: For Mining lease 10 km, SWMB: For Beneficiation Plant 10 km, SWMB & GWMB : Common sampling stations in Mining lease & Screening cum Beneficiation Plant 10 km.

Figure 3.3: Photographs of water sampling

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Jharalawa Nala</td><td>Nala Near Central Workshop</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Nerli Ghati Nala</td><td>Sankani Nadi</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Bacheli</td><td>Nerli</td></tr>
</table>

3.3.4 Ambient Noise Locations

The environmental assessment of noise from the mining activity and vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses, and annoyance to general community. A preliminary reconnaissance survey has been undertaken to identify the major noise generating sources in and around the mining lease area, based on the activities in the village area and due to traffic. One location within core zone of Mining lease & Screening cum Beneficiation Plant each has been undertaken. 8 locations for both Mining lease & Screening cum Beneficiation Plant in buffer zone have been monitorted in which 3 locations were common in both. The details of the sampling locations are given in **Table 3.4** below and shown in **Plate No. 3.3.**

Table 3.4
Ambient Noise Monitoring Locations

Sl. No.	Name of Location	Distance, Direction from ML Area (in km)	Distance, Direction from Benificiation Plant (in km)	GPS Coordinate	Remarks
Core Zone					
NM1	Within lease area	-,-	7.5, SW	18°42'0.79"N 81°12'43.72"E	
NB1	Proposed Screening Plant	6.5, NE	-,-	18°46'24.08"N 81°15'32.73"E	
Buffer zone specific					
NM2	Akash Nagar CISF Camp	1.4, SW	11.4, SW	18°40'18.60"N 81°11'43.23"E	
NM3	Outside ML area Near Substation-2 Downhill Conveyor DEP.-5	0.1, S	10.0, SW	18°41'43.39"N 81°12'22.96"E	
NM4	500 M. East from ML Boundary	0.5, E	7.3, SW	18°42'26.98"N 81°13'15.28"E	
NM5	500 M. North from ML Boundary	0.5, N	6.2, SW	18°43'45.18"N 81°12'51.23"E	
NB2	Within 500M Downwind Direction from Beneficiation Plant	7.5, NE	0.5, NE	18°46'41.96"N 81°15'57.19"E	
NB3	Dhurli	10.1, NE	3.5, NE	18°47'36.46"N 81°17'17.04"E	

NB4	Bhansi	7.5, NE	1.5, NE	18°46'17.82"N 81°16'30.25"E	
NB5	Porokameli	5.5, NE	1.4, S	18°45'20.63"N 81°15'49.75"E	
Buffer Zone Common					
NMB1	Near proposed conveyor alignment	3.5, NE	2.9, SW	18°45'25.86"N 81°13'58.03"E	
NMB2	Nerli	4.7, NE	3.7, S	18°44'2.89"N 81°15'46.45"E	
NMB3	Bacheli	3.4, E	7.3, S	18°42'11.89"N 81°14'53.28"E	

3.3.5 Soil Quality Locations

The term soil, refers to the loose material composed of weathered rock and other minerals, in addition to partially decayed organic matter that covers large parts of the earth's surface. Soil is an indispensable component of the terrestrial ecosystem. Hence, the impact of the mining activity on soil, needs to be properly evaluated to plan the mitigation measures wherever required. Soil formation is influenced mainly by climate, geology and other biotic interactions. Hence, it is essential to identify the impacts in the study area on the soil characteristics, which would affect the agricultural, and afforestation potential. Accordingly, an assessment of the baseline soil quality has been carried out. One sample location has been taken from core zone of Mining lease & Screening cum Beneficiation Plant each. 5 samples from common locations of buffer area of Mining lease & Screening cum Beneficiation Plant have been undertaken. The details of the sampling locations are given in **Table 3.5** below and shown in **Plate No. 3.3.** Photographs of soil sampling is shown in **Figure 3.4**.

Table. 3.5
Soil Sampling Locations

Sl. No.	**Name of Location**			**GPS Coordinate**	**Remarks**
Core Zone					
SM1	ML Area	-,-	9.3 SW	18°41'57.10"N 81°12'50.75"E	
SB1	Proposed Screening Plant	6.4, NE	-,-	18°42'9.53"N 81°12'56.21"E	
Buffer Zone Common					
SMB1	Bacheli	3.4, E	7.3, S	18°42'11.89"N	

				81°14'53.28"E	
SMB2	Near Conveyor	3.7, NE	2.9, SW	18°45’34.99"N 81°13’57.50"E	
SMB3	Bhansi	7.9, NE	1.5, NE	18°46’52.47"N 81°16’48.53"E	
SMB4	Nerli	5.6, NE	4.0, SE	18°44’0.37"N 81°16’15.57"E	
SMB5	Behnar	8.2, E	5.9, SE	18°43’17.04"N 81°17’9.31"E	

Figure 3.4: **Photographs of Soil Sampling**

Core zone ML area

Beneficiation Plant

Bacheli

3.4 Sampling Procedure

3.4.1 Micro Meteorological Monitoring

Micro meteorological station was set up on roof top of Mine Office to record various meteorological parameters. For recording various parameters following apparatus were used:

a) Thermometer (for Temperature)

b) Hygrometer (for Humidity)

c) Anemometer (for wind speed)

d) Wind vane (for wind direction)

e) Rain gauge (for Measurement of rain fall)

The "Cloud cover" was recorded by visual observation of the sky.

3.4.2 Ambient Air Monitoring

Time averaged in-situ sampling was adopted by passing a known volume of air through a trap, and a collecting medium (filter paper and bubbler). Fine Dust Sampler and Respirable Dust Sampler were used for the purpose. The analytical methods followed for ambient air quality monitoring is described below:

a. Particulate Matter less than 2.5 micron ($PM_{2.5}$)

The samples for $PM_{2.5}$ were collected on filter paper by Fine dust sampler operated at maximum rate of 16.67 lpm and concentrations were determined gravimetrically on 24 hours basis.

b. Particulate Matter less than 10 micron (PM_{10})

The samples for PM_{10} were collected on filter paper by RDS/Fine dust sampler operated at maximum rate of 1.2 cu.m./min./16.67 lpm and concentrations were determined gravimetrically on 24 hours basis.

c. Sulphur-dioxide (Improved, West & Gaeke Method)

Sulphur-dioxide measurement was done by aspirating a measured volume of air through sodium tetrachloromercurate solution. It forms a stable dichloro-sulphitomercurate. The amount of SO_2 is estimated by the reading from spectrophotometer at 560 nm.

d. Nitrogen Oxides (Modified Jacob & Hochheiser Method)

Nitrogen oxides were estimated by bubbling air through 0.1 N sodium hydroxide (with sodium arsenate) solution to form a stable solution of sodium nitrite. The nitrite ion produced during a sampling is determined using spectrophotometer at 540 nm by reacting the exposed absorbing reagent with phosphoric acid, sulphanilamide and NEDA.

e. Carbon Monoxide [IS: 5182 (Part-X) 1976]

Grab sample of ambient air is taken in the sampling tube. The sample is injected into gas chromatograph (with methaniser) where it is carried from one end of the column

to other. During the movement, the carbon monoxide is converted into methane and sample undergoes distribution at different rates, ultimately separating from one another. The separated constituents are detected in form of distinct peaks in the plotter.

Other parameters like Ozone and Ammonia were monitored and analyzed by Chemical method and Indophenol Blue Method respectively. Benzene, BaP, trace metals etc. were monitored and analysed as per CPCB guidelines.

3.4.3 Water Quality Monitoring

As per the standard practice, one sample from each station was collected once, during the season. Grab water samples were collected in plastic container by standard sampling technique. Necessary precautions were taken for sample preservation. The physical parameters viz. pH, temperature & conductivity were measured at site by using portable water analysis kit. DO was fixed on spot as per Winkler's method, Parameters like hardness, colour, taste and odour, residual chlorine and free ammonia were analysed at the site, immediately after collection of water samples. The parameters as defined "General Standards for Discharge of Environmental Pollutions [GSR 422(E) and GSR 801 (E)] were analyzed as per the procedures defined in IS: 3025 and "standard methods for water and waste water analysis" (AWWA, APHA).

3.4.4 Ambient Noise Level

Ambient noise level monitoring was done by an integrating sound level meter in dB (A). Outdoor noise measurements were made at a height of 1.5m, above the ground and away from sound reflecting sources like walls, buildings etc. the Ambient noise level monitoring was carried out day and night as given below:

Ambient Noise Level Monitoring

Sl. No.	Time (hrs.)	Duration (minutes)
1	08:00-11:00	30
2	14:00-17:00	30
3	18:00-21:00	30
4	00:00-03:00	30

3.4.5 Soil Quality

Soil samples were collected and analysed by following standard procedures diagnosis and improvement of Saline and Alkali Soils, Agriculture hand book no.60 of US Department of Agriculture. Objective of study was to know quality of different soil profiles, its fertility potential and biological status (from 0 to 30 cm) in the area. Samples were collected up to the depth of 0-30 cm from the surface at 4 sampling spots. At each spot, surface litter was scrapped and samples were taken using depth sampler. These samples were kept for some time for air drying at room temperature. Samples were stored in polythene bags with label at the top. Soil samples were collected with the help of core sampling tube and rammer. The debris up to the surface was removed with the help of spade, then core of measured size was kept on the cleaned soil surface which was hit vertically with the help of rammer. Once

the core gets in the soil the soil gets fitted, it was taken out by digging the surrounding earth with the help of shovel, (A manual agricultural implement with a curved blade fixed into a wooden handle).

Samples were analysed for the following parameters:

- pH
- Electrical Conductivity
- Nitrogen
- Phosphorous
- Potassium
- Calcium
- Magnesium
- Organic Carbon
- Iron
- Boron
- Natural Moisture content
- Bulk density
- Grain size distribution
- Cation exchange capacity

3.5 Data Analysis

3.5.1 Meteorological Study

Meteorological data was recorded hourly for three months. Calm condition prevailed over 12.40 % of the time of the study period. The first predominant wind direction was from South-West to North-East over approx. 5.5 % of the time in which speed of 0.30 to 3.0 m/s was recorded and second predominant wind direction was from North-West to South-East over approx. 5.0 % of the time in which speed of 0.3 to 3.0 m/s was recorded. The seasonal wind rose diagrams for 24 hours period is given in **Plate No. 3.4**. The maximum & minimum temperature, relative humidity (%) & Rainfall (mm) recorded during the season are given below:

Table 3.6

Summary of Meteorological Parameters Measured at Project Site

Month	Temperature (^{0}C)		Rainfall	Relative Humidity (%)	
	Maximum	Minimum	mm	Max	Min
March 2022	34.23	18.77	4.6	96.15	16.55
April 2022	39.19	20.10	1.8	95.15	25.58
May 2022	36.46	18.44	0	98.84	30.5

3.5.2 Ambient Air Quality

Ambient air quality for core and buffer locations were monitored at Mining lease & Beneficiation Plants within study area. The ambient air results of 12 monitoring locations of Mining lease area and 11 locations of Screening Cum Beneficiation Plant are given in **Annexure 3.1 (A) to Annexure 3.1 (O)** and the overall Maximum and Minimum values are discussed below in **Table 3.7**.

Table 3.7

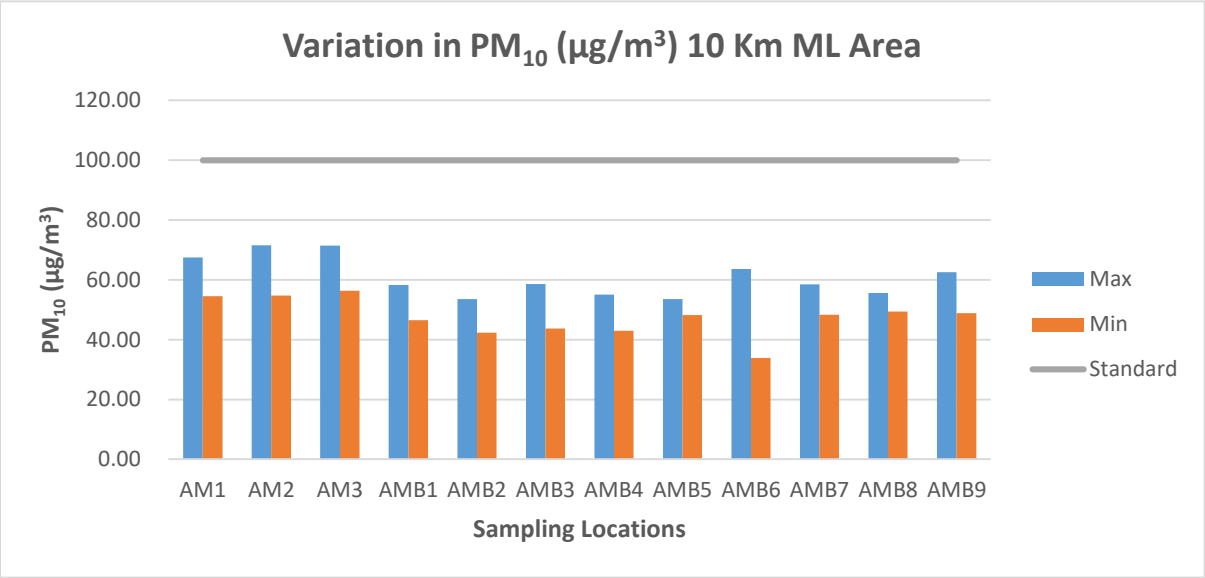
Ambient Air Quality Results-Maximum & Minimum Values

	Parameter	**PM_{10}(µg/m^3)**		**$PM_{2.5}$(µg/m^3)**		**SO_2(µg/m^3)**		**NO_2(µg/m^3)**	
SN	**Locations**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**
AM1	Within lease area	67.53	54.54	33.98	27.08	13.16	7.20	29.16	18.41
AB1	Proposed Screening plant	59.50	47.13	23.28	15.50	15.40	7.26	24.80	15.54
AM2	Akash Nagar CISF Camp	71.50	54.79	30.60	24.60	12.27	7.29	25.08	18.60
AM3	Padapur	71.40	56.30	38.50	24.40	14.20	7.26	25.08	17.63
AB2	Pujaripara	63.18	33.82	23.50	18.54	13.43	8.24	25.38	18.40
AMB1	Within 500m downwind direction from lease area	58.30	46.50	34.06	25.37	15.39	9.08	26.05	18.26
AMB2	Timmenar	53.60	42.30	25.39	20.20	12.26	6.94	31.56	17.82
AMB3	Near proposed conveyor alignment	58.65	43.71	25.19	19.67	12.34	6.38	24.78	17.95
AMB4	Within 500M Downwind Direction from Beneficiation Plant	55.12	42.98	24.52	19.43	13.60	6.38	25.16	18.69
AMB5	Near Kanya Ashram, Dhurli	53.52	48.23	29.19	20.22	11.20	6.59	23.50	15.80
AMB6	Bhansi	63.62	33.82	24.29	18.54	11.62	8.24	25.38	18.59
AMB7	Porokameli	58.54	48.29	30.53	22.24	13.54	8.24	25.72	18.08
AMB8	Nerli	55.60	49.38	30.84	23.35	12.40	6.27	24.62	13.82
AMB9	Bacheli	62.59	48.89	35.50	21.40	10.82	8.34	24.61	15.27

3.5.3 Variation in Ambient Air Quality of ML area

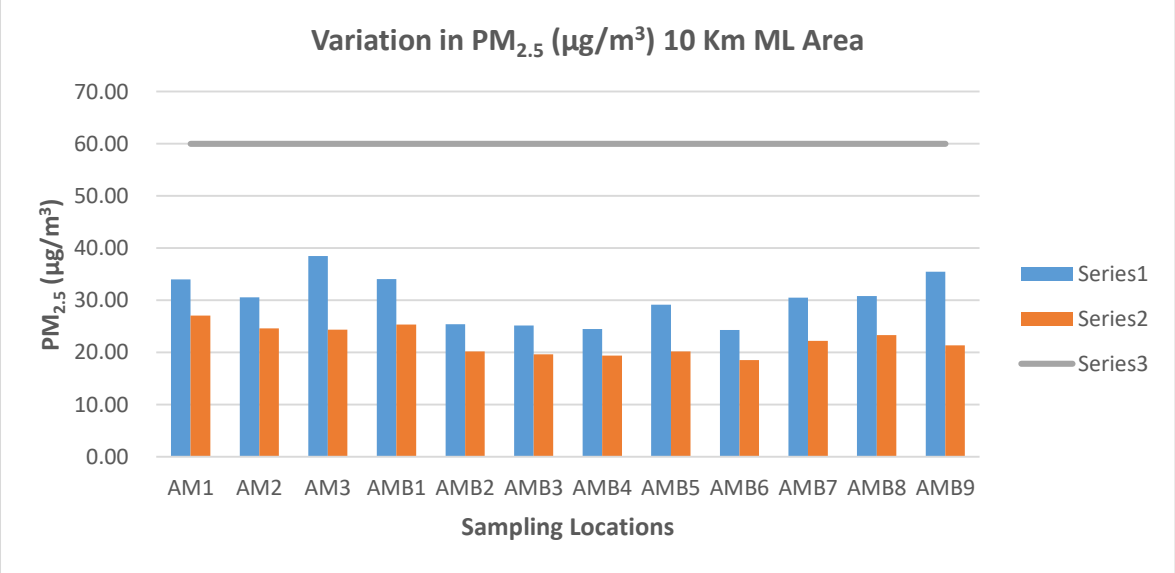
Variation in ambient air quality for core and buffer locations of ML Mining lease shown in **Figure 3.5-3.8**. Out of 12 locations the maximum Respirable Particulate Matter (PM_{10}) was found to be 71.50 µg/m^3 at Akashnagar and 71.40 µg/m^3 at Padapur followed by 67.53 µg/m^3 at ML area. Variationin Particulate Matter (PM_{10}) in ML area given in **Figure 3.5**.

Figure 3.5: Variation in PM_{10} at different monitoring Locations (10 Km) of Mining Lease



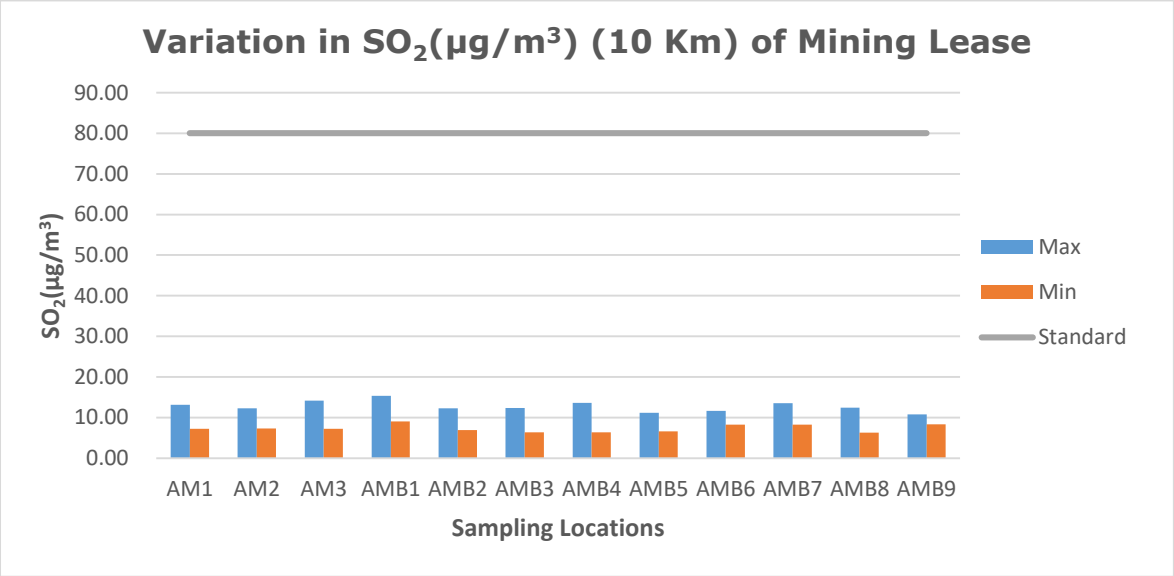
Variationin Fine Particulate Matter ($PM_{2.5}$) in ML area given in **Figure 3.6**.

Figure 3.6: Variation in $PM_{2.5}$ at different monitoring Locations (10 Km) of Mining Lease



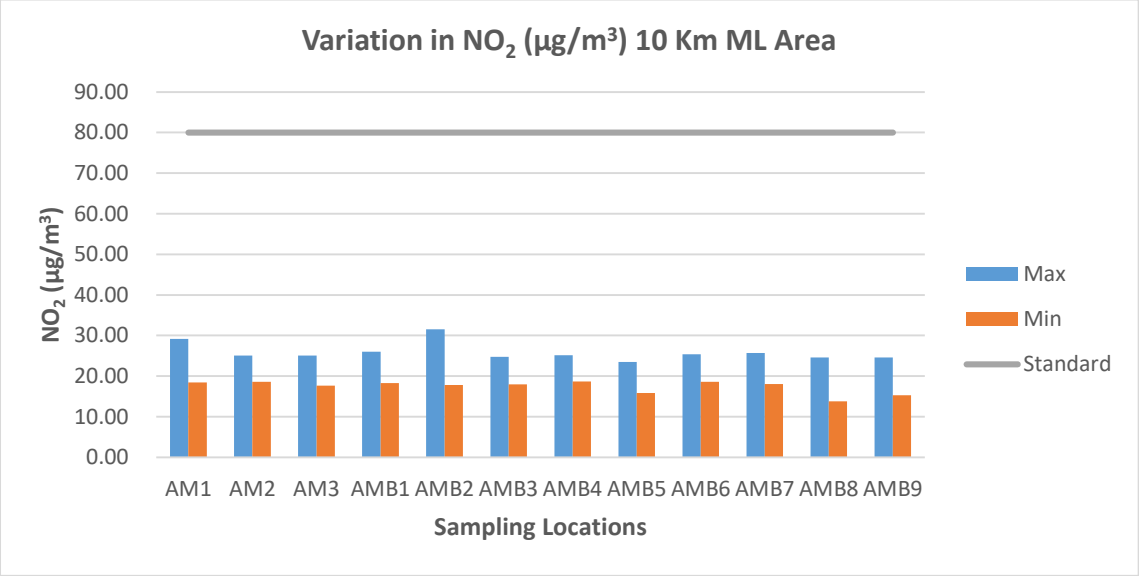
Variation in SO_2 (µg/m^3) conc. values are in ML area given in **Figure 3.7**.

Figure 3.7: Variation in SO_2 at different monitoring Locations (10 Km) of Mining Lease



Variation in NO_2 (µg/m^3) conc. values are in ML area given in **Figure 3.8**.

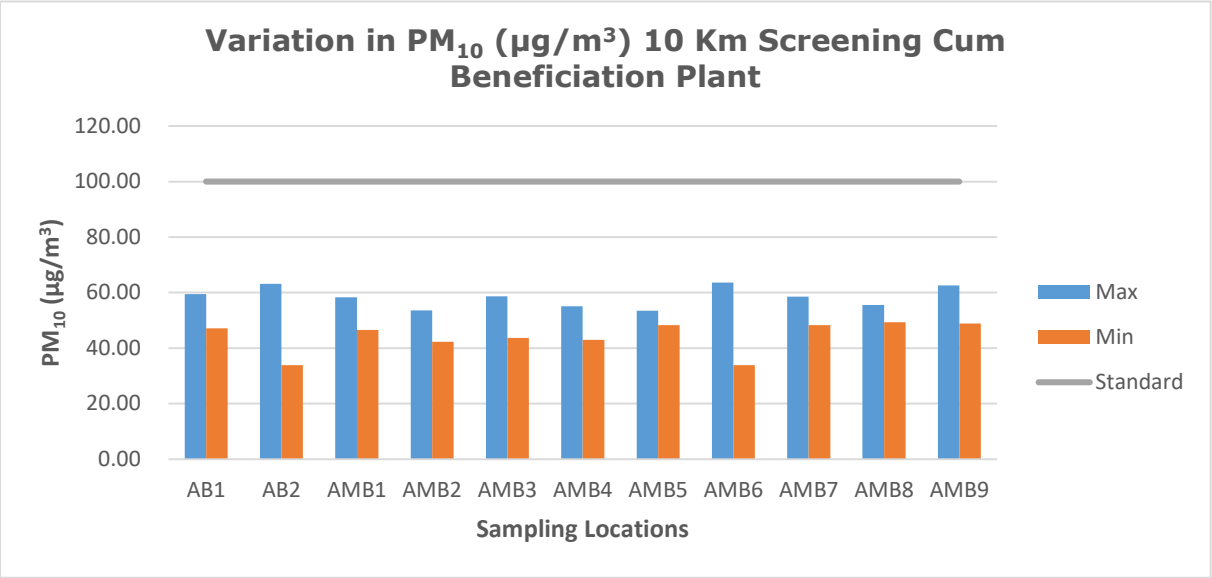
Figure 3.8: Variation in NO_2 at different monitoring Locations (10 Km) of Mining Lease



Variation in Ambient Air Quality of Screening cum Beneficiation Plant

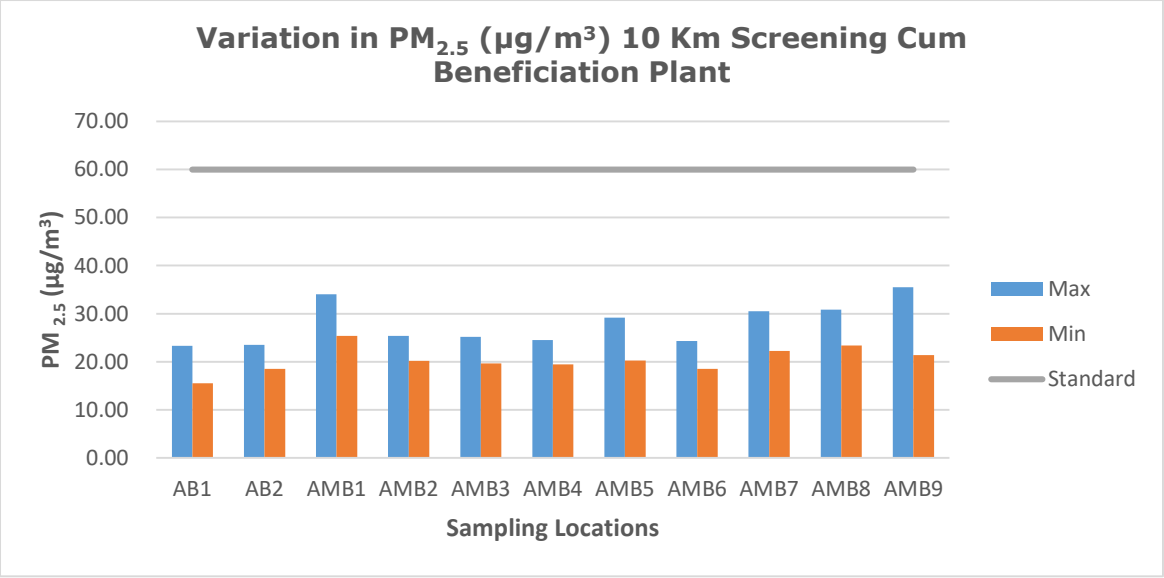
Variation among 11 locations in ambient air quality for core and buffer area at Screening cum Beneficiation Plant are shown in **Figure 3.9-3.12**. Variation in PM_{10} is given in **Figure 3.9**.

Figure 3.9: Variation in PM_{10} at different monitoring Locations (10 Km) of Screening cum Beneficiation Plant



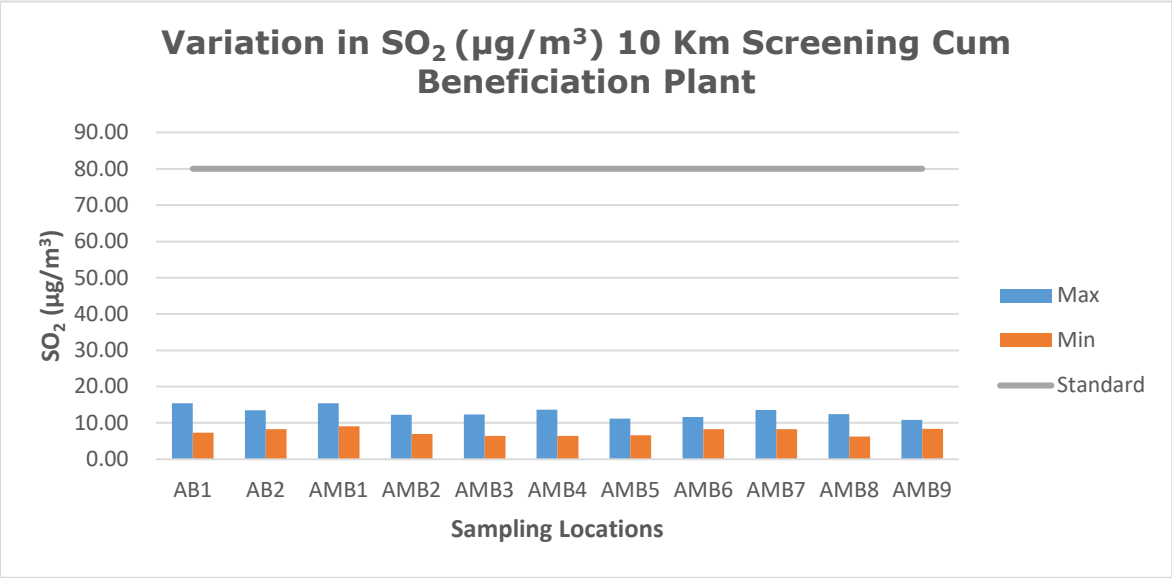
Variation in $PM_{2.5}$ on core and buffer area at Screening Cum Beneficiation Plant are shown in **Figure 3.10**.

Figure 3.10: Variation in $PM_{2.5}$ at different monitoring Locations (10 Km) of Screening cum Beneficiation Plant



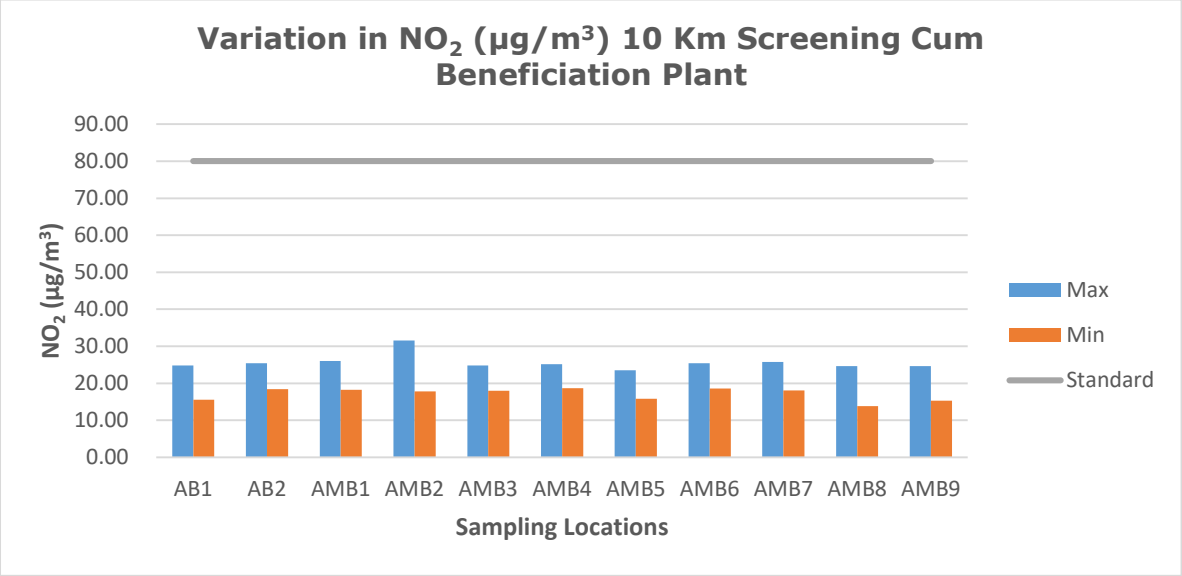
Variation in SO_2 on core and buffer area at Screening cum Beneficiation Plant are shown in **Figure 3.11**.

Figure 3.11: Variation in SO_2 at different monitoring Locations (10 Km) of Screening cum Beneficiation Plant



Variation in NO_2 on core and buffer area at Screening Cum Beneficiation Plant are shown in **Figure 3.12**.

Figure 3.12: Variation in NO_2 at different monitoring Locations (10 Km) of Screening Cum Beneficiation Plant



Ambient Air Quality for Rest of the Parameters

Ambient air quality for O_3, CO, NH_3, C_6H_6, As, Ni, BaP and Pb were monitors once in a month. The results at different locations of Mining lease area and Proposed Screening plant are tabulated in **Table 3.8** below:

Table 3.8

Location: AM1 (Within lease area)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
19.03.22	11.6	635.4	36.2	BDL	BDL	BDL	BDL	BDL
20.04.22	16.4	642.6	37.8	BDL	BDL vc	BDL	BDL	BDL
21.05.22	15.9	681.5	41.5	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AB1 (Proposed Screening plant)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
18.03.22	12.8	725.5	31.4	BDL	BDL	BDL	BDL	BDL
19.04.22	13.7	712.5	30.2	BDL	BDL	BDL	BDL	BDL
20.05.22	10.8	722.5	35.3	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AM2 (Akash Nagar CISF Camp)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
18.03.22	13.1	770.6	35.3	BDL	BDL	BDL	BDL	BDL
19.04.22	12.6	740.3	34.8	BDL	BDL	BDL	BDL	BDL
20.05.22	13.4	730.2	35.8	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AM3 (Padapur)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
18.03.22	13.2	710.6	34.2	BDL	BDL	BDL	BDL	BDL
19.04.22	14.1	740.6	35.8	BDL	BDL	BDL	BDL	BDL
20.05.22	14.7	720.5	34.8	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AB2 (Pujaripur)								

Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
18.03.22	13.2	710.6	34.2	BDL	BDL	BDL	BDL	BDL
19.04.22	14.1	740.6	35.8	BDL	BDL	BDL	BDL	BDL
20.05.22	14.7	720.5	34.8	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AMB1 (Within 500m downwind direction from lease area)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
18.03.22	12.5	640.3	33.1	BDL	BDL	BDL	BDL	BDL
19.04.22	11.9	720.4	34.8	BDL	BDL	BDL	BDL	BDL
20.05.22	11.6	710.6	34.6	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AMB2 (Timmenar)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
18.03.22	11.1	610.2	30.3	BDL	BDL	BDL	BDL	BDL
19.04.22	11.6	630.5	30.8	BDL	BDL	BDL	BDL	BDL
20.05.22	12.1	620.4	31.2	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AMB3 (Near proposed conveyor alignment)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
18.03.22	10.3	725.1	32.5	BDL	BDL	BDL	BDL	BDL
19.04.22	12.4	685.2	30.9	BDL	BDL	BDL	BDL	BDL
20.05.22	13.2	695.2	30.6	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AMB4 (Within 500M Downwind Direction from Beneficiation Plant)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)

18.03.22	13.6	664.1	41.3	BDL	BDL	BDL	BDL	BDL
19.04.22	14.7	752.2	36.5	BDL	BDL	BDL	BDL	BDL
20.05.22	12.2	830.1	36.2	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AMB5 (Near Kanya Ashram, Dhurli)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
18.03.22	14.5	632.8	33.1	BDL	BDL	BDL	BDL	BDL
19.04.22	12.4	643.6	35.1	BDL	BDL	BDL	BDL	BDL
20.05.22	14.3	624.2	36.4	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AMB6 (Bhansi)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
18.03.22	11.8	612.3	34.1	BDL	BDL	BDL	BDL	BDL
19.04.22	14.5	635.1	31.1	BDL	BDL	BDL	BDL	BDL
20.05.22	18.3	626.2	35.6	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AMB7 (Porokameli)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
18.03.22	14.1	650.6	33.2	BDL	BDL	BDL	BDL	BDL
19.04.22	13.5	690.1	34.6	BDL	BDL	BDL	BDL	BDL
20.05.22	13.8	710.8	35.3	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AMB8(Nerli)								
Date	O_3 ($\mu g/m^3$)	CO ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb ($\mu g/m^3$)
18.03.22	11.6	680.6	32.1	BDL	BDL	BDL	BDL	BDL
19.04.22	12.4	710.4	33.2	BDL	BDL	BDL	BDL	BDL

20.05.22	13.2	720.1	34.6	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100
Location: AMB9 (Bacheli)								
Date	O_3 (µg/m^3)	CO (µg/m^3)	NH_3 (µg/m^3)	C_6H_6 (µg/m^3)	As (ng/m^3)	Ni (ng/m^3)	BaP (ng/m^3)	Pb (µg/m^3)
18.03.22	12.4	660.1	35.6	BDL	BDL	BDL	BDL	BDL
19.04.22	12.1	690.6	36.2	BDL	BDL	BDL	BDL	BDL
20.05.22	11.4	680.2	36.8	BDL	BDL	BDL	BDL	BDL
Standard	100	2000	400	5	6	20	1	1
Detection Range	-	-	-	1-100	1-100	1-100	1-100	1-100

From the Graphs and tables, it is clear that all the parameters at all the locations are within limit (As per NAAQS Limit).

Free Silica: The results of Free Silica at different locations of Mining lease area and Proposed Screening plant are shown in **Table 3.9** below

TABLE 3.9
MINERALOGICAL COMPOSITION IN RESPECT TO THE FREE SILICA OF PM_{10}

SN	**Parameter**	**SiO_2(µg/m^3)**
	Locations	
AM1	Within lease area	0.9
AB1	Proposed Screening plant	1
AM2	Akash Nagar CISF Camp	1.4
AM3	Padapur	1.3
AB2	Pujaripara	0.6
AMB1	Within 500m downwind direction from lease area	0.5
AMB2	Timmenar	1.1
AMB3	Near proposed conveyor alignment	1.1
AMB4	Within 500M Downwind Direction from Beneficiation Plant	1.4
AMB5	Near Kanya Ashram, Dhurli	0.6
AMB6	Bhansi	1.5
AMB7	Porokameli	1.4
AMB8	Nerli	0.7
AMB9	Bacheli	1.5

3.5.4 Water Quality

The water quality monitoring was done at 16 locations in the study area. The water quality results are given in **Annexure 3.2 (A) to Annexure 3.2 (B).** Out of 16 samples collected from different locations for Deposit-4 ML & Screening cum Beneficiation Plant, 8 locations represent surface water and 8 locations represent groundwater.

3.5.4.1 Surface Water

The water samples are collected from Gali Nala (SWM-1), Berudi Nadi (SWM-2), Confluence Point of Sankani & Koyar River (SWB-1), Jharalawa Nala Near Gaamewada (SWB-2), Nala Near Central Workshop, Bacheli (SWMB-1), Nerli Ghati Nala Near CRPF Camp-230 (SWMB2), Nerli DN Discharge D/S of Dam (SWMB3) and Sankani Nadi (SWMB-4) during the study period. The few important parameters of water quality analysis are given below:

TABLE 3.10

RESULTS OF THE SURFACE WATER QUALITY MONITORING

Code No.	**Sampling Point**	pH	Total Dissolved Solids (mg/l)	Chlorides as Cl (mg/l)	Nitrate as NO_3 (mg/l)	Iron as Fe (mg/l)	Fluorides as F (mg/l)	Total Coliform organisms (MPN/100ml)
SWM1	Gali Nala	6.93	292	22	7.30	0.330	0.54	380
SWM2	Berudi Nadi	7.15	205	10	6.11	0.240	0.12	240
SWB1	Confluence Point of Sankani & Koyar River	6.76	287	24	8.45	0.230	0.37	410
SWB2	Jharalawa Nala Near Gaamewada	7.07	240	14	7.24	0.200	0.24	230
SWM1	Nala Near Central Workshop, Bacheli	6.90	280	20	5.02	0.400	0.66	350
SWM2	Nerli Ghati Nala Near CRPF CAMP-230	7.29	249	20	5.11	0.130	0.39	210
SWM3	Nerli DN Discharge D/S of Dam	6.66	240	16	6.10	0.170	0.56	240
SWM4	Sankani River	7.19	191	12	5.11	0.200	0.24	240
Desirable Limits								
IS: 2296 (Class C)		6.5-8.5	1500	600	1.50	50.00	50.00	5000

The analysis result shows that all the parameters are well within the prescribed limit of IS: 2296 (Class C) i.e. for surface water quality.

3.5.4.2 Ground Water

The water samples are collected from Bhansi Bore Well (GWMB-1), Nerli Bore Well (GWMB-2), Bacheli Bore Well (GWMB-3), Behnar (GWMB-4), Porokameli (GWMB5), Dhurli (GWMB6), Badekameli (GWMB7) and Padapur Bore Well (GWM1). The few important parameters of water quality analysis are given below in **Table 3.11**.

Table 3.11

Results of the Ground Water Quality Monitoring

Ground Water Location	pH	Total Dissolved Solid as TDS (mg/l)	Total Hardness as $CaCO_3$ (mg/l)	Iron as Fe (mg/l)	Chlorides as Cl (mg/l)	Nitrate as NO_3 (mg/l)	Fluoride as F (mg/l)	Total Coliform (MPN/100 ml)
Bhansi	7.05	145	52	0.12	6	5.01	0.41	Absent
Nerli	6.97	188	68	0.33	10	6.12	0.16	Absent
Bacheli	6.85	160	52	0.34	12	5.01	0.18	Absent
Behnar	6.97	121	48	0.11	10	6.22	0.42	Absent
Porokameli	7.1	163	56	0.21	14	BDL	0.21	Absent
Dhurli	7.08	133	52	0.08	8	BDL	0.36	Absent
Badekameli	7.15	155	56	0.3	8	5.01	0.16	Absent
Padapur	6.98	152	64	0.26	10	BDL	0.2	Absent
	IS: 10500:2012							
Accepted Limit	6.5-8.5	500	200	0.3	250	45	1	Absent
Permissible Limit	No relaxation	2000	600	No relaxation	1000	No relaxation	1.5	Absent

The ground water from all the locations as mentioned above is used for drinking purpose. The result shows that all the parameters are well within the acceptable limit of **IS: 10500**.

3.5.5 Ambient Noise

The ambient noise level survey was carried out at 8 locations in the study area and the results of the ambient noise levels in terms of maximum and minimum and day and night Leq values are given in **Table 3.12.**

TABLE. 3.12
RESULTS OF AMBIENT NOISE LEVEL MONITORING

SN	Sampling Location (Area Code)	Noise level in dB(A)			
		Max	Min.	Day (Leq)	Night (Leq)
NM1	Within Mining lease area (A)	53.8	43.8	47.5	40.52
NB1	Proposed Screening Plant (A)	61.14	56.4	53.6	42.5
NM2	Akash Nagar CISF Camp (A)	64.4	57.2	52.64	47.86
NM3	Outside ML area Near Substation-2 Downhill Conveyor DEP.-5 (A)	65.52	66.8	63.72	53.9
NM4	500 M. East from ML Boundary (A)	54.34	41.72	48.64	36.4
NM5	500 M. North from ML Boundary (A)	53.6	43.8	47.5	40.52
NB2	Within 500M Downwind Direction from Beneficiation Plant (A)	58.56	46.82	44.72	37.4
NB3	Dhurli (C)	47.95	38.6	35.8	29.9
NB4	Bhansi (B)	64.6	56.42	56.4	43.7
NB5	Porokameli (C)	53.9	42.5	39.54	35.48
NMB1	Near proposed conveyor alignment (A)	53.1	43.8	47.2	39.52
NMB2	Nerli (C)	52.46	35.94	37.6	25.76
NMB3	Bacheli (B)	65.8	55.6	55.4	48.3

From the above data, it can be seen that the ambient noise levels were found to be within the prescribed limit as per ambient noise quality standards with respect to noise prescribed by CPCB as given in below table.

Ambient Air Quality Standard in Respect of Noise

Area Code	Category of Area	Limit of dB (A) Leq	
		Day Time	Night Time
A	Industrial Area	**75**	**70**
B	Commercial Area	**65**	**55**
C	Residential Area	**55**	**45**
D	Silence Zone	**50**	**40**

Note:

1. Day time is reckoned in between 6:00 AM and 10:00 PM.
2. Night time is reckoned in between 10:00 PM and 6:00 AM
3. Silence zone is defined as area up to 100m around such premises as hospitals, educational institutions & courts. The silence zones are to be declared by a competent authority.
4. Mixed categories of areas should be declared as one of the four above-mentioned categories by the competent authority and the corresponding standard shall apply.

3.5.6 Traffic density survey

The traffic survey is essential to realistically and accurately assess the prevailing traffic volumes and travel characteristics by undertaking classified volume count. The objective of traffic volume count survey is to assess the traffic intensity on the existing roads i.e. from Kirandul to Geedam. The iron ore is mainly transported to pellet plants located in and around Raipur which covers a total distance of 400 Km. The transportation route is shown in **Plate No. 3.5.** The traffic density survey was conducted at 1 location on Kirandul-Bacheli SH road.

Twenty-four hours continuous volume count was manually undertaken during May 2022. The analysis of traffic counts provides an estimate of average daily traffic (ADT). In order to convert recorded vehicles into a common scale, the passenger car unit (PCU) equivalent factor as per IRC:64 have been adopted. The **Table 3.13** reveals ADT (Average daily Traffic) in terms of number which translates into PCU (Passenger Car Unit).

TABLE 3.13
TRAFFIC DENSITY AT BHANSI VILLAGE ON KIRANDUL-GEEDAM ROAD

Type of Vehicle	PCU Factor	No. of Vehicles/Day	No. PCU/Day	No. of Vehicles in PCU/hour
LMV (Car / Jeep / Van / Three Wheelers)	1.0	532	532	22
Two Wheelers	0.5	1108	554	23
HMV(Two Axel Truck/Three Axle Truck/Bus)	3.0	642	1926	80
More Than Three Axel Truck	4.5	12	54	2
Total		**2294**	**3066**	**128**

As per guidelines for capacity of roads in rural areas of IRC, recommend design series volumes for 2 lane roads are 15000 PCU/day hence the traffic is within the standard limit.

Existing Traffic Scenario and LOS			
V (Volume in PCU/Day)	**C (Capacity in PCU/Day)**	**Existing V/C Ratio**	**LOS**
3066	15000	0.2044	B

V/C	LOS	Performance
0.0-0.2	A	Excellent
0.2-0.4	B	Very Good
0.4-0.6	C	Good/ Average/ Fair
0.6-0.8	D	Poor
0.8-1.0	E	Very Poor

Hence existing traffic falls under B LOS i.e. very good.

3.5.7 Soil Quality

The analysis of the results of the soil quality monitoring is given in below **Table.**

SN	Parameter	SB1	SM1	SMB3	SMB4	SMB5	SMB2	SMB1
1	pH	7.10	7.15	6.83	7.21	6.66	6.89	5.98
2	Elec.Conductivity (µmhos/cm)	104.0	113.0	154.00	169.00	171.00	110.00	212.0
3	Nitrogen Av. (Kg/ha)	75.60	56.90	121.70	132.50	128.30	96.80	96.8
4	Phosphorous Av. (Kg P_2O_5/ha)	11.10	13.10	15.20	13.20	17.10	14.10	24.20
5	Potassium Av. (Kg/ha)	92.0	84.70	117.00	126.00	130.40	80.50	244.0
6	Calcium (Kg/ha)	380.0	428.0	688.00	748.00	820.00	460.00	460.0
7	Magnesium (Kg/ha)	128.00	144.0	188.00	228.00	272.00	136.00	120.0
8	Iron (mg/kg)	395.00	451.00	675.00	712.00	821.00	467.00	267.0
9	Boron Av.(mg/kg)	0.81	1.22	1.21	1.42	1.78	0.89	1.22
10	Organic Carbon (%)	0.91	0.85	1.23	1.32	1.19	0.82	0.88
11	Natural Moisture content %	5.20	7.11	10.20	9.80	8.30	6.45	10.2
12	Porosity (%)	17.54	14.59	22.34	21.29	18.22	20.65	27.46
13	Water Holding Capacity (%)	12.10	13.20	15.10	14.10	12.40	13.50	32.8
14	Bulk Density(gm/cc)	1.45	1.39	1.48	1.51	1.47	1.53	1.40
15	Grain Size Distribution							
a)	Textural Class	Silt Clay Loam	Silty Clay	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam
b)	Sand (%)	30	34	54	50	47	52	39.0
c)	Silt (%)	32	46	21	28	20	16	21.0
d)	Clay (%)	38	20	25	22	33	32	40.0
16	Cation Exchange Capacity (mg/100g)	9.85	7.55	8.54	8.62	9.11	8.15	11.08

From the results it is observed that the pH of soil is normal ranging 6.66-7.21, average nitrogen (N) values were in medium to high range (56.90-132.5 kg/ha), average potassium (K) value is also in the range of low to high (80.50-130.4 kg/ha). The average phosphorus (P) values were found to be medium (11.10-17.10 kg/ha) range.

3.6 Socio- Economic Environment

Introduction

All the Mining projects have social and economic linkages. Therefore, setting up a new project has impact on the socio–economic environment of the locality around it. This impact may be marginal or non–marginal. The intensity of impact may depend upon the various social and environmental factors associated with it and the extent of change, caused by the project to alter the existing equilibrium of the socio-economic system. Influx of people from outside during various stages of the project may also alter the existing cultural identity of the local people. Further, there will be a cash flow associated with the project which may affect the existing socio–economic activities and may introduce many more new activities associated with the project to which the local people may have strong adherence.

M/s CMDC-NMDC Limited proposes to develop a green field project i.e. Bailadila Iron Ore Deposit-4 as an standalone project. Study area is falling in Bade Bacheli and Kuakonda Tehsils, South Bastar Dantewada district of Chhattishgarh, which have 25 villages and 2 municipalities. The demographic and socio-economic details of 10 km radius of study area as per Census 2011 are given in **Annexure 3.4**. Socio-Economic status of the population is an indicator for the development of the region. Any developmental project of any magnitude will have a bearing on the living conditions and on the economic base of population in particular and the region as a whole. The Major religions in the study area are Hindu 96.3% whereas Muslim (1.21%) of the total population respectively. Main spoken languages of the area area Gondi, Halbi and Hindi. Kosra, rice and madiya are the main food Grains of study area. Tribes of the study area are non-vegetarians. Two perennial rivers Sankani and Dankini are the major surface water source of the area. Men's wear very limited clothes and female decorate themselves with tattoo. The main occupation of the tribes is farming, poultry farming and animal husbandry.

Socio-Economic Scenario (Urban & Rural) in the 10 km radius of the Bailadila Iron Ore Deposit-4 mine has been assessed by Secondary data collection from statistical records (Census 2011) and validated by questionnaire survey & group discussion results of Primary survey.

Objectives of the study

The proposed project will impact the social and economic conditions of the people of the region in terms of direct and indirect employment, skill diversification, infrastructure development, business development etc. On this background, the present study is directed towards the following objectives:

i) To assess the present demographic profile of the study area;
ii) To assess the impact of the project on pattern of demand;
iii) To examine the impact of the project on consumption pattern;
iv) To examine the employment and income effects of the project;
v) Assessment of the educational status of the people and to explore the impact of the project on education;

vi) To ascertain the impact of the project on industrialization in the study area;
vii) To examine the impact of the project on community development activities;
viii) To analyze peoples' perception regarding impact of the project;

Primary data was collected through discussions at selected villages for identifying the needs of the village.

Methodology Adopted for the Study

The methodology adopted for the study is based on the following process:

Review of Secondary Data

Baseline data on Socio-economic parameters were generated using information available with Government agencies, census data etc. Data from the secondary sources, viz. the latest available District Statistical Handbook, 2011 Census data and various census updates based on the 2011 census, were explored / reviewed for getting the demographic profile, viz., number of households, population, social composition, literacy and occupational structure, etc. of the population within the study area (10 km radius) of the project site.

The secondary data was used to supplement the primary data collected through limited field survey.

Exiting Socio-Economic Scenario

The information on socio-economic aspects of the study area as defined in this Chapter has been compiled from secondary sources, which include various public offices. The sociological aspects of this study include human settlements, demography, social, such as Scheduled castes and Scheduled Tribes and literacy levels besides infrastructure facility available in the study area. The economic aspects include occupational structure of workers. The salient features of the demographic and socio-economic details are presented in the following sections.

The house hold & population of the study area (10 Km) in three different distance range 0-3 km, 3km-7 km & 7-10 are given below in **Table – 3.14**).

TABLE-3.14

VILLAGES IN THE STUDY AREA

Sr. No.	Village Name	House Holds	Population	Sr. No.	Village Name	House Holds	Population
0-3 km				19	Padhapur	99	406
1	Bade Bacheli	5398	21435	**Sub Total**		**6935**	**29129**
2	Bhansi	347	1365	***7-10 km***			
3	Porokameli	45	200	**Sub Total**		118	404
4	Kirandul	44	180	20	Manjhiguda	224	969
5	Bhatpada	38	193	21	Kadampal	148	557
Sub Total		**5872**	**23373**	22	Kamaloor	247	1210
3-7 km				23	Kodripal	513	2048
6	Belnar	224	1085	24	Masenar	406	1619
7	Markapal	48	204	25	Molasnar	78	321
8	Porewada	10	34	26	Pinabacheli	13	54
9	Bainpal	150	709	27	Timmenar	118	404
10	Basanpur	53	226	**Sub Total**		**1747**	**7182**
11	Dhurli	404	2068	**Grant total**		**14554**	**59684**
12	Gamawada	389	1574				
13	Hiroli	21	115				
14	Hiroli	178	802				
15	Jhirka	68	305				
16	Kirandul	4638	18887				
17	Kodenar	460	1843				

18	Nerli	193	871			

SOURCE: - CENSUS: 2011

Population, Household Size & Sex Ratio:

The total population of 27 villages is 59684 within 14554 Households in study area. Household size is 4.1. District base Population**,** Household Size & Sex Ratio of study area given in **Table 3.15.**

TABLE – 3.15

POPULATION, HOUSEHOLD SIZE & SEX RATIO

	Total (0 - 10 km)
Household	14554
Population	59684
Male Population	30314
Female Population	29370
Household Size	4.1
Sex Ratio	969

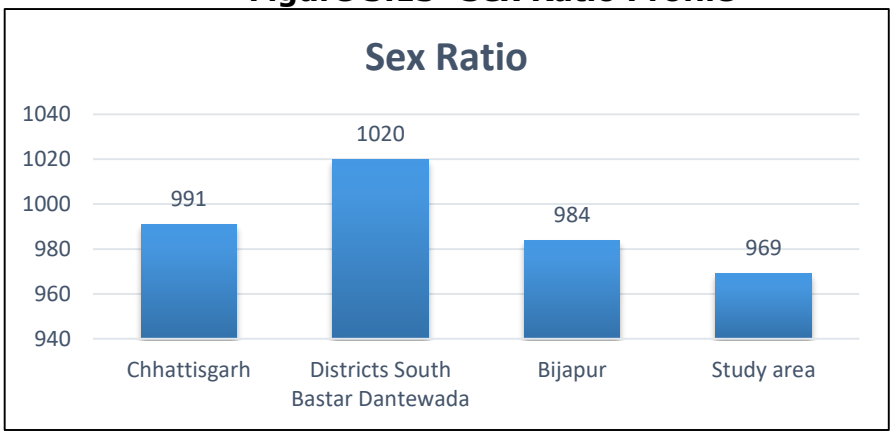
SOURCE: - CENSUS: 2011

Sex Ratio

The study area has an overall density of 189.97 people per km^2. The sex ratio i.e. No. of females per thousand males for the state Chhattisgarh and districts South Bastar Dantewada & Bijapur is 991 and 1020 & 984 respectively. The sex ratio in the study area is 969 as per census 2011. In comparison to the South Baster Dantewada district sex ratio in the study area is low.

The details are given in **Annexure – 3.4** Comparative Sex Ratio is given in below **Figure 3.13**

Figure 3.13- Sex Ratio Profile



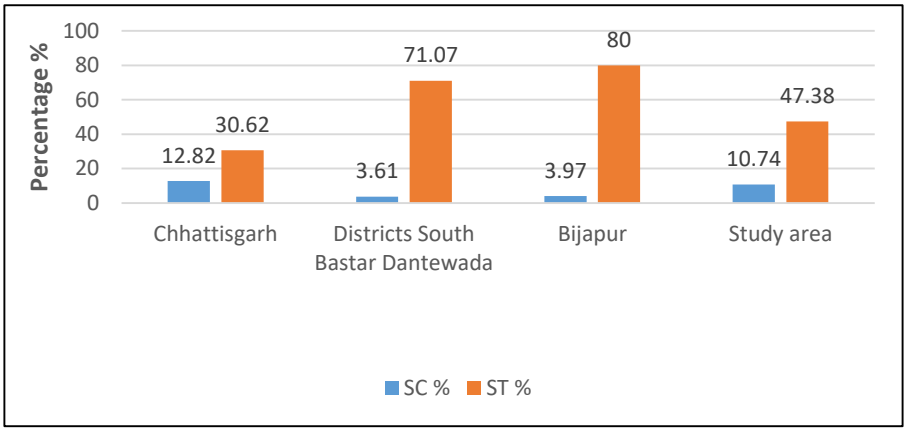
Source: - Census: 2011

Scheduled Caste (SC) & Scheduled Tribe (ST) Population

In the study area, as per 2011 census, 10.74% of the population is from Scheduled Castes (SC) and 47.38% comes from Scheduled Tribes (ST). Overall the data on social stratification reveals that the SC and ST population is more than 58.12%.

In comparison with study area proportion of SC population is less than the state average and ST population is more than state average (Chhattisgarh state average - SC 12.82% and ST 30.62%). Comparative analysis of SC & ST population is given below. The details of SC & ST population are given in **Annexure – 3.4.**

Figure - 3.14 Comparative Analysis of SC & ST Percentage

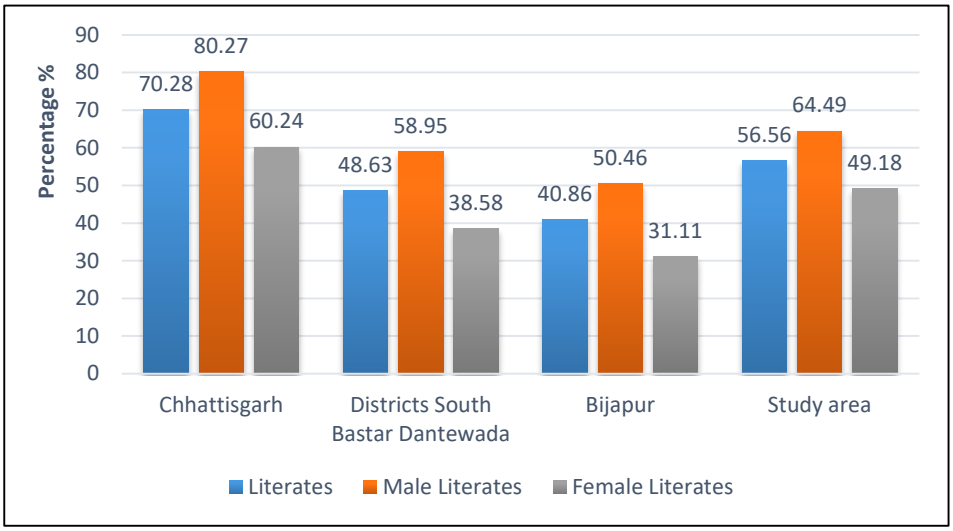


Source: - Census: 2011

Literacy

The data of study area reveals that literacy rate is 56.56% as per 2011 census, which is found to be more than South Baster Dantewada and Bijapur district's literacy rate (South Baster Dantewada district 48.63% and Bijapur district 40.86%). The distribution of literate and literacy rate in the study area is given in **Annexure – 3.4** The Literacy status of the study area is given in Comparative analysis of literacy level is given in below.

Figure – 3.15: Comparative Analysis of Literacy Level in the Study Area



Source: - Census: 2011

Economic Pattern and Livelihood

Total work participation in the study area is 43.45% and the non-workers constitute 56.55%. Work participation rate is less in study area as compared to the South Baster Dantewada district (51.12%) and Bijapur district (52.7%). The main workers to the total workers are 81.37% and the marginal workers constitute to 18.63% to the total workers.

Comparative Analysis of the Workforce in the Study Area

The employment pattern in the villages indicate that only 27.59 % work as cultivators, 10.68% as agricultural labourers, 61.01% as other workers and 0.68 % as household industry workers. Most of the villagers are agriculturists. The occupation status in the study area is given in **Annexure – 3.4**

Comparative Analysis of Economic Activity in the Study Area

The male workers account to 67.34% and female workers to 32.66% of the total working population.

TABLE - 3.16
WORK PARTICIPATION: MALE & FEMALE

Category	Study Area			
	Male		Female	
	No.	%	No.	%
Total Workers	17464	67.34	8470	32.66

Main Workers	15692	60.51	5410	20.86
Marginal Workers	1772	6.83	3060	11.79
Cultivators	3918	15.11	3236	12.48
Agricultural Laborers	821	3.16	1950	7.52
Household Workers	134	0.52	42	0.16
Other Workers	12591	48.55	3232	12.46

Source: - Census: 2011

Basic Amenities of Dantewada District

(i) Educational Facilities

Education is a very important determinant of socio-economic development of any area. Universal primary education is one of the essential development strategies of a developing country like India, which focuses mainly over raising the Net Enrolment Ratio (NER) in primary education. As per Government of India norms, the education facilities available should be as follows:

a. Availability of primary school within one kilometer of habitation,
b. Availability of middle school within 3 kilometer of habitation and
c. Availability of high school and secondary education within 5 kilometers of habitation

The district has 6 PG/UG College and 1014 schools in 2022 (https://dantewada.nic.in/). As per the Government of India norms, the education facilities in the district in general and in particular in the blocks falling in study area are less than adequate to fulfill the Government of India norms.

(ii) Health Care System

The health care facilities available in the district are given in **Table 3.17.**

TABLE 3.17

HEALTH CARE SYSTEM IN DANTEWADA DISTRICT

1	Community Health Centres	4
2	District Hospital	1
3	Primary Health Centres	13
4	Sub-Health Centres	76
5	Jeevan Deep Samitis	15
6	Mitanin	1372

https://dantewada.nic.in/en/departments/health/

Validation of Socio-Economic Scenario of study area by Primary survey
Primary Survey Methodology

Socio-economic survey was carried out covering the villages / towns of the study area to record awareness, opinion, apprehensions, quality of life and expectations of the local people about the proposed project. The opinion of local people about the proposed project was obtained through Socio-economic survey of the villages /towns in the study area.

A brief about the sampling design adopted for the field survey is described below. The survey has been conducted through specially designed questionnaire covering the main aspect of the present study.

Sampling Design

For selection of respondents from the study area, Two Stage Random Sampling has been adopted. In the first stage, villages are selected and in the second stage, households/respondents are selected. From each selected village, the respondents are selected randomly to account intra-village variability among the respondents for the character under study. As the variability of the characters in each study strata do not vary widely among the households, a smaller sample size is expected to represent the population.

Primary survey was conducted during March to May 2022 and primary data was collected based on specifically designed questionnaire and focused group discussion. Samples of about 15 respondents from 8 villages were drawn from the study area which are Bade Bacheli, Porokameli, Kirandul, Kadampal, Nerli, Bhansi, Bhatpada & Kodenar.

Composition of the Questionnaire

Households / respondents were interviewed with the structured questionnaire specifically designed for this study keeping in view the objectives of the study. The questionnaire consists of following major sections:

Demographic profile of the households

a. Educational status
b. Health status
c. Employment (sources of employment)
d. Income (income from various sources)
e. Information on family budget
f. Consumption and saving
g. Availability of Basic amenities such as drinking water, electricity etc.
h. Respondents' perception about the project

Sex Ratio Considered by Primary survey:

The overall average sex ratio is 1001 females for every thousand male population. Most of the villages in the study area, female sex ratio is high with 1161 in Nerli,1148 in Porokameli, 1049 in Kadampal and least is 891 in Bhansi.

TABLE – 3.18

DISTRIBUTION OF TOTAL NUMBER OF HOUSEHOLDS AND POPULATION RESULTS OF PRIMARY SURVEY

S. No	Name of the village	Sex Ratio (for every 1000 males)
1	Bade Bacheli (M)	936
2	Porokameli	1148
3	Kirandul	932
4	Kadampal	1049
5	Nerli	1161
6	Bhansi	891
7	Bhatpada	892
8.	Kodenar	995

Source: **Primary survey**

Scheduled Caste and Scheduled Tribe Population in Primary survey:
Out of the 8 villages including Bade Bacheli, Kirandul, Bhansi and Kodenar in the study, most are Scheduled Tribe only. The following **Table – 3.19** gives clear picture of the total scheduled caste and scheduled tribe population in the study villages.

TABLE – 3.19
VILLAGE -WISE SCHEDULED CASTE AND SCHEDULED TRIBE POPULATION RESULTS OF PRIMARY SURVEY

Sl. No.	Name of the village	Total Scheduled Caste Population			Total Scheduled Tribe Population		
		Total	Male	Female	Total	Male	Female
1	Bade Bacheli	2770	1423	1347	7242	3537	3705
2	Porokameli	0	0	0	401	185	216
3	Kirandul	3001	1488	1513	4234	2154	2080
4	Kadampal	0	0	0	969	473	496
5	Nerli	0	0	0	763	351	412

6	Bhansi	26	14	12	895	464	431
7	Bhatpada	0	0	0	193	102	91
8	Kodenar	535	273	262	546	267	279
	Total	**3632**	**3198**	**3134**	**15243**	**7533**	7710

Source: **Primary survey**

Literacy Level study in Primary survey:

The literacy is one of the vital factors for human development. The higher village level literates find in Bade Bacheli (14587) followed by Kirandul and Kodenar.The following **Table-3.20** gives a clear picture of the total literate and illiterates resulted by primary survey.

TABLE-3.20
LITERACY LEVEL RESULTS OF PRIMARY SURVEY

S. No	Name of the Village	Total Literate			Total Illiterate		
		Total	Male	Female	Total	Male	Female
1	Bade Bacheli	14587	8373	6214	6848	2698	4150
2	Porokameli	72	51	21	334	138	196
3	Kirandul	13919	7813	6106	4968	1963	3005
4	Kadampal	595	337	258	374	136	238
5	Nerli	208	128	80	663	275	388
6	Bhansi	632	402	230	733	320	413
7	Bhatpada	86	55	31	107	47	60
8.	Kodenar	1239	688	551	604	236	368
	Total	**31338**	**17847**	**13491**	**14631**	**5813**	8818

Source: **Primary survey**

Total Working and Non-Working Force study in Primary survey:

The following **Table 3.21** gives a clear picture of the Working, non-working, workers and marginal workers.

TABLE- 3.21
DISTRIBUTION OF TOTAL WORK FORCE CONSIDERED RESULTS OF PRIMARY SURVEY

S. No.	Village	Total Workers			Total Non-Workers			Total Main Worker			Total Marg. Worker		
		T	M	F	T	M	F	T	M	F	T	M	F
1	Bade Bacheli	7906	6398	1508	13529	4673	8856	7180	5903	1277	726	495	231
2	Porokameli	240	111	129	166	78	88	225	104	121	15	7	8
3	Kirandul	7013	5624	1389	11874	4152	7722	6452	5259	1193	561	365	196
4	Kadampal	582	248	334	387	225	162	285	210	75	297	38	259
5	Nerli	397	208	189	474	195	279	396	207	189	1	1	0
6	Bhansi	683	390	293	682	332	350	551	376	175	132	14	118
7	Bhatpada	115	53	62	78	49	29	115	53	62	0	0	0
8	Kodenar	946	536	410	897	388	509	665	439	226	281	97	184
	Total	**17882**	**13568**	**4314**	**28087**	**10092**	**17995**	**15869**	**12551**	**3318**	**2013**	**1017**	**996**

Source: Census 2011, Govt. of Chhattisgarh

Village Wise Cultivators, Agricultural Laborers and Main Other Workers study in Primary survey

Higher % of Cultivators found in Bade bacheli, where as highest Agriculture laborers found in Nerli village. The major working population is engaged in cultivation, and agricultural activity, and household works only. The following **Table 3.22** gives an unambiguous picture of the livelihood (village wise) is presented below:

TABLE – 3.22

VILLAGE WISE CULTIVATORS, AGRICULTURAL LABORERS AND MAIN OTHER WORKERS - RESULTS OF PRIMARY SURVEY

SLNo	Village	Cultivators			Ag. Labourers			HH workers		
		Total	M	F	Total	M	F	Total	M	F
1	Bade Bacheli (M)	194	142	52	199	139	60	47	33	14
2	Porokameli	25	17	8	138	46	92	0	0	0
3	Kirandul	70	33	37	49	25	24	78	55	23
4	Kadampal	367	176	191	109	9	100	0	0	0
5	Nerli	0	0	0	294	142	152	3	3	0
6	Bhansi	490	254	236	44	20	24	10	6	4
7	Bhatpada	115	53	62	0	0	0	0	0	0
8	Kodenar	142	67	75	144	51	93	40	30	10
9	**Total**	**1403**	**742**	**661**	**977**	**432**	**545**	**178**	**127**	**51**

Source: Census 2011.Govt. of Chhattisgarh

Languages and Religion

Gondi, Halbi and Hindi are the prominent language spoken in this district.

Amenities

The study area is having all amenities which take care of day-to-day requirements. All the amenities available at study are mainly provided by NMDC Ltd. are meeting requirements of all the villages. The amenities available at study area are given below:

TABLE – 3.23

AMENITIES AT STUDY AREA

Schools /Colleges	Name of existing schools 1. KV School 2. DAV School 3. Prakash School 4. BIOP School

	5. State Govt School 6. Anganwadi 7. Arvind College 8. Polytechnic College
Banks	SBI, UCO, Gramin Bank
Hospital	NMDC Project Hospital, State Govt. Hospital
Post Office	5
Recreation /Sports Club	4
Parks	8
Bus Stop	2
Library	2
Railway Station	3

The main market is Bacheli, Kodenar and Kirandul. The Main marketing products are forest produce like Tamarind, Mohua, Paddy, Mango, Amla, Shekkakai, Vegetables, Lichi, Jackfruit, Honey etc.

Minor forest produces like leaves, fruits (Mhua & Imali), Datun, fire wood, Basta, Boda, Tikhur, Chati, Dhup, Chiraungi, Fish baskets, soop made from Bamboo are major earning source of villagers. 'Mahua' making is a common activity in the villages.

Imali fruits

Drying the Mahua fruit

Mahua fruit collection

NMDC has established a variety of local-level institutions, including self-help groups (SHGs), cluster-level associations of SHGs, user groups/village and development committees. The common diseases in the area are cough, cold, malaria and seasonal diseases. Covid-19 also affected the people.

Peoples's Perception about the Project

It is observed that 92% of them have identified creation of employment opportunity as the main advantage. People are hopeful of getting employment in the project and through other indirect employment opportunities. About 94% of the respondents are expecting improvement in business. About 84% of the respondents are of the view that the living standard of those employed will improve. About 78% of the respondents are of the view that the infrastructure facilities in the area will improve. Around 50% of the respondents feel water scarcity in the area. The major disadvantage is that about 30% of the respondents are showing concern to health due to environmental pollution.

Peoples' Perception on the Project

Perception	**No. of Respondents**	**Distribution (%)**
Advantages		
Employment opportunity	46	92
Business development	47	94
Improvement in Living Standards	42	84
Improvement in infrastructure	38	78
Dis-Advantages		
Water scarcity	25	50
Damage to health	15	30
Total Respondents	**50**	

Perceptions on Major Advantage:

i. Present project may generate more employment, directly and indirectly, and major portion of it may be provided to the local people.
ii. Development of business opportunity in the area.
iii. Improvement in living standard.

Perceptions on Major Disadvantage:

i. Water scarcity in the study area is expected to drawl of ground water by the project.
ii. Health damage due to pollution arising from the project.

Basic Needs of the People

People feel that the project has positive impact on their lives. The project will provide them employment and hope for better future. M/s. NMDC to some extents are addressing the issues of poverty, unemployment, and drinking water under its CSR policies in the nearby areas for meeting the social infrastructure demand and strengthen by this project.

It appears that the expectations and needs of the villagers are quite moderate. The people in the study require basic minimum amenities wherever they are not available and improving these facilities wherever these are inadequate

Basic issues which need to be addressed are related to the following:

a) Education & communication
b) Health care and enhancement of drinking water source.
c) Alternative livelihood and environmental protection
d) Infrastructure development including drainage
e) Financial inclusion through enhanced banking facilities
f) Enhancement of sports and cultural activities

Socio Economic Survey through questionnaire survey and Focused Group Discussion was carried out with the help of NMDC officials to collect information on Primary Data and Needs of villages. Photographs of the Focussed Group Discussions are shown in **Figure 3.16.**

Figure 3.16: Photographs of Primary Survey

	
Individual Interactions at Bhansi Village	**Group Discussion at Bhansi Village**

Conclusion

The primary & secondary socio-economic study gives a clear picture of its population, average household size, literacy rate and sex ratio etc. It was also found that a part of population was suffering from lack of earning source to run their day-to-day life. Their expectation is to earn some income for their sustainability on a long-term basis. The infrastructure and amenities available in the area denotes the economic wellbeing of the region. The study area as a whole possesses an average level of infrastructural facilities. This area lacks higher level of amenities like higher education, health, drinking water and communication network. In terms of education and health facilities, the area is less than moderate. However, NMDC is already

providing medical facilities but still more medical facilities are needed like maternity and child care center. Though the area is well connected with road transport and communication facilities still more frequent transportation service is required. The overall socio-economic status of the target population is average in terms of literacy, work participation rate etc.

3.7 Flora and Fauna

3.7.1 Background

Study of the biological environment is one of the most important aspects of EIA. The extent of natural forests and tree cover in Chhattisgarh is adequate and a total of 6,314x10^3 ha forests/tree cover area is recorded in the State from total Geographical area (13,519 x10^3 ha) which is about 45.7% of the total state's geographical area (FSI 2021). More than half (53.88%) of total Geographical area óf Dantewada district is covered with forest (FSI 2021). In which very dense forest area is 250.6x10^2 ha, moderately dense forest is 2325.8 x10^2 ha and open forest 1896.47 x10^2 ha.

Deposit-4 Mining Lease plan on SOI Topo sheet is enclosed as **Plate No-3.6**. DFO, Dantewada Forest Division vide Letter No. KTA/2466 dated 31/03/2022 **Annexure-3.5)** granted permission to M/s Ecomen Laboratories Pvt Ltd for carrying out ecological studies in the study area. The study of Flora & Fauna was undertaken by the EIA consultant during April 2022 in the study area. In the study area (10km radius) there is no National Park, Wildlife Sanctuary, Biosphere Reserve, or archeological site. Two reserve forests fall in study area. (i) Bijapur Reserve Forest (ii) Bailadila Researve Forest.

3.7.2 Bio-climatic Features of the Study area

The National Agricultural Research Project (NARP) delineated agroclimatic zones based on soil type, temperature, rainfall (agrometeorological characteristics) and geologic constraints. Chhattisgarh is divided into 3 agro-climatic zones, i.e C.G. Plains, Plateau, and and Northern Hills. Dantewada District falls under the Agro-climatic Zone, Bastar plateau zone[1]. The area falls under climatic region "Tropical Sawanna Climate (Aw)" as per Köppen classification system.

The district is classified in to Agro-climatic / Ecological Zone by different agencies as given in **Table 3.24.**

TABLE - 3.24

AGRO-CLIMATIC/AGRO-ECOLOGICAL CLASSIFICATION OF STUDY AREA IN DANTEWADA DISTRICT[2]

Agro Ecological Sub Region (ICAR)	Eastern (Chotanagpur) plateau and eastern ghats sub humid eco-region (12.1)
Agro-Climatic Zone (Planning Commission)	Eastern plateau and hill region (VII)
Agro Climatic Zone: National Agricultural Research Project (NARP)[2]	Bastar Plateau Zone

1 http://agriportal.cg.nic.in/agridept/AgriEn/Default.aspx

2 Source: Agriculture Contingency Plan for District: Dantewada. https://agricoop.nic.in/sites/default/files/CHH12-Dantewada%20draft%20plan-10.07.14.pdf.

Climatic Region (Koppen's)[3]	Tropical Sawanna Climate (Aw)
Bio-geographic Zone (Wildlife Institute of India)	6. Deccan Peninsula
Bio-geographic Province (Wildlife Institute of India)	6c Deccan Peninsula–Eastern Highlands

The Major crops of the district are minor millets, kulthi, urd, moong, maize, giniger and rice in kharif season and 97 % area under rainfed. The irrigation percent of the district is only 2.

3.7.3 Methodology

The study area taken for the study is 10 km radius with the Core Zone Boundary as center. The different methods adopted were as follows:

Scope

1. To assess the flora and fauna present in the Core (Deposit-4 mining lease area & Screening cum Beneficiation Plant under Infrastrucuture Lease) and Buffer zone (10 km radius of above areas).
2. To document flora and fauna species occurring in the core zone and buffer area
3. Check the occurence of species protected by specific legislation (Rare, endangered, critically endangered, endemic and vulnerable).
4. To identify designated location and features of ecological significance.

Activities undertaken during the study

The present study is based on field studies conducted during summer season (April to June 2022). The biotic environment is studied/investigated with respect to the following biotic components in the study area and at the project site

(i) Flora survey
- Tree, shrub, herb species etc. identification
- Diversity of species
- Analysis of Rare-Endangered-Threatened flora

(ii) Fauna survey
- Documentation of Avian, Reptilian, Mammal and other faunal diversity
- Observations by direct and indirect evidences (Direct evidence- Sighting and hearing, Indirect evidence- Pug marks, nests and other signs)
- Analysis of Scheduled species

(iii) Habitat/microhabitat diversity in the project zone and surrounding areas.

(iv) Photo of some species encountered during the study.

3 Koppen's classification for the World Climatic regions is totally based on the vegetation, as the effects of temperature and rainfall are directly evident and visible on it.

3.7.4 Survey Limitation

This study records the evidence of flora and fauna present during the site visit and field survey. It does not record any floral or faunal species that may appear during other times of the year, and as such, were not evident at the time of visit. The report represents ecological status of the area during the particular period of the study.

3.7.5 Approach of the study

To assess the ecological issues and document flora and fauna associated with the project, following tasks were undertaken:

1. Preliminary site visit
2. Desk Study
3. Core zone (mining lease area & Screening Cum Beneficiation Plant) and Buffer Zone Survey

3.7.6 Desk Study

The purpose of desk study is to identify habitats and species of local conservation value which may not have been present or apparent during the survey visit e.g. spring/monsoon periods. Desk study is also helpful in understanding the historical biodiversity and ecological status of the site. The desk study is carried out by literature survey and study of "Working Plan of Dantewada Forest Division 2007-18" in respect of ecology and biodiversity of the region. The information has been collected specific to the region and quoted in the report accordingly.

3.7.7 Habitat Survey

This survey involves collection of flora and fauna under various strategies which differed as per habit and habitat of concerned group of species.

3.7.8 Flora

Project area has been explored during the field visit and documented as checklist of floral diversity of core and buffer zone. Plants have systematically identified and listed in field area however, photograph of unidentified vegetation from all kinds of habitats and vegetations have been taken and followed standard herbarium techniques for identification (Jain & Rao 1977). Micro-floral study (Lower Plants) Pteridophytes have been studied. The correct nomenclature has been provided after consulting large number of recent literature and different websites like GRIN, IPNI, ILDIS, The Plant List, Wikipedia, Tropicos, etc. RET Category of flora and fauna has been confirmed by Red Data Book IUCN checklist and Wildlife Protection Act, 1972 status. The structure and composition of vegetation / forest cover was studied by using Phytosociological methods. In each quadrat, Plants with more than 30 cm CBH at breast height (1.37 m) have been considered as tree species and all individuals with circumference ≥ 30 cm CBH at breast height (1.37 m) have been counted and measured for basal area (BA) calculation.

Field surveys were undertaken to analyze and estimate diversity, density, dominance and frequency of different members of plant population. Observations were made in the forest area as well as in non-forest areas by laying plots and adopting quadrat method. The quadrat method includes preparation of square sample plots or units for quantitative analysis of vegetation. The sample plot method given by Clements (1898), EIA Hand Book (ch.7, pp.44) was followed.

Co-existence and competition both are affected directly by number of individuals in the community. Therefore, it is essential to know the quantitative structure of the community. To characterize the community as a whole, certain derived parameters are used i.e. Density, Frequency Basal cover and IVI.

The Simpson Diversity Index (Simpson 1949) and Shannon diversity index (Shannon & Wiener 1963) gives a clear picture of community structure in quantitative terms. To summarize the above, following parameters were used during Floristic diversity and Phytosociological assessment:

1. Density, Frequency, Basal Cover, IVI
2. Diversity Index
   a) Simpsons Index (D)
   b) Shannon diversity index

To evaluate the floral composition of the area the following method were used:

The size of the quadrat was selected by species area curve method. By this way, successively higher quadrat sizes are taken till the number of species encountered becomes constant. For present survey 10 m x 10 m plots were selected for the study. Therefore, plot quadrat of 10 x 10 m was laid at selected sample site in buffer zone. In each quadrat, all individuals with circumference ≥ 30 cm CBH at breast height (1.37 m) has been counted and measured for basal area (BA) calculation.

Frequency:

Frequency is the percentage of total quadrats containing at least one rooted individual of a given species.

$$\text{Frequency \%} = \frac{\text{Number of sampling unit in which a species occurred}}{\text{Total number of units studied}} \text{ x } 100$$

Density

Density is determined by the number of plants rooted within each quadrat. It is presented as individuals per ha in study.

$$\text{Density} = \frac{\text{Total number of individual}}{\text{Total number of quadrats studied}} \text{ x } 100$$

Shannon–Wiener Index (H') (Shannon & Wiener 1963) and Simpson's Index (C) (Simpson 1949) has been derived from the field data to observe the species composition and vegetation structure.

Dominance

Basal cover is taken as dominance citeria of a particular species in plant communities. Basal cover is determined as follows:

Dominance (Basal area) = πr^2 (r = diameter /2)

Importance Value Index

The importance value, or the importance percentage, gives an overall estimate of the influence of importance of a plant species in the community. Count by given formula

IVI= Relative frequency + Relative density + Relative dominance

Simpson's Diversity Index (Concentration of Dominance)

It considers, the number of species, the number of individuals of each species, and total number of individuals of all species

Simpson's Index (C) is calculated as follows:

$$C = \frac{\Sigma\, ni\,(ni-1)}{N\,(N-1)}$$

Where, C is the Simpson diversity index, ni is the number of individuals belonging to a species i, and i=1 to K. K is the total number of species N is the total number of individuals of all species.

Shannon-Wiener Index (Species Diversity)

This index represents the average degree of uncertainty in predicting to which particular species an individual chosen at random from a sample will belong to. This measure considers.

- The total number of individuals of all species.
- The number of individuals of every species.
- The proportion of individuals of each species in the total number of individuals of all species.

Shannon-Wiener Index (Shannon & Wiener 1963) is represented as follows:

$$H' = - \Sigma pi \log pi$$

Here, pi is the proportion of the total number of individuals that occur in the species i, i.e.(ni/N). ni is the number of individuals of a species i, and i = 1 to K. K is the

total number of species. N is the total number of individuals of all species in the sample. The value of Shannon-Wiener Index varies from 0 to log K.

3.7.9 Fauna and Avifauna

The assessment of wild fauna was made based on random sightings. For terrestrial and aquatic faunal study, we have identified birds, reptile, amphibians, fishes and animals by field guide. The secondary evidences were also recorded through calls, dung boles, scats, and spoors, rub signs, signs of debarking, drag mark etc. for identification of fauna. Bird field guides (eg. Grimmette et al. 2003) has been used for bird identification. For birds, actual counts at each sampling site were made, by walk through in a chosen one kilometer stretch of the site and the number of birds were directly counted and listed. Species list was prepared along with taxonomic position of each species.

3.8 Sampling Stations

Sampling Stations

Majority of the region and the study area falling in 10 km radius, consists of mining projects, allied and other commercial activities. Therefore, sampling locations were strategically selected to collect the maximum data on vegetation pattern, faunal diversity and habitat diversity. The details of sampling locations are given in the **Table 3.25** the sampling locations are shown in **Plate No-3.6.**

TABLE -3.25
SAMPLING LOCATIONS FOR ECOLOGICAL STUDIES

Sr. No.	Location	Location	GPS Coordinates	Direction
1	Core Zone (mining lease area)	Within ML	18^0 39’00.20” N $81^0$14’31.70” E	-
2	Core Zone (Screening Cum Beneficiation Plant	Screening Cum Beneficiation Plant	18^0 38’24.00” N $81^0$14’46.50” E	From ML- NE
3	Akash Nagar Forest area Bailadila RF	Buffer area of Mining Lease - MB	18^0 40’21.26” N $81^0$11’45.35” E	From ML- SSW; From Beneficiation: SW
4	Near Bhansi Station Forest area Bailadila RF	Common buffer area in Mine lease boundary and Beneficiation Plan- MBB	18^0 46’49.37” N $81^0$15’54.26”E	From ML-NE From Beneficiation: WWS

5	Gamewada Forest area	Buffer area of Beneficiation Plant-BB	18^0 48'51.75" N $81^0$18'49.78" E	From ML-NE Beneficiation: SE

Observations

Observations are made for all possible habitats and flora-fauna species in and around the 10 Km radius Deposite 4 Project (except micro-organisms). All possible landscape features within core zone have been covered. The observations recorded are site, time and season specific. However, the actual observation data was supported by data obtained from secondary sources i.e. reports, research papers, literature survey etc.

The Project being a mining project, the impact of the project can be multifold and therefore the ecological richness and sensitivity of the locations have been examined critically.

3.9 Habitat and Forest Type Diversity

The Dantewada district of Chhattisgarh lies on the Gondwana Biodiversity Zone, which mostly comprises of the Tropical Forests. As this area is full of terrains, much of the forest remains unexplored and it is highly probable that this area contains some of the undocumented species. The forest area in the buffer zone comes under Reserve Forest and mostly very dense/dense nature.

The vegetation occurring in the area belongs to Southern tropical dry deciduous forests (Class-5A) which intermingles with Class-5B (Northern tropical dry deciduous type) according to Champion and Seth Classification of forest types of India 1968. According to the classification of Legris and Pascal (1982) the area falls under Deciduous climax forests and this type of forests does not have the potentiality of secondary moist deciduous forests.

Results

A: Core Zone (Forest Ecology Data used for forest clearance report will be analysed and then finalized for core zone EB data)

Draft Core Zone Data As per our field survey

Due to consideration of integrated and interlinked project, Mining Lease Area and Screening cum Beneficiation Plant both have been considerd as core zone and studied in detail.

Mining Lease (Core zone I) of & Screening cum Beneficiation Plant (Core zone II)

The core zone I & II are studied for the following:

i. Vegetation present & their status

ii. Fauna and Avifauna present

3.10 Mining Lease (Core zone I)

Majority of the landscape in the Mining Lease area is characteristic of having dense forest with patches of degraded natural landscape. Mining lease area are dominated by *Terminalia tomentosa, Syzygium cumini, Acacia catechu, Cassia fistula.* Most of the herb and shrub species prevalent in the open spaces were weeds.

3.10.1 Quantitative & Qualitative characteristics of Flora diversity

Floristic study was undertaken to document diversity, density, dominennence and IVI of tree vegetation. Checklist of tree, shrub and herb species have been prepared. Quantitative sampling was done by using quadrat size of 10 X 10 m in each zone. Quadrats were laid randomly at various identified locations. For this purpose, studies in core zone of mining lease area, core zone in beneficiation plant have been considered in project core zone and primary data have been prepared by site visit. For buffer zone study primary and secondary both data were used for ecological purpose.

3.10.2 Quantitative Floristic diversity of Core Zone Mining area

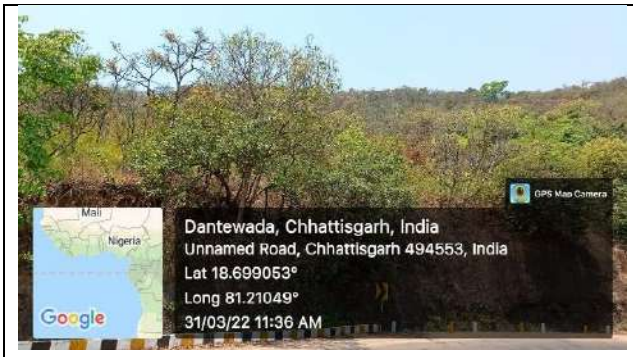
Total 23 tree species found. Tree density was 770 per ha and Total Basal Cover was 355.15 m^2 /ha. *Tectona Grandis* (29.96) was the most dominant species followed by *Anogeissus latifolia* (25.51), *Acacia catechu* (21.60), *Trema orientalis* (18.51), *Terminalia tomentosa* (18.34), etc. Value of Simpson index was 0.073 and Shannon diversity index value was 2.867. The ecological quantitative cherectristics details given in **Table 3.26**.

TABLE-3.26
FLORISTIC DIVERSITY OBSERVED IN (DEPOSIT 4 AREA BAILADILA RF)

SN	Species	Frequency	Density	Basal area(m2/ha)	IVI	Simpson index	Species Diversity
1	*Acacia catechu*	50	60	24.03	21.60		
2	*Adina cordifolia*	30	30	29.12	16.32		
3	*Albizzia odoratissima*	10	10	12.96	6.36		
4	*Anogeissus latifolia*	50	70	33.32	25.51		
5	*Bauhinia acuminate*	20	20	22.05	11.62		
6	*Bauhinia Malabarica*	10	10	2.94	3.54		
7	*Boswellia serrata*	20	20	15.38	9.74		
8	*Buchananla lanzan Spreng*	10	10	3.65	3.73		
9	*Cassia fistula*	40	40	15.23	15.12		
10	*Dillenia pentagyna*	30	30	7.69	10.29	0.073	2.867
11	*Diospyros melanoxylon*	20	20	10.13	8.27		
12	*Emblica officinales*	40	50	19.39	17.59		
13	*Lannea coromandelica*	30	30	23.12	14.63		
14	*Mallotus philippensis*	40	40	12.71	14.41		
15	*Mltragyna parvlflora*	20	20	14.68	9.55		

16	*Pterocarpus Marsupium*	40	70	3.89	15.82		
17	*Sleichera oliosa*	30	30	11.53	11.37		
18	*Syzizium cumini*	20	20	4.30	6.62		
19	*Tectona Grandis*	70	90	29.87	29.96		
20	*Terminalia bellerica*	20	20	1.85	5.94		
21	*Terminalia tomentosa*	70	60	2.44	18.34		
22	*Trema orientalis*	30	10	46.11	18.51		
23	*Zizyphus mauritiana*	10	10	8.78	5.18		
	Grand Total	**710**	**770**	**355.15**	**300.00**		

Floristic diversity observed in Core Zone area of Mining lease



Overview of Core zone Forest vegetation

Sampling during Core zone Forest vegetation

Figure 3.17: Pictorial view of Floristic diversity study in Core Zone of mining lease area

Quadrate Study in Core Zone area

3.10.3 Qualitative Floral Diversity in Core Zone of Mining Lease Area

Total 17 tree species, 1 climber, 8 shrubs and 20 herbs species were found in core zone area and are listed below in **Table 3.27**.

TABLE 3.27
PLANT CHECKLIST OF CORE ZONE OF MINING AREA

SN	Local Name	*Scientific Name*	Family	Habbit
1	Khair	*Acacia catechu*	Fabaceae	Tree
2	Gajar ghas	*Ageratum conyzoides*	Asteraceae	Herb
3	Satawar	*Asparagus racemosus*	Asparagaceae	Climber
4	Amata, Kachnar	*Bauhinia acuminata*	Fabaceae	Tree
5	-	*Botrychium daucifolium*	Ophioglossaceae	Herb
6	Madar	*Calotropis procera*	Apocynaceae	Shrub
7	-	*Capparis spinosa*	Capparaceae	Shrub
8	Amaltash	*Cassia fistula*	Fabaceae	Tree
9	-	*Cassia occidentalis*	Fabaceae	Herb
10	Chakod	*Cassia tora*	Fabaceae	Herb
11	Rattlepod	*Crotalaria sp.*	Fabaceae	Herb
12	Doob	*Cynodon dactylon*	Poaceae	Herb
13	-	*Cyperus rotundus*	Cyperaceae	Herb
14	-	*Desmodium triflorum*	Fabaceae	Herb
15	Tendu	*Diospyros melanoxylon*	Ebenaceae	Tree
16	-	*Euphorbia hirta*	Euphorbiaceae	Herb
17	-	*Evolvulus alsinoides*	Convolvulaceae	Herb
18	Duddhi	*Evolvulus nummularius*	Convolvulaceae	Herb
19	Kakai	*Flacourtia indica*	Flacourtiaceae	Shrub
20	Fetra	*Gardenia gummifera*	Rubiaceae	Shrub
21	Haldu	*Haldina cordifolia*	Rubiaceae	Tree
22	-	*Hemidesmus indicus*	Apocynaceae	Herb
23	-	*Ixora pavetta*	Rubiaceae	Tree
24	Lendia (Geja)	*Lagerstroemia parviflora*	Lythraceae	Tree
25	Lantana	*Lantana camara*	Verbenaceae	Shrub
26	Roli (Sinduri)	*Mallotus philipensis*	Euphorbiaceae	Tree
27	-	*Panicum repens*	Poaceae	Herb

28	-	*Parthenium hysterophorus*	Asteraceae	Herb
29	Chind, Khajoor	*Phoenix sylvestris*	Arecaceae	Tree
30	Anwla	*Phyllanthus emblica*	Phyllanthaceae	Tree
31	Karanj	*Pongamia pinnata*	Fabaceae	Tree
32	Beeja	*Pterocarpus Marsupium*	Fabaceae	Tree
33	-	*Ricinus communis*	Euphorbiaceae	Shrub
34	Kusum	*Schleichera oleosa*	Sapindaceae	Tree
35	-	*Sida cordata*	Malvaceae	Herb
36	-	*Sida cordifolia*	Malvaceae	Herb
37	-	*Sida cordifolia*	Malvaceae	Herb
38	-	*Solanum zylanicum*	Solanaceae	Herb
39	Jamun	*Syzygium cumini*	Myrtaceae	Tree
40	Teak	*Tectona Grandis*	Lamiaceae	Tree
41	-	*Terminalia tomentosa*	Combretaceae	Tree
42	-	*Trema orientale*	Urticaceae	Tree
43	-	*Triumfetta rhomboidea*	Malvaceae	Shrub
44	-	*Urena lobate*	Malvaceae	Herb
45	-	*Vernonia cinerea*	Compositae	Herb
46	-	*Woodfordia fruticosa*	Lythraceae	Shrub
Source: Primary source by field visit				

3.10.4 Faunal Diversity in Core Zone of Mining Area

The Core Zone is a dense forest landscape. Fauna checklist has been orepared by Primary survey (direct siting & indirect evidences) and secondary data survey with villagers. Based on primary source, the details of Fauna diversity observed in core zone is given in **Table 3.28.**

TABLE 3.28
FAUNA DIVERSITY IN CORE ZONE OF MINING LEASE AREA (PRIMARY SOURCE)

Sl. No.	Common Name / Local Name	Scientific Name	WPA (1972) Schedule	IUCN Status (Global)
Mammals				
1	Field Rat	*Bandicota bengalensis*	V	LC
2	Five striped squirrel	*Funambulus pennantii*	IV	LC
3	Indian Hare	*Lepus nigricollis*	IV	LC

Sl. No.	Common Name / Local Name	Scientific Name	WPA (1972) Schedule	IUCN Status (Global)
4	Indian Fox	*Vulpes bengalensis*	II	LC
5	Blue Bull (Nilgai)	*Boselaphus tragocamelus*	III	LC
Reptiles				
1.	Indian Rat Snake (Dhaman)	*Ptyas mucosa*	II	LC
2.	Common Krait	*Bungarus caeruleus*	IV	LC
Birds				
1.	Jungle Bush Quail	*Perdicula asiatica*	IV	LC
2.	Grey Quail	*Coturnix pectoralis*	IV	LC
3.	Baya weaver bird	*Ploceus philippinus*	IV	LC
4.	Fork-tailed Drengo	*Dicrurus adsimilis*	IV	LC
5.	Red vented bulbul	*Pycnonotus cafer*	IV	LC
6.	Common Pariah Kite	*Milvus migrans*	-	LC
7.	Small blue kingfisher	*Alcedo atthis*	IV	LC
8.	Indian Paradise flycatcher	*Terpsiphone paradisi*	-	LC
9.	Cattle Egret	*Bubulcus ibis*	IV	LC
10.	House sparrow	*Passer domesticus*	-	LC
11.	Cotton Pigmy Goose	*Nettapus coromandelianus*	IV	LC
12.	Common Hoppoe	*Upupa epops*	-	LC
13	White Bellied Wood Peeker	*Dryocopus Javensis*	IV	LC
14	Common Myna	*Acridotheres tristis*	IV	LC

EX	Extinct
EW	Extinct In The Wild
RE	Regionally Extinct (regional category)
CR	Critically Endangered
EN	Endangered
VU	Vulnerable
LR/cd	Lower Risk: Conservation Dependent
NT or LR/nt	Near Threatened
LC or LR/lc	Least Concern
DD	Data Deficient
NA	Not Applicable (regional category)

Source: Primary source (Based on Survey and Interaction with Local Villagers)

3.10.5 Screening Cum Beneficiation Plant (Core zone II)

Frequency, density, dominennence and IVI along with stand diversity indices are given for tree vegetation in **Table 3.29.**

The details of Quantitave floristic diversity observations in Beneficiation Plant core zone are given in **Table 3.29.** Total 20 tree species found in ecological study. Stem density was 1035 stem/ha and Total Basal Cover was 461.7 m^2/ha in Core zone. Tectona Grandis (30.8), *Anogeissus latifolia* (26.34) *Lannea coromandelica* (25.64) and were dominant species whereas, *Boswellia serrata* (25.14) & *Diospyros melanoxylon* (18.67) were codomenent species of core area. Value of Simpson index was 0.106 and Shannon diversity index value was 2.55.

TABLE-3.29
FLORISTIC DIVERSITY OBSERVED IN BENEFICIATION PLANT CORE ZONE

SN	Species	Frequency	Density (Stem/Ha)	Basal area(m^2/Ha)	IVI	Simpson index	Species Diversity
1	Acacia catechu	20	20	11.72	6.94		
2	Haldenia cordifolia	30	30	9.53	8.67		
3	Anogeissus latifolia	60	75	53.93	26.34		
4	Bauhinia acuminate	30	30	7.95	8.32		
5	Boswellia serrata	90	80	29.08	25.14		
6	Buchananla lanzan	50	50	22.78	15.94		
7	Cassia fistula	40	40	23.81	13.96		
8	Diospyros melanoxylon	30	80	33.41	18.67		
9	*Pterocarpus Marsupium*	30	50	22.56	13.42		
10	Phyllanthus emblica	10	10	3.41	2.94		
11	Ixora pavetta	20	50	21.96	12.06	0.106	2.55
12	Lannea coromandelica	60	80	48.47	25.64		
13	Mallotus philippensis	40	80	16.57	16.26		
14	Schleichera oleosa	20	20	4.28	5.33		
15	Syzygium cumini	20	30	12.03	7.97		
16	*Tectona Grandis*	90	90	47.45	30.08		
17	Terminalia tomentosa	50	60	25.01	17.39		
18	Terminalia bellirica	40	50	32.97	16.91		

19	Terminalia arjuna	40	60	21.84	15.47		
20	Ziziphus mauritiana	40	50	12.9	12.56		
Grand Total		**810**	**1035**	**461.7**	**300**		

Figure 3.18: Ecological Sampling at Screening cum Benification plant

Sampling during Core zone Forest vegetation

Sampling during Core zone Forest vegetation

Under story Vegetation of screening cum beneficiation plant core zone

Nearest location near screening cum beneficiation plant

3.10.6 Qualitative Floral Diversity in Core Zone of Screening cum Beneficiation Plant

Total flora species found in core zone area of Screening cum Beneficiation plant are given in **Table 3.30.**

TABLE-3.30
FLORISTIC DIVERSITY OBSERVED IN CORE ZONE OF SCREENING CUM BENEFICIATION PLANT

SN	Local Name	Scientific Name	Family	Habbit
1	Gulugunji	*Abrus precatorius*	Fabaceae	Climber
2	-	*Acacia caesia*	Fabaceae	Shrub
3	Khair	*Acacia catechu*	Fabaceae	Tree
4	Gajar ghas	*Ageratum conyzoides*	Asteraceae	Herb
5	Dhawda	*Anogeissus latifolia*	Combretaceae	Tree
6	-	*Aristida adscensionis*	Poaceae	Grass
7	Satawar	*Asparagus racemosus*	Asparagaceae	Climber
8	Amata, Kachnar	*Bauhinia acuminata*	Fabaceae	Tree
9	Amta	*Bauhinia malabarica*	Fabaceae	Tree
10	-	*Boaswellia serrate*	Burseraceae	Tree
11	-	*Bonnaya brachiata*	Linderniaceae	Herb
12	-	*Botrychium daucifolium*	Ophioglossaceae	Herb
13	Bogenbelia	*Bougainvillea sp.*	Nyctaginaceae	Shrub
14	Achar (Char)	*Buchanania lanzen*	Anacardiaceae	Tree
15	Amaltash	*Cassia fistula*	Fabaceae	Tree
16	Chakod	*Cassia tora*	Caesalpiniaceae	Herb
17	-	*Catesbaea spinosa*	Rubiaceae	Shrub
18	-	*Clerodendron serratum*	Verbenaceae	Shrub
19	Doob	*Cynodon dactylon*	Poaceae	Grass
20	-	*Cyperus rotundus*	Cyperaceae	Herb
21	-	*Dactyloctenium aegyptium*	Poaceae	Grass
22	-	*Digitaria sanguinalis*	Poaceae	Grass
23	Tendu	*Diospyros melanoxylon*	Ebenaceae	Tree
24	Bhurbhuci	*Eragrostis tenella*	Poaceae	Grass
25	-	*Euphorbia hirta*	Euphorbiaceae	Herb
26	-	*Evolvulus nummularius*	Convolvulaceae	Herb
27	Bar (Bargad)	*Ficus benghalensis*	Moraceae	Tree
28	Gular	*Ficus glomerata*	Moraceae	Tree
29	-	*Fimbristylis japonicum*	Cyperaceae	Herb
30	Kakai	*Flacourtia indica*	Flacourtiaceae	Tree
31	Fetra	*Gardenia gummifera*	Rubiaceae	Tree
32	Gamari (Siwan)	*Gmelina arborea*	Verbenaceae	Tree
33	Dhaman	*Grewia tiliaefolia*	Tiliaceae	Tree

34	-	*Gymnema sylvestre*	Apocynaceae	Climber Woody
35	Haldu	*Haldina cordifolia*	Rubiaceae	Tree
36	Anjan	*Hardwickia binata*	Fabaceae	Tree
37	-	*Ixora pavetta*	Rubiaceae	Tree
38	-	*Jatropha gossypifolia*	Euphorbiaceae	Shrub
39	Lendia (Geja)	*Lagerstroemia parviflora*	Lythraceae	Tree
40	Jhingan (Moyanm, Mode)	*Lannea coromandelica*	Anacardiaceae	Tree
41	Lantana	*Lantana camara*	Verbenaceae	Shrub
42	-	*Lygodium japonicum*	Lygodiaceae	Herb
43	-	*Mahonia sp.*	Berberidaceae	Shrub
44	Roli (Sinduri)	*Mallotus philipensis*	Euphorbiaceae	Tree
45	Kaim (Kalam, Mundi)	*Mitragyna parviflora*	Rubiaceae	Tree
46	Beeja	*Pterocarpus Marsupium*	Fabaceae	Tree
47	Chind, Khajoor	*Phoenix sylvestris*	Arecaceae	Tree
48	Anwla	*Phyllanthus emblica*	Phyllanthaceae	Tree
49	Kans (Padyar)	*Saccharum spontaneum*	Poaceae	Grass
50	Kusum	*Schleichera oleosa*	Sapindaceae	Tree
51	Ramdaton	*Smilax ovalifolia*	Smilacaceae	Climber
52	-	*Stephania hernandifolia*	Menispermaceae	Herb
53	Jamun	*Syzygium cumini*	Myrtaceae	Tree
54	Teak	*Tectona Grandis*	Lamiaceae	Tree
55	Arjun (Koha)	*Terminalia arjuna*	Combretaceae	Tree
56	Baheda	*Terminalia bellirica*	Combretaceae	Tree
57	-	*Terminalia tomentosa*	Combretaceae	Tree
58	Tun	*Toona ciliate*	Meliaceae	Tree
59	-	*Trema orientale*	Urticaceae	Tree
60	Ber	*Ziziphus mauritiana*	Rhamnaceae	Tree
Source: Primary Survey				

3.10.7 Faunal Diversity in Screening cum Beneficiation Plant Core Zone

Screening cum Benefication plant Core Zone is surrounded by dense forest landscape. This area is also poor in faunal diversity but Avifaunal diversity is rich due to dense forest. Possibility of bigger mammals is very low due to the cumulative disturbance caused by associated activities. Based on primary source and public

interviews, the details of Fauna diversity observed in Screening cum Benefication plant core zone is given in **Table 3.31.**

TABLE 3.31

FAUNA DIVERSITY CORE ZONE AREA OF SCREENING CUM BENEFICIATION PLANT (PRIMARY SOURCE)

Sl. No.	Common Name / Local Name	Scientific Name	WPA (1972) Schedule	IUCN Status (Global)
	Mammals			
1.	Field Rat	*Bandicota bengalensis*	V	LC
2.	Three striped squirrel	*Funambulus pennantii*	IV	LC
3.	Jangle Cat	*Felis chaus*	II	LC
4.	Indian Hare	*Lepus nigricollis*	IV	LC
5.	Indian Fox	*Vulpes bengalensis*	II	LC
	Reptiles			
1.	Cobra	*Naja naja*	II	LC
2.	Indian Rat Snake (Dhaman)	*Ptyas mucosus*	II	LC
3.	Common Krait	*Bungarus caeruleus*	IV	LC
	Birds			
1.	Jungle Bush Quail	*Perdicula asiatica*	IV	LC
2.	Grey Quail	*Coturnix pectoralis*	IV	LC
3.	Baya weaver bird	*Ploceus philippinus*	IV	LC
4.	Fork-tailed Drengo Racket-Tailed Drenge	*Dicrurus adsimilis*	IV	LC
5.	Red vented bulbul	*Pycnonotus cafer*	IV	LC
6.	Common pariah kite	*Milvus migrans*	-	LC
7.	Small blue kingfisher	*Alcedo atthis*	IV	LC
8.	Indian Paradise flycatcher	*Terpsiphone paradise*	-	LC
9.	Cattle Egret	*Bubulcus ibis*	IV	LC
10.	House sparrow	*Passer domesticus*	-	LC
11.	Cotton Pigmy Goose	*Nettapus coromandelianus*	IV	LC
12.	Yellow Footed Green Pigeion	*Treron phoenicopterus*	IV	LC
13.	Common Hoppoe	*Upupa epops*	-	LC
14.	Large Billed Crow (formerly as Jungle Crow)	*Corvus macrorhynchos*	-	LC
15.	Red Jungle Fowl	*Gallus gallus*	IV	LC

Sl. No.	Common Name / Local Name	Scientific Name	WPA (1972) Schedule	IUCN Status (Global)
16.	Blue rock Pigeon	*Columba livia*	-	LC
17.	Rufous woodpecker	*Micropternus brachyurus*	IV	LC
18.	Common Flame Back	*Dinopium javanense*	IV	LC
19.	White Bellied Wood Peeker	*Dryocopus Javensis*	IV	LC
20.	House crow	*Corvus splendens*	V	LC
21.	Koel (Cuckoos)	*Eudynamys scolopaceus*	IV	LC
22.	Common Myna	*Acridotheres tristis*	IV	LC
23.	Comb Duck	*Sarkidiornis melanotos*	IV	LC
24.	Indian Roller (Blue Jays)	*Coracias benghalensis*	IV	LC
25.	Blue Throated Barbet	*Psilopogon asiaticus*	-	LC
26.	Common Barn Owl	*Tyto alba*	-	LC
27.	Brown Fish Owl	*Ketupa zeylonensis*	IV-	LC

EX	Extinct
EW	Extinct in the Wild
RE	Regionally Extinct (regional category)
CR	Critically Endangered
EN	Endangered
VU	Vulnerable
LR/cd	Lower Risk: Conservation Dependent
NT or LR/nt	Near Threatened
LC or LR/lc	Least Concern
DD	Data Deficient
NA	Not Applicable (regional category)

Source: Primary source (Based on Survey and Interaction with Local Villagers)

B. Buffer zone

The study area (Buffer Zone) is studied for the following:

(i) Vegetation present & their status in Forest Area

(ii) Fauna and Avifauna present

(iii) Location of National Parks & Wildlife sanctuaries

(iv) Endangered Species

3.10.8 Buffer zone Quantitative study

The study area for Buffer zone is 10km radius of mining lease boundary and 10km radius of Screening cum Beneficiation Plant of Deposit-4 have been taken which covers Bailadila Reserve Forest and Bijapur Reserve Forest. Buffer zone is mostly covered with undulated hilly terrain within 180m-1200m altitude. More than half of the Buffer zone is within Bailadila RF and Bijapur RF. Three locations have been selected in 10 KM buffer area of Mine lease boundary and Screening Cum Beneficiation Plant both, which are (i) Akash Nagar forest area (Mining Lease Buffer-MB) (ii) Near Bhansi Station Forest area (Common buffer area in Mine lease boundary and Beneficiation Plant MBB) and (iii) Gamewada forest area (buffer area of Beneficiation Plant BB).

Divisional Forest Officer, Dantewada, there are no location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/Elephant Reserves (existing as well as proposed) within 10 km of the Mining Lease of Bailadila Deposit-4.

3.10.9 Quantitative Floristic diversity of Buffer Zone

The Project Buffer area is undulating, the hillocks and slopes are either denuded of vegetation or with trees most of which are natural or otherwise replanted by mono-cultures of Kusum, Siddha and Mango etc.

During the study, forest areas in the buffer region were visited and quadrats were laid at regular intervals to collect representative data of floral diversity of the region. There are sheer rocky cliffs, which are almost devoid of vegetation except small trees and shrubs growing in the cracks on the rock face found in some places of the study area. There are stretches of barren land whose vegetation comprises of grasses, herbs and small shrubs. There are also patches of land covered with dense thickets of Lantana with few widely distributed.

The entire 10 km buffer area falls within Bailadila Reserve Forest. The quantitative characteristics of various three studied areas are given below RF within buffer zone is given in Table.

SN	Location	Forest distance from Mining Lease (KM)	Direction from Mining Lease	Forest distance from Screening cum Beneficiation plant	Direction from Screening cum Beneficiation plant	GPS Coordinates
MB	Akash Nagar Forest area Bailadila RF	2.8	SSW	12.4	SW	18^0 40'21.26" N $81^0$11'45.35" E
MBB	Near Bhansi Station Forest area Bailadila RF	7.41	NE	0.9	WWS	18^0 46'49.37" N $81^0$15'54.26" E
BB	Gamewada Forest area	14	NE	7.2	SE	18^0 48'51.75" N $81^0$18'49.78" E

During the study, forest areas in the buffer region were visited and quadrats were laid at regular intervals to collect representative data of floral diversity of the region. There are sheer rocky cliffs, which are almost devoid of vegetation except small trees and shrubs growing in the cracks on the rock face found in some places of the study area. There are stretches of barren land whose vegetation comprises of grasses, herbs and small shrubs. There are also patches of land covered with dense thickets of Lantana with few widely distributed.

The entire 10 km buffer area falls within Bailadila Reserve Forest. The quantitative characteristics of various studied areas within buffer zone is given in below table.

Frequency, density, dominennence and IVI along with stand diversity indices are given for tree vegetation in following Table as given below.

3.10.10 Quantitative Floristic diversity of Buffer zone

(I) Akash Nagar Forest area

Total 11 tree species found in Buffer area of Mining lease (Akash Nagar Forest area-MB). Stem density was 1090 stem ha-1 and Total Basal Cover was 351.73 m^2 ha-1 in Buffer area of Mining lease. Terminalia tomentosa (62.77) was the most dominant species and Schleichera oleosa (33.20), Ixora pavetta (32.69) are co-domenent species of Buffer area of Mining lease. Value of Simpson index was 0.12 and Shannon diversity index value was 2.22. Frequency, density, dominennence and IVI along with stand diversity indices are given for tree vegetation in following **Table 3.32.**

TABLE-3.32

QUANTITATIVE FLORISTIC DIVERSITY OBSERVED IN CORE ZONE OF MINING AREA

SN	Species	Frequency	Density (stem/ ha)	Total Basal Cover (m^2/ha)	IVI	Simpson index	Species Diversity
1	*Acacia catechu*	20	40	20.61	13.304		
2	*Haldina cordifolia*	40	50	14.65	16.301		
3	*Bauhinia acuminata*	60	110	27.68	29.282		
4	*Cassia fistula*	60	60	17.50	21.8		
5	*Diospyros melanoxylon*	30	90	27.53	21.745		
6	*Phyllanthus emblica*	50	120	31.72	29.462		
7	*Ixora pavetta*	60	110	39.69	32.696		
8	Schleichera *oleosa*	50	140	38.42	33.202	**0.12**	**2.22**
9	*Syzygium cumini*	50	50	15.67	18.477		
10	*Terminalia tomentosa*	70	230	100.11	62.771		
11	*Trema orientale*	40	90	18.14	20.96		
	Grand Total	**530**	**1090**	**351.73**	**300**		

Near Bhansi Station Forest area Bailadila RF (MBB)

Total 17 tree species found in Gali Nala forest. Tree density was 660 per ha and Total Basal Cover was 351.50 m^2 ha-1. *Lannea coromandelica* (43.77), *Lagerstroemia parviflora* (24.32) & Albizia odoratissima (24.14) were the most dominant species followed by *Mallotus philippensis* (19.84), *Diospyros melanoxylon* (19.24), Syzygium cumini (18.87), etc. Value of Simpson index was 0.17 and Shannon diversity index value was 1.97. The ecological quantitative characteristics details given in **Table 3.33.**

TABLE-3.33
FLORISTIC DIVERSITY OBSERVED IN (NEAR BHANSI STATION FOREST AREA BAILADILA RF-MBB)

SN	Species	Frequency	Density	Basal area (m^2/ha)	IVI	Simpson index	Species Diversity
1	*Acacia catechu*	40	40	12.68	15.92		
2	*Haldina cordifolia*	20	20	16.78	10.93		
3	*Albizia odoratissima*	50	50	30.75	24.14		

4	*Anogeissus latifolia*	30	30	16.46	13.91		
5	*Cassia fistula*	40	40	20.40	18.12		
6	*Diospyros melanoxylon*	40	40	24.35	19.24		
7	*Ficus benghalensis*	30	30	21.37	15.31		
8	*Gmelina arborea*	20	20	4.23	7.36		
9	*Grewia tiliaefolia*	30	30	14.27	13.29	0.17	1.97
10	*Ixora pavetta*	40	40	7.71	14.51		
11	*Buchananla lanzan*	30	30	15.70	13.70		
12	*Lagerstroemia parviflora*	50	50	31.39	24.32		
13	*Mallotus philippensis*	50	50	15.64	19.84		
14	*Syzygium cumini*	40	40	23.06	18.87		
15	*Lannea coromandelica*	70	80	72.82	43.77		
16	*Terminalia arjun a*	30	30	15.02	13.51		
17	*Ziziphus mauritiana*	30	40	8.87	13.27		
	Grand Total	**640**	**660**	**351.50**	**300**		

Source: Primary Survey

(III) Gamewada Forest area (BB)

Total 14 tree species found in Gamewada Forest area. Tree density was 640 per ha and Total Basal Cover was 340.92 m^2 ha^{-1}. On the basis of IVI values, *Syzizium cumini* (32.00), *Madhuca latifolia (30.26), & Mallotus philiooensis (29.92)* were the most dominant species followed by *Diospyros melanoxylon (26.67), Cassia fistula (23.94) & Anogeissus latifolia (23.93)* etc. Value of Simpson index was 0.13 and Shannon diversity index value was 2.05. The ecological quantitative cherectristics details given in **Table 3.34.**

TABLE 3.34
FLORISTIC DIVERSITY OBSERVED IN
(NEAR GAMEWADA FOREST AREA-BB)

SN	Species	Frequency	Density	Basal area(m2/ha)	IVI	Simpson index	Species Diversity
1	*Haldina cordifolia*	20	20	18.78	12.48		
2	*Alblzzla lebbek*	40	50	24.22	22.61		
3	*Anogeissus latifolia*	50	50	22.16	23.93		
4	*Bauhinia Malabarica*	20	30	11.94	12.04		
5	*Cassia fistula*	50	50	22.21	23.94	0.13	2.05
6	*Diospyros melanoxylon*	40	70	27.40	26.67		

7	*Ficus bengalensis*	20	20	19.48	12.69		
8	*Ficus glomerata*	30	30	29.94	19.24		
9	*Lannea coromandelica*	40	40	21.39	20.22		
10	*Mallotus philippensis*	50	90	21.29	29.92		
11	*Madhuka Latifolia*	50	70	56.04	36.99		
12	*Syzizium cumini*	70	80	42.79	38.51		
14	*Terminalia tomentosa*	40	40	23.29	20.77		
	Grand Total	**520**	**640**	**340.92**	**300.00**		

Source: Primary Survey

Figure- 3.19: Pictorial view of Floristic diversity area of buffer zone

Quadrat Study in Akash Nagar Forest

Quadrat study in Gamewada Forest

Lannea & Legerstromia dominated forest in Buffer area

Identification & Listing of Herb/Shrub in Buffer area

3.10.11 Qualitative cherectristice of Floristic diversity observed in Buffer area

Total 93 tree species, 12 Climbers, 47 shrubs and 63 herbs, 9 Ferns and 24 grasss species found in buffer zone area and given in **Table 3.35.**

TABLE-3.35

FLORISTIC DIVERSITY OBSERVED IN BUFFER ZONE OF PROJECT AREA (BASED ON PRIMARY & SECONDRY DATA)

SN	Local Name	Scientific Name	Family	Habbit
1	Gulugunji	*Abrus precatorius*	Fabaceae	Climber
2	Khair	*Acacia catechu*	Fabaceae	Tree
3	Bili-jali	*Acacia leucophloea*	Mimosaceae	Tree
4	Kaadu-seege	*Acacia pennata*	Mimosaceae	Climber
5	Chirchira	*Achyranthes aspera*	Amaranthaceae	Herb
6	-	*Adiantum incisum*	Adiantaceae	Fern
7	-	*Adiantum philippense*	Adiantaceae	Fern
8	Bel	*Aegle marmelos*	Rutaceae	Tree
9	-	*Aerva lanata*	Amaranthaceae	Herb
10	Gajar ghas	*Ageratum conyzoides*	Asteraceae	Herb
11	Akol	*Alanzium salviifolium*	Cornaceae	Tree
12	Chichwa	*Albizia odoratissima*	Fabaceae	Tree
13	Siris Safed	*Albizia procera*	Fabaceae	Tree
14	Siris-Kala	*Albizzia lebbeck*	Fabaceae	Tree
15	-	*Alocasia macrorrhizos*	Araceae	Herb
16	Honagonne	*Alternanthera sessilis*	Amaranthaceae	Herb
17	-	*Alysicarpus monilifer*	Fabaceae	Herb
18	-	*Amaranthus spinosus*	Amaranthaceae	Herb
19	Nelaberu	*Andrographis paniculate*	Acanthaceae	Herb
20	-	*Angiopteris evecta*	Angiopteridaceae	Fern
21	Dhawda	*Anogeissus latifolia*	Combretaceae	Tree
22	Kadamb	*Anthocephalus cadamba*	Rubiaceae	Tree
23	-	*Antidesma acidum*	Phyllanthaceae	Tree
24	-	*Aristida adscensionis*	Poaceae	Grass
25	-	*Aristolochia indica*	Aristolochiaceae	Herb Creeper
26	Kathal	*Artocarpus heterophyllus*	Moraceae	Tree
27	Satawar	*Asparagus racemosus*	Asparagaceae	Climber
28	-	*Atylosia scarabaeoides*	Fabaceae	Shrub
29	-	*Atylosia sp.*	Fabaceae	Herb
30	Neem	*Azadirachta indica*	Meliaceae	Tree

31	Baans	*Bambusa arundinacea*	Poaceae	Grass Woody
32	-	*Barleria cristata*	Acanthaceae	Herb
33	-	*Barleria prionitis*	Acanthaceae	Herb
34	Amata, Kachnar	*Bauhinia acuminata*	Fabaceae	Tree
35	Amta	*Bauhinia malabarica*	Fabaceae	Tree
36	Kachnarbel	*Bauhinia vahlii*	Fabaceae	Climber
37	-	*Bidens sp.*	Ast*er*aceae	Herb
38	-	*Blechnum orientale*	Bluchnaceae	Fern
39	-	*Blumea sp.*	Asteraceae	Herb
40	Semal	*Bombax ceiba*	Malvaceae	Tree
41	-	*Bonnaya brachiata*	Linderniaceae	Herb
42	-	*Borassus flabellifer*	Arecaceae	Tree
43	Salai	*Boswellia serrata*	Burseraceae	Tree
44	-	*Botrychium daucifolium*	Ophioglossaceae	Herb
45	Bogenbelia	*Bougainvillea sp.*	Nyctaginaceae	Shrub
46	Kasai, Khaja	*Bridelia retusa*	Euphorbiaceae	Tree
47	Achar (Char)	*Buchanania lanzen*	Anacardiaceae	Tree
48	Muttuga	*Butea monosperma*	Fabaceae	Tree
49	-	*Butea superba*	Fabaceae	Shrub
50	-	*Caesalpinia bonduc*	Fabaceae	Shrub
51	Aak	*Calotropis gigantea*	Asclepiadaceae	Shrub
52	Madar	*Calotropis procera*	Apocynaceae	Shrub
53	-	*Capparis spinosa*	Capparaceae	Shrub
54	-	*Careya arborea*	Lecythidaceae	Tree
55	-	*Carissa spinarum*	Apocynaceae	Shrub
56	-	*Caryota urens*	Arecaceae	Tree
57	Girach	*Casearia vareca*	Salicaceae	Shrub
58	Amaltash	*Cassia fistula*	Fabaceae	Tree
59	-	*Cassia occidentalis*	Fabaceae	Herb
60	Chakod	*Cassia tora*	Caesalpiniaceae	Herb
61	-	*Catesbaea spinosa*	Rubiaceae	Shrub
62	Bhavamga	*Celastrus paniculatus*	Celastraceae	Shrub
63	Anne-soppu	*Celosia argentea*	Amaranthaceae	Herb
64	Bhirra	*Chloroxylon swietenia*	Rutaceae	Tree
65	-	*Christella dentata*	Thelypteridaceae	Fern
66	-	*Cleistanthus collinus*	Phyllanthaceae	Tree

67	-	*Clerodendron serratum*	Verbenaceae	Shrub
68	-	*Coccinia grandis*	Cucurbitaceae	Climber
69	-	*Cochlospermum religiosum*	Bixaceae	Tree
70	Peeparbel	*Combretum roxburghii*	Combretaceae	Climber
71	-	*Crinum asiaticum*	Amaryllidaceae	Herb
72	Rattlepod	*Crotalaria sp.*	Fabaceae	Herb
73		*Cryptolepis buchananii*	Periplocaceae	Climber
74	Nela-tengu	*Curculigo orchioides*	Hypoxidaceae	Herb
75	-	*Curcuma amada*	Zinziberaceae	Herb
76	-	*Curcuma aromatic*	Zingiberaceae	Herb
77	-	*Cuscuta reflexa*	Convolvulaceae	Herb
78	-	*Cymbopogon martini*	Poaceae	Herb
79	Doob	*Cynodon dactylon*	Poaceae	Grass
80	-	*Cyperus rotundus*	Cyperaceae	Herb
81	Tree Furn	*Cythea arborea*	Cyatheaceae	Tree
82	-	*Dactyloctenium aegyptium*	Poaceae	Grass
83	Dhobin	*Dalbergia paniculata*	Fabaceae	Tree
84	Sheesham	*Dalbergia sissoo*	Fabaceae	Tree
85	-	*Delonix regia*	Caesalpiniaceae	Tree
86	-	*Dendrocalamus strictus*	Poaceae	Grass Woody
87	-	*Dendrophthoe fulcata*	Loranthaceae	Herb
88	-	*Desmodium laxiflorum*	Fabaceae	Shrub
89	Kaadu pullampuras	*Desmodium triflorum*	Fabaceae	Herb
90	-	*Dicranopteris linearis*	Dicranopteridaceae	Fern
91	-	*Digitaria sanguinalis*	Poaceae	Grass
92	Kalla (Karmata)	*Dillenia pentagyna*	Dilleniaceae	Tree
93	-	*Dioscorea alata*	Dioscoreaceae	Herb
94	Baichandi	*Dioscorea bulbifera*	Dioscoreaceae	Climber
95	-	*Dioscorea floribunda*	Dioscoreaceae	Shrub
96	-	*Dioscoria alata*	Dioscoriaceae	Shrub
97	-	*Dioscoria belophylla*	Dioscoriaceae	Shrub
98	-	*Dioscoria pentaphylla*	Dioscoriaceae	Shrub
99	Tendu	*Diospyros melanoxylon*	Ebenaceae	Tree
100	-	*Dryopteris sp.*	Dryopteridaceae	Fern

101	-	*Eclipta prostrata*	Asteraceae	Herb
102	-	*Elephantopus scaber*	Asteraceae	Herb
103	Mandia	*Eleusine coracana*	Poaceae	Grass
104	-	*Eleusine indica*	Poaceae	Grass
105	-	*Embelia robusta*	Primulaceae	Shrub
106	Bhurbhuci	*Eragrostis tenella*	Poaceae	Grass
107	-	*Eragrostis unioloides*	Poaceae	Grass
108	-	*Eranthemum pulchellum*	Acanthaceae	Shrub
109	-	*Eucalyptus spp*	Myrtaceae	Tree
110	Bagai, Sabai	*Eulaliopsis binata*	Poaceae	Grass
111	-	*Euphorbia hirta*	Euphorbiaceae	Herb
112	-	*Euphorbia microphylla*	Euphorbiaceae	Herb
113	-	*Evolvulus alsinoides*	Convolvulaceae	Herb
114	-	*Evolvulus nummularius*	Convolvulaceae	Herb
115	Bar (Bargad)	*Ficus benghalensis*	Moraceae	Tree
116	Gular	*Ficus glomerata*	Moraceae	Tree
117	Kath Gular	*Ficus hispida*	Moraceae	Tree
118	Peepal	*Ficus religiosa*	Moraceae	Tree
119	-	*Fimbristylis japonicum*	Cyperaceae	Herb
120	Kakai	*Flacourtia indica*	Flacourtiaceae	Tree
121		*Flemingia strobilifera*	Fabaceae	Herb
122	Fetra	*Gardenia gummifera*	Rubiaceae	Tree
123	Papara	*Gardenia latifolia*	Rubiaceae	Tree
124	Phetra-Safed	*Gardenia turgida*	Rubiaceae	Tree
125	Kekad	*Garuga pinnata*	Burseraceae	Tree
126	Gamari (Siwan)	*Gmelina arborea*	Verbenaceae	Tree
127	Gudsukari	*Grewia hirsuta*	Tiliaceae	Shrub
128	Dhaman	*Grewia tiliaefolia*	Tiliaceae	Tree
129	-	*Gymnema sylvestre*	Apocynaceae	Climber Woody
130	-	*Habenaria diphylla*	Orchidaceae	Herb
131	Haldu	*Haldina cordifolia*	Rubiaceae	Tree
132	Anjan	*Hardwickia binata*	Fabaceae	Tree
133	-	*Helicteres isora*	Sterculiaceae	Shrub
134	-	*Hemidesmus indicus*	Apocynaceae	Herb Creeper

135	Kushal, Lampa	*Heteropogon contortus*	Poaceae	Grass
136	Banbhendi	*Hibiscus ficulneus*	Malvaceae	Shrub
137	Duddhi	*Holarrhena antidysenterica*	Apocynaceae	Tree
138	Dhimarbel	*Ichnocarpus frutescens*	Apocynaceae	Climber
139	Chhir (Dab)	*Imperata cylindrica*	Poaceae	Grass
140	-	*Indigofera cassioides*	Fabaceae	Shrub
141	Ghirol	*Indigofera pulchella*	Fabaceae	Herb
142	-	*Indigofera tinctoria*	Fabaceae	Shrub
143	-	*Ionidium suffruticosum*	Violaceae	Herb
144	Behaya	*Ipomoea crassipes*	Convolvulaceae	Shrub
145	-	*Ixora pavetta*	Rubiaceae	Tree
146	-	*Jatropha gossypifolia*	Euphorbiaceae	Shrub
147	Kanghi	*Kydia calycina*	Malvaceae	Tree
148	Lendia (Geja)	*Lagerstroemia parviflora*	Lythraceae	Tree
149	Jhingan (Moyanm, Mode)	*Lannea coromandelica*	Anacardiaceae	Tree
150	Lantana	*Lantana camara*	Verbenaceae	Shrub
151	-	*Leea macrophylla*	Vitaceae	Shrub
152	-	*Leea sp.*	Vitaceae	Herb
153	-	*Lygodium flexuosum*	Lygodiaceae	Fern
154	-	*Lygodium japonicum*	Lygodiaceae	Herb
155	-	*Lygodium sp.*	Lygodiaceae	Shrub
156	Mahua	*Madhuca longifolia*	Sapotaceae	Tree
157	-	*Mahonia sp.*	Berberidaceae	Shrub
158	Roli (Sinduri)	*Mallotus philipensis*	Euphorbiaceae	Tree
159	Aam	*Mangifera indica*	Anacardiaceae	Tree
160	-	*Melastoma malabathricum*	Melastomataceae	Shrub
161	-	*Memecylon umbellatum*	Melastomataceae	Tree
162	-	*Meyna spinosa*	Rubiaceae	Shrub
163	Badi Kari	*Miliusa tomentosa*	Annonaceae	Tree
164	Choti Kari	*Miliusa velutina*	Annonaceae	Tree
165	Chuimui	*Mimosa pudica*	Fabaceae	Herb
166	Kaim (Kalam, Mundi)	*Mitragyna parviflora*	Rubiaceae	Tree

167	Fadu kumbala	*Morinda tinctoria*	Rubiaceae	Tree
168	-	*Mucuna pruriens*	Fabaceae	Herb
169	-	*Nephrolepis exaltata*	Nephrolepidaceae	Fern
170	Harsingar	*Nyctanthus arbor-tristis*	Nyctanthaceae	Tree
171	Nai-thulasi	*Ocimum americanum*	Lamiaceae	Herb
172	Dhaura	*Ougeinia oogeinensis*	Fabaceae	Tree
173	-	*Oxytenanthera abyssinica*	Poaceae	Grass
174	-	*Panicum repens*	Poaceae	Grass
175	Kosra (Kutaki)	*Panicum sumatrense*	Poaceae	Grass
176	-	*Parthenium hysterophorus*	Asteraceae	Herb
177	-	*Paspalidium flavidum*	Poaceae	Grass
178	Kondon	*Paspalum scrobiculatum*	Poaceae	Grass
179	-	*Pennisetum glauca*	Poaceae	Grass
180	-	*Pennisetum sp.*	Poaceae	Grass
181	-	*Perotis indica*	Poaceae	Grass
182	Indrjata	*Petalidium barlerioides*	Acanthaceae	Shrub
183	Chind	*Phoenix acaulis*	Arecaceae	Shrub
184	Chind, Khajoor	*Phoenix sylvestris*	Arecaceae	Tree
185	-	*Phragmites karka*	Poaceae	Grass
186	-	*Phyllanthus amarus*	Euphorbiaceae	Herb
187	Anwla	*Phyllanthus emblica*	Phyllanthaceae	Tree
188	-	*Phyllanthus niruri*	Phyllanthaceae	Herb
189	Ashok	*Polyalthia cerasoides*	Annonaceae	Tree
190	Karanj	*Pongamia pinnata*	Fabaceae	Tree
191	Honne	*Pterocarpus marsupium*	Fabaceae	Tree
192	-	*Randia uliginosa*	Rubiaceae	Tree
193	Arand	*Ricinus communis*	Euphorbiaceae	Shrub
194	-	*Rivea hypocrateriformis*	Convolvulaceae	Climber woody
195	-	*Rungia parviflora*	Acanthaceae	Herb
196	Kans (Padyar)	*Saccharum spontaneum*	Poaceae	Grass
197	-	*Saccopetalum tomentosum*	Annonaceae	Tree
198	Kusum	*Schleichera oleosa*	Sapindaceae	Tree

199	-	*Schrebera swietenioides*	Oleaceae	Tree
200	-	*Scoparia dulcis*	Plantaginaceae	Herb
201	Bhilma (Bhilwa)	*Semecarpus anacardium*	Anacardiaceae	Tree
202	Kari Indu	*Senegalia caesia*	Fabaceae	Tree
203	Sarai (Sal)	*Shorea robusta*		Tree
204	-	*Sida cordata*	Malvaceae	Herb
205	-	*Sida cordifolia*	Malvaceae	Herb
206	-	*Sida rhombifolia*	Malvaceae	Herb
207	Ramdaton	*Smilax ovalifolia*	Smilacaceae	Climber
208	-	*Solanum verbascifolium*	Solanaceae	Tree
209	-	*Solanum zeylanicum*	Solanaceae	Herb
210	Some	*Soymida febrifuga*	Meliaceae	Tree
211	-	*Spermacoce hispida*	Rubiaceae	Herb
212	-	*Spondias mangifera*	Anacardiaceae	Tree
213	-	*Stephania hernandiifolia*	Menispermaceae	Herb
214	-	*Stephania sp.*	Menispermaceae	Shrub
215	Kullu	*Sterculia urens*	Malvaceae	Tree
216	Papad (Bada)	*Stereospermum personatum*	Bignoniaceae	Tree
217	Papad (Chota)	*Stereospermum suaveolens*	Bignoniaceae	Tree
218	-	*Streblus asper*	Moraceae	Shrub
219	-	*Strychnos nux-vomica*	Loganiaceae	Tree
220	Chirayata	*Swertia angustifolia*	Gentianaceae	Shrub
221	Jamun	*Syzygium cumini*	Myrtaceae	Tree
222	Imali	*Tamarindus indica*	Fabaceae	Tree
223	Sagon	*Tectona grandis*	Lamiaceae	Tree
224	-	*Tephrosia purpurea*	Fabaceae	Shrub
225	Arjun (Koha)	*Terminalia arjuna*	Combretaceae	Tree
226	Baheda	*Terminalia bellirica*	Combretaceae	Tree
227	Alale, Harda	*Terminalia chebula*	Combretaceae	Tree
228	Saja (Ain, Adan)	*Terminalia elliptica*	Combretaceae	Tree
229	-	*Terminalia tomentosa*	Combretaceae	Tree
230		*Thespesia lampas*	Malvaceae	Shrub
231	Fhul Bahari	*Thysanolaena latifolia*	Poaceae	Grass
232	Tun	*Toona ciliate*	Meliaceae	Tree

233	-	*Trema orientale*	Urticaceae	Tree
234	-	*Trichosanthes sp.*	Cucurbitaceae	Herb
235	-	*Tridax procumbens*	Compositae	Herb
236	-	*Triumfetta rhomboidea*	Malvaceae	Shrub
237	-	*Urena lobata*	Malvaceae	Herb
238	-	*Ventilago denticulata*	Rhamnaceae	Shrub
239	-	*Vernonia cinerea*	Compositae	Herb
240	-	*Vetiveria zizanioides*	Poaceae	Herb
241	Badanike	*Viscum articulatum*	Santalaceae	Shrub
242	-	*Vitex negundo*	Lamiaceae	Shrub
243	-	*Woodfordia fruticosa*	Lythraceae	Shrub
244	Hale, Halegouri	*Wrightia tinctoria*	Apocynaceae	Tree
245	-	*Xylia xylocarpa*	Fabaceae	Tree
246	Ber	*Ziziphus mauritiana*	Rhamnaceae	Tree
247	-	*Ziziphus oenopolia*	Rhamnaceae	Shrub
248	-	*Ziziphus rugosa*	Rhamnaceae	Shrub
249	-	*Zornia diphylla*	Fabaceae	Herb
Source: *Primary & Secondry Survey*				

The shrub and herb diversity are dominated by weeds. The floristic diversity observed in the area is shown in the following **Figures 3.20, 3.21 & 3.22.**

Figure-3.20: Pictures of some dominating tree species of study area

	
Tamarindus indica	*Bombax ceiba*

	
Spondias mangifera	*Acacia catechu*
	
Morinda tinctoria	*Cassia fistula*
	
Mallotus phillippensis	*Diospyros melanoxylon*
	

Artocarpus Heterophyllus	*Madhuca longifolia*
	
Ficus hispida	*Phyllanthus emblica*
	
Trema orientale	*Hardwickia binata*
	
Syzygium cumini	*Albizzia lebbeck*

Figure-3.21: Photographs of some dominating shrub species of study area

	
Melastoma malabathricum	*Lantana camara*
	
Woodfordia fruticosa	*Bougainvillea* sp.

Figure-3.22: Pictures of some dominating herb species of study area

	
Mimosa pudica	*Ageratum conyzoides*

Flemingia strobilifera

Crotalaria sp.

Fern area Vegetatipon

3.10.12 Faunal Diversity in Buffer Zone

Based on primary source and secondry data sources, the details of Fauna diversity observed in buffer zone is given in **Table-3.36**. Pictures of common fauna species are given in **Figures 3.23** & **3.24**.

TABLE 3.36
FAUNA DIVERSITY IN BUFFER ZONE (BASED ON PRIMARY & SECONDRY DATA SOURCE)

Sl. No.	Common Name / Local Name	Scientific Name	WPA (1972) Schedule	IUCN Status (Global)
Mammals				
1.	Rhesus Macaque (Red)	*Macaca mulatta*	II	LC
2.	Common Langur (Grey Langur)	*Semnopithecus entellus*	II	LC
3.	Sloth Bear	*Melursus ursinus*	I	VU
4.	Spotted Deer (Cheetal)	*Axis axis*	III	LC
5.	Grey Musk Shrew	*Suncus murinus*	-	LC
6.	Field Rat	*Bandicota bengalensis*	V	LV
7.	Five striped squirrel	*Funambulus pennantii*	IV	LC
8.	Indian Pangolin	*Manis crassicaudata*	I	EN
9.	Indian Giant Flying Squirrel	*Petaurista philippensis*	II	LC
10.	Jangle Cat	*Felis chaus*	II	LC
11.	Indian Hare	*Lepus nigricollis*	IV	LC
12.	Jackal	*Canis aureus*	II	LC
13.	Barking Deer	*Muntiacus muntjak*	III	LC
14.	Indian Fox	*Vulpes bengalensis*	II	LC
15.	Common Mongoose	*Urva edwardsii*	II	LC
16.	Blue Bull (Nilgai)	*Boselaphus tragocamelus*	III	LC
17.	Indian Porcupine	*Hystrix indica*	IV	LC
18.	Sambar Deer	*Rusa unicolor*	III	VU
19.	Indian Wild Boar	*Sus scrofa*	III	LC
20	Panther	*Panthera pardus*	I	VU
Reptiles				
1.	Cobra	*Naja naja (Linnaeus)*	II	LC
2.	Python	*Python molurus*	I	NT
3.				

EX	Extinct

4.	Indian Rat Snake (Dhaman)	*Ptyas mucosus*	II	LC
5.	Viper	*Daboia russelii*	II	LC
6.	Common Krait	*Bungarus caeruleus*	IV	LC
8.	Water Snake (Checkered keelback Snake)	*Fowlea piscator*	II	LC
9.	Bengal Monitor Lizard	*Varanus bengalensis*	I	NT
	Birds			
1.	Jungle Bush Quail	*Perdicula asiatica*	IV	LC
2.	Grey Quail	*Coturnix pectoralis*	IV	LC
3.	Baya Weaver Bird	*Ploceus philippinus*	IV	LC
4.	Fork-tailed Drengo	*Dicrurus adsimilis*	IV	LC
5.	Red Vented Bulbul	*Pycnonotus cafer*	IV	LC
6.	Common Pariah Kite	*Milvus migrans*	-	LC
7.	Small Blue-king Fisher	*Alcedo atthis*	IV	LC
8.	Indian Paradise Flycatcher	*Terpsiphone paradise*	-	LC
9.	Cattle Egret	*Bulbulcus ibis*	IV	LC
10.	House sparrow	*Passer domesticus (Linnaeus)*	-	LC
11.	Eurasian Eagle Owl	*Bubo bubo*	IV	LC
12.	Cotton Pigmy Goose	*Nettapus coromandelianus*	IV	LC
13.	Yellow Footed Green Pigeion	*Treron phoenicopterus*	IV	LC
14.	Common Hoppoe	*Upupa epops*	-	LC
15.	Large Billed Crow (formerly as Jungle Crow)	*Corvus macrorhynchos*	-	LC
16.	Red Jungle Fowl	*Gallus gallus*	IV	LC
17.	Blue Rock Pigeon	*Columba livia (Gmelin)*		LC
18.	Bastar Hill Myna (Common Hill Myna)	*Gracula religiosa*	I	LC
19.	Rufous Woodpecker	*Micropternus brachyurus*	IV	LC
20.	Common Flame Back Woodpecker	*Dinopium Javanense*	IV	LC

EW	Extinct in the Wild

21.	White Bellied Wood Pecker	*Dryocopus javensis*	IV	LC
22.	House crow	*Corvus splendens*	V	LC
23.	Koel (Cuckoos)	*Eudynamys scolopaceus*	IV	LC
24.	Common Peafowl	*Pavo cristatus*	I	LC
25.	Common Myna	*Acridotheres tristis*	IV	LC
26.	Comb Duck	*Sarkidiornis melanotos*	IV	LC
27.	Indian Roller (Blue Jays)	*Coracias benghalensis*	IV	LC
28.	Blue Throated Barbet	*Psilopogon asiaticus*	-	LC
29.	Lesser Whistling Teal (Duck)	*Dendrocygna javanica*	IV	LC
30.	Painted Partridge (or Painted Francolin)	*Francolinus pictus*	IV	LC
31.	Grey Francolin (formerly Grey Partridge)	*Ortygornis pondicerianus*	IV	-
32.	Large Indian Parakeet	*Psittacula eupatria*	-	NT
33.	Common Barn Owl	*Tyto alba*	-	LC
34.	Brown fish Owl	*Ketupa zeylonensis*	IV	LC

RE	Regionally Extinct (regional category)
CR	Critically Endangered
EN	Endangered
VU	Vulnerable
LR/cd	Lower Risk: Conservation Dependent
NT or LR/nt	Near Threatened
LC or LR/lc	Least Concern
DD	Data Deficient
NA	Not Applicable (regional category)
Source: Primary source (Based on Survey and Interaction with Local Villagers)	

No schedule I species were directly sighted or any other evidence has been found for their presense in project core area during our primary survey. However, in secondry data gathered from working plan of Dantewada Forest Division plan the schedule I species already reported in study area are given in **Table 3.37**.

TABLE 3.37
SCHEDULE I SPECIES FOUND IN THE STUDY AREA

Sl. No.	Common Name / Local Name	Scientific Name	WPA (1972) Schedule	IUCN Status (Global)
Mammals				
1	Sloth Bear	*Melursus ursinus*	I	VU
2	Indian Pangolin	*Manis crassicaudata*	I	EN
3	Panther	*Panthera pardus*	I	VU
Reptiles				
1	Python	*Python molurus*	I	NT
2	Bengal Monitor Lizard	*Varanus bengalensis*	I	NT
Birds				
1	Bastar Hill Myna	*Gracula religiosa peninsularis* (Linnaeus)	I	LC
2	Common Peafowl	*Pavo cristatus* (Linnaeus)	I	LC

Figure 3.23: Mammals of study area

Macaca mulatta

Urva edwardsii (Syn. Herpestes edwardsii)

Figure 3.24: Avifouna of study area

	
Bulbulcus ibis	*Acridotheres tristis*
	
Pycnonotus cafer	*Dicrurus adsimilis*

3.10.13 Aquatic fauna:

Deposit-4 ML area is located at south-eastern ridge of Bailadila range trending N-S. The major natural sources of water are Galli nallah, Sankani Nallah and Bacheli nallah. Galli nallah joins Talperu River and Sankani Nallah & Bacheli nallah join Sankani River. Sankani river flows into Indravati River - a tributary of River Godavari. Gali nalla joins to Talperu River and finally drains into river Godavari. The Streams are perennial in nature which forms the potential source of water for the project use. The variety of aquatic fauna found in the region is given in **Table 3.38.**

TABLE -3.38
LIST OF AQUATIC FAUNA FOUND IN WATER BODIES

1.	Catla	*Catla catla*
2.	Chanda	*Chanda ranga*
3.	Magur	*Clarias batrachus*
4.	Singhi	*Heteropneustes fossilis*
5.	Rohu	*Labeo rohita*

6.	Cat Fish	*Wallago attu*
7.	Kotri	*Puntius sophore*

3.10.14 Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/Elephant Reserves (existing as well as proposed), if any, within 10 km of the mining lease and screening cum benefication plant

As per study conducted in the study area and as per information collected from Forest Range Office, Bacheli and Divisional Forest Officer, Dantewada, it is found that there are no National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/Elephant Reserves/(existing as well as proposed) within 10 km radius of the mining lease. The plans of Deposit-4 Mining Lease, screening cum beneficaiton plant and 10km radius thereof are showing no presence of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/Elephant Reserves/(existing as well as proposed). Rare, endangered or threatened species were not observed during the study in the study core area.

3.11 Land use

Land Use/ Land Cover mapping (using Remote Sensing & GIS):

Introduction

The land use/land cover information relates to the status, spatial distribution & area extent of different land cover/land use categories. Land cover and land use are terms that are often used interchangeably; however, they have different meanings. Land cover results from a complex mixture of natural and anthropogenic influences and is the composition and characteristics of land surface elements (Cihlar, 2000). In contrast, land use is characterized by economic uses of land and people's relationships with the environment (Avery and Berlin, 1992). For example, a land cover of forest, when considered as a land use, could be a park. To classify land use with satellite imagery often requires the use of supplementary information such as fieldwork. The land cover/ land use classification system is based on the methodology given in 'Manual of Nationwide land use/land cover mapping using Digital Techniques'.

Remote sensing is the science and art of obtaining information about an object, area or phenomena through the analysis of data acquired by a device that is not in contact with the object, area, or phenomena under investigation. The data analysis process involves examining the data using various image processing techniques by a digital computer. Its application in the field of environmental management is of great prominence. The inherently digital nature of remotely sensed data, supporting quantitative & statistical analysis of spectral measurement, led to rapid advancement in the field of digital techniques. With a view to facilitate utilization of this modern technology in the management of the resources, a chain of digital image processing steps has been carried for the land use/land cover mapping. The entire investigations have been carried out using ERADAS digital image processing software and Geographic Information System (ARC GIS).

3.11.1 Data Input

3.11.2 Satellite Data

LISS-IV composite band of visible and near infrared B2, B3 and B4 with spatial resolution of 5.8m of 18/04/2022 is used for the land use land cover study.

3.11.2.1 Collateral Data used

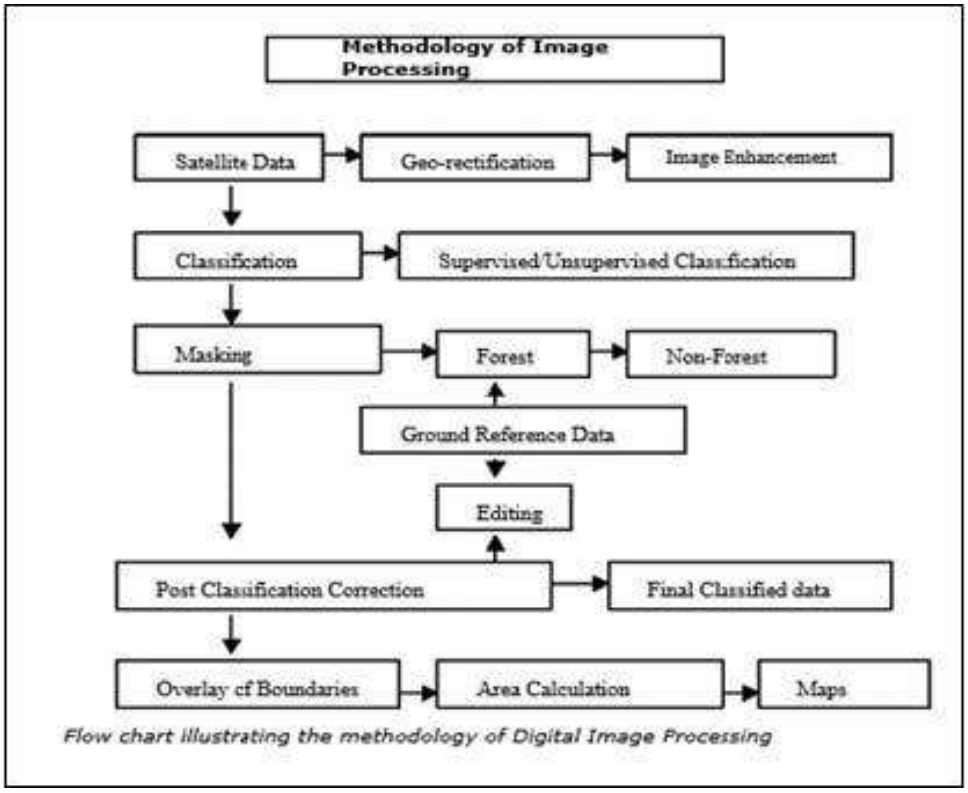
- Survey of India Topographical Map Ground
- Truth Information
- Other Collateral Information

3.11.2.2 Methodology

The research on remote sensing has been directed for several decades towards image processing & development of methods for digital map generation especially on land use/land cover. The primary aims were to produce thematic maps that could be quickly updated. However, maps obtained from digital automatic classification fails to fully satisfy the purpose for which it is generated. Therefore, digital

classification procedure has been used for generation of maps on land use/land cover from satellite data. The technique is based on stratified approach.The overall methodology for land use/land cover map generation is explained in the flowchart in **Figure 3.25**.

Figure 3.25: Methodology of Image Processing



Eradas Image Processing Software was used for digital processing of the spatial data. Digital image processing techniques were applied for the mapping of the land use/land cover classes of the provided area (in reference to mining lease and screening cum beneficiation plant) from the satellite data (Refer **Plate No. - 3.7 and Plate No. - 3.9**). The methodology applied comes under following steps:

3.11.2.3 Image Enhancement

Image enhancement is one of the important image processing functions primarily done to improve the appearance of the imagery to assist in visual interpretation and analysis. Various options of image enhancement techniques were tried out to get the best image for visual interpretation. Histogram equalized stretch enhancement techniques were applied to the imagery of the study area for better interpretation of different features in the satellite imagery.

The LISS-IV of 5.8m (**Plate No. - 3.8**) has been used for digital classification of land use categories (in reference to mining lease). The subset area of 10 km radius area has been stratified by generating forest mask from topographical map. In non-forest area, the un-supervised classification has been applied. In this particular type of

classification spectral classes are grouped first, based solely on the numerical information in the data, and are then matched by the analyst to information classes. Unsupervised classifiers do not utilize training sets as the basis for classification. Rather it involves algorithms called clustering algorithms, that examine the unknown pixels in an image and aggregate them into a number of classes based on the natural groupings or clusters present in the image values. The analyst specifies the desired number of classes. Thus, unlike supervised classification, it does not start with a pre-determined set of classes, however it is neither done completely without human intervention. The cultural features like roads, villages and forest boundaries have been drawn from the existing maps.

The land use classified through supervised classification of the area and the cultural features of roads, rail and village locations have been overlaid. The land use/ land cover map of the area has been extracted using 10 km radius mask and area statistics have been generated.

3.11.2.4 Results and Discussions

General Land use/ Land cover in consideration to mineing lease area

The land use/ land cover map has been generated on 1:50,000 scale using digital classification of LISS-IV. Based on the methodology developed for the present land use/ land cover, categories have been grouped under the following major land use/land cover categories.

TABLE 3.39
MAJOR LAND USE/LAND COVER CATEGORIES OF STUDY AREA

Sl. No	Category	Area in Ha	% of the Study Area
1	Dense Forest	13691.6	31.64
2	Mining Area	1841.7	4.26
3	Rocky/Barren Area	4237.76	9.79
4	Waterbodies	13.33	0.03
5	Streams	125.54	0.29
6	Fallow Land	4681.25	10.82
7	Land With Shrub	9588.16	22.16
8	Settlements	9088.83	21.01
	Total	**43268.17**	**100**

Dense Forest

Forest with canopy cover more than 60% is considered as dense forest. Location of dense forest within study area is shown in **Plate No. 3.8.** This represents the area under Dense Forest lands, about 13691.6 Ha or 31.64 % of the study area. The study area contains natural vegetation.

Mining Area

The total area falling in mining area in the study area is 1841.7 Ha which is 4.26 % of the study area.

Rocky/Barren Area

Based on satellite data, The Rocky and the Barren land are observed in the Western part of the study Area. These areas consist of hard formations and with less to none green cover. The total area falling within the water bodies are 4237.76 Ha which is about 9.79 % of the total study area.

Water Bodies

Based on satellite data, the water bodies and water-logged areas are giving the same tone and texture so it is very difficult to discriminate water logged areas with the water bodies. Presently old water logged is also being considered as water body in the study area. The total area falling within the water bodies are 13.33 Ha which is about 0.03 % of the total study area.

Streams

Based on satellite data, the Streams are giving the different tone and texture so it is typically little difficult to discriminate water bodies areas with the streams. The total area falling within the streams are 125.54 Ha which is about 0.29 % of the total study area.

Fallow land

Based on satellite data and ground truth, the total agricultural & fallow land, are classified by using image classification techniques. Existing agricultural area which are left unplanted were depicted by utilizing multispectral satellite data. current fallow land is 4681.25 Ha area which is about 10.82% of the total study area.

Land with Scrub

Scrub lands are quite similar with degraded forest in image characteristics. These lands are further examined on the ground and cross checked with the forest boundaries to classify into scrub lands. Scrub lands are 9588.16 Ha which is about 22.16 % of the study area.

Settlements

The village locations and built-up area extent have been extracted from the satellite data of high resolution and also from the existing topographical maps. The area occupied by Settlement class shown in the classified image is therefore based on the visual interpretation of high-resolution satellite data and also topographical maps. The major Settlement is about 9088.83 Ha which is 21.01 % of the total study area.

General Land use/ Land cover in consideration to screening cum benefication plant

The land use/ land cover map has been generated on 1:50,000 scale using digital classification of LISS-IV. Based on the methodology developed for the present land use/ land cover, categories have been grouped under the following major land use/land cover categories.

TABLE 3.40
MAJOR LAND USE/LAND COVER CATEGORIES OF STUDY AREA

SL No	Category	Area in Ha	% of the study area
1	Forest Area	14911.5	44.15
2	Rocky Barren Area	6382.22	18.90
3	Land With shrubs	10977.5	32.50
4	Settlements	786.69	2.33
5	Waterbodies	20.23	0.06
6	Mining area	642.23	1.90
7	Stream	54.02	0.16
	Total	**33774.39**	**100**

Dense Forest

Forest with canopy cover more than 60% is considered as dense forest. Location of dense forest within study area is shown in **Plate No.3.10.** This represents the area under Dense Forest lands, about 14911.5 Ha or 44.15 % of the study area. The study area contains natural vegetation.

Rocky/Barren Area

Based on satellite data, The Rocky and the Barren land are observed in the Western part of the study Area. These areas consist of hard formations and with less to none green cover. The total area falling within the water bodies are 6382.22 Ha which is about 18.90 % of the total study area.

Land with Scrub

Scrub lands are quite similar with degraded forest in image characteristics. These lands are further examined on the ground and cross checked with the forest boundaries to classify into scrub lands. Scrub lands are 10977.5 Ha which is about 32.50 % of the study area.

Settlements

The village locations and built up area extent have been extracted from the satellite data of high resolution and also from the existing topographical maps. The area occupied by Settlement class shown in the classified image is therefore based on the visual interpretation of high-resolution satellite data and also topographical maps. The major Settlement is about 786.69 Ha which is 2.33 % of the total study area.

Water Bodies

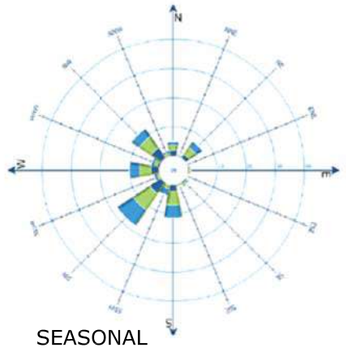
Based on satellite data, the water bodies and water-logged areas are giving the same tone and texture so it is very difficult to discriminate water logged areas with the water bodies. Presently old water logged is also being considered as water body in the study area. The total area falling within the water bodies are 20.23 Ha which is about 0.06 % of the total study area.

Mining Area

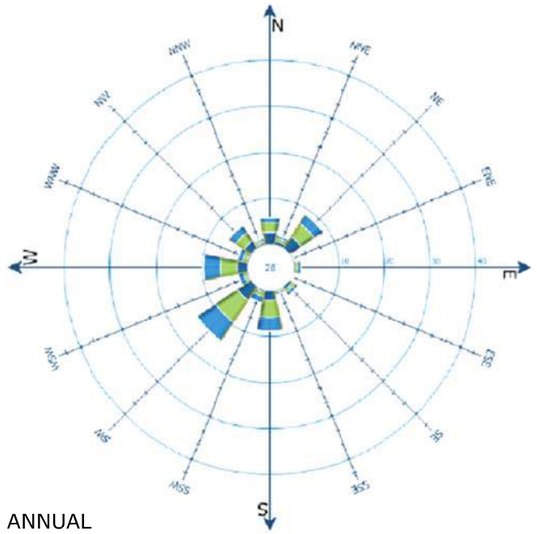
The total area falling within Proposed mining is 642.23 Ha which 1.90 % of the study area

Streams

Based on satellite data, the Streams are giving the different tone and texture so it is typically little difficult to discriminate water bodies areas with the streams. The total area falling within the streams are 54.02 Ha which is about 0.16 % of the total study area.



SEASONAL



ANNUAL

KAMALUR
SUKHIJORI NALA
JHIRKA
BASANPUR
PUJARIPARA
GAMAWADA
MOSENAR
AB2
DHURLI
AMB5
SAWKANI NADI
GAMAWADA
AMB4
AB1
BHANSI
AMB6
PALI NADI
PODOWADA
SCREENING PLANT
KUSIPAL
TIMINAR
AMB-2
MARI NADI
AMB3
POROKAMELI
KAMELI
AMB7
BADE KAMELI
BHATPARA
NOLASNAR
BERUDI NADI
Pump house
PEDDAPARA
NERLI
AMB1
AMB8
GAYATAPARA
KONDAPARA
MANJIPARA
HIROLI
BEHNAR
TUMAKA NALA
DUMRIPALNAR
SANKANI NADI
KOYAR NADI
B I J A P U R R . F .
AMB9
BACHELI
KAWADGAON
AM1
AMLIPARA
MANJHIPARA
PINA BACHELI
BERUDI NADI
CHALKIPARA
KUMHARPARA
AM2
BAILADILA
PADAPUR
AM3
BAINPAL
KOYAR NADI
B A I L A D I L A R . F .
KODENAR
KADAMPAL
GALI NALA
KIRANDUL
KOYAR NADI
KUNTIYAPARA
JHIRAM NADI
BAILADILA

SCALE - 0 1 2 3 4 5 km

REF.:-SURVEY OF INDIA TOPOSHEET NO.- 170

65 F-1	65 F-5
65 F-2	65 F-6

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- LEASE BOUNDARY
- ROAD
- RIVER / NALLA
- RAILWAY LINE
- PUMP HOUSE WITH PIPE LINE
- RESERVED FOREST
- DISTRICT BOUNDARY
- BUFFER AREA OF MINING AREA
- BUFFER AREA OF SCREENING PLANT

CODE	LOCATION
AMBIENT AIR LOCATION	A
CORE ZONE	
AM1	WITHIN LEASE AREA
AB1	SCREENING PLANT
BUFFER ZONE SPECIFIC	
AM2	AKASH NAGAR CISF CAMP
AM3	PADAPUR
AB2	PUJARIPARA
BUFFER ZONE COMMON	
AMB1	WITHIN 500M DOWNWIND DIRECTION FROM LEASE AREA
AMB2	TIMMENAR
AMB3	NEAR CONVEYOR ALIGNMENT
AMB4	WITHIN 500M DOWNWIND DIRECTION FROM BENEFICIATION PLANT
AMB5	NEAR KANYA ASHRAM,DHURLI
AMB6	BHANSI
AMB7	POROKAMELI
AMB8	NERLI
AMB9	BACHELI

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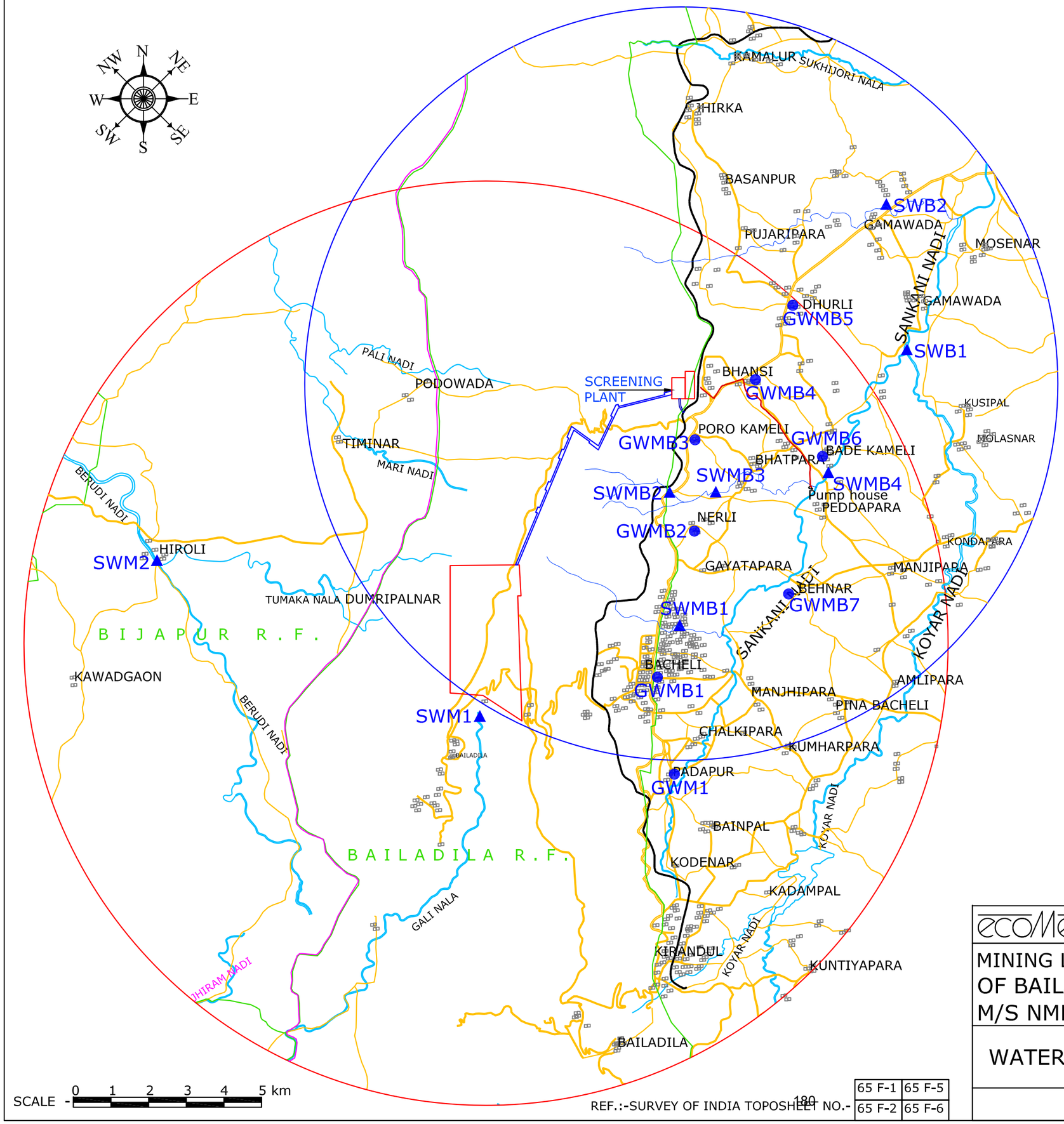
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4 M/S NMDC-CMDC LIMITED

PLAN SHOWING MICRO-METEOROLOGICAL & AMBIENT AIR LOCATIONS

PLATE NO.-3.1



SCALE - 0 1 2 3 4 5 km

REF.:-SURVEY OF INDIA TOPOSHEET NO.- 180

65 F-1	65 F-5
65 F-2	65 F-6

CODE	LOCATION
GROUND WATER LOCATION ● GW	
BUFFER ZONE SPECIFIC	
GWM1	PADAPUR
BUFFER ZONE COMMON	
GWMB1	BACHELI
GWMB2	NERLI
GWMB3	POROKAMELI
GWMB4	BHANSI
GWMB5	DHURLI
GWMB6	BADE KAMELI
GWMB7	BEHNAR
SURFACE WATER LOCATION ▲SW	
BUFFER ZONE SPECIFIC	
SWM1	GALI NALA
SWM2	BERUDI NADI
SWB1	CONFLUENCE POINT OF SANKANI& KOYAR RIVER
SWB2	JHARALAWA NALA NEAR GAMEWADA
BUFFER ZONE COMMON	
SWMB1	NALA NEAR CENTRAL WORKSHOP,BACHELI
SWMB2	NERLI GHATI NALA NEAR CRPF CAMP-230
SWMB3	NERLI DAM DISCHARGE
SWMB4	SANKANI NADI

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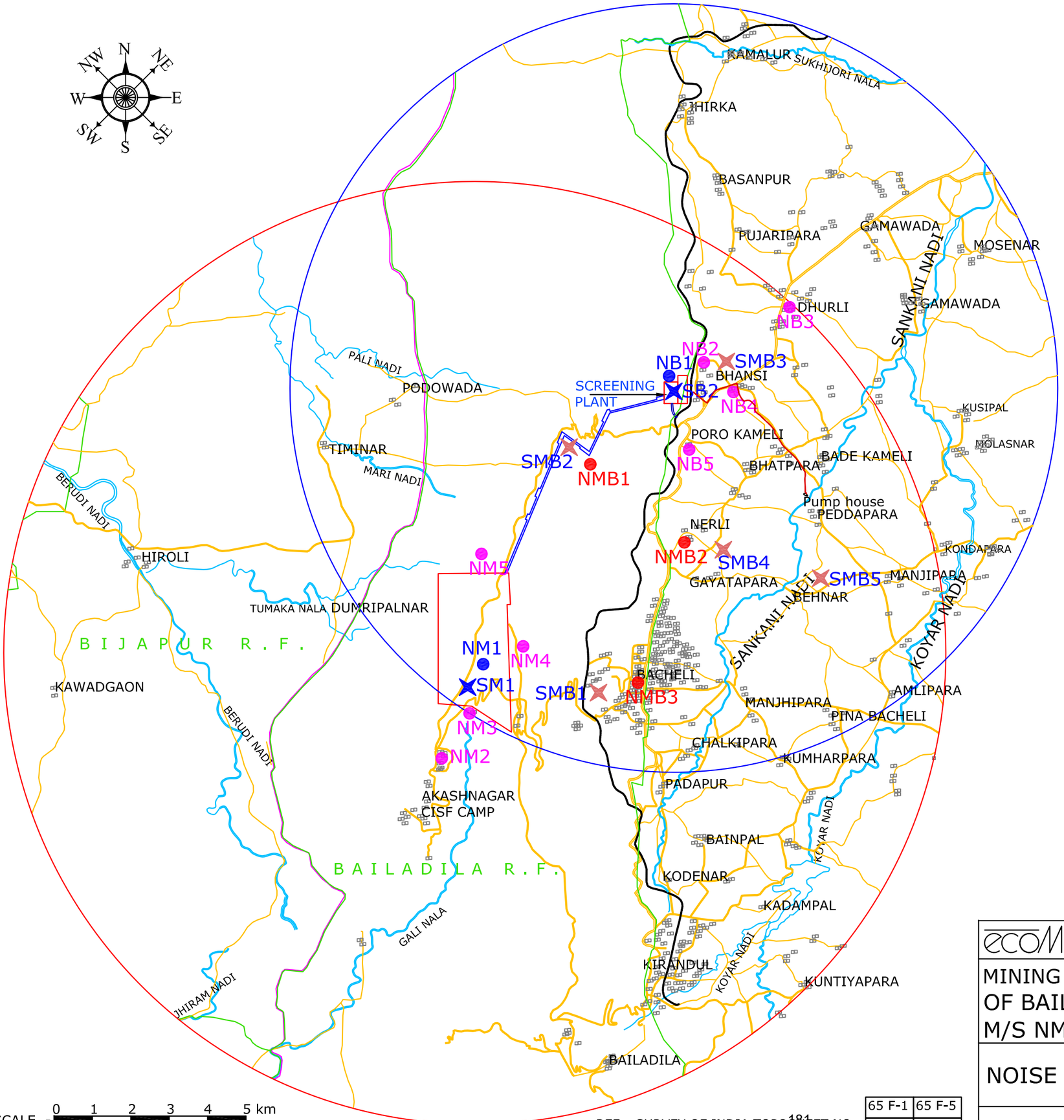
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

WATER LOCATION MAP

PLATE NO.-3.2



SCALE - 0 1 2 3 4 5 km

REF.:-SURVEY OF INDIA TOPOSHEET NO.- 181

65 F-1	65 F-5
65 F-2	65 F-6

CODE	LOCATION
NOISE MONITORING LOCATION	
CORE ZONE	●NM/NB
NM1	WITHIN LEASE AREA
NB1	SCREENING PLANT
BUFFER ZONE SPECIFIC	●NM/NB
NM2	AKASH NAGAR CISF CAMP
NM3	OUTSIDE ML AREA NEAR SUBSTATION-2 DOWNHILL CONVEYOR DEP.-5
NM4	500 M. EAST FROM ML BOUNDARY
NM5	500 M. NORTH FROM ML BOUNDARY
NB2	WITHIN 500M DOWNWIND DIRECTION FROM BENEFICIATION PLANT
NB3	DHURLI
NB4	BHANSI
NB5	POROKAMELI
BUFFER ZONE COMMON	●NMB
NMB1	NEAR CONVEYOR
NMB2	NERLI
NMB3	BACHELI

SOIL SAMPLING LOCATION	✕S
CORE ZONE	
SM1	ML AREA D-4
SB1	PROPOSED SCREENING PLANT
BUFFER ZONE COMMON	✕S
SMB1	BACHELI
SMB2	NEAR CONVEYOR (FOREST LAND)
SMB3	BHANSI
SMB4	NERLI (AG. LAND)
SMB5	BEHNAR (AG. LAND)

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MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

NOISE & SOIL SAMPLING LOCATION

PLATE NO.-3.3

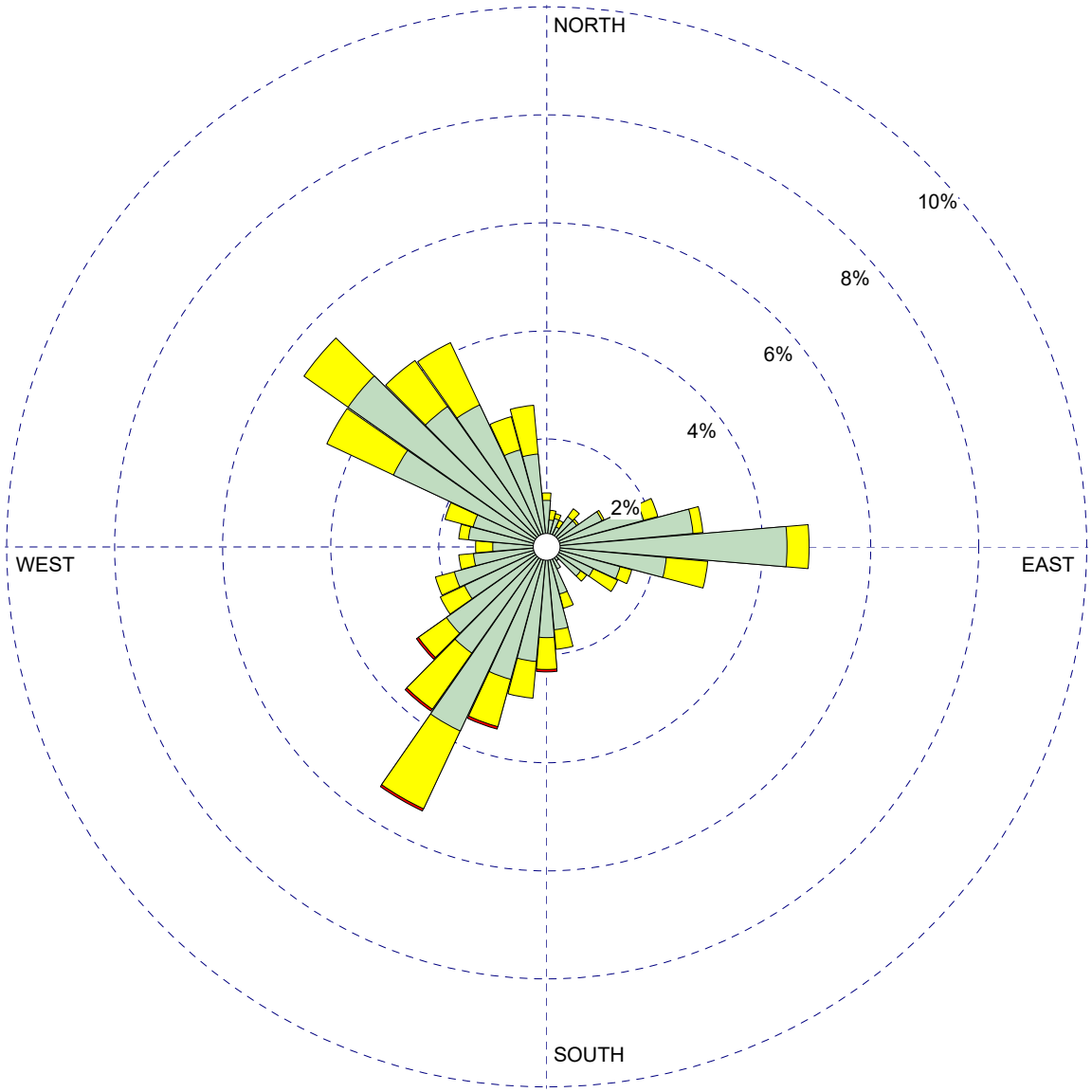
WIND ROSE PLOT:

Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)

COMMENTS:



WIND SPEED (m/s)

- >= 20.5
- 16.9 - 20.5
- 13.9 - 16.9
- 10.8 - 13.9
- 8.1 - 10.8
- 5.3 - 8.1
- 3.0 - 5.3
- 1.4 - 3.0
- 0.3 - 1.4

Calms: 18.70%

DATA PERIOD:

Start Date: 01-03-2022 - 00:00
End Date: 31-05-2022 - 23:00

TOTAL COUNT:	CALM WINDS:
2207 hrs.	**18.70%**

AVG. WIND SPEED:

0.80 m/s

COMPANY NAME:

Ecomen Laboratories Pvt Ltd

MODELER:

Rajneesh

DATE:

28-08-2022

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

PROJECT NO.:

Deposit-4

WRPLOT View - Lakes Environmental Software

PLATE NO.-3.4

BAILĀDILA RESERVED FOREST

TO DANTEWARA

TO DANTEWARA

SH-5

SCREENING PLANT

BHANSI RS

BHANSI

TRAFFIC STUDY LOCATION

Pump house

MINING AREA D-4

BACHELI RS

BACHELI

TO KIRANDUL

BAILĀDILA RF

DHURLI

KAMELI

NERLI

GAMĀWĀDA

MOLASNĀR

Bechapāl

Uripāl

Indripāl

Päli Nadi

Porowāda

Mari Nadi

Timinār

Tumaka Nāla

Dumripālnār

Bāsanpur

Mirkāpāra

Pujāripāra

Dogipāra

Bhānsi

Pirmāpāra

Dhurli

Mundrāpāra

Jāmāra

Gamāwāda

Masenār

Päia Dongri △536

Sheet rock △514

Murdipāra

Poro Kameli

Teak Plantation

Patelpāra

Bare Kameli

Mosepāra

Bhatipāra

Upparapāra

Māsāpāra

Sankani Nadi

Kirka Dongri . 616

Khālipāra

Molasnār

Kondapāra

Mālgujārpāra

Itāpāra

Kunjāmpāra

Gumka

Borgapāra

Peddapāra (Mālguzārpāra)

Udela

Kotwārpāra

Manjipāra

Koyar Nadi

Chālkpāra

Kumhārpāra

Jimmepāra

Dorapāra

Mukardampāra

Gāyatāpāra

Sehnār

Dense jungle mainly teak

Dense jungle mainly sajha

Open mixed jungle

Dense mixed jungle

Dense jungle mainly bamboo

Track follows boundary

Moorrabe in dry season

Disused

Kirandul Branch

Main power line

EOR Kottavalasa Kirandul Railway

Sankani Nadi

Koyar Nadi

Spring

Sheet rock

Teak Plantation

Market (Sun)

INDEX

- LEASE BOUNDARY
- ROAD
- CONVEYOR BELT
- RAILWAY LINE
- PIPE LINE WITH PUMP HOUSE

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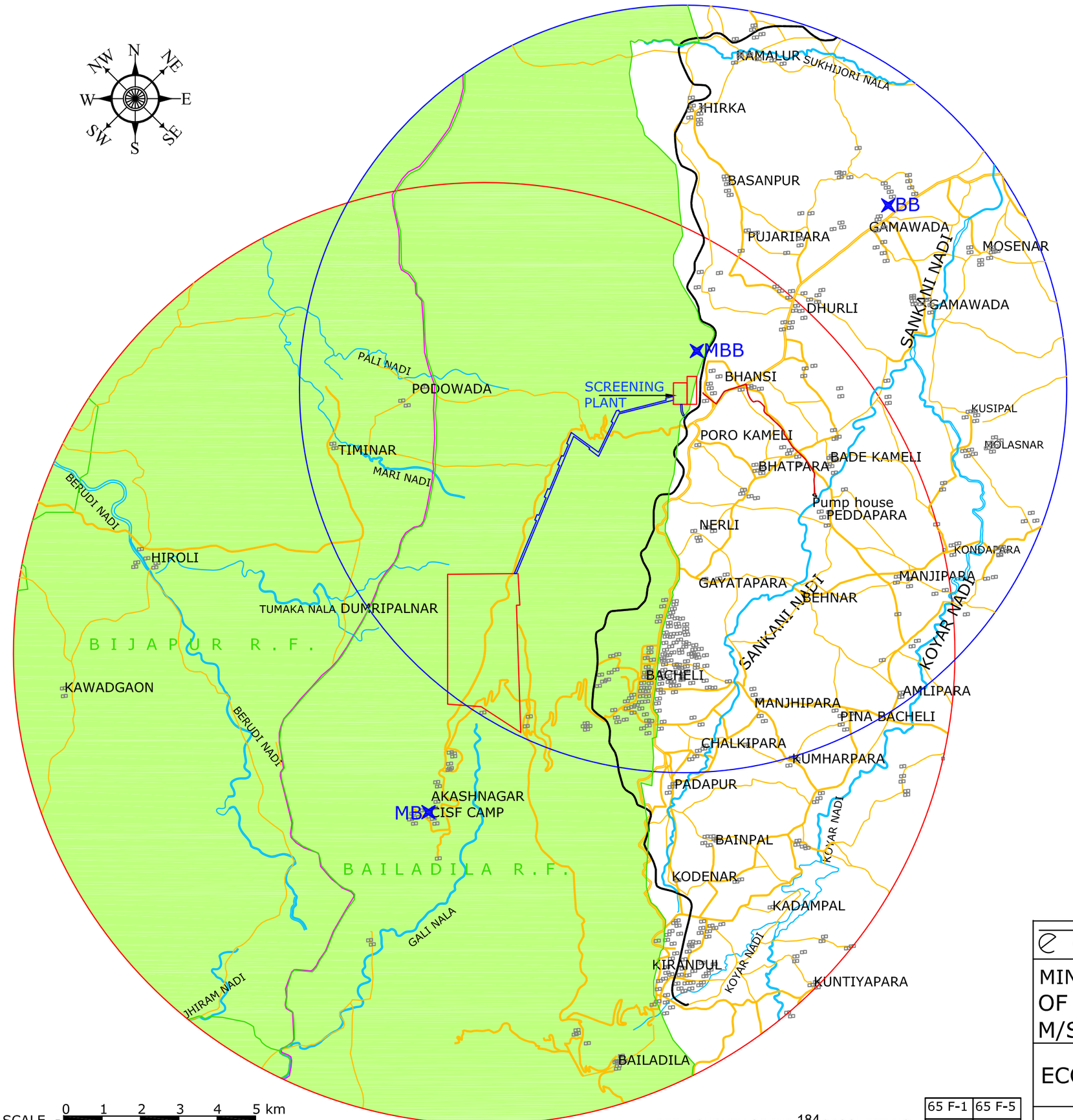
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

TRAFFIC STUDY LOCATION

PLATE NO.-3.5



ECOLOGICAL STUDY LOCATION ✖E	
MB	AKASHNAGAR
MBB	NEAR CONVEYOR (FOREST LAND)
BB	BHANSI

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- BUFFER AREA OF SCREENING PLANT

SCALE - 0 1 2 3 4 5 km

REF.:-SURVEY OF INDIA TOPOSHEET NO.- 184

65 F-1	65 F-5
65 F-2	65 F-6

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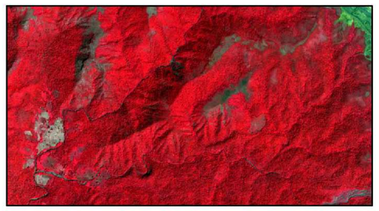
MINING LEASE & SCREENING CUM BENEFICIATION PLANT
OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

ECOLOGICAL STUDY LOCATIONS

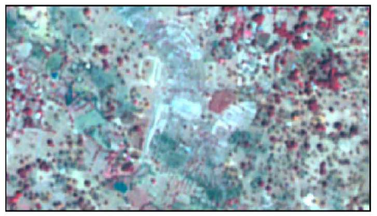
PLATE NO.- 3.6

HIGH RESOLUTION SATELLITE IMAGE
OF MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

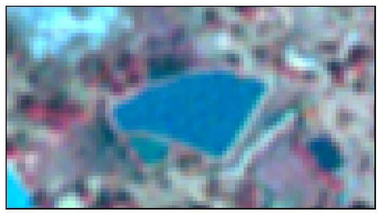
N



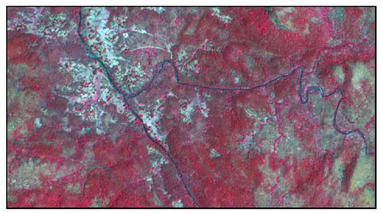
DENSE FOREST



FALLOW LAND

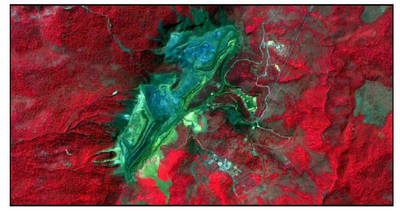


WATERBODY



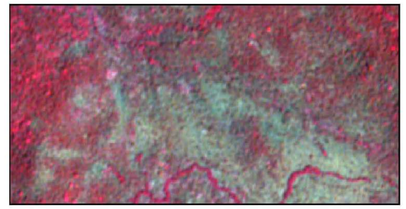
STREAM

SETTLEMENTS



MINING AREA

LAND WITH SCRUB



ROCKY /BARRENAREA

0 1.75 3.5 7 10.5 14 Kilometers

185

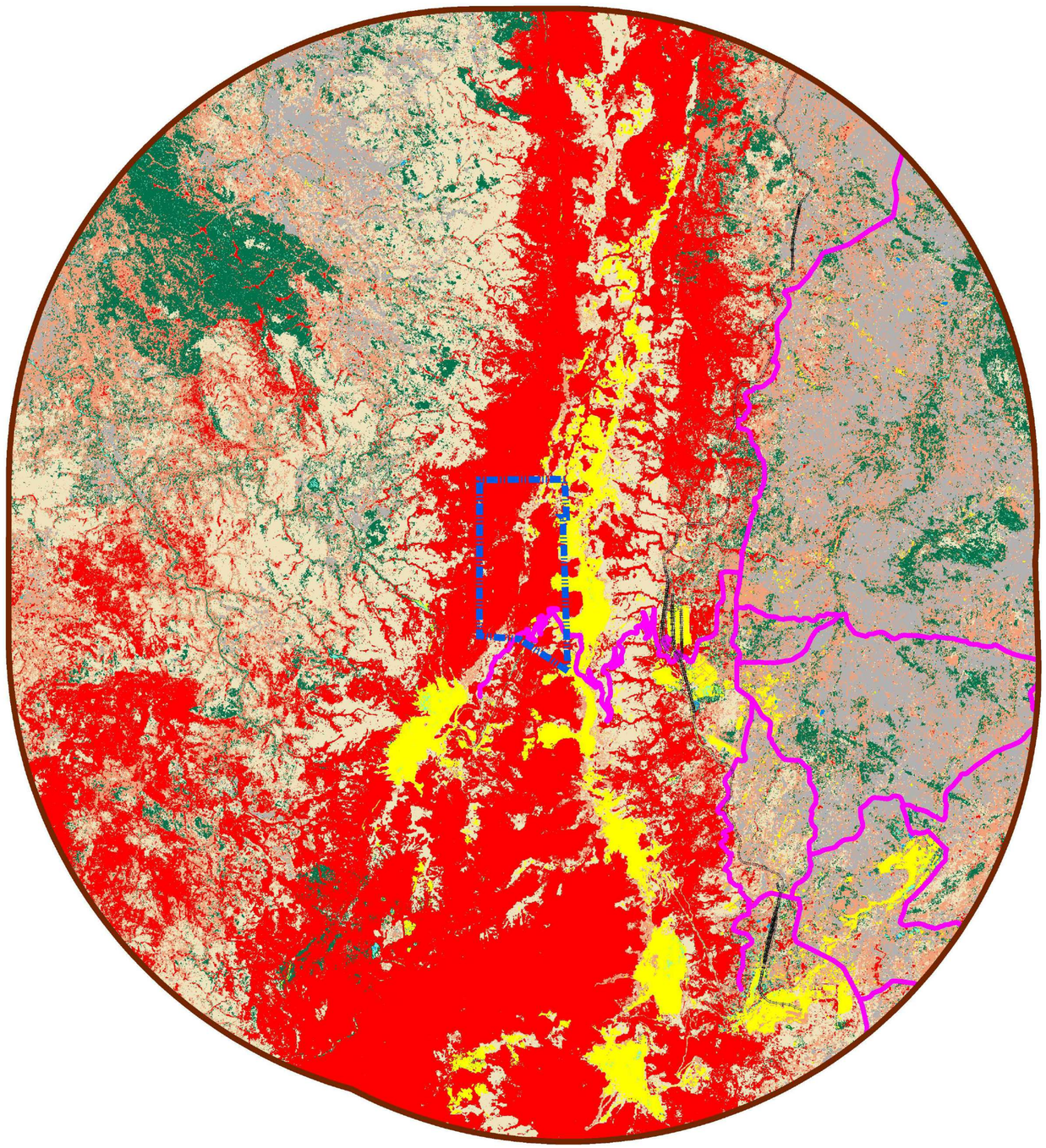
PLATE NO.3.7
TECHNO MINING SOLUTIONS, BANGALORE

LAND USE / LAND COVER MAP

OF MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

M/S NMDC-CMDC LIMITED

N



0 2.25 4.5 9 13.5 18 Kilometers

DENSE FOREST

MININIG AREA

ROCKY/BARREN AREA

WATERBODIES

RAILWAY LINES

STREAMS

FALLOW LAND

LAND WITH SCRUB

SETTLEMENTS

ROADS

LEASE AREA

PLATE NO.3.8
TECHNO MINING SOLUTIONS, BANGALORE

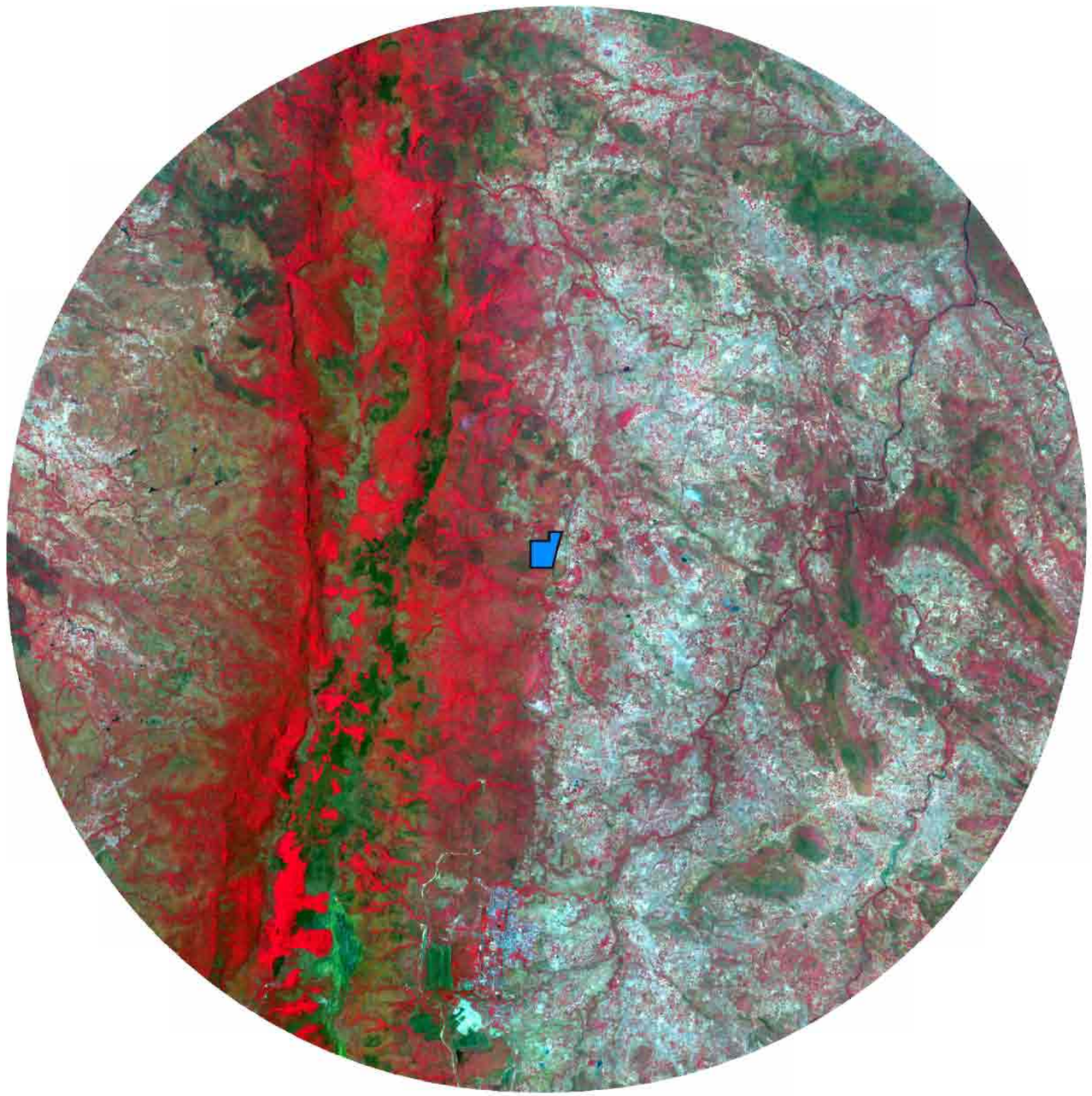
HIGH RESOLUTION SATELLITE IMAGE
OF MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

N

DENSE FOREST

WATERBODY

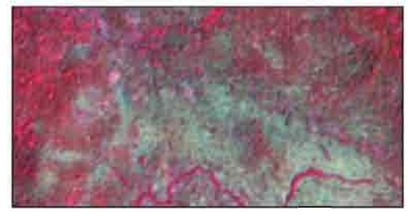
STREAM



SETTLEMENTS

MINING AREA

LAND WITH SCRUB



ROCKY /BARRENAREA

0 2 4 8 12 16 Kilometers

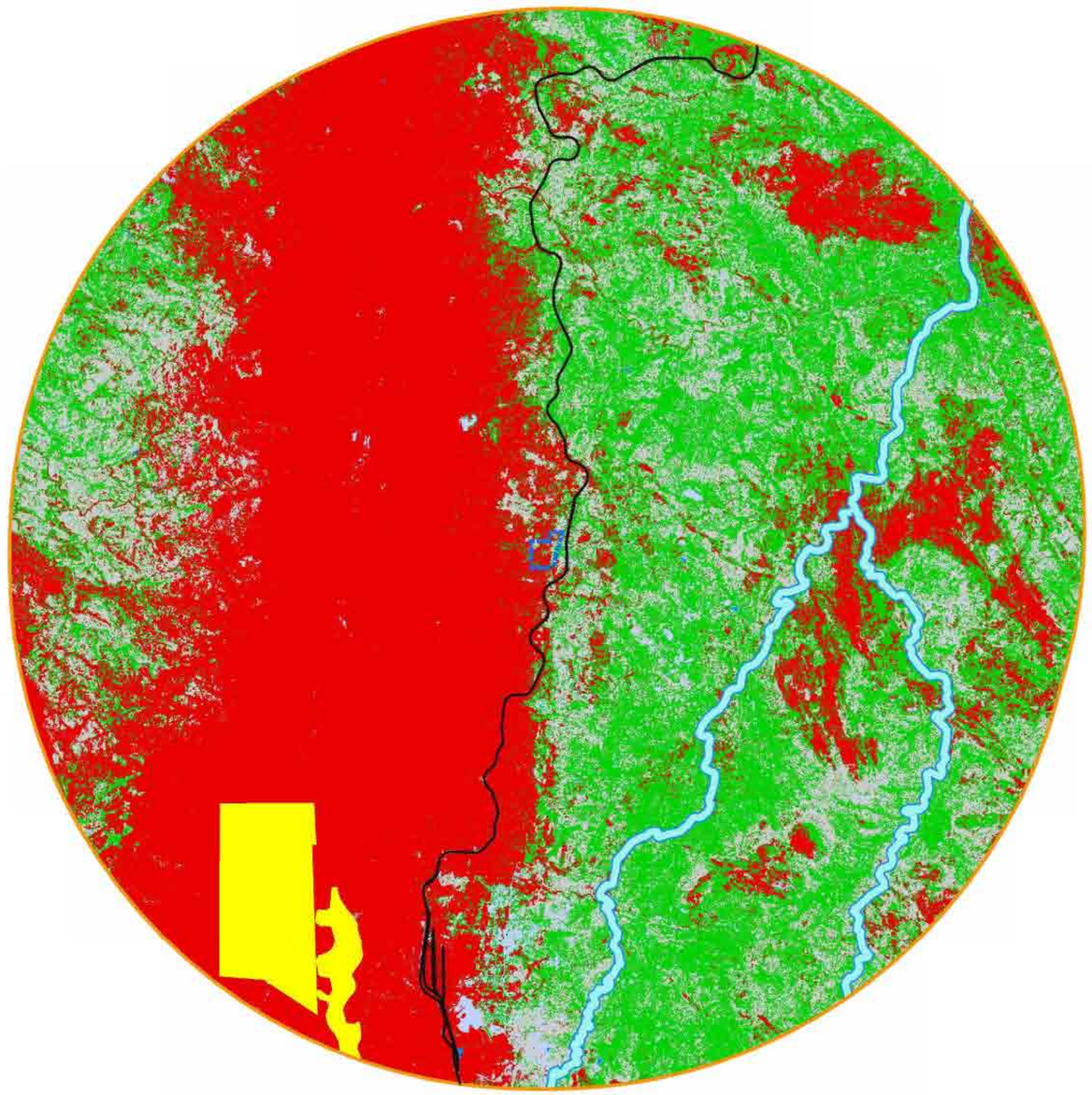
PLATE NO. 3.9
ECOMEN LABORATORIES PVT LTD.LUCKNOW

LAND USE / LAND COVER MAP

OF MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

M/S NMDC-CMDC LIMITED

N



0 2.25 4.5 9 13.5 18 Kilometers

DENSE FOREST

MININIG AREA

ROCKY/BARREN AREA

WATERBODIES

RAILWAY LINES

STREAMS

LAND WITH SCRUB

SETTLEMENTS

LEASE AREA

PLATE NO.-3.10

CHAPTER – 4
ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.0 Introduction

Mining being site specific activity, excavation will be done at a place where mineral actually exist. Open cast iron ore mines can cause disturbance in ecology, resulting in various pollution problems.

The study area of Bailadila Iron Ore Mining Lease, Deposit-4 is in a mining Complex, where other mines are in operation over decades. The Bailadila Iron Ore Mining Lease, Deposit-4 of M/s NMDC-CMDC Ltd is situated near village Bacheli/ Bhansi, Tehsil- Bade Bacheli with Screening cum Beneficiation facilities at village Bhansi, South Bastar Dantewada district, Chhattisgarh. The proposed mining project is a fully mechanized opencast mining project with 7.0 MTPA capacity. Conventional mining system with shovel dumper combination mining technology will be adopted. The sequence of the operations will be development of mine benches, drilling, blasting, excavation, loading, crushing, screening, stacking and transportation. Present status of the environmental parameters has been dealt in the **Chapter-3**. The result of monitoring studies serves as basis for assessing the impact of mining on various Environmental components. Environmental impacts of mining & screening cum beneficiation activities arises because of various operations carried out during the process of mining such as drilling, blasting, excavation, transportation of ore, crushing, downhill conveyor, screening, ore loading, mineral beneficiation etc.

The main objectives of EIA study are:

- To identify the environmental impacts due to mining operations.
- To delineate the level of degradation in various environment aspects, in terms of physical, chemical, biological and sociological aspects due to mining.
- To establish the methodology of monitoring the environmental parameters by identifying the locations etc.
- To recommend and implement mitigation measures of the identified impacts.

Anticipated environmental impacts are discussed in section 4.1 and mitigation measures are discussed in section 4.2.

4.1.0 Anticipated Environmental Impacts

4.1.1 Topography

The topography of the area is discussed in **Chapter-2**. The highest elevation is 1210 m above MSL and the lowest elevation is about 1020 m above MSL. The ore body has a general NNE-SSW trend with steep easterly slope and forms a gentle slope towards west.

The topographical changes in the mining area will be due to mining operations, Ore-crushing, dumping of waste and allied activities are restricted to the mine lease area only.

Change in topography and landscape can change drainage pattern of the lease area. Major anticipated impacts can be soil erosion/ loss of top soil etc. In Deposit-4 due to proper planning and various engineering measures drainage pattern will not change to a great extent and so also erosion etc.

4.1.2 Land Environment Land use

The mining lease area consists of 646.596 Ha. of forest land and an area of 122.5428 Ha. will be required for infrastructure outside the mining lease. The existing land use pattern and the anticipated land use and land use pattern at conceptual stage are shown in **Table 4.1, 4.2 & 4.3** respectively. At the end of life of mine (Conceptual Stage), mined out area in the lease and area under dump will be 164.63 Ha. and 74.07 Ha. respectively.

TABLE -4.1 (A)
PRESENT LAND USE PATTERN
Present Land use pattern of the Mining Lease Area

Sl. No.	Head	Area put on use at start of plan period (Ha.)
1	Land under Public Infrastructure / Utilities (water bodies, roads, railways, electric lines, telephone lines etc.)	9.123
2	Covered under Mine Infrastructure (plants, shades, buildings etc.)	5.318
3	Land under Forest	632.155
Total		**646.596**

TABLE - 4.1 B
PRESENT LAND USE PATTERN OF THE SCREENING CUM BENEFICIATION PLANT

Sl. No.	Head	Area (Ha)
1	Forest land	100.077
2	Revenue forest (Bade Jhad ke Jungle)	12.0952

3	Private revenue land (residential & agricultural land)	6.9585
4	Govt. revenue land (road/open land)	1.0101
5	Railway Land	2.4020
Total		**122.5428**

TABLE -4.1 (C)
PROPOSED LAND USE PATTERN IN ML AREA (FOREST AREA)

Sl. No.	Land Use	Area (Ha)
1	Area under Mining (In-situ)	94.1100
2	Area under Float Ore	70.5200
3	Overburden/Waste Dumping	74.0700
4	Infrastructure (Crushing Plant, Workshop, Administrative Building, Roads etc.)	65.9000
5	Explosive Magazine Area	15.3700
6	Tree-Fern Area (Non-diverted)	76.4960
7	Green belt- Safety Zone along the ML Boundary	08.4880
8	Area under Environmental Protection, improvement and EMP Works	241.6420
	Total	**646.5960**

TABLE 4.2 (A)
PROPOSED LAND USE PATTERN IN SCREENING CUM BENEFICIATION PLANT AREA

Sl. No.	Description	Area (Ha)				
		Forest	Revenue Forest Land (Bade Jhad ke Jungle)	Pvt. Revenue Land	Govt. Revenue Land	Railway Land
1	Major part of Downhill conveyor system including	43.0000	-	-	-	-

Sl. No.	Description	Area (Ha)				
		Forest	Revenue Forest Land (Bade Jhad ke Jungle)	Pvt. Revenue Land	Govt. Revenue Land	Railway Land
	overhead electrical line & water pipeline					
2	Screening Plant including all allied facilities	18.2810	-	-	-	-
3	Loading Plant including all allied facilities	10.2390	6.4106	3.2936	0.1107	-
4	Railway siding	1.0410	5.1193	3.6594	0.3055	2.4020
5	Existing roads widening / strengthening for two-way traffic and new approach roads to all the plants & transfer houses	27.5160	-	-	-	
6	Pump House	-	0.4000	-	-	-
7	Pipe line	-	0.1653	0.0055	0.5939	-
	Total	**100.0770**	**12.0952**	**6.9585**	**1.0101**	**2.4020**

TABLE - 4.3

PROPOSED LAND USE PATTERN-CONCEPTUAL STAGE

Sl. No.	Category	Proposed Land Use Pattern at Conceptual Stage (Ha)	Percentage
1	Mined out Area Reclaimed but not fully rehabilitated	1.84	0.28
2	Mined out Area fully	142.75	22.08

	Rehabilitated from Reclaimed area		
3	Area under Water Reservoir considered Rehabilitated	20.04	3.10
4	Stabilized Waste dump Rehabilitated	74.07	11.46
5	Rehabilitated Area under utility services	54.371	8.41
6	Area under utility services not rehabilitated	26.899	4.16
7	Green belt-safety zone along the ML boundary	8.488	1.31
8	Area under environmental protection, improvement and EMP works	241.642	37.37
9	Tree fern area (non-diverted)	76.496	11.83
Total		**646.596**	**100.00**

Source: Approved Mine Plan

Due to above activities the landscape of the terrain will be modified to some extent. Further impacts due to change in land scenario and land use can affect the land use, top soil and drainage pattern of the surrounding area of mining lease and screening cum beneficiation for which mitigation measures have to be taken. Refer. **Plate No. 4.1 & 4.2** for Present land use & Proposed land use.

4.1.3 Top Soil

The quantity of topsoil generated and its recovery will be very negligible. In the process of exploitation, in the process of mining, if top soil will be encountered, it will be utilised for plantation purposes immediately. In the process of mining and screening cum beneficiation, several changes will occur in physical, chemical and microbiological properties of soil as a result of mining, screening, beneficiation and storage. The top soil samples will be analysed during the mining and beneficiation process.

4.1.4 Drainage

Deposit-4 mine is in the south direction of the western ridge of the Bailadila Iron Ore range, which extends for a length of about 40 kms width varying from 5 to 10 kms. The range rises sharply 600 mtrs above the surrounding rolling plateau of Bastar. This area receives annual rainfall of 1250-1670 mm. Suitable drains will be made in the mine haul road and benches so that water flows out to fixed area and ultimately to be held by check dam. The water table in this area is much below the ultimate working level of mine, thus there is no problem of water accumulation in the mine. The proposed activities are not expected to change the existing drainage pattern of the area. As major operations are dry (Wet Screening will be only for 4

months of monsoon period), there will be no discharge of any water from mining process. The rainwater during the monsoon has a tendency to flow in the natural drainage system of the area. It is required to ensure the quality of runoff water during rainy season, before it leaves the lease area. Precautionary measures by constructing Garland drains, run off channels, check dams & settling sumps will be helpful in making the runoff water free from any silt during the rainy season. This will ensure that no polluted water goes out from the mining area and screening cum beneficiation plant. The drainage map of the study area (buffer zone) is given in **Chapter-2** as **Plate No. 2.6** and drainage map of the Mining Lease area is given in the **Plate No. 4.12**.

4.1.5 Air Environment

The mined-out area will be of 164.63 ha till conceptual period. The potential sources of air pollution (air borne dust and emissions) arising will be due to drilling, blasting, crushing, screening, waste dumps, haul roads, exhaust fumes of internal combustion engines fitted on trucks dumpers, dozers, motor graders (HEMM) etc., combusting of domestic fuel oil and transportation of ore in the vicinity. The mine will handle production capacity of 7.0 MTPA ROM Iron ore and 6.41 MTPA Waste Excavation (Total Excavation 13.41 MTPA) along with 2000 TPH Crushing plant inside lease area and Screening Cum Beneficiation Plant (750 TPH of 4 lines each) along with 2200 TPH Downhill Conveyor and Loading Facilities in 122.5428 Ha (100.077 Ha. Forest area and 22.4658 ha. Revenue land (Govt., Private and Bade Jhad Ke Jungle)) area.

The level of the pollutants in the area are within the permissible limit at present, as indicated in the **Chapter-3.** There will be increase in particulate matter in future with the commencement of production. The control measures should be taken on drilling operation, haul road, dry processing units, loading and unloading area to keep fugitive emission & other emissions well within the safe limits.

Atmospheric pollutants are hazardous to all living organism in biosphere. The dust produced during mechanized opencast mining and allied activities not only impacts human beings, but also the plant and animals around the ML area. Therefore, strict mitigation measures are absolutely essential to ensure clean environment and maintain sustainability of ecosystem.

The major gaseous pollutants of concern in iron ore mines are sulphur dioxide and oxides of nitrogen. Sulphur dioxide can cause respiratory problems. Oxides of nitrogen can react in the atmosphere with hydrocarbons to produce photo-chemical smog. In addition to this, the sulphur dioxide and oxides of nitrogen can generate an acid rain harmful to vegetation and materials.

It was found that the gaseous pollutants in core and buffer zone of Deposit-4 are well within the standard limits hence no such impacts have been observed.

Impacts during Construction Phase of Screening cum Beneficiation Plant

During the construction phase of the project, a considerable amount of civil work activities like grading of land, excavation, back filling, storing, piling etc involving movement and transportation of earth will take place. This will lead to generation of a large emission of fugitive dust. The fugitive nature of dust will have local impacts in the area where the activity will be carried out. Water spraying is proposed to be carried out on the roads, which will be used for transportation of materials to suppress fugitive dust. Further, the civil construction activities will be temporary in nature and will not last after construction and will not have any long-term impact on the ambient air quality.

Impacts during Operational Phase of Screening cum Beneficiation Plant

The proposed beneficiation plant is likely to have impact on the air environment beyond the core zone. While the impact of fugitive emissions will be within the core area, the effect of emissions from the point sources is a major concern, as it will have an impact on the ambient air quality in the surrounding area. It is also proposed to limit the design emission norms well within the prescribed standards. In the beneficiation project, the process chosen will be Dry Screening for 8 months and Wet Screening for 4 months of monsoon period.

4.1.5.1 Air Quality dispersion Modelling

Preamble

Impact assessment is an important part of Environmental Impact Assessment Study. There are various techniques available to predict the impacts. Mathematical modelling is an established and accepted technique to predict the impacts.

Cumulative Impact Assessment

Cumulative impact assessment has been done by considering all the mining activity of the proposed mine (Deposit-4) and adjoining mines, for whom expansion is proposed. Impact of all existing mines will be reflected in the baseline data hence for modelling purpose those mine has not been considered whom expansion is not proposed. Apart from mining activity other allied activities are also considered in modelling like use of crusher and beneficiation plant in the study area.

The two mines which are considered for air quality impact prediction are Deposit-4 and Deposit-5. The rate capacity considered for modelling are given below:

Name of Mine	Production (Ore) In Tonnes	Production (Waste) In Tonnes	Total excavation In Tonnes
Deposit-4 (Peak Production)	7000000	6414000	13414000
Deposit-5 (Peak Production)	2000000	1000000	3000000

The model has been run for worst case scenario and for control case. The two cases have been considered for only PM_{10} and $PM_{2.5}$ as the dust is major pollutant in the mining region. In case of NO_2 and SO_2 no worst-case analysis has been done. The major source for NO_2 and SO_2 in mining area are operation of HEMMs. To control NO_2 and SO_2, already Bharat stage VI machines had been deployed and catalytic converter were already installed so without control scenario has not been calculated. The quantities considered under peak and normative production of Deposit-4 are given below:

	Yearly Production MTPA	**Normative TPD**	**Peak TPD**
ROM Ore	7.00	26119.40	28266.69
Waste	6.41	23917.91	25884.21
Total Excavation	**13.41**	**50037.31**	**54150.89**

The EMP measures for peak and normative production are discussed under Section 4.2 (air environment).

The emission rate has been calculated using the formula shown in **Table 4.4** given below:

Table - 4.4

Emission Estimation Equations and Default Emission Factors for Various Operations at Mines[a]

Operation/Activity	TSP Equation	PM_{10} Equation	TSP Emission Factor	PM_{10} Emission Factor	PM_{10}/TSP Ratio based on Emission Factors	Units	Emission Factor Rating
Draglines	$E = 0.0046 \times \frac{d^{1.1}}{M^{0.3}}$	$E = 0.0022 \times \frac{d^{0.7}}{M^{0.3}}$	0.06	0.026	0.43	kg/m^3	B
Excavators/Shovels /Front-end loaders (on overburden)	$E = k \times 0.0016 \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$ using k=0.74	As for TSP, using k=0.35	0.025	0.012	0.47	kg/t	C
Excavators/Shovels /Front-end loaders (on ore)	$E = k \times \frac{0.0596}{M^{0.9}}$ using k=1.56	As for TSP, using k=0.75	0.029	0.014	0.48	kg/t	C
Bulldozers on waste	$E = 35.6 \times \frac{s^{1.2}}{M^{1.4}}$	$E = 6.33 \times \frac{s^{1.5}}{M^{1.4}}$	101	32	0.32	kg/hr	B
Bulldozer on material other than waste	$E = 2.6 \times \frac{s^{1.2}}{M^{1.3}}$	$E = 0.34 \times \frac{s^{1.5}}{M^{1.4}}$	17	4	0.24	kg/hr	B
Trucks (dumping overburden)			0.012	0.0043	0.36	kg/t	
Trucks (dumping ore)			0.010	0.0042	0.42	kg/t	
Drilling	--	--	0.59	0.31	0.52	kg/hole	B
Blasting	$E = 0.008 \times A^{1.5}$	As for TSP, multiplying by 0.52	--	--	0.52	kg/blast	C
Wheel and bucket			--	--			

[a] This includes combustion generated PM_{10} also.
d = drop distance in metres;
M = moisture content in %;
U = mean wind speed in m/s;
A = area blasted in m^2;
D = depth of blast holes in metres;

[a] This includes combustion generated PM10 also.
d = drop distance in metres;
M = moisture content in %;
U = mean wind speed in m/s;
A = area blasted in m2;
D = depth of blast holes in meters;
s = silt content in %;
k = 0.74 for particle less than 30 micrometres;
k = 0.35 for particle less than 10 micrometres;
W = vehicle gross mass in tonnes;
S = mean vehicle speed in km/hr;
L= road surface silt loading in g/m2;
w = number of wheels;
t = tonne;
VKT = vehicle kilometres travelled;
☐ = negligible.

TABLE 4.5
USEPA EMISSION FACTORS FOR VARIOUS CLASSES OF MINING EQUIPMENT (KG/1000L FUEL) [A,B]

	PM_{10}	CO	NO_X	SO_X (as SO_2)	VOCs (exhaust)	Emission Factor Rating
Track type tractor	3.03	9.4	34.16	3.73	3.31	C
Wheeled tractor	5.57	32.19	52.35	3.73	7.74	C
Wheeled dozer	17.7	14.73	34.29	3.74	1.58	C
Scraper	3.27	10.16	30.99	3.74	2.28	C
Grader	2.66	6.55	30.41	3.73	1.53	C
Off-highway truck	17.7	14.73	34.29	3.73	1.58	C
Wheeled loader	3.51	11.79	38.5	3.74	5.17	C
Track type loader	2.88	9.93	30.73	3.74	4.85	C

Source: USEPA (1998).

TABLE - 4.6
DETAILS OF THE SOURCES AND THEIR EMISSION RATES

	Deposit-5		Deposit-4	
Open Pit	**Ore**	**Road**	**Ore & Waste**	**Road**
Drilling (kg/day)	4.1481481		27.82162963	
Blasting (kg/day)	2.48		11.39	
Loading (kg/day)	11.111111		74.52222222	
Unloading Point (kg/day) (Other than pit, Waste dump)	13.99		42.43	
Total (kg/day)	17.739259	18.844444	113.7338519	273.84433
Total (without control) (kg/day)		223.45		1825.63
PM_{10}-total g/s	0.2053155	0.218107	1.316364026	3.1694945
$PM_{2.5}$-total g/s	0.0964983	0.102231	0.618691092	1.4896624

	Deposit-5	Deposit-4	Unit
Primary Crushing	0.00004	0.000040	kg/t
Emission Factor	0.2962963	1.987259	Kg/day
Emission Rate (PM_{10})	0.0034294	0.023001	g/s
Emission Rate ($PM_{2.5}$)	0.0016118	0.0108103	g/s
Secondary Crushing	0.00012	0.000120	kg/t
Emission Factor	0.8888889	5.961778	Kg/day
Emission Rate (PM_{10})	0.0102881	0.069002	g/s
Emission Rate ($PM_{2.5}$)	0.0048354	0.032431	g/s
Tertiary Crushing	0.0001	0.000100	kg/t
Emission Factor	0.7407407	4.968148	Kg/day
Emission Rate (PM_{10})	0.0085734	0.057502	g/s
Emission Rate ($PM_{2.5}$)	0.0040295	0.0270258	g/s
	0		
Transfer & Handling	0.00006	0.000060	kg/t
Emission Factor	0.4444444	2.980889	Kg/day
Emission Rate (PM_{10})	0.005144	0.034501	g/s
Emission Rate ($PM_{2.5}$)	0.0024177	0.0162155	g/s

TABLE 4.7

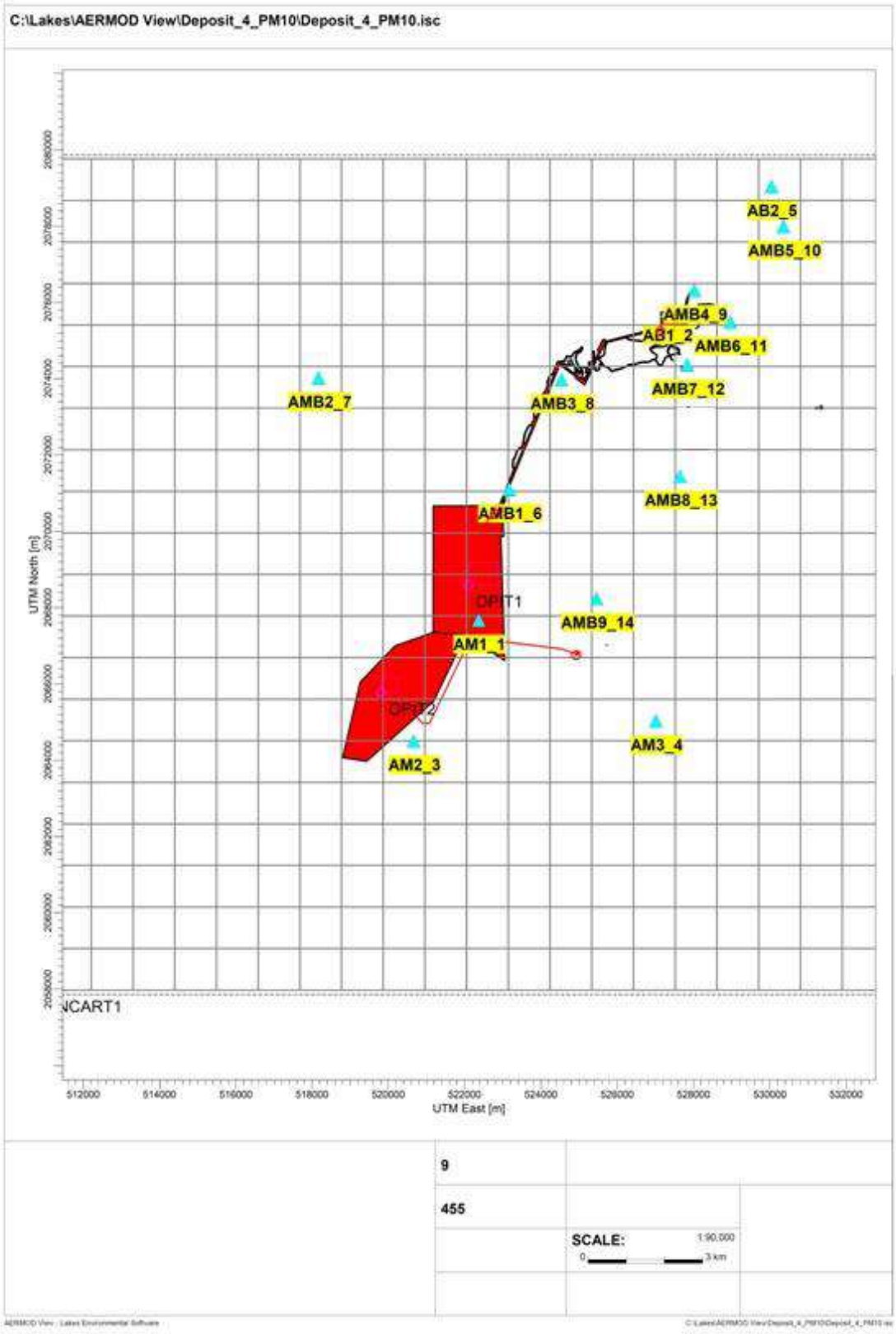
DETAILS OF THE SOURCES AND THEIR EMISSION RATES (NO_X & SO_2)

	Deposit-5	Deposit-4	Unit
Total Diesel Consumption	0.30	0.30	L/T
Nox Emission Factor	34.16	34.16	Kg/1000L
Nox Emission Rate	0.72	4.39	g/sec
SO_2 Emission Factor	3.73		Kg/1000L
SO_2 Emission Rate	0.079	0.48	g/sec

Receptor Network

The selection and location of the receptor network are important in determining the maximum impact from a source and the area where there is significant air quality impact. Impacts were assessed at locations beyond the fence line. Consequently, the receptor locations were selected as a grid that is defined by discrete Cartesian receptors, square in shape, and with origin at the centre of the proposed project site. Total 455 receptors have been selected for the 10 km buffer of the project with 20 points each side. Fourteen discrete receptors are also taken for this study.

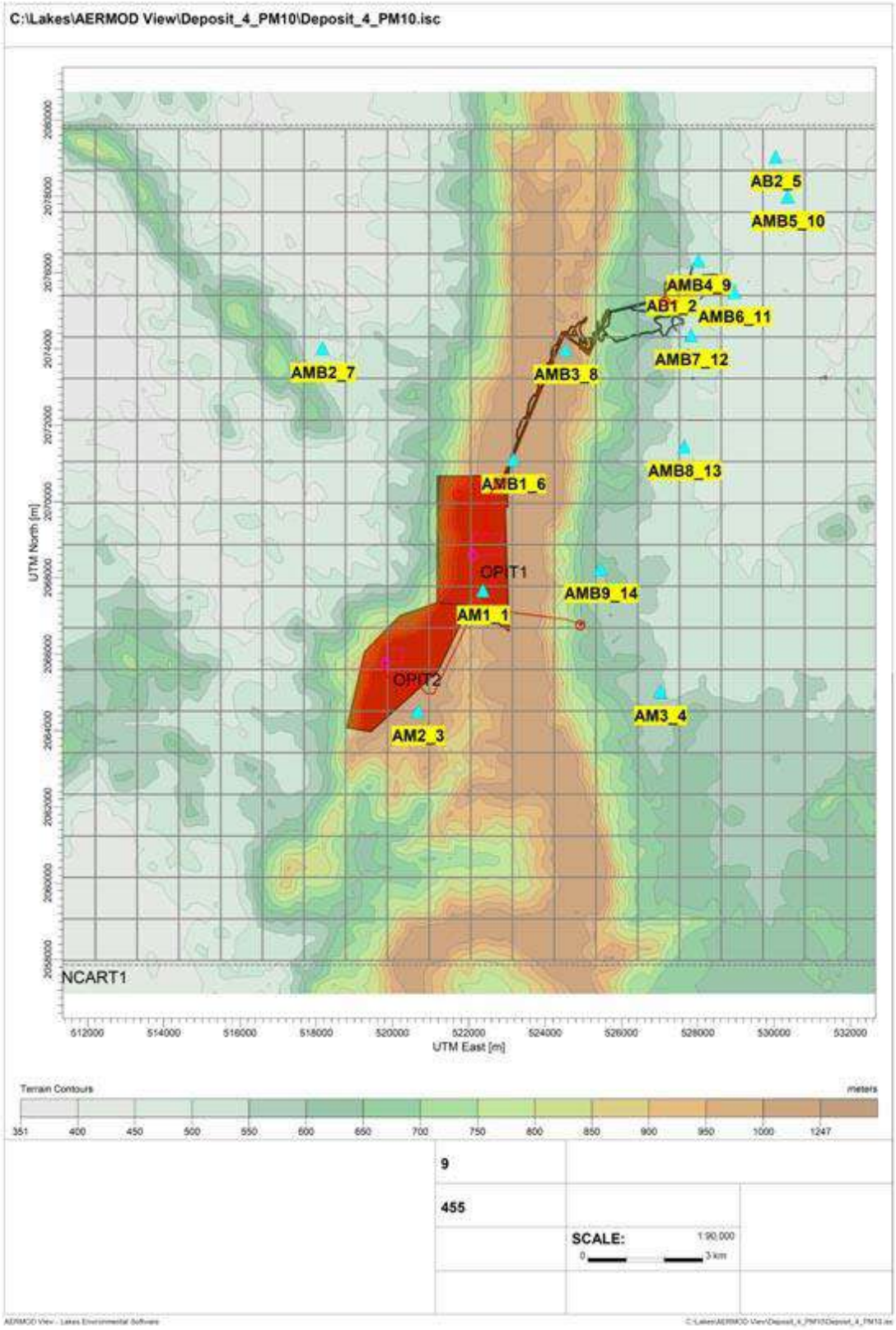
FIGURE 4.1
MODEL DOMAIN SHOWING RECEPTOR AND 10 KM EXTENT



Terrain Considerations

The classification of the land use in the vicinity of the proposed project is needed because dispersion rates differ between urban and rural areas. In general, urban areas cause greater rates of dispersion because of increased turbulent and buoyancy-induced mixing. This is due to the combination of greater surface roughness caused by more buildings and structures and greater amounts of heat released from concrete and similar surfaces. The USEPA guidance provides two procedures to determine whether the character of an area is predominantly urban or rural. One procedure is based on land-use type, and the other is based on population density. Both procedures require an evaluation of characteristics within a 3-km radius from the subject source, but the land-use methodology is considered more accurate. Hence, this method was applied and it was determined that the rural dispersion coefficient be selected for this modelling project. Additionally, the topography in the region of the project is defined as terrain. Measurements of the terrain in the area surrounding the proposed project were made using terrain data obtained from SRTM 30 m derived from the Web GiS. It was determined that the topography varies from 351 m to 1247 m in study area.

FIGURE 4.2
TERRAIN MAP WITH RECEPTOR LOCATION



Mathematical Model for Pollutants Dispersion

Aermod View model has been used to predict the impacts. This model for area sources uses the steady state Gaussian plume equation for a continuous source.

Further the model has following specialties:

- Simulates dispersion from single/multiple/area/line/volume sources.
- Allows calculations to be made at a user specified regular rectangular/radial grid or at specified special receptors.
- Provides estimates of concentrations for any averaging time period for the entire period of input meteorology.
- Allows calculations to be underwritten for source groups as selected by the user.
- Uses Pasquill-Gifford or Briggs dispersion curves (for urban areas) as selected by the user, to derive the plume spread parameters.
- Adjusts dispersion curves to account for user specified information on aerodynamic roughness.
- Adjusts for wind speed variation with height, using user specified default urban/rural power law coefficients.
- Simulates dispersion from buoyant, non-buoyant point sources, non-buoyant area, non-buoyant volume sources and non-buoyant line sources.
- Simulates dry deposition using a simple tilted plume model with user specified reflection coefficients.
- Simulates building wake effects.
- Can include the effects of exponential decay.
- Uses Briggs' 1975 plume rise algorithm to calculate plume height.
- The ground level concentration at a receptor located downwind of all or a portion of the source area is given by a double integral in the upwind (x) and crosswind (y) directions as:

$$x = \frac{Q_A K}{2\pi U_s} \int_{x} \left\{ \frac{VD}{\sigma_y \sigma_z} \exp[-0.5] \int_{y} \left[\frac{y^2}{\sigma_y} \right] dy \right\} dx \qquad \textbf{(2)}$$

QA	=	Area source emission rate (mass per unit area per unit time)
K	=	units scaling coefficient
V	=	Vertical term.
D	=	Decay term as a function of x
σy, σz	=	standard deviation of lateral and vertical concentration distribution (m)
Us	=	mean wind speed at release height

Vertical Term

The vertical term includes the effects of source elevation, receptor elevation, plume rise, limited mixing in vertical and gravitational settling and dry deposition of particulates (with diameters greater than about 0.1 micron).

In the present case effects on ambient air concentrations due to gravitational settling and dry deposition have been neglected. The vertical term without deposition effects is given by:

$$V = \left[(1 + \gamma) \exp\left(\frac{-He^2}{2\sigma_z^2} \right) + \sum_{i=1}^{\infty} \gamma^{n-1} \exp\left(\frac{-(2n\,Hm - He)^2}{2\sigma_z^2} \right) + \exp\left(\frac{-(2n\,Hm + He)^2}{2\sigma_z^2} \right) \right] \quad \textbf{(3)}$$

where,

H = Effective release height of emissions (plume rise + physical stack height)

Hm = Mixing height

γ = reflection coefficient

The infinite series term in equation accounts for the effects of restrictions on vertical plume growth at the top of mixing layer. Complete reflection from earth surface has been assumed (γ = 1). For number of sources more than one simulation is done for each individual source and then added. In order to calculate σy and σz for various receptor points for given wind direction following equations are used.

X = (X® – X(S)) Sin (WD) – (Y® – Y(S)) Cos (WD) (4)

y = (X® – X(S)) Cos (WD) – (Y® – Y(S)) Sin (WD) (5)

where X®, Y® are receptor point coordinates and X(S) and Y(S) are source coordinates and WD is wind angle from north.

Dispersion Coefficients

Equations that approximately fit the Pasquill-Gifford curves (Turner, 1970) are used to calculate σy and σz in meters for rural area. The equations used to calculate σy is of the form

σy = 465.11628 (x) tan (TH) (6)

where,

TH = 0.017453293 [c-d ln (x)] (7)

In the above equations downwind distance `x' is in kilometres and coefficients `c' and `d' are listed in **Table 4.8**. The equation used to calculate σz is of the form:

$\sigma y = axb$ (8)

TABLE 4.8
COEFFICIENTS USED TO CALCULATE LATERAL VIRTUAL DISTANCES

		$\sigma y = \frac{\sigma y0\ l/q}{P}$
Pasquill Stability Category	P	Q
A	209.14	0.890
B	154.46	0.902
C	103.26	0.917
D	68.26	0.919
E	51.06	0.921

where downwind distance x is in kilometres and σz is in meters. The coefficients `a' and `b' are given in **Table 4.9.**

TABLE 4.9

PARAMETERS USED TO CALCULATE PASQUILL-GIFFORD VERTICAL DISPERSION COEFFICIENT (σZ)

σz (meters) = axb (x in km)			
Pasquill Stability Category	x (km)	a	B
A*	<.10	122.800	0.94470
	0.10 – 0.15	158.080	1.05420
	0.16 – 0.20	170.220	1.09320
	0.21 – 0.25	179.520	1.12620
	0.26 – 0.30	217.410	1.26440
	0.31 – 0.40	258.890	1.40940
	0.41 – 0.50	346.750	1.72830
	0.51 – 3.11	453.850	2.11660
	>3.11	**	**
B*	<.20	90.673	0.93198
	0.21 – 0.40	98.483	0.98332
	>0.40	109.300	1.09710
C*	All	61.141	0.91465
D	<.30	34.459	0.86974
	0.31 – 1.00	32.093	0.81066
	1.01 – 3.00	32.093	0.64403
	3.01 – 10.00	33.504	0.60486
	10.01 – 30.00	36.650	0.56589
	>30.00	44.053	0.51179

TABLE 4.9 (CONTD…)

σz (meters) = axb (x in km)			
Pasquill Stability Category	x (km)	a	B
E	<.10	24.260	0.83660
	0.10 – 0.30	23.331	0.81956
	0.31 – 1.00	21.628	0.75660
	1.01 – 2.00	21.628	0.63077
	2.01 – 4.00	22.534	0.57154
	4.01 – 10.00	24.703	0.50527
	10.01 – 20.00	26.970	0.46713
	20.01 – 40.00	35.420	0.37615
	>40.00	47.618	0.29592
F	<.20	15.209	0.81558
	0.21 – 0.70	14.457	0.78407
	0.71 – 1.00	13.953	1.68465
	1.01 – 2.00	13.953	0.63227
	2.01 – 3.00	14.823	0.54503
	3.01 – 7.00	16.187	0.46490
	7.01 – 15.00	17.836	0.41507
	15.01 – 30.00	22.651	0.32681
	30.01 – 60.00	27.074	0.27496
	>60.00	34.219	0.21716

* If the calculated value of σz exceeds 5000 m, σz is set to 5000 m.

** σz is equal to 5000 m.

Meteorological Conditions Used in Predictions

The hourly meteorological data has been generated at the site and the same has been used in the predictions. The hourly wind speed, temperature, direction and stabilities have been used. The hourly data was available for the months of March-May, 2022.

Atmospheric Stability

Many alternative models are developed by different authors to relate σy and σz with downwind distance x under different atmospheric stability conditions. Unfortunately, none of these have been found to be comprehensive enough to be applicable under all types of topographic and meteorological conditions. On the basis of available information, "Pasquill Gifford" stability classification system for study area has been followed. This classification is built in the model.

The Pasquill Gifford stability classification divides atmospheric stability into six classes based on solar insolation/cloud cover conditions. Details of this classification are given **Table 4.10.**

TABLE- 4.10
PASQUILL – GIFFORD STABILITY CLASSIFICATION

Surface wind speed (m/s)	**Day time insolation**			**Night time conditions**	
	Strong	Moderate	Slight	Thin low clouds <4/8	Overcast clouds >3/8
0 – 2	A	A – B	B	E	F
2 – 3	A – B	B	C	E	F
3 – 5	B	B – C	D	D	E
5 – 6	C	C – D	D	D	D
>6	C	D	D	D	D

A – Extremely unstable
B – Moderately unstable
C – Slightly unstable
D – Neutral
E – Slightly stable
F – Moderately stable

Ambient air quality and background concentrations

Ambient air quality standards promulgated by Central Pollution Control Board (CPCB) for industrial, residential and rural areas are as follows:

TABLE 4.11

AMBIENT AIR QUALITY STANDARDS BY CPCB

Concentration ($\mu g/m^3$) (24 hours average)			
PM_{10}	**$PM_{2.5}$**	**SO_2**	**NO_2**
100	60	80	80

The above standards are for a sampling period of 24 hours. The maximum concentration of pollutants (PM_{10}, $PM_{2.5}$, NO_2 and SO_2) recorded at habitat in the study area during summer months are given below:

Plan and frame work of computations:

Selection of locations:

The locations have been selected around the mining area covering an area of 10 km radius from mining centre. The entire area has been put on grid network and grid spacing has been taken as 500 m.

TABLE - 4.12

MAXIMUM CONCENTRATION

Station Code	Location	Maximum Concentration in µg/m³			
		PM_{10}	$PM_{2.5}$	NO_2	SO_2
AM1	Within lease area	67.53	33.98	29.16	13.16
AB1	Proposed Screening plant	59.50	23.28	24.80	15.40
AM2	Akash Nagar CISF Camp	71.50	30.60	25.08	12.27
AM3	Padapur	71.40	38.50	25.08	14.20
AB2	Pujaripara	63.18	23.50	25.38	13.43
AMB1	Within 500m downwind direction from lease area	58.30	34.06	26.05	15.39
AMB2	Timmenar	53.60	25.39	31.56	12.26
AMB3	Near proposed conveyor alignment	58.65	25.19	24.78	12.34
AMB4	Within 500M Downwind Direction from Beneficiation Plant	55.12	24.52	25.16	13.60
AMB5	Near Kanya Ashram, Dhurli	53.52	29.19	23.50	11.20
AMB6	Bhansi	63.62	24.29	25.38	11.62
AMB7	Porokameli	58.54	30.53	25.72	13.54
AMB8	Nerli	55.60	30.84	24.62	12.40
AMB9	Bacheli	62.59	35.50	24.61	10.82

Plan of computation

The emission rate, dispersion coefficients and other input data being now available to compute the following:

- The 24-hourly averaged concentration with hourly data for the post monsoon season;
- The identification of grid point having peak concentration for the values; and Preparation of isopleths.

Results and Discussions – air quality modelling

Peak 24 hourly concentrations in worst case Scenario

TABLE -4.13

24 HOURLY PEAK CONCENTRATIONS COMPUTED IN WORST CASE SCENARIO

S. No.	Season	Concentrations (μg/m³)	
		PM_{10}	**$PM_{2.5}$**
1	Summer	57.5	27.0

TABLE -4.14

24 HOURLY PEAK CONCENTRATIONS COMPUTED IN CONTROLLED CASE SCENARIO

S. No.	Season	Concentrations (μg/m³)			
		PM_{10}	**$PM_{2.5}$**	**NO_2**	**SO_2**
1	Summer	18	8.46	11.4	7.58

As mentioned earlier peak 24 hourly PM_{10}, $PM_{2.5}$, NO_2 and SO_2 concentrations have been computed using hourly meteorological data. The isopleths of various concentrations have also been drawn and these are given in **Plate 4.3** for PM_{10}, **Plate 4.4** for $PM_{2.5}$ in worst case scenario and **Plate 4.5** for PM_{10}, **Plate 4.6** for $PM_{2.5}$, **Plate 4.7** for NO_2 and **Plate 4.8** for SO_2 in controlled case scenario. The concentrations at the locations of ambient air quality have been discussed below in **Table 4.14.**

TABLE 4.15

POST PROJECT CONCENTRATION DUE TO BAILADILA IRON ORE DEPOSIT-4 PROJECT

S. No.	Location	Background Concentration (μg/m³)				Predicted Incremental Concentration (μg/m³)				Post Project Concentration (μg/m³)			
		PM_{10}	$PM_{2.5}$	NO_2	SO_2	PM_{10}	$PM_{2.5}$	NO_2	SO_2	PM_{10}	$PM_{2.5}$	NO_2	SO_2
1	Within lease area	67.53	33.98	29.16	13.16	1.43	0.68	2.24	1.49	68.96	34.66	31.40	14.65
2	Proposed Screening plant	59.50	23.28	24.80	15.40	1.19	0.56	0.24	0.16	60.69	23.84	25.04	15.56
3	Akash Nagar CISF Camp	71.50	30.60	25.08	12.27	1.68	0.79	1.70	1.13	73.18	31.39	26.78	13.40
4	Padapur	71.40	38.50	25.08	14.20	1.39	0.66	2.81	1.87	72.79	39.16	27.89	16.07
5	Pujaripara	63.18	23.50	25.38	13.43	0.17	0.08	0.13	0.09	63.35	23.58	25.51	13.52
6	Within 500m downwind direction from lease area	58.30	34.06	26.05	15.39	7.72	3.63	3.38	2.25	66.02	37.69	29.43	17.64
7	Timmenar	53.60	25.39	31.56	12.26	0.16	0.07	0.15	0.10	53.76	25.46	31.71	12.36
8	Near proposed conveyor alignment	58.65	25.19	24.78	12.34	0.82	0.38	0.68	0.46	59.47	25.57	25.46	12.80
9	Within 500M Downwind Direction from Beneficiation Plant	55.12	24.52	25.16	13.60	0.37	0.17	0.24	0.16	55.49	24.69	25.40	13.76
10	Near Kanya Ashram Durli, Dhurli	53.52	29.19	23.50	11.20	0.18	0.08	0.17	0.11	53.70	29.27	23.67	11.31
11	Bhansi	63.62	24.29	25.38	11.62	0.30	0.14	0.25	0.17	63.92	24.43	25.63	11.79
12	Porokameli	58.54	30.53	25.72	13.54	0.38	0.18	0.30	0.20	58.92	30.71	26.02	13.74

13	Nerli	55.60	30.84	24.62	12.40	0.66	0.31	1.37	0.91	56.26	31.15	25.99	13.31
14	Bacheli	62.59	35.50	24.61	10.82	2.48	1.18	4.05	2.70	65.07	36.68	28.66	13.52

It is clear from the predicted values that the concentrations of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 are well within the stipulated limits of CPCB for Rural and Residential areas at all locations.

4.1.6 Noise & Vibration

Noise will be generated from drilling, blasting, excavation, sizing and transportation of ores. Noise will be also due to operations like crushing, screening, washing, storage and dispatch of ores. Blasting causes ground vibrations, noise and fly rocks. When an explosive charge will be fired in a hole, stress waves propagate radically in all directions and cause the rock particles to oscillate. This oscillation will be felt as ground vibration. It is proposed to deploy 150 mm dia. rotary percussive drills along with crawler drills of 100 mm dia. for mine development and bench preparation of mines during 1st five years of operation. Afterwards the blast hole drilling shall be done by 250 mm dia. rotary drills to achieve the ultimate target of the mine, i.e., 7.0 MTPA of Iron Ore ROM production. In the addition of the above-mentioned drills, crawler drills of 100 mm dia. are proposed to be deployed to drill with the toes, uneven bench floors and cliff remnants.

Normally 3 to 4 row blasting patterns are adopted to minimize ground vibration, noise and fly rock control. The diameter of holes are 150 mm and the depth of holes on an average is 14.5 m (including that of sub grade drilling of 1.2 meter for bench height variations etc.). The average burden is 4 to 5 meters and the average spacing is 5 to 6m. The details are discussed in **Chapter-2**.

The operation of machinery in the open cast mine and in screening cum beneficiation plant will result in considerable noise which not only will affects the people working in the mine and beneficiation plant, but also in the surrounding areas. Generally, Noise will be transmitted over more distances when mine workings will be on the hill tops. Vibrations through ground will also affect the fauna as they are more sensitive to these unusual ground and air vibrations. The vibration and air blast from blasting can lead to community concern primarily due to fear of structural damage.

The project will adopt controlled blasting and other measures due to which impact will be minimized.

The mining operations using deep hole drilling and blasting using ordinary detonators will bound to produce ground vibrations. As the Deposit-4 mine is located at hill top and there is no habitation surrounding the mining lease area, the noise levels will have insignificant impact on the existing ambient noise levels in the residential areas.

Impacts during Construction Phase of Screening cum Beneficiation Plant

Noise levels will also likely to increase due to increased movement of trucks and other diesel-powered material handling equipment. This will have an adverse impact in the vicinity of the construction activities. However, movement of trucks and machinery will be mainly during daytime to keep the impact of increased noise minimum. Since the construction phase will be temporary, the impact on ambient noise levels will be temporary and cease once the construction phase is over.

Impacts during Operation Phase of Screening cum Beneficiation Plant

During normal operations, ambient noise levels will increase significantly only close to the compressors and blowers and other plant operations. But this will be confined only within plant boundary. The noise level within the plant boundary will be confined within shops. The level will be further minimized when the noise reaches the plant boundary and the nearest residential areas beyond the plant boundary, as elaborate green belt development will be envisaged for attenuation of noise and fugitive emissions. All the equipment in the proposed plant will be designed/operated in such a way that the noise level shall not exceed 80 dB (A). However, if during operation, the noise level exceeds the above norms then the protective measures given in Environmental Management Plan will be followed.

4.1.7 Water Environment

Surface water

There are no major streams in Deposit-4 mining lease and screening cum beneficiation plant area. However, there are small streams originating from the north eastern slope of mining lease and formed as Galli Nalla and Sankani Nalla. The open cast mining operation can pollute the surface water sources as well as water flowing out of the area due to increased erosion of the excavated areas and the dumps. The single most important environmental aspect of mines and beneficiation plant are the surface runoff from various areas during monsoon season. Surface run off from the mining, beneficiation area and other areas gets laden with aluminous lateritic soil from mine benches, exposed outcrops etc. As the iron ore contains only traces of sulphur, the surface runoff water does not get acidic, but become highly turbid due to loosening of soils by the mining activities. Major sources of runoff from the mine and screening cum beneficiation plant will be waste dump areas, ore handling and stockpile areas, mine haul roads, service centres etc.

These can affect the aquatic ecology of surrounding water bodies. Discharge of mine effluents to the nearby surface water bodies without proper treatment may affect vegetation in the surrounding area.

- The total water requirement inside the mining lease will be 4250 KLD. The total water requirement for screening cum beneficiation facility (outside the mining lease of Bailadila Iron Ore Deposit-4) at full rated capacity is 8630 KLD

(approx.) and 5500 KLD in wet and dry operations respectively. Thus, maximum water requirement will be 12880 KLD (Mining operation-4250 KLD + Wet screening operations -8630 KLD). Permission for withdrawal of water from Sankani Nalla and Nerli Nalla (Sankani Nadi) will be obtained from Water Resource Department, GoCG. NCL has submitted application for obtaining water permission for 20,000 KLD (considering entire Bailadila Deposit-4 project with peak rated capacity and future requirements including separate township) with Water Resource Department, GoCG.

- Water flow measurements at the above sources are regularly carried out in each season throughout the year and the results, indicate ample water availability.
- Considering the availability of surface water in the area vis-a-vis the consumption, the impact of withdrawal of surface water for various uses mentioned above will be insignificant.

Ground water

There will not be any impact on the ground water resources as there is no ground water tapping for mining, screening cum beneficiation plant and allied activities.

In the lease area, no water table / aquifers were encountered up to the exploratory drilling level 1140 mRL. In Deposit-4 Iron Ore mine, the mine working will not intersect ground water table during its life time.

A cross section showing the lowest mining levels and the available ground water table has been shown in the **Plate 4.9**.

4.1.8 Impact of mining & screening cum beneficiation plant on water availability

Mining & screening cum beneficiation plant and associated activities will have quantitative and qualitative impacts on the water regime in and around the mines.

Open cast mining operations many times puncture the ground water table which affects the ground water table in the surrounding area. Pumping operations results in reduction of groundwater table. As discussed above the mine working will not intersect the ground water table. Hence impact on ground water will be negligible.

4.1.9 Soil Quality

In the process of opencast mining, several changes will occur in physical, chemical and microbiological properties of soil as a result of mining and storage. The open cast mining operation directly results in removal of the soil which affects the soil fertility of the ML area. The heavy rainwater causes soil erosion in the mining lease area. During the monsoon season, the surface runoff carries silt and soil along with it and may cause more turbidity of the nearby water bodies. The soil samples have been analysed and quality is discussed in **Chapter-3.**

4.1.10 Waste Generation

The details of waste generation are discussed under **Sub-section 2.6.4 & 2.6.5** in **Chapter-2.** The area occupied by waste dump shall be 74.07 ha inside the lease area. The suitable terracing shall be done at regular interval to maintain the slope of the dump. The waste rock shall be accommodated in designated 5 nos. waste dump. The waste dump shall be reclaimed and rehabilitated by geo-coir matting, planting soil binding species on slopes, plantation of trees on terraces of waste dump. Proper engineering structures such as buttress walls, garland drain etc to be constructed at the toe of the waste dump.

4.1.11 Flora and fauna

The survey has not indicated the presence of any rare, endangered or endemic species within the mining lease area and screening cum beneficiation plant area. The fauna reported in this area does not fall under category of rare species and are all common migratory type. Specific corridors for movements & breeding grounds are also not reported. No wild life Sanctuary or any other wild life area exists within vicinity of Core zone & Buffer zone of Mining Lease and screening cum beneficiation plant area. Specific corridors for movements or breeding grounds have not been reported. The forest in the study area is of degraded type.

Since the major portion of the mining lease area is located in the forest area and on hill top the impacts on nearby areas are as under:

- Removal of vegetation (flora) from the area required for mining and other purposes, and thereby displacement of fauna.
- Dust due to mining and associated activities, which will be deposits on the leaves of the plant in the surrounding and hampers the process of photosynthesis and stunted growth.
- Noise and vibrations due to blasting, movement of HEMMs/vehicles and operation of fixed plants will not be not conducive for the development of wild animals and birds.

4.1.12 Socio-Economic Conditions

The impacts of the human activities, specially, mining, screening cum beneficiation and associated activities, on the society assume a great importance. As soon as a mineral is discovered and proved, and its mining potential will be established, impacts on the society will take shape like increase in the value of the land, people from outside will start buying land for establishing businesses etc. Mining, screening cum beneficiation and associated activities can cause the following impacts on the society.

- Displacement of the people
- Loss of livelihood
- Changes in population dynamics
- Cost of living

- Water scarcity
- Health impacts
- Infrastructure facilities
- Employment opportunities
- Increase in aspiration

The above impacts will be considered by the project proponent and various measures will be undertaken for upliftment of the socioeconomic conditions of the area. The screening cum beneficiation activities will have displacement of human settlements to some extent at Bhansi & Porokameli villages and rehabilitation and land acquisition process as per applicable statutory provisions has been initiated. Resettlement of oustees and their rehabilitation will be taken care of as per applicable law. Further, no negative effects are anticipated out of activities of the mining and beneficiation operations of Bailadila Iron Ore Deposit-4.

4.1.13 Impact due to the possible Accident

Following accident may occur during the operation of mine and beneficiation.

- Forest fire
- Failure of waste dump
- Failure of pit slope
- Lubricant & HSD storage chambers/ tankers

In case of mis happening, local population and wildlife may get affected.

4.1.14 Impact due to the final decommissioning or rehabilitation

Possibility of falling down of the human being, animals etc. in mine pits that cause death or major injury. Since this is new project, workings are not started/matured for decommissioning/closure of mine & beneficiation. Fencing all along the boundary will be made to avert the said risk.

4.2 Mitigation Measures

4.2.0 General Views

Careful planning & implementation of proper environment management practices are essential for sustainable development. The impact assessment discussed in above sections has highlighted certain areas which need special attention. The projects will undertake control measures for all anticipated environmental impacts.

The impact assessment of the mining and screening cum beneficiation operations has highlighted certain areas which need special attention. The projects will carry out control measures for air, water, noise pollution etc. and draw up plans for reclamation & rehabilitation of broken land as also solid waste management. Project Proponent will undertake due precautions as discussed in the following paragraphs:

4.2.1Topography

The mine lease area consists of 646.596 Ha of Forest land. Screening Cum Beneficiation Plant will be 750 TPH of 4 lines each along with 2200 TPH Downhill Conveyor System and Loading Facilities in 122.5428 Ha. area at outside the Mine Lease area of Bailadila Iron Ore Deposit-4. The mining shall be carried out by a system of benches. The mine bench height will be maintained at 12 m and its minimum operating width will be 30 m. At the final stage of the mine, the biological reclamation should be carried out by planting on the degraded mined out areas and OB dumps. The mining would marginally affect the overall view of the area, but will grossly modify the local topography of the mined area at the end of mining. The area surrounding the Mine lease has natural vegetation. The landscape of this terrain will be modified to some extent due to mining and beneficiation activities. Suitable drains will be constructed in the mine haul roads and benches, so that water will flow out to fixed area and ultimately will be held by the check dams. In future, rehabilitation shall be carried out on mine as suggested in the approved Progressive Mine Closure Plan and Final Mine closure Plan.

Haul Road

The rain water during rainy season will be controlled by suitably providing cross slopes of about 1% for the benches. While preparing and advancing the benches, main roads and other ancillary roads, suitable slope and drainage will be provided and maintained so as to avoid unwanted accumulation of water. The drainage on the main road will be kept towards hill side and roads will be given 1% slope towards drainage so that the water will not be accumulated on the roads.

Mine Benches

On the benches, 1° slope will be maintained and kept away from the face and joining to drainage of the roads so that water is not accumulated on the face.

Discharge to perennial nallahs

No wastewater will be allowed to discharge from the mining and screening cum beneficiation area into the natural watercourses. Natural water flow during monsoon will be routed into the low-lying areas after passing through various engineering measures for grade stabilization structures where silt and sediments gets arrested. The check dams and check bunds will be de-silted well before monsoon season every year to ensure clear water discharge towards downstream. The de-silted material will be stacked separately and suitable protective measures will be adopted to prevent further run-off from the stacked material.

OB dumps will be terraced properly and provided with suitable retaining/toe walls of sufficient height and width at the toe of the dump in order to avoid the surface run-off. The detailed management for OB dumps of Bailadila Iron Ore Deposit-4 will be as discussed in **Chapter-2** under **section 2.6.10.2** & **2.6.10.3**.

4.2.2 Land use

At the end of the life of mine, the land use pattern of the mining lease area is given in **Table 4.3.** The proposed reclamation & rehabilitation will be undertaken as given in **Table 4.16**. The measures include technical and biological reclamation of mined out areas, plantation with native species on dumps and mined out benches. The part of mine pit shall be restored as a water reservoir and remaining part will be backfilled. The post mining reclamation and afforestation plan is placed as **Plate 4.10.** The land use plan after fifth year is placed as **Plate 4.13.**

TABLE 4.16
RECLAMATION AND REHABILITATION
(POST MINING)

Sl. No.	Land Use at Conceptual Stage	Area (Ha)	Method of Reclamation and Rehabilitation	Area (Ha)
1	Mined out Area Reclaimed but not fully rehabilitated	1.84	Plantation (terrace & slope plantation), Coir matting	1.84
2	Mined out Area fully Rehabilitated from Reclaimed area	142.75	Backfilling and Plantation	142.75
3	Area under Water Reservoir considered Rehabilitated	20.04	Water reservoir by collection of rain water	20.04
4	Stabilized Waste dump Rehabilitated	74.07	Plantation (terrace & slope plantation), Coir matting	74.07
5	Rehabilitated Area under utility services	54.371	Plantation	54.371
6	Area under utility services not rehabilitated	26.899	Internal/approach road	26.899

7	Green belt-safety zone along the ML boundary	8.488	Plantation	8.488
8	Area under environmental protection, improvement and EMP works	241.642	Plantation	241.642
9	Tree fern area (non-diverted)	76.496	Protection & conservation as per biodiversity plan	76.496
Total		**646.596**		**646.596**

Source: NMDC-CMDC Limited

4.2.3 Top Soil

There is negligible top soil in the area. The available quantity shall be used in plantation works.

4.2.4 Drainage

There will be no specific problem of water accumulation in the mine area as mine is located on the top of hill. The activities will not be expected to change the existing drainage pattern of the area. The rainwater during the monsoon will have a tendency to flow in the natural drainage system of the area. Silt settling tanks will be constructed at suitable locations.

The following drainage management measures will be undertaken:

i. Proper gradient and drainage arrangement at the overburden dumping area.
ii. The water will be allowed to flow down the dump slopes through garland drain.
iii. Plantation of indigenous and other economically important trees, shrubs, herbs and grasses at the point of discharge and on OB dumps will be taken up, so that the sediment/silt flow will be arrested from the site and soil moisture will be maintained.
iv. Number of check dams and check bunds will be constructed on water course. 5 no.s check dams and 9 no.s check bunds are proposed. Every year before onset of the monsoon de-silting of Check dam & Check bunds will be done to arrest the overflow of the silt. Regular water sampling is proposed to be carried out every year during winter period, pre-monsoon period, monsoon period and post monsoon period. Two waste dumps envisaged in the mine will be protected using toe wall, buttress wall at the bottom of the waste dumps. At suitable places geo-textile will be used for waste dump stabilization. Garland drains will be made to channelize the surface run off into the series of check dams / bunds. It is proposed to prepare channels beside haul roads for controlled passage of rain water wash offs.

4.2.5 Air Environment

Concentration of Respirable Particulate Matter PM_{10} & $PM_{2.5}$ and the Gaseous Emission levels are within the limits prescribed by the CPCB. The following control measures will be adopted to keep the fugitive dust under control:

4.2.5.1 Drilling Operations

When the blast holes will be drilled, the cuttings from the holes will be flushed out of the holes by passing the compressed air through drill rods and the cuttings will be allowed to fall outside the collar of the blast hole by means of blowers. The dust thus generated during drilling will be suppressed and allowed to settle in the form of a cone near the collar of the blast hole itself by use of water during drilling so that the air will not be polluted by the blast hole drilling. During drilling operation sharp bits will be used and wet drilling system will be practiced.

Secondary drilling in the mining operation will not be a regular feature but some drilling for removal of toe and in ledges, occasionally, will be carried out. Secondary drilling will be done by 100 mm dia. crawler drills and subsequently blasting is done by controlled charging. However, blasting of boulders will be minimized keeping in view the vibration and noise hazards. For handling the boulders rock breaker will be introduced.

4.2.5.2 Blasting

The air gets polluted during blasting operations will be in the form of chemical gasses produced during the explosion and dust generated during blasting. However, in the mine the number of holes blasted during any blast event will not exceed a maximum of 30/40 holes per blast and on an average about 20 per blast. The gasses generated during explosion will not likely to contribute much to the air pollution and as such will effects will be there due to chemical gases produced during the explosion and dust generated during the blast on vegetation or on the residents of the nearby township or residential houses. Optimal use of explosives, controlled blasting techniques with the use of NONEL (Non-Electric Detonators), optimization of initiation systems will be adopted. Regular water sprinkling before and after the blasting in the surrounding area of the blasting face will be adopted.

4.2.5.3 Excavation and Haulage of Ore and Waste

During ore or waste excavation, hauling of ore/waste, feeding of ROM in crusher and dumping of waste in waste dump yard during dry months, some dust will be generated. Blasted ore and waste will be reclaimed from blasted muck pile by shovels and same will be transported from mine face to the crushing plant/waste dump by 100 tonnes capacity dumpers. To lessen the generation of dust during excavation, the excavators will have inbuilt mechanism of air-conditioned cabin to protect the operator from fugitive dust and water will be sprayed on the blasted muck pile. Also, main mine haul roads where dumper will ply, will also be sprayed with water through 28 KL capacity water sprinklers (four nos.) during dry seasons.

Thus, there will be negligible dust generation during excavation and haulage of ore and waste.

4.2.5.4 Dust Suppression system in Crushing Plant and Downhill Conveyor System.

Crushing Operation

Fugitive dust will be generated in the crushing plant during dry months when the ROM ore will be crushed in the crushers and will be carried to the primary surge pile through conveyer. In order to ensure effective dust suppression, water will be sprayed in the form of a mist in the crusher. Since crushing will be done by the equipment which will be housed in an enclosure, there will be no threat of air pollution to the surrounding areas due to the crushing plant as the GI sheet enclosure premises. The atomized water sprinklers aided with compressed air will be installed at the point of ore dumping platform at Deposit-4 crushing plant for effective dust suppression.

Down Hill conveyor Operation

Crushed ore from the crusher will be transported through a system of closed conveyor belts to screening cum beneficiation plant for further processing. This system will be developed in order to control the dust generation during transportation of ore from one place to another. The conveyor system will be stretched from crushing plant to screening plant covering a distance of around 8.7 km. It will be ensured that conveyor system will work efficiently and therefore able to control dust emission.

1. Dry fog dust suppression system (DSS) will be installed at Primary Crusher and Secondary Crusher area and in Downhill conveyor system.
2. The locations where DSS will be installed along with nozzles are dumper platform, all screen levels, conveyor transfer chutes, intermediate stockpiles, screening plant, loading plant etc.

4.2.5.5 Primary Stock Pile

Some dust generation may take place in dry months when the crushed ROM ore from the crushing plant will be discharged in to a Primary Surge Pile (PSP) created below the crushing plant. During the process of discharge, fraction of ore particles will tend to move away from this falling stream of ore. However, since the PSP will be located on hill slope and most of the time it assumes the shape of a funnel with its truncated concave face facing the open area of hilltop. The wind, which generally blows towards the PSP, will make the dust particle to fall back into the PSP itself, thereby contributing less to the ambient air pollution. Further, stockpile will be covered with tarpaulin to mitigate the dust emission.

4.2.5.6 Screening and Loading Operation

During stacking of lump and fines, some dust may generate and arrangements will be made to ensure effective dust suppression by water spraying. It is generally observed that the suspended particulate matter settles down within the mining

area itself due to their higher specific gravity. The sparsely populated villages, which are situated far away from the mining lease & screening cum beneficiation plant will not encounter problem due to dust arising from the proposed mining and screening cum beneficiation operations of Deposit-4. The dry fog dust suppression system will be continued at different transfer points during the non-monsoon season. The screening plant will be housed in a huge GI sheet enclosure, which will act as a good shield for the prevention of dust particles escaping out of the plant building. Fixed water sprinklers in the loading plant area will be used. All the HEMMs and other vehicles will be maintained in good condition so as to keep the exhaust emissions well within the limits. All project vehicles will be undergone Pollution Under Control tests to assess their emissions. Maintenance of vehicles will be carried out to keep emission levels under control.

4.2.5.7 Control Measures at Mineral Processing Plants (Screening cum Beneficiation Plant)

- Water will be sprinkled on the ore before crushing. The atomised water sprinkler aided with compressed air at the point of ore dumping platform will be installed at crushing plant;
- Water sprinklers along with compressed air forming mist will be installed at all transfer points in the mineral processing plant to suppress the dust at Deposit-4;
- All the conveyor belts will be covered and will be equipped with telescoping chutes at transfer points to reduce the vertical fall of ore material;
- The vehicles will be maintained properly and exhaust emission will be checked regularly;
- Speed restrictions will be imposed on the HEMMs and light vehicles to minimize the dust generation in mining and mineral processing plant areas;
- In the Loading plant area, lump ore & fine ore reclaimers will be provided with dust suppression arrangement. The mist water will be sprayed while reclaiming the ore from stockpile for loading into railway wagons through wagon loader.

4.2.5.8 Impact of transportation on the environment

The blasted ore from mine face to the crushing plant will be transported by 100 tonnes capacity dumpers. These dumpers will ply between the faces of various blocks and crushing plant carrying the blasted ore to the crushing plant. The dumpers will be well maintained so that exhaust smoke does not contain abnormal values of noxious gases and unburnt fuel. To mitigate the other source of air pollution will be due to the dust generated during the movement of dumpers in the mine, regular water Sprinkling will be carried out on the roads leading to the active area of the mine workings during all the shifts. Four water sprinklers will be deployed for regular water sprinkling. Each water sprinkler will have a capacity of 28 KL. Crushed ore from the crusher situated inside the mining lease will be transported to the screening cum beneficiation plant through a network of closed

conveyor belts. Water will be sprinkled through directed nozzles at all transfer chutes inside the conveyor gallery. Final product (lump & fine), during the construction phase of the project when small scale mining will be carried, will be transported through high-capacity trucks (30-35 tonnes) covered with tarpaulin. After commissioning of screening cum beneficiation plant and railway siding facility, final product will be transported through rail.

Deposit-4 Iron Ore Mine is surrounded by many other mines. The list of mines within 10 Km radius is shown in **Plate 2.11** and tabulated below in **Table 4.17.**

TABLE 4.17
SURROUNDING MINES OF DEPOSIT-4

S. No.	Name of the ML	Iron Ore despatch (max)	Iron Ore despatch (Cap. Expansion)
1	Deposit -14	5.00	10.00
2	Deposit -14 NMZ	5.50	08.50
3	Deposit -5	10.00	10.00
4	Deposit -10	6.00	06.00
5	Deposit -11	11.30	11.30
	Total	**37.80**	**45.8**

Source: NMDC-CMDC Limited

4.2.5.9 Iron Ore Transportation Route and Road Traffic

Transportation of Iron Ore from mine will be mainly through existing KK railway line and through using existing SH/NH road. Iron ore will be transported through trucks which will be fully covered by tarpaulin sheets, so dust generated from movement of vehicle will be intrinsic in nature. The dedicated broad gauge single Railway line of 450 KM from Kottavalasa to Kirandul (KK Line) was constructed during 1960-66 and opened for goods traffic in 1966-67. The line was electrified in four phases from 1980-82. The capacity of this railway line is 28 MTPA. NMDC has also taken up doubling of KK line between Kirandul to Jagdalpur & Jagdalpur to Amdagaon for Iron ore transportation. By doubling KK line, the capacity of Iron ore transportation by rail increases to 40 MTPA. Also, railway has also planned to connect Rawghat to Jagdalpur (approx. 140 km). Completion of this rail route will enable transportation of iron ore from Bailadila sector to the iron and steel industry situated in other parts of Chhattisgarh.

The execution of doubling of KK railway line of 150 KM is divided into 3 sections. Section-I (from Jagdalpur to Silakjhori) is 45 Kms and doubling is completed on 17.06.2017. Section-II (from Kirandul to Gidam) is 52 kms and 7 kms doubling is completed. Section-III (from Gidam to Silakjhori) is 53 kms and 22 kms doubling is completed. Works in both Section-II & III are in progress and the completed

portions are opened to traffic. Out of 150 kms approx., 74 kms doubling is completed. The remaining work in all the sections will be completed by FY 2023-24.

The KK railway line is also shared by other mines of NMDC situated in Bacheli and Kirandul for transportation of Iron ore. Maximum transportation of Iron ore from Deposit-4 ML will be done through railway line after completion of construction of screening cum beneficiation plant. During first five years for production of 2 MTPA, transportation of iron ore will be through existing NH/SH road. The map showing the transport route is placed as **Plate 4.11.**

The contribution of pollutants from all the active mines is reflected in the baseline status. The cumulative contribution due to the mine and other active mines indicates that PM_{10}, $PM_{2.5}$, SO_2 and NO_2 are within limit.

As per the traffic study (discussed in section 3.5.7, chapter-3) number of PCU per day on Kirandul-Geedam Road at Bacheli is 3066. As per guidelines for capacity of roads in rural areas of IRC, recommend design series volumes for two lane roads are 15000 PCU/day hence the traffic is within the standard limit.

During Mine Operation, PCU per day is given in below:

For First Five years	
Total Capacity of mine (for first five years)	2000000 TPA
No. of Dispatch working days	300
Extraction and Transportation of mineral	6667 Tons/day
Dispatch Ratio (Road : Train) for initial first five years	10:0
Transportation by Road for initial first five years	667 Tons/day
Dumpers Capacity	30
Frequency of trucks/Dumpers deployed/day	222 Trips
No. of Dumpers/trucks deployed/day (up & down)	444.44 say 444
PCU per day	1333.33 say 1333
After first Five years	
Total Capacity of mine (after first five years)	7000000 TPA
No. of working days	300
Extraction and Transportation of mineral	4666.67 Tons/day
Dispatch Ratio (Road : Train) after first five years	2:8
Transportation by Road for after first five years	933 Tons/day
Dumpers Capacity	30
Frequency of trucks/Dumpers deployed/day	31 Trips
No. of Dumpers/trucks deployed/day (up & down)	62
PCU per day	186

Existing for first five years and after first five years traffic scenario after proposed project & LOS is given below:

Existing Traffic Scenario and LOS			
V (Volume in PCU/day)	C (Capacity in PCU/day)	V/C Ratio	LOS
3066	15000	0.2044	B
After Proposed Project (first five years) Traffic Scenario & LOS			
3066+1333=4399	15000	0.2933	B
After Proposed Project (after first five years) Traffic Scenario & LOS			
3066+186=3252	15000	0.2168	B

After proposed project, LOS on Kirandul-Geedam Road at Bhansi will be "B" i.e. Very Good (for first five years & after first five years). From the above, it is clear that due to proposed project, there will be negligible impact on existing traffic and LOS will not be changed i.e. "B".

Note:

i. PCU – Passenger Car Unit
ii. Equivalency factor – 1 Truck = 3 PCU
iii. Volume in number of vehicles that pass-through a given point on the road during a designated time is expressed in hour or day, unit of length in km.

4.2.5.10 Other Mitigation measures to control Air Pollution

i. Workers will be provided with Personal Protective Equipment's to minimize dust exposure;
ii. Drilling operations will be mainly carried out during day light hours by adopting wet drilling and using dust collectors;
iii. Optimal use of explosives;
iv. Blasting will be avoided during high wind speed, night time and temperature inversion periods;
v. During high winds, excavation and transportation operations will be suspended.
vi. Haul roads and service roads will be graded to remove the accumulated loose material;
vii. HEMM will be Well maintained;
viii. Regular water sprinkling on the mine haul roads & other service roads will be done. Water sprinklers of capacity 28 KL will be operated;
ix. Crushing plant & screening cum beneficiation plant will be housed in a huge GI sheet enclosure which will act as a good shield for prevention of dust particles to escape out of the plant;
x. All belt conveyors will be covered with M. S. Sheets to stop the dust getting air borne;
xi. Speed control Mechanism for conveyors to prevent fine ore spillage;

xii. Development of green belt barrier along the lease boundary and screening cum beneficiation plant. Greenbelt barriers will also be developed in service centre, canteen, administrative offices, etc;
xiii. The dumpers will not be overloaded so as to prevent spillage of the ore on the haul roads during transportation.

4.2.5.11 Air Pollution Control Measures at Peak and Normative Production

The air pollution control measures for normative and peak production are given in **Table 4.18.**

TABLE – 4.18

AIR POLLUTION CONTROL MEASURES FOR NORMATIVE AND PEAK PRODUCTION AT BAILDILA IRON ORE DEPOSIT-4 PROJECT

Source	Normative Production	Peak production	Remarks
Drilling	Four drills will be used, each with wet drilling and a dust collector (cyclone).	Four drills will be used, each with wet drilling and a dust collector (cyclone).	The number of holes to be drilled will be increased. All drilling machines will be provided with a wet drilling arrangement and a cyclone arrangement for the suppression of dust.
Blasting	The number of holes that will be blasted will range between 60 and 150.	The number of holes that will be blasted will range between 60 and 150.	The blast frequency in a week will be increased without changing the charge weights. Frequency of water sprinkling before and after the blasting in the surrounding area will be increased.
Excavators	Six excavators will be deployed. Wetting of blasted piles will be done	Six excavators will be deployed. Wetting of blasted piles will be done	Utilisation of excavators will be increased. Blasted piles will be wetted by spraying water. A total of five water tankers (each of 28 kl) will be deployed.
Transportation of Ore	A total of 18 Dumpers for the Ore Transportation from mine benches to Ore	A total of 18 Dumpers for the Ore Transportation from mine benches to Ore	The number of trips will increase. The frequency of water sprinkling on haul roads

Source	Normative Production	Peak production	Remarks
	dressing plant will be deployed. Dust suppression On haul roads by tankers will be taken up.	dressing plant will be deployed. Dust suppression On haul roads by tankers will be taken up.	will be increased at peak production.
Crusher	2000 TPH crusher Mist water sprinkling at hoppers	2000 TPH crusher Mist water sprinkling at hoppers	No additional crushing beyond crusher capacity is envisaged
Conveyors	Closed Conveyors	Closed Conveyors	No additional conveying beyond the capacity is envisaged.

4.2.6 Noise and Vibration

The noise will be generated by drilling, blasting, movement of heavy machinery, crushing and air blast in the mining lease at the hilltop. Air blast will cause due to unconfined or partially confined explosion and detonating cords exposed in atmosphere. Site Mix Emulsion Explosives (SME) in conjunction with cast boosters and Non-Electric delay detonators explosives will be used for blasting. Where ever possible, blasting will be done using Non-Electric Bottom Initiation System. The secondary blasting will be limited to the uneven bench floors and toes. The boulders will be broken with the help of 'Rock Breaker' instead of secondary blasting. Blasting Performance Improvement Study will be undertaken after start of the mining operations.

Noise pollution mitigative measures

The following control measures will be adopted to keep the ambient noise levels well below the prescribed limits:

- Deep hole blasting will be restricted to day time hours only;
- Proper and timely maintenance of mining and beneficiation machineries;
- Noise levels will be controlled by using optimum explosive charge per delay and milli second delay detonators and proper stemming to prevent blow out of holes;
- Speed of moving dumpers and other vehicles running in the mine will be limited to moderate Speed (25 km/hr) to prevent undue noise as per DGMS circulars enforcing safety standards;
- Provision of user-friendly soft type ear muffs/ear plugs to workers in noise prone area in the mine;
- Effective arrangements will be made for timely repairs and original equipment manufacturer's recommendations with respect to schedule maintenance

procedures and practices in respect of the entire mineral processing plant equipment and principal mining machineries;
- The operator's cabin will be safely guarded from the noise pollution by preventing it from the noise arising because of the machineries;
- The noise level generated by blasting will be only momentary;
- The Crushers in the mine area will be completely enclosed in a covered building to minimize the sound propagation;
- Use of rubber coated screens in Screening Plant;
- Rubber lining at transfer points of conveyors.

Ground Vibration Control Measures

The following measures will be adopted to contain the Peak Particle Velocity (PPV) due to blasting within the permissible limits.

- Proper blast design;
- Avoiding excess confinement of charges;
- Number of blast holes per delay will be kept one;
- Proper stemming of holes will be carried out;
- Blasting will be avoided during foggy conditions and when wind velocity will be more than 25 km/hour;
- The burden distance will not be exceeded 50% of bench height;
- The spacing to burden distance of 1: 5 will be used owing to the fractured geological formation;
- Staggered pattern of blasting will be adopted;
- Shorter stemming lengths of less than 2/3rd of burden distance will be avoided to reduce overloading of holes and also to control fly rock;
- Maximum number of rows will be restricted to two since increase in number of rows will results in more confinement of charges in the last rows;
- Number of delays used per blast will be more so as to reduce charge weight per delay and creation of shock waves. In addition to this, wherever confinement will be more, like the corners of the block being blasted, belly holes, etc., extra delay will be provided. Each line of blast holes will also be divided to blast at two or more different timings by using delays;
- A delay or 8-10 milliseconds will be adopted as the strata are medium hard with high frequency of jointing/fracturing;
- Blasting operations will be carried out only during day time as per mine safety guidelines;
- A safe distance of about 500 m from centre of blasting will be maintained; and
- During blasting, other activities in the immediate vicinity will be temporarily stopped.

4.2.7 Water Environment

The water quality analysis results of all locations show that all the parameters are within the prescribed limits as per the standards of IS: 10500 and IS: 2296 (Class C). Rain water runoff only will likely to cause turbidity for which adequate control

measures will be undertaken. There are no major streams in Deposit-4 mining lease and screening cum beneficiation plant area. However, there are small streams originating from the north eastern slope of mining lease and formed as Galli Nalla and Sankani Nalla. A number of natural rainwater drainage courses cross the ridges and meet one of the above streams.

Number of check dams and check bunds will be constructed on nallas. Number of check dams and check bunds are proposed for protection of the water course from siltation. Every year before onset of the monsoon de-silting of Check dam & Check bunds will be done to arrest the overflow of the silt. Regular water sampling is proposed to be carried out every year during winter period, pre-monsoon period, monsoon period and post monsoon period.

- The total water requirement inside the mining lease will be 4250 KLD. The total water requirement for screening cum beneficiation facility (outside the mining lease of Bailadila Iron Ore Deposit-4) at full rated capacity is 8630 KLD (approx.) and 5500 KLD in wet and dry operations respectively. Thus, maximum water requirement will be 12880 KLD (Mining operation-4250 KLD + Wet screening operations -8630 KLD). Permission for withdrawal of water from Sankani Nalla and Nerli Nalla (Sankani Nadi) will be obtained from Water Resource Department, GoCG. NCL has submitted application for obtaining water permission for 20,000 KLD (considering entire Bailadila Deposit-4 project with peak rated capacity and future requirements including separate township) with Water Resource Department, GoCG. A modular STP of 200 KLD capacity will be installed at screening cum beneficiation plant based on MBBR technology to treat domestic waste water. Two ETP of 10 KLD capacity each will be installed at service centre within the mining lease area and at screening cum beneficiation plant to treat the wastewater generated. Water balance for monsoon season and dry season are given below as **Figure No. 4.3** & **Figure No. 4.4** respectively.

FIGURE - 4.3
WATER BALANCE DURING MONSOON SEASON

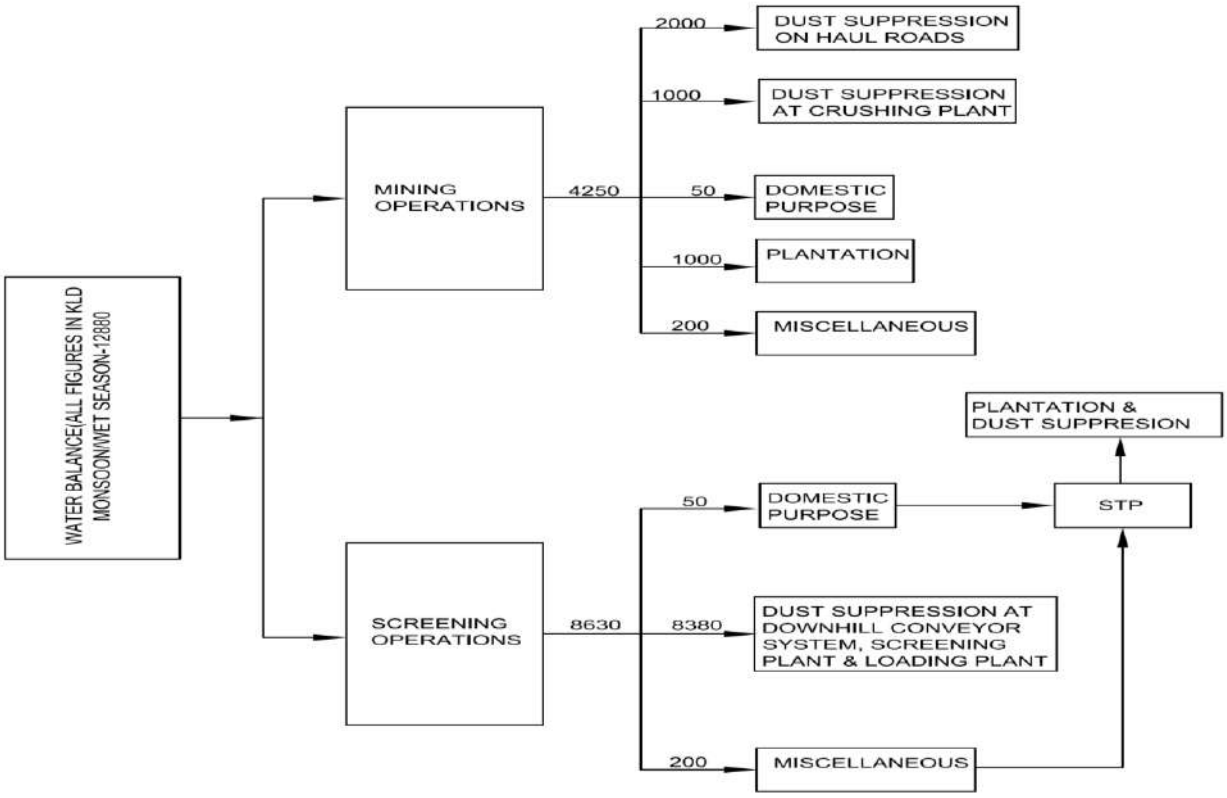
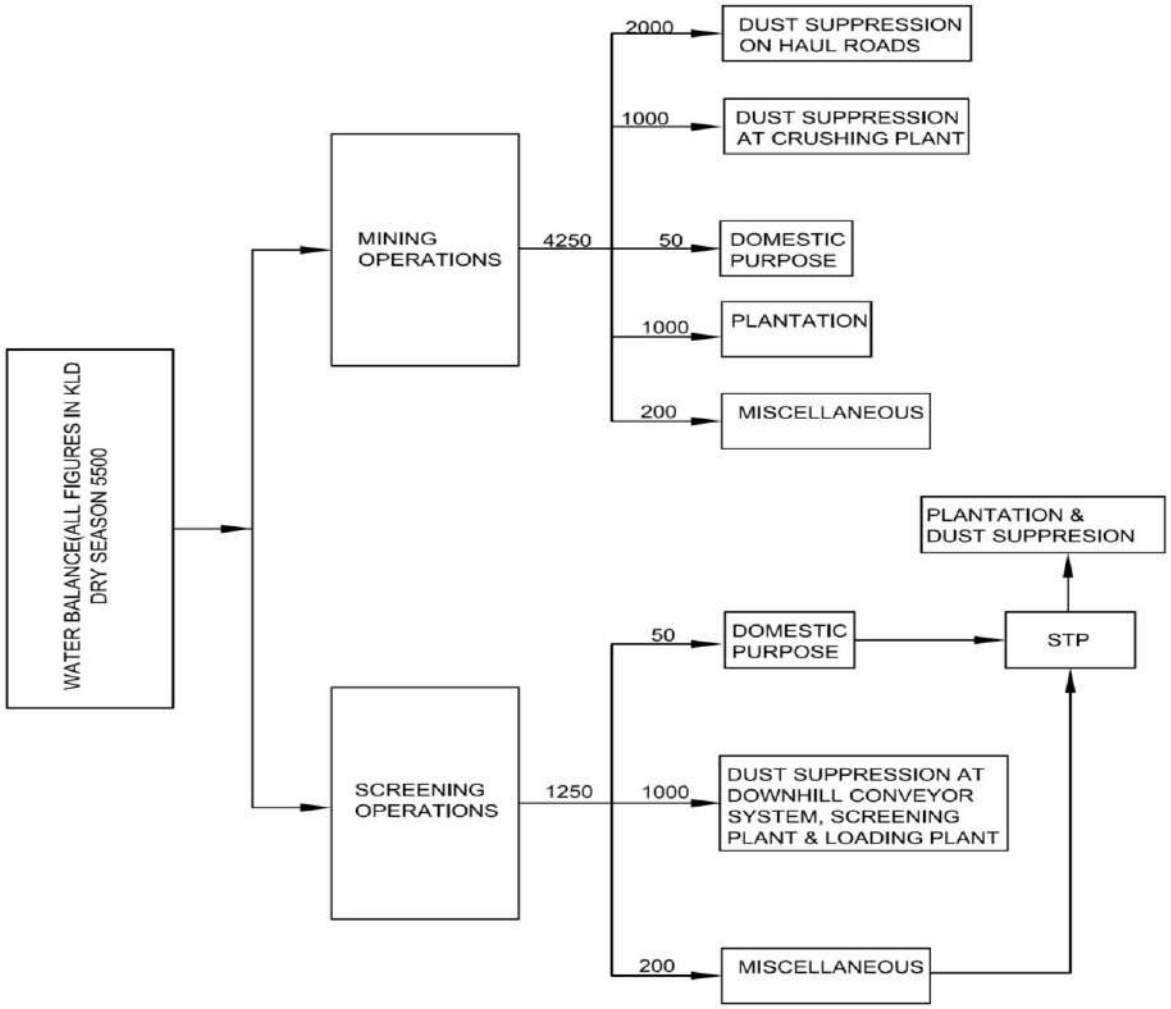


FIGURE 4.4
WATER BALANCE DURING DRY SEASON



The water management in the screening cum beneficiation plant

The filtrate from belt filter and hydraulic pressure filter will be fed to concentrate thickener and tailing thickener respectively. The overflow from concentrate / tailing thickener will be collected in water reclamation tank and will be used as process water in the screening cum beneficiation plant. Thus, only makeup water will be needed from the fresh water source. The dried cake recovered from belt filter and hydraulic pressure filter will be sent to fine ore stockpile and low-grade stockpile respectively. Pressure filter technology will help in maximum recovery of water and zero discharge of slime out of the beneficiation process.

Action plan for the stockpiles with impervious floor

The floor of the stockpiles in the plant area will be made impervious by use of geopolymer binders or laying of clay. In market, there are various manufactures which are providing specially formulated liquids (polymer binder) to replace use of concreting in surface laying. These liquids are environment friendly. Further garland drains throughout the outer boundary of the stockpiles will be made and

water of the garland drains will be channelized in the catch pits to trap the run off iron ore.

Following Engineering measures are proposed for mining lease area

Gully Control Measures

Control of erosion is important for both during mining and post mining period as the waste materials emanating from the fragmented areas such as mine pits, and waste dumps can cause damages to the local environment including forest, soil, water, etc. The main objective of the gully control measures is to protect the reclaimed area from erosion/runoff due to rain water flow. The gully control measures are effective in retaining silt/sediment/boulders in the stream water channels and due to silt/sediment retention, the channel gradient, flow velocity and consequently carrying capacity of the water course will be reduced and thus, control the further advancement of gully leading to its reclamation. Engineering measures are the first line of defence in controlling erosion and they also facilitate quick re-establishment of vegetation over the disturbed and degraded areas.

a. Gabion (Wire Crate) Check Dams (GCD)

The gabion check dams are preferred in main drainage channels receiving large quantities of runoff and debris, usually in the middle and lower reaches, for grade stabilization of channel bed and retention of soil and debris. These will be constructed with stones/boulders hand packed closely in wire mesh cages made of galvanized iron wire of 10mm gauge thickness. GCDs will encourage good plant growth due to increased moisture regime. They are highly preferred for soil conservation owing to qualities *viz*., flexibility, porous, stable and economical, *etc*. GCDs are proposed for the primary surface water courses around the ML area for arresting silt and sediment movement in the surface water flow during rainy season.

b. Loose Boulder Check Dams (LBCD)

The LBCDs are quite suitable for stabilization of first order stream channels of watersheds receiving small quantities of runoff/ debris. Interspaces may be planted with brush wood and log wood of sprouting plants for additional support. The life of the design usually lasts for 3-5 years. LBCDs are proposed for the primary surface water courses around the ML area for arresting silt and sediment movement in the surface water flow during rainy season.

c. Stone Masonry Check Dam (SMCD) - cement sand mortar (1:6)

This is usually considered as a key structure constructed at the end of all the gully control structures like GCD, LBCD, etc., to prevent runoff further from the lease area. SMCDs are proposed in various surface water courses for the control of erosion from the lease area.

d. Box culvert

To protect the natural spring water flow, a suitable site-specific box culvert is planned to be constructed for facilitating free flow of water from the spring into the natural drain.

4.2.8 Details of Engineering measures for Waste dump management and to protect soil erosion, water pollution and recharge of ground water

Measures for the Management of Waste Dumps

For stabilization of waste dumps, different types of Retaining/Toe Walls together with Garland Drain are generally preferred depending on the terrain and nature of substratum.

a. Toe Wall/ Retaining Wall/ Buttress Wall

Retaining/Toe Walls will be constructed at the precipitous slope for arresting sliding/erosion. The structure will be made in such a way that its bottom width will be taken as two thirds of its height and the width is reduced in steps at the top. Retaining wall/Toe wall is the primary requirement for protection of waste dumps from erosion. These will be constructed at the toe of the active dump area. The slope of the dump will be made into terraces of appropriate height and width as proposed in the Dump Management Plan. Berms will be provided at the toe of each terrace for facilitating water flow over the slope area and draining towards downstream. The overall height and slope angle of the dump will be maintained.

b. Garland Drains

Garland drains will be constructed below the retaining/Toe walls and will made to connect the natural water courses downstream for smooth flow of runoff water from the disturbed areas. These will be designed as per the quantum of rainwater flow in the area. It will be made at 1-2 m below the Retaining/Toe wall. The garland drain will be connected to those drains receiving flow from berms and finally channelized through the silt arresting structures such as check dams, settling tanks, etc., before draining into the natural water courses.

c. Geo-textile/Coir mat

Highly degraded waste dump conditions like steep slopes, poor soil fertility, lack of moisture, etc., which cannot be rehabilitated in any other manner, will be protected by covering with geo-textile/coir mat followed by establishing slope stabilization vegetation including native grasses, herbs, shrubs and trees. The coir materials will be made of coir. It is primarily meant for facilitating vegetation growth over the slopes by preventing erosion, maintaining soil moisture, etc. This will also enable relatively faster colonization of vegetation cover over the dump slopes and the vegetation cover so established with the entangled masses of root system would facilitate dump slopes to stabilize and thereby minimize erosion.

d. Gabion (Wire Crate) Toe Wall (GTW)

These will be constructed with stones/boulders hand packed closely in wire mesh cages made of galvanized iron wire of 10mm gauge thickness. GTWs will encourage

good plant growth due to increased moisture regime. They are considered as one of highly preferred measures for soil conservation owing to qualities *viz*., flexibility, porous, stable and economical, etc.

Proposed Reclamation and Rehabilitation Measures for Waste Dump Management

For stabilizing the dumps, engineering structures will be made, biological measures to achieve faster restoration is proposed. The combinations of grasses, herbs, shrubs, creepers and tree species shall be used in restoration process. Depending upon stability and age, the plantation can be done either by seed broadcasting, hydro-seeding or planting of seedlings. Hydro-seeding will be practiced to stabilize barren steep slopes and fragile unstable Surface. In addition to hydro seeding, planting of suitable herbs and shrubs shall be done on the slopes by making holes in geo-textile coir mat.

Dump No -1 (D1)- Dumping shall be done in terrace of having 20 mtr. height each to keep the dump stable. Total 1 number of terraces will be maintained. Total area occupied by dumping will be 1.69 Hectare. Total 1.83 Lakh Tonne of waste will be accommodated in this dump. This dump will be active to dump the waste generated till 1st year of operation. The dump will be reclaimed in phase wise manner by using engineering & biological measures during the 3rd year.

Dump No -2 (D2)- Dumping shall be done in terrace of having 30 mtr. height each to keep the dump stable. Total 5 number of terraces will be maintained. Total area occupied by dumping will be 20.07 Hectare. Total 10.16 million Tonne of waste will be accommodated in this dump. This dump will be active to dump the waste generated till 8th year of operation. The dump will be reclaimed in phase wise manner by using engineering & biological measures during the 9th to 10th year.

Dump No -3 (D3)- Dumping shall be done in terrace of having 30 mtr. height each to keep the dump stable. Total 5 number of terraces will be maintained. Total area occupied by dumping will be 21.13 Hectare. Total 8.33 million Tonne of waste will be accommodated in this dump. This dump will be active to dump the waste generated till 10th year of operation. The dump will be reclaimed in phase wise manner by using engineering & biological measures during the 11th to 12th year.

Dump No -4 (D4)- Dumping shall be done in terrace of having 30 mtr. height each to keep the dump stable. Total 5 number of terraces will be maintained. Total area occupied by dumping will be 18.5 Hectare. Total 10.64 Million Tonne of waste will be accommodated in this dump. This dump will be active to dump the waste generated till 12th year of operation. The dump will be reclaimed in phase wise manner by using engineering & biological measures during the 13th to 14th year.

Dump No -5 (D5)- Dumping shall be done in terrace of having 30 mtr. height each to keep the dump stable. Total 3 number of terraces will be maintained. Total area occupied by dumping will be 12.68 Hectare. Total 6.81 Million Tonne of waste will be accommodated in this dump. This dump will be active to dump the waste generated till 14th year of operation. The dump will be reclaimed in phase wise manner by using engineering & biological measures during the 15th to 16th year.

Further, Coir matting shall be used to trap sediment, to protect stream banks and wetland shores from erosion and to provide a stable substrate for plant establishment in the waste dump terraces. Subsequently, plantation will be done in the dump slopes in a phased manner. A total of 74.07 Ha of area under waste dump shall be reclaimed by using engineering & biological measures.

In order to stabilize waste dumps, toe wall at its toe and to catch water drains (garland drains) and silt arresting structures should be constructed as per design. The height of the dumps and their terraces would be strictly maintained as per the design permitted for the purpose in the statutory clearances such as E.C., Mining Plan, Scheme of Mining, etc.

Fresh dumping of waste would be carried out by adopting retreating method starting from bottom and reaching up to the top by creating terraces at every 20-30 m height with a top width of 20-30 m. Berms would be provided at the toe of each terrace to avoid water flow over the dump slopes. Wherever necessary, garland drains should be provided and connected to the vertical drains and finally to the check dams followed by Silt Settling Tanks (SSTs) to control run-off from the slopes. Haul road and mine approach road would also be provided with stone pitched drains. Inactive dumps would be vegetated with suitable plantation immediately after the terraces are made. All the plantation activities would preferably be taken up during monsoon seasons to enjoy the benefit of rainwater for the same. Geo-textile/coir mat may be opted for the dumps which are having adverse conditions like steep slopes, poor soil fertility and instability and lack of moisture content. This will also enable to achieve good growth of vegetation cover over the dump slopes. Enriched plantation may also be adopted on top flat area and sloping area depending upon the condition.

4.2.8.1 De-silting of Check Dams

The check dams will be used in arresting the silt material. The settled material will be removed as and when required before monsoon season by mechanical means.

4.2.9 Measures for Water Conservation

The mining operations will be conducted at hill top which is at a higher-level than the ground water level. The ground water level will not be intersected during mining operation. Since major requirement of the water will be fulfilled from the existing Sankani Nalla and Nerli Nalla to meet the water requirements of mining, beneficiation and allied activities. The water from this nallah will be tapped by providing pick-up weir on downstream side of nallah and distributed by pumping to Screening Plant (partly), Loading Plant, Township, Administration building, Guest house and other infrastructures is proposed at Bhansi. There is negligible impact on Ground water.

Rain Water Harvesting and Water Conservation Measures:

Rain water harvesting will not be possible at the mining lease as the mining operations will occur at the hill top. There will be provision of five rain water harvesting pit at the beneficiation plant. Details of rain water harvesting is given below:

Total screening & loading Plant area = 383350 m^2
Average Annual Rainfall = 1254.4 mm = 1.254 m
Total rainfall at project site = 480720.9 m^3/year

Thus, sufficient rainwater is available for water recharge at project site against the water drawn.

Available Run-off from Site

S. No.	Catchment	Area (m^2)	Run-off Coefficient	Average Annual Rainfall (m)	Available Annual Run-off (m^3)
1.	Roof top/Covered Area	7664.36	0.85	1.254	8169.44
2.	Green	90389	0.20	1.254	22669.56
3.	Road & Paved Areas	285296.6	0.70	1.254	250433.39
	Total Annual Available Run-off				**281272.39**

Calculation for RWH Pits

S. No.	Catchment	Area	Run-off Coefficient	Peak Hourly Rainfall (m)*	Available Run-off (cum/hr)
1.	Roof top/Covered Area	7664.36	0.85	0.0125	81.43
2.	Green	90389	0.20	0.0125	225.97
3.	Road & Paved Areas	285296.6	0.70	0.0125	2496.35
Total Run-off					2803.75 m^3/hr
Out of 2214.5 m^3/hr, water used for recharging (Roof top & Paved Areas)					2577.78 m^3/hr
Retention Time					15 min
Available Run-off					644.45 m^3
Capacity of RWH Pit (m^3)					137.31
Nos. of Pits proposed					5
Pit Size					6.5mx6.5mx3.25m
*Considering 1% of average annual rainfall as peak hourly rainfall.					

4.2.10 Soil Quality

Bailadila Deposit-4 project will undertake afforestation work. In the first five years, 62000 saplings will be done in safety zone and dump of mine site. Green area at the screening cum beneficiation plant will be 400575 m^2 (33% of plant area) and afforestation/gap plantation will be done 2500 trees per hectare i.e. a total of 100144 trees for afforestation/gap plantation. In future the total dump area shall be covered under plantation. This will help in soil erosion at mining lease area and screening cum beneficiation plant area.

4.2.10.1 Soil Management Plan

The microbes play an important role in maintaining the biological equilibrium of the ecosystem. The most practical way to increase the nitrogen capital of soil ecosystems is to establish nitrogen-fixing plants, usually legumes, which can quickly increase the nitrogen levels in the soil system. The easiest method is to broadcast large quantity of seeds of Horse gram (Macrotyloma uniflorum) and Hamata grass (Stylosanthes fruticosa) immediately after first showers. Vesicular Arbuscular Mycorrhizal (VAM) fungi and Plant Growth Promoting Rhizobacteria (PGPR) will be applied along with fully composted farmyard manure or vermicompost to increase the fertility of the soil as well as growth of the plants.

The following measures in respect of soil management shall be adopted in reclamation and rehabilitation of mined areas:

- As the beneficial microbes are present in the topsoil, it must be removed and stacked separately and will be used for reclamation and rehabilitation of mine and beneficiation areas.
- Necessary precautionary measures will be taken to preserve the fertility and shelf life of the soil.
- The topsoil containing beneficial microflora will be used for raising plantations over different reclaimed areas such as dumps, backfilled areas, etc.

In addition, adopting the following measures with the use and application of beneficial microorganisms as bio-inoculants (bio-fertilizers) along with organic fertilizers will be very effective during the mine reclamation and rehabilitation programmes:

- The beneficial microorganisms will be introduced as bio-fertilizers during afforestation in mined out areas through planting of suitable fast growing native plant species (inoculated with bio-fertilizers and organic fertilizers) like grasses, herbs, shrubs and trees. These bio-fertilizer inoculated plants together with application of vermicompost will ensure better survival and establishment of plants in such hostile soil environment.
- The seedlings will be inoculated with Vesicular Arbuscular Mycorrhizal (VAM) fungi and other beneficial microorganisms like PGPRs (Azotobacter, Azospirillum, Phosphobacterium and Rhizobium) in nursery along with the manures like fully composted farmyard manure/vermicompost, leaf compost,

etc. The bio-fertilizer inoculated seedling/sapling shall be planted during the process or rehabilitation of mined areas.

- The bio-fertilizer inoculated seedlings/saplings will be planted during the process of rehabilitation of mined areas.
- The pits dug out for planting of saplings for afforestation will be filled with the mixture of biofertilizers and organic manures (preferably 15 g biofertilizers + 750 g to 1 kg organic manure per pit).

4.2.11 Waste Management

The details of waste generated are discussed in **Chapter 2.** Lateritic material, shale and banded iron formations (BIF) analyzing less than 45% Fe has been considered as waste. Waste (Shale and Banded Hematite Quartzite) will be dumped in the Waste Dump outside ultimate pit limit. Remaining amount of Waste will be backfilled in the North Block after extracting all the Ores and associated waste materials of the Deposit during the life of the Mine. Total mineable waste in the Bailadila Deposit-4 is 68.17 MT. The overall stripping ratio of deposit is 1:0.63. The maximum waste excavation of 6414000 Tonnes will be done during the 16th Year of operations. Detail of existing and proposed waste dumps are given in **Table 4.19.**

TABLE 4.19
DETAILS OF WASTE DUMPS

Year Wise Dump Details							
Sl. No.	**Year**	**Dump Id**	**Type of Dump**	**Proposed Area (ha)**	**Height (m)**	**Total Dump Quantity (m^3)**	**New Dump Location**
1	Year 1	D1	Waste	1.69	20	72339	Northing-2069730 to 2069450 & Easting-522341 to 522456
2	Year 1	D2	Waste	20.07	150	636316	Northing -2070536 to 2069913 & Easting-521581 to 522111
3	Year 2	D2	Waste	20.07	150	164147	Northing -2070536 to 2069913 & Easting-521581 to 522111
4	Year 3	D2	Waste	20.07	150	107614	Northing -2070536 to 2069913 & Easting-521581 to 522111
5	Year 4	D2	Waste	20.07	150	299885	Northing -2070536 to 2069913 & Easting-521581 to 522111
6	Year 5	D2	Waste	20.07	150	164666	Northing -2070536 to 2069913 & Easting-521581 to 522111

SOURCE: *NMDC-CMDC LIMITED (*Mining Plan as Approved by IBM*)*

Refer **Plate no. 4.14** and **4.15** for Dump plan and Dump section at the end of the life of the mine.

4.2.11.1 Overburden Dump Management

Efforts will be made to stabilize active dumps. The overburdens will be dumped as per the specifications of IBM and MoEF&CC stipulated conditions and the slope of the dump will be maintained at not more than 28^0. For stabilizing the dumps, engineering structures will be made, followed by biological measures, to achieve faster restoration. The combinations of grasses, herbs, shrubs, creepers and tree species shall be used in restoration process. Depending upon stability and age, the plantation will be done either by seed broadcasting, hydro-seeding or planting of seedlings. in addition to seed broadcasting and planting of seedlings, planting of suitable herbs and shrubs shall be done on the slopes by making holes in geo-textile coir mat.

Benches and trenches will be made to make the slopes of OB dumps gentle, followed by seed broadcasting and planting of seedlings of shrubs, namely *Clerodendrum viscosum, Helicteres isora, Indigofera cassioides etc. trees species like Aegle marmelos, Alangium salvifolium, Albizia lebbeck, Albizia procera, Annona squamosa, Anogeissus latifolia, Cassia fistula, Dalbergia sissoo etc.* Root *stock/slips of grasses, namely, Bothriochloapertusa, Cymbopogonflexuosus, C. martini, C.nardus, Cynodondactylon, Dactylocteniumaegyptum, Dichanthiumannulatum, Eleusineindica, Heteropogoncontortus*, etc.

The species for seed broadcasting shall be used in a combination of grasses, legumes and other species for stabilizing. The plants will include grasses like *Pongamia pinnata, Pterocarpus marsupium, Syzygium cumini, Terminalia arjuna, Wrightia tinctoria, Ziziphus mauritiana etc and Herbs & Grasses like Cymbopogon martini, Cynodon dactylon, Dactylocteniuma egyptium, Heteropogon contortus etc* and other shrubs like *Woodfordia fruiticosa, Phoenix loureirii* etc. These species will get established themselves in due course of time in disturbed areas.

Grass species for planting in mined out areas/OB dump slopes for stabilization will be Aristida setacea, Chrysopogon fulvus, Cymbopogon martini, Dactyloctenium aegyptium, Eleusine indica, Eulalia trispicata, Eulaliopsis binate, Heteropogon contortus, Imperata cylindrica, Themeda quadrivalvis,

At the end of life of the mine, five nos. of dumps will be formed viz Waste dump-1 (D1), Waste dump-2 (D2), Waste dump-3 (D3), Waste dump-4 (D4) and Waste dump-5 (D5)

Further, Coir matting shall be used to trap sediment, from erosion and to provide a stable substrate for plant establishment in the waste dump terraces. Subsequently, plantation will be done in the dump slopes in a phased manner as shown in **Plate - 4.14.**

A total of 74.07 Ha. of the area under waste dump shall be reclaimed by coir matting and plantation of local species.

4.2.11.2 Reclamation & Rehabilitation of mined out areas

Land Reclamation

Land degradation will be one of the major adverse impacts of open cast mining activities and effort to control adverse impacts would be incomplete without appropriate land reclamation strategy. Since the excavation will be started from the hill top in the shape of benches, the reclamation shall essentially include the reclamation of theses benches in the form of steps. Land degradation will also take place by dumping of waste, and the reclamation of this dumping area shall also be included in the programme. It is always necessary to keep the area under disturbance at any stage to the minimum possible. This can be ensured by phase wise reclamation of the waste dumps as and when quantities of waste dumping completed upto the accommodated capacities of dumps.

The detailed conceptual land use is given in **Table 4.3.** Out of total lease area of 646.596 ha, an area of 619.697 ha shall be reclaimed and rehabilitated at the end of life of mine, showing 619.697 ha (95.84%) of land shall be rehabilitated under plantation and water body.

4.2.12 Flora & Fauna

The plantation will be done to cover biodiversity and multi-species, as an attempt to develop vegetation that matches within natural vegetation around the area. This is likely to keep intact the fauna of the region as well. There are no endangered species of flora found in the leasehold and beneficiation plant area.

Conservation of Flora and fauna

Conservation and sustainable use of biodiversity is fundamental to sustainable development. Mining is an extractive industry which has significant direct and secondary environmental impacts. Mining activities interfere with various biological processes of life which result in destruction of biodiversity. The project will adopt 'biodiversity friendly' practices. The practices will includes:

- Improving the coherence of and access to information on biodiversity
- Engaging in joint conservation and sustainable development projects
- Working towards more effective land use planning systems

These areas shall be fenced to protect the forest as Biodiversity Conservation area within the mine area.

Management Plan for Fauna

The habitat management in and around the mine lease with site specific species will enable colonization of floral and faunal communities. Following shall be made to encourage the native fauna conservation in the mine rehabilitation program.

- A dense greenbelt consisting of herbs, shrubs and trees of different species around the mine lease area and also the haul roads will not only act as a dust and noise barrier, but also improve the habitat conditions.

- Suitable landscape based ecological restoration by planting shrubs, grasses and herbs to attract Herpeto fauna assemblage and improve long term habitat connectivity.
- Planting of fruit yielding and shelter providing species will attract birds and insects.
- Awareness programmes amongst the local people as well as mining staff regarding the importance of wildlife, their habits and habitats will be organized.
- The water stored in the engineering structures in the mining lease area will act as a water hole for the wildlife present in the region.
- Adequate cares will be taken during rainy season to reduce the sediment load and water quality to protect the aquatic faunal diversity in the water bodies around the ML.
- 'Fauna Return Strategy' shall be made by creating food, shelter & breeding sites within mining lease.
- The return of the species shall be expedited by creating fauna habitats and corridors during rehabilitation using logs, stumps and other natural materials.
- The proposed check dams in the mine lease areas will prevent the soil erosion, store sufficient quantity of filtered water in the area and act as water holes for the faunal as well as other wild lives present in the region.
- The loss of vegetation cover due to construction of haul roads and vehicular movements will restrict the animal movements to the adjoining areas.
- Fire will play hazardous role in the destruction of habitat. Fire preventing squad shall be formed to fight the fire.

4.2.12.1 Afforestation

Afforestation will be done in consultation with Chhattisgarh Rajya Van Vikas Nigam Limited. NMDC-CMDC Ltd will pay amounts to State Forest Department while obtaining Forest Clearance for raising compensatory afforestation, safety zone plantation and towards NPV charges.

Green-belt development Programme

In order to minimise the impact of mining on Environmental component outside the mining lease area, green belt zone will be established in Safety Zone inside the mining lease area. The green belt will act as a barrier to trap the suspended dust particles and also suppress air pollutants. The area proposed for green belt development includes the area under safety zone all along the mine lease boundary. Out of 8.488 ha. of Safety zone area, it is proposed for 3.058 Ha all along the mine lease boundary will be planted with native species at a rate of 2500 plants per hectare in the 1st year (1.248 Ha.) and second year (1.81 Ha.). Rest 5.43 Ha of Safety zone area will be planted @ 1000 plants per ha. of 1.81 Ha. each year in the successive 3rd year, 4th year and 5th year. Plantation in the Dump No.-1

is proposed in the 3rd year of 1.672 Ha.@ 1500 plants per Ha. Gap plantation in the remaining area is proposed @ 1000 plants per ha. of a total area of 48.38 Ha. in the 2nd year (12.08 Ha.), 3rd Year (12.08 Ha.), 4th Year (12.08 Ha.), and 5th Year (12.08 Ha.). It is proposed for plantation of 62000 saplings in the 1st five years for a total area of 58.48 Ha. The details of proposed plantation are depicted below in **Table 4.20**.

TABLE - 4.20

YEAR WISE PROPOSED PLANTATION FOR FIRST FIVE YEARS

Sr. No.	Year	Green Belt Location (s)	Area Proposed to be Covered (Ha)	Number of Plants Proposed	Expected Survival Rate (%)	Estimated Expenditure (INR)
1	Year 1	Safety Zone	1.248	3000	85	312000
2	Year 2	Safety Zone	1.81	4500	85	497750
3	Year 2	Gap Plantation	12.08	11500	85	3322000
4	Year 3	Safety Zone (Gap Plantation)	1.81	2000	85	547525
5	Year 3	Dump Plantation at Dump-1	1.672	2500	85	505780
6	Year 3	Gap Plantation	12.08	11500	85	3654200
7	Year 4	Safety Zone (Gap Plantation)	1.81	2000	85	602277.5
8	Year 4	Gap Plantation (Other than safety zone)	12.08	11500	85	4019620
9	Year 5	Safety Zone (Gap Plantation)	1.81	2000	85	662505
10	Year 5	Gap Plantation (Other than safety zone)	12.08	11500	85	4421582

SOURCE: *NMDC-CMDC LIMITED (*Mining Plan as approved by IBM*)*

Green area at the infrastructural facilities outside mining lease will be 400575 m^2 (33% of the total area of outside mining lease) and afforestation/gap plantation will be done as 2500 trees per hectare i.e. a total of 100144 trees for afforestation/gap plantation. An undertaking for the progressive bench plantation up to HFL for eco restoration of water bodies is enclosed **Annexure 4.1**. Approx. 21696 trees will be cut in outside mining lease area (screening cum beneficiation plant). Details of trees to be cut with girth class wise are attached as **Annexure 4.2.**

Details of greenbelt at beneficiation plant is depicted below in Table and greenbelt plan is attached as **Plate No. 2.1** & **Plate No. 2.2**.

Particular	Green Belt Patch (GB)	Area (m^2)
Loading Plant	GB1	15512
	GB2	5569
	GB3	13278
	GB4	6018
	GB5	14845
Screening Plant	GB6	3060
	GB7	6897
	GB8	5435
	GB9	9446
	GB10	4773
	GB11	9671
	GB12	2420
Along Conveyor Belt	GB13	303651
Total		**400575**

4.2.12.2 Importance of Grasses

Grasses are drought tolerant and can colonize fast in low nutrient soil. Due to the presence of fibrous root system, grasses help in checking soil erosion. For stabilization of sloppy areas rows of grasses will be planted. Slips will be planted in the contours at a distance of one foot. The species suggested are given in **Table 4.21**. Grasses species will be planted for Soil Moisture Conservation (SMC) and stabilization of loose material and steep slopes.

TABLE - 4.21

GRASS SPECIES RECOMMENDED FOR PLANTING IN MINED OUT AREAS/OB DUMP SLOPES FOR STABILIZATION

S. No.	Name of the species	Family	Habitat
1	*Arundodonax*	Poaceae	Shrub
2	*Chrysopogonfulvus.*	Poaceae	Herb
3	*Cymbopogonnardus*	Poaceae	Herb
4	*Cymbopogon martini*	Poaceae	Herb
5	*Eulaliatrispicata*	Poaceae	Herb
6	*Heteropogoncontortus*	Poaceae	Herb
7	*Imperatacylindrica*	Poaceae	Herb
8	*Themedatriandra*	Poaceae	Herb
9	*Thysanolaena maxima*	Poaceae	Shrub

Grasses have the capacity to bind soil particles with very high regenerative capacity and high viability of seeds. Other annual or perennial herbs will also be used for stabilization. They are also available naturally on the site. Crotalaria laburnifolia, C. retusa, Smithia conferta, Tephrosia purpurea, and T. villosa will be

the other important plant species. They will improve soil nitrogen status. These plant seeds can easily be collected from adjacent areas. Broadcasting of seeds during monsoon periods will give better results.

4.2.12.3 Plantation of Trees and Shrubs

Mixed plantations of trees and shrubs are proposed to be taken up along with the grass component on slopes of mined-out areas. **Table 4.22** shows local hardy species of trees and shrubs suggested for planting.

TABLE - 4.22
TREES & SHRUBS RECOMMENDED FOR PLANTING ON SLOPES OF MINED OUT AREAS

Sr. No.	Name of the species	Family	Habitat
1	*Albiziachinensis*	Mimosaceae	*Tree*
2	*Bombaxceiba*	Bombacaceae	Tree
3	*Brideliaretusa*	Euphorbiaceae	Tree
4	*Buchananialanzan*	Anacardiaceae	Tree
5	*Callicarpatomentosa*	Verbenaceae	Tree
6	*Careyaarborea*	Baringtoniaceae	Tree
7	*Cassia fistula*	Caesalpiniaceae	Tree
8	*Clerodendrumviscosum*	Verbenaceae	Small tree
9	*Dilleniapentagyna*	Dilleniaceae	Tree
10	*Diospyrosmontana*	Ebenaceae	Tree
11	*Erythrinaindica*	Papilionaceae	Tree
12	*Glochidion*zeylanicum.	Euphorbiaceae	Tree
13	*Glycosmispentaphylla*	Rutaceae	Shrub
14	*Lanneacoromandelica*	Anacardiaceae	Tree
15	*Mallotusphilippensis*	Euphorbiaceae	Tree
16	*Phoenix loureiroi*	Arecaceae	Shrub
17	*Phyllanthusemblica*	Euphorbiaceae	Tree
18	*Syzygiumcumini*	Myrtaceae	Tree

Sr. No.	Name of the species	Family	Habitat
19	*Terminaliabellirica*	Combretaceae	Tree
20	*T.elliptica*	Combretaceae	Tree
21	*Tremaorientalis*	Ulmaceae	Small tree
22	*Wendlandiatinctorea*	Rubiaceae	Small tree
23	*Ziziphusrugosa*	Rhamnaceae	Small tree

4.2.12.4 Plantation of Trees and Shrubs Along the Banks of Nallas

For mine drainage management, the engineering structures for erosion control will be implemented. These structures will further strengthen by the planting of different trees and shrubs. To protect the area from erosion and to stabilise the slopes along the nallas, the following trees and shrubs will be planted, which are given in **Table 4.23.**

TABLE - 4.23
PLANTS RECOMMENDED FOR FOOT HILLS OF THE SLOPES AND STREAMS

Sr. No.	Name of the species	Family	Habitat
1	*Ardisiasolanacea*	Myrsinaceae	Shrub
2	*Caryotaurens*	Arecaceae	Tree
3	*Ficusauriculata*	Moraceae	Tree
4	*Ficusracemosa*	Moraceae	Tree
5	*Ficussemicordata*	Moraceae	Tree
6	*Glochidionzeylanicum*	Euphorbiaceae	Tree
7	*Litseaglutinosa*	Lauraceae	Tree
8	*Mangiferaindica*	Anacardiaceae	Tree
9	*Melastomamalabathricum*	Melastomaceae	Shrub
10	*Memecylonumbellatum*	Melastomaceae	Small tree
11	*Mimusopselengi*	Sapotaceae	
12	*Mitragynaparvifolia*	Rubiaceae	Tree
13	*Murrayapaniculata*	Rutaceae	Tree
14	*Neolamarckiacadamba*	Rubiaceae	Tree
15	*Pongamiapinnata*	Rubiaceae	Tree
16	*Putranjeevaroxburghii*	Euphorbiaceae	Tree
17	*Syzygiumcumini*	Myrtaceae	Tree

18	*Terminaliaarjuna*	Combretaceae	Tree
19	*Thysanolaena maxima*	Poaceae	Shrub

4.2.12.5 Species Proposed for Plantation

The details of species will be considered for greenbelt/afforestation are given in **Table 4.24.**

TABLE 4.24
TREE SPECIES CONSIDERED FOR GREENBELT/AFFORESTATION

Sr. No.	Botanical name	Family	Hindi name
1	*Alangiumsalvfolium*	Alangiaceae	Akola/ Ankol
2	*Albizialebbeck*	Mimosaceae	Kala siris
3	*Albiziaprocera*	Mimosaceae	Safedsiris
4	*Azadirachtaindica*	Meliaceae	Neem
5	*Cassia fistula*	Caesalpiniaceae	Amaltas
6	*Dalbergialatifolia*	Fabaceae	Shisham
7	*Dalbergiapaniculata*	Fabaceae	Takoli
8	*Dalbergiasissoo*	Fabaceae	Sissoo
9	*Ficusbenghalensis*	Moraceae	Bargat
10	*Ficusracemose*	Moraceae	Gular
11	*Ficusreligiosa*	Moraceae	Pipal
12	*Grewiatiliifolia*	Tiliaceae	Dhaman/ Dhamini
13	*Holopteleaintegrifolia*	Ulmaceae	Papri
14	*Mitragynaparvifolia*	Rubiaceae	Kaim
15	*Neolamarckiacadamba*	Rubiaceae	Cadamba
16	*Phyllanthusemblica*	Euphorbiaceae	Aonla
17	*Pithecelobiumdulce*	Mimosaceae	Janglijilebi
18	*Pongamiapinnata*	Fabaceae	Karanj
19	*Terminaliaarjuna*	Combretaceae	Arjun
20	*Tremaorientalis*	Ulmaceae	Indian charcoal tree/ Gio
21	*Xyliaxylocarpa*	Caesalpiniaceae	Jambu

4.2.12.6 Safety Zone Fencing and Plantation

The safety zone fencing and plantation will be undertaken in consultation with Chhattisgarh Rajya Van Vikas Nigam in phases. The safety zone fencing will be carried out as given below in **Table 4.25.**

TABLE 4.25
PROPOSED SAFETY ZONE FENCING WORKS

Year	Proposed Fencing Length (m)	Co-ordinates from	Co-ordinates to	Remarks
Year 1	2543	523009:2067939	521842:2070670	Outer-fencing
Year 1	3678	523043:2066622	522997:2070263	Inner-fencing
Year 2	2543	521843:2070670	521175:2068787	Outer-fencing
Year 2	3678	522996:2070263	521184:2069150	Inner-fencing
Year 3	2531	521175:2068787	523051:2066608	Outer-fencing
Year 3	3678	521184:2069150	523043:2066622	Inner-fencing
Year 4	Nil	Nil		
Year 5	Nil	Nil		

4.2.12.7 Conservation Plan

There are seven Schedule I Species found in the Study Area namely Sloth Bear, Indian Pangolin, Panther, Python, Bengal Monitor Lizard, Bastar Hill Myna and Common Peafowl. The salient features of wild life management plan are as below:-

- Maintenance of ecological balance through preservation and restoration of wherever it has been disturbed due to project developmental activities,
- Conservation, preservation and betterment of natural habitats in Impact zone
- Rehabilitation of critical species (endemic and threatened species of this region), if any with provisions for in-situ or ex-situ conservation of critical/ important plant/ animal species,
- Mitigation and control of project induced biotic and/or abiotic pressures/influences that may affect the natural habitats,
- Habitat enhancement in project Impact zone by taking up forestation and soil conservation measures,
- Creating all round awareness regarding conservation and ensuring people's participation in the conservation efforts and minimizing human - animal conflict.

Wildlife conservation & management plan has been approved by Chief Wildlife Warden vide Order No./V.PRA/Prabandha-637/253 Nava Raipur, dated 25.09.2023 **Annexure-4.3** And Biodiversity Conservation Plan and Soil, Water & Moisture Conservation for tree fern area has been prepared and approved by Biodiversity Board of Chhattisgarh vide order no./Jai.V.Bo/17 Raipur dated 21.08.2023 **Annexure-4.4.**

A Wildlife conservation & management plan has been prepared and approved by Chief Wildlife Warden Chhattisgarh. An amount of Rs. 19.32 Crs. has been allotted

towards Wildlife Conservation & Management Plan. A Biodiversity Conservation Plan and Soil, Water & Moisture Conservation for tree fern area has been prepared and approved by Biodiversity Board of Chhattisgarh. An amount of Rs. 31.08 Crs. has been recommended for implementation of provisions thereof.

The details of the fund allocated for Wild Life conservation and management plan and Biodiversity Conservation Plan and Soil, Water & Moisture Conservation Plan are given below in **TABLE 4.26 and 4.27**

TABLE 4.26

WILDLIFE CONSERVATION & MANAGEMENT PLAN

Sl. No.	ITEM	Total (Rs in lacs)
1	Improvement of water availability by digging of ponds and water holes.	250.00
	Improvement and maintenance of existing water sources	50.00
	Soil water conservation works (LBCD, BCD, Gulley plucking, Dams)	130.00
2	Removal of invasive Alien species hindering the growth and regeneration of valuable species for wild life. (800 Ha)	80.00
	Mopping up the same area to remove the remnants	32.00
3	Pasture development by removing alien species in natural grass lands and also in potential grass lands where the density of canopy <0.4 (500 Ha)	100.00
	Pasture development by Planting / sowing of palatable grass seeds/ slips (500 Ha)	160.00
	Maintenance works for first Three years (500 Ha)	49.50
4	Improvement of stock by dressing of existing stumps of browsable species and cut back (The DFO should inspect the area and after proper marking and hammering, the dressing of live stumps can be permitted) and Gap plantation of fruit bearing trees like Aonla, Jamun, Bel, Ghular, Bargad, and Peepal by planting in 1st year itself) (500 Ha)	75.00
	Maintenance of fruit trees plantation for 5 years	100.00
5	Monitoring and Evaluation of works	20.00
6	Fire Protection	150.00
7	Habitat improvement activities - food resource enhancement for Sloth Bear and FHA i.e. 30 plots @ 4 Ha each (120 Ha.)	96.00
	5 years maintenance of food resource enhancement area for Sloth Bear and FHA i.e., 30 plots @ 4 Ha each (60 Ha.)	85.12
8	Budgetary provision for Development of Reptile habitat niche- 7 locations 20 niches and maintenance from 8th year upto 12th year.	25.00

	Budgetary provision for Development of Denning niche for small mammals 'Rock boulder den' 7 locations 10 niches and maintenance from 8th year upto 12th year	15.00
	Budgetary provision for Development of Denning niche for small mammals 'earthen den' 7 locations 10 niches and maintenance from 8th year upto 12th year.	15.00
	Budgetary provision for Monitoring of dens	3.50
	Budgetary provision for Development of earthen and rock dens after monitoring	30.00
9	Status Survey of Snake Species. Initiate baseline surveys of snake in the nearest five protected forests sharing the buffer zone	15.00
	Monitoring and assessment of the survey in 2nd year onwards	10.00
	Based on the availability of the species, the survey can be extended to the rests of next five in 3rd year	10.00
	Monitoring and assessment of the status survey in 4th, 6th, 8th and 10th year	8.00
10	Arrangement of utility vehicle for the field to transport of man, materials used in Human- Wildlife conflicts. With POL and maintenance for 10 years	110.00
11	Empowering and sensitizing people for protection of wildlife and Eco-development works etc.	100.00
12	Budget for Status survey of threatened mammals and intensive monitoring at least once in two years.	22.00
13	Awareness and Training or People to reduce Human Wild Life Conflicts	15.0
	Total	**1756.12**
	10% Escalation	**175.612**
	Grand Total	**1931.732**

TABLE - 4.27

Biodiversity Conservation Plan and Soil, Water & Moisture Conservation Plan

Sr. No	ITEM	Total (Rs. in Lacs)
1	Cost of Infrastructure development for nursery for tree fern and REET spp.	100.00
	Nursery Development for Tree Fern and RET species for plantation of 125 Ha. In Impact / Buffer area Please Refer Chapter 5, point 5.11	66.4126

2	**Conservation of Tree Fern (For details Please refer chapter 5)** In situ conservation & Protection of Tree fern and its associates falling in Project area Within ML area and along Galli nalla (75. 0 Ha)	100
	Ex situ conservation of Tree fern and. its associates falling outside Project area (Within 10 Km from periphery of ML area) (75 Ha.)	105
3	Budgetary provision for RET species (For details Please refer chapter 5) (i) Nursery Development for RET species for plantation of 50 Ha. In Impact / Buffer area. Please refer chapter 5	40.659
	(ii) In-situ Conservation of RET species in PF/RF of (Within 10 Km from periphery of ML area) and its maintenance one plot of 10 Ha. Each year for 5 years (5 Plots = 50 Ha.)	100.00
	(iii) Maintenance of RET species in-situ plots (5years) (50 Ha.)	75.00
	(iv)Ex-situ Conservation of RET species and including maintenance for 5 years (Within 10 Km from periphery of ML area) (50 Ha)	150.0
4	Budgetary provision for Biodiversity Conservation & protection of Forest. (Watch and Ward for 15 years	75.00
5	Biodiversity Park is proposed to develop at Dantewada district for Education purpose of Front-line staff, Miners and People and students.	200. 0
6	Budgetary provision for Research Monitoring and Evaluation of plan including cost of subject specialist/ experts/ expert NGO.	35.00
7	Development of Training and Interpretation center A. Construction of center	100.00

	B. Regular Training, Awareness program, Seminar, Lectures and Orientation program on Biodiversity Conservation	90.00
8	Budgetary provision for Training & Awareness for BMC Members at Village level in Buffer area.	90.0
9	I) Budgetary provision for Grass and leaf fodder species in common land, /farmers land area in 24 affected villages in Impact / Buffer zone (total 120 Ha). Grass land plan and rotational grazing shall be prepared by forest department.	48.00
	II) Additional budgetary provision for Maintenance of grass and leaf fodder plots 5 years	25.00
	(III) Budgetary provision for Additional 100 Ha grass and leaf fodder plot in adjoining forest area (10 Ha each from 6th year onward) including maintenance. Grass land plan and rotational grazing shall be prepared by forest department.	50.00
10	Plantation of Horticulture species and Ethno-botanical/ medicinal importance species in affected 24 villages and their maintenance for 3 years	120.0
11	Organizing study tour and exposure visit within country for Experts/ Scientists/ People/ Villagers/ Students etc.	50.00
12	**Monitoring of EX-SITU and IN-SITU Conservation activities:** A panel of Expert team shall monitor the EX-SITU and IN-SITU Conservation activities. The budget shall be deposited in Chhattisgarh Biodiversity Board's account.	40.0
13	(I) Budgetary provision for Providing and fixing of Bird nesting boxes (50 boxes in 4 locations and replicate after 2 years) i.e., 400 boxes	8.00

	(II) Budgetary provision for Monitoring activity after 2 years	2.00
14	Budgetary provision for Development of Butterfly habitat development in 5 areas (near human habitations)	15.00
15	Estimated cost of Soil, Water and Moisture conservation in respect of Tree Fern area fall in ML area. Please refer Part B and Chapter IV	910.1382
16	Repair and Maintenance of SWM Conservation Structure After Every Third year till Plan Period	40.00
17	Provision for Chain link fencing 6feet height for the protection of tree fern area in Buffer Zone (10 Kms radius from ML area) and other area having sporadic occurrence of tree fern species.	190.0
	Total	**2825.212**
	10% Escalation	**282.5212**
	Grand Total	**3107.733**

4.2.13 Socio-economic Environment

The project imparts social benefits to the surrounding population in the form of employment opportunities, educational facilities, roads, communication facilities, transportation, marketing, banking, postal services, and health facilities directly or indirectly. The location of the mine and beneficiation plant will help to improve the financial resources of the surrounding population by way of petty trade and employment opportunities. The projects will encourage the setting up of various utility services and petty trade for local people, i.e., in and around the mining lease and beneficiation plant area, mainly in Bacheli and adjacent villages of Dantewada and Bijapur Dist. Following will be provided to the nearby villages.

1. Mobile health camp
2. Facilitating Govt. for immunization programme conducted from time to time.
3. Annual donation for festival and other voluntary activities.
4. Organizing sports activities.
5. Annual donation for sports.
6. Plantation
7. Contribution for forest protection.
8. Distribution of fruit bearing trees.
9. Maintenance of road

4.2.13.1 Public health implications of the project

Due to mining, beneficiation and allied operations which will be confined to lease & beneficiation areas, there will be negligible major health implications for the public. The common and seasonal diseases that may occurs in the study will be diarrhoea, malaria, cold and fever, and jaundice. NMDC-CMDC Ltd will provides free in-patient and outpatient medical treatment for the local adivasi population as NMDC Ltd has a full-fledged Project Hospital at Bacheli.

4.2.13.2 Specific programme for upliftment of SC/ST population of the study area

As per Census 2011, SC & ST population is almost 58.12 % of the total population. The percentage of SC & ST population to total population is 10.74 & 47.38 respectively. Hence the peripheral/ CSR activities proposed to be done will mainly focus on upliftment of SC/ST population.

The company will focus on the following activities for upliftment of SC/ST population:

1) Education & communication
2) Health care
3) Livelihood
4) Sports & culture
5) Infrastructure & development

4.2.14 Management plan for the possible Accident

The project proponent will prepare an action plan to prevent accident and disaster management in case it happens like:

- Surface/Forest fire
- Failure of waste dump
- Failure of pit slope
- Lubricant & HSD storage chambers/ tankers

4.2.15 Occupational Safety & Health Management

Occupational health hazard associated with Iron ore mining operations are silicosis, hearing loss, eye vision loss, skin diseases etc. Notified diseases applicable to the Iron Ore mining operations are Silicosis and Noise induced hearing loss (exposure to high noise levels) as per 3rd Schedule of the Occupational Safety, Health and Working Conditions Code, 2020 No. 37 Of 2020 dated 28th September, 2020. The persons working in the mine will be required to undergo initial medical examination (IME) & periodic medical examination (PME). Every year 20% of the total work force will be covered under periodic medical examination.

Project will be having a well-equipped occupational health center. Occupational Health Centre will have sufficient technical personnel with specialized training and experience in such field as occupational medicine, industrial hygiene, ergonomics, occupational health and nursing. Equipment and appliances of proper type should

be provided for carrying out the assigned functions. The Occupational Health Centre will carry out the following functions:

(i) identification and assessment of the risk from health hazards at work place;
(ii) surveillance of the factors in working environment and work practice which may affect workers' health;
(iii) surveillance of workers' health in relation to work;
(iv) education of workers on sanitation, cleanliness, hygiene and health care;
(v) collaborating in providing information, training and education in the fields of occupational health, industrial hygiene and ergonomics;

Monitoring of Personal Dust Sampling for Free Silica for persons (representative) working in mining operations and ore processing plants operations will be conducted once every six months. An audiometry test will be conducted for employees under initial and periodic medical examination. In addition, a Mine Pit Safety Committee will be formed and manned by equal participation from management and workers. Safety shoes, helmets, and uniforms will be issued to each worker. Other safety equipment will be used according to the nature of the job involved, like nose filter/mask, ear plug/muff, safety goggles, gum boots, etc.

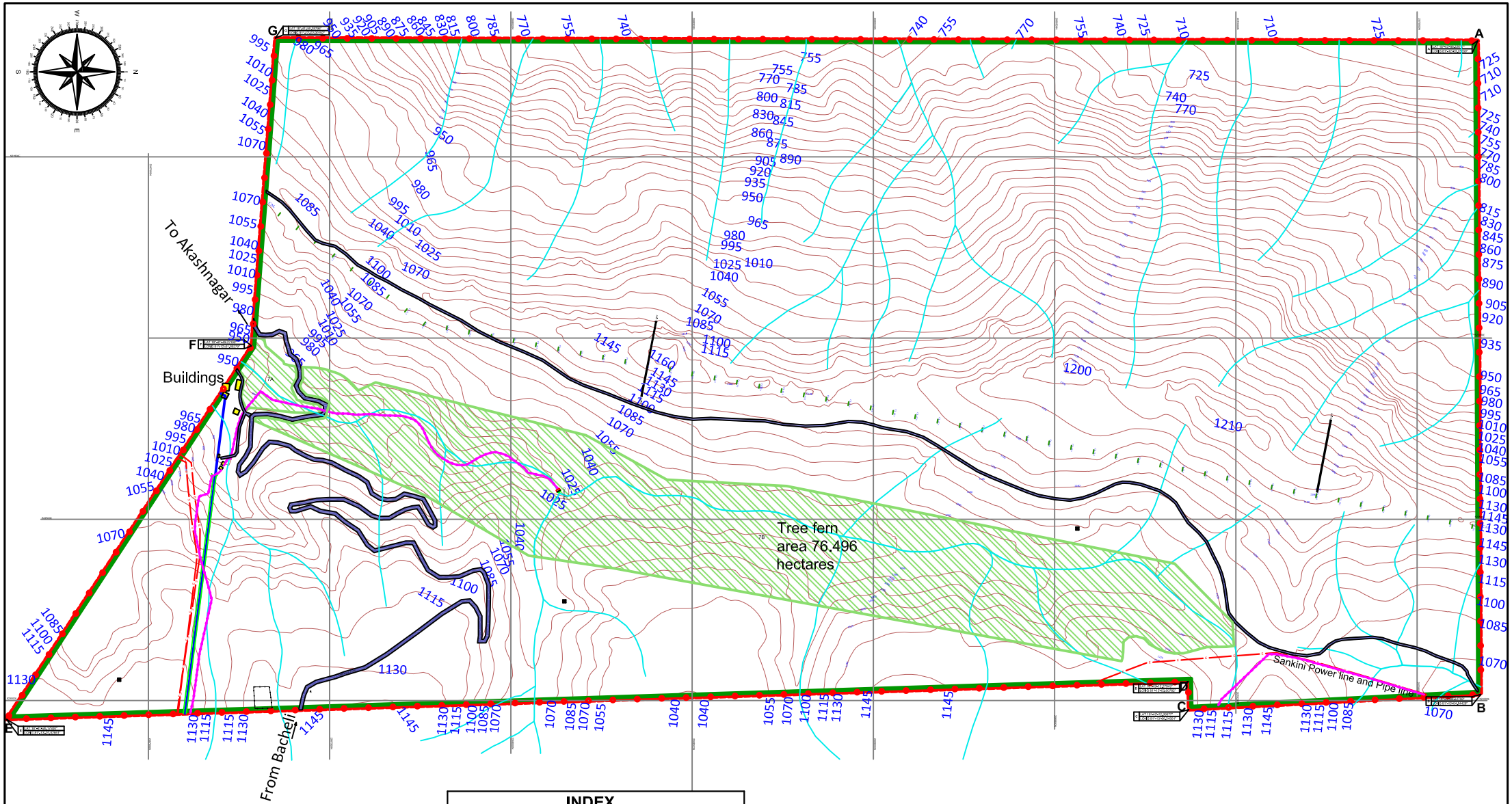
The first aid box will be made available for immediate treatment at work areas. First aid training will be imparted to the selected employees regularly. The list of first aid members will be displayed at strategic places.

Annual budget allocation for occupational health centre for Bailadila Iron Ore Deposit-4 is given in Table.

Sl. No.	**Particulars**	**Annual Budget (INR)**
1.	Statutory medical examination including Initial Medical Examination for trainees & contractual labours, PME for employees, stool test for cooks, conducted as per recommendations of DGMS safety conferences	980000
2.	Eye refraction test for HEMM operators	55000
3.	Issue of PPE	1960000
4.	Health awareness program (diabetes, occupational diseases, heart health, chronic diseases, stress etc.)	112000
5.	Awareness training on OHS code & rules	420000
6.	OHS training by external faculty	840000
7.	OHS related hospital equipment's upgradation	280000
8.	First aid facilities	140000
9.	Misc. (masks, sanitizers etc.)	840000
10.	**Total**	5627000 (Fifty-Six lakhs Twenty-Seven thousand only)

4.2.16 Power (Energy) Conservation

- Solar Cell Sensor Switches and Solar Lights will be provided.
- Solar heaters/solar devices will be used at canteens, buildings, parks etc.
- Energy-efficient motors will be installed in the Screening Plant.
- Will generate power through a downhill conveyor.
- Leakages of oil, fuel, or lubricants will be plugged. Used oil, batteries, and cotton waste will be collected and sold to authorised agencies.



ML CO ORDINATES(WGS84 DATUM) OF DEPOSIT-4		
PILLAR	LONGITUDE	LATITUDE
A	81° 12' 03.25650"	18° 43' 38.32617"
B	81° 13' 04.84428"	18° 43' 38.52758"
C	81° 13' 06.24991"	18° 43' 12.30677"
D	81° 13' 03.60782"	18° 43' 12.27943"
E	81° 13' 07.02661"	18° 41' 26.17920"
F	81° 12' 31.89279"	18° 41' 48.22195"
G	81° 12' 02.90192"	18° 41' 50.38796"

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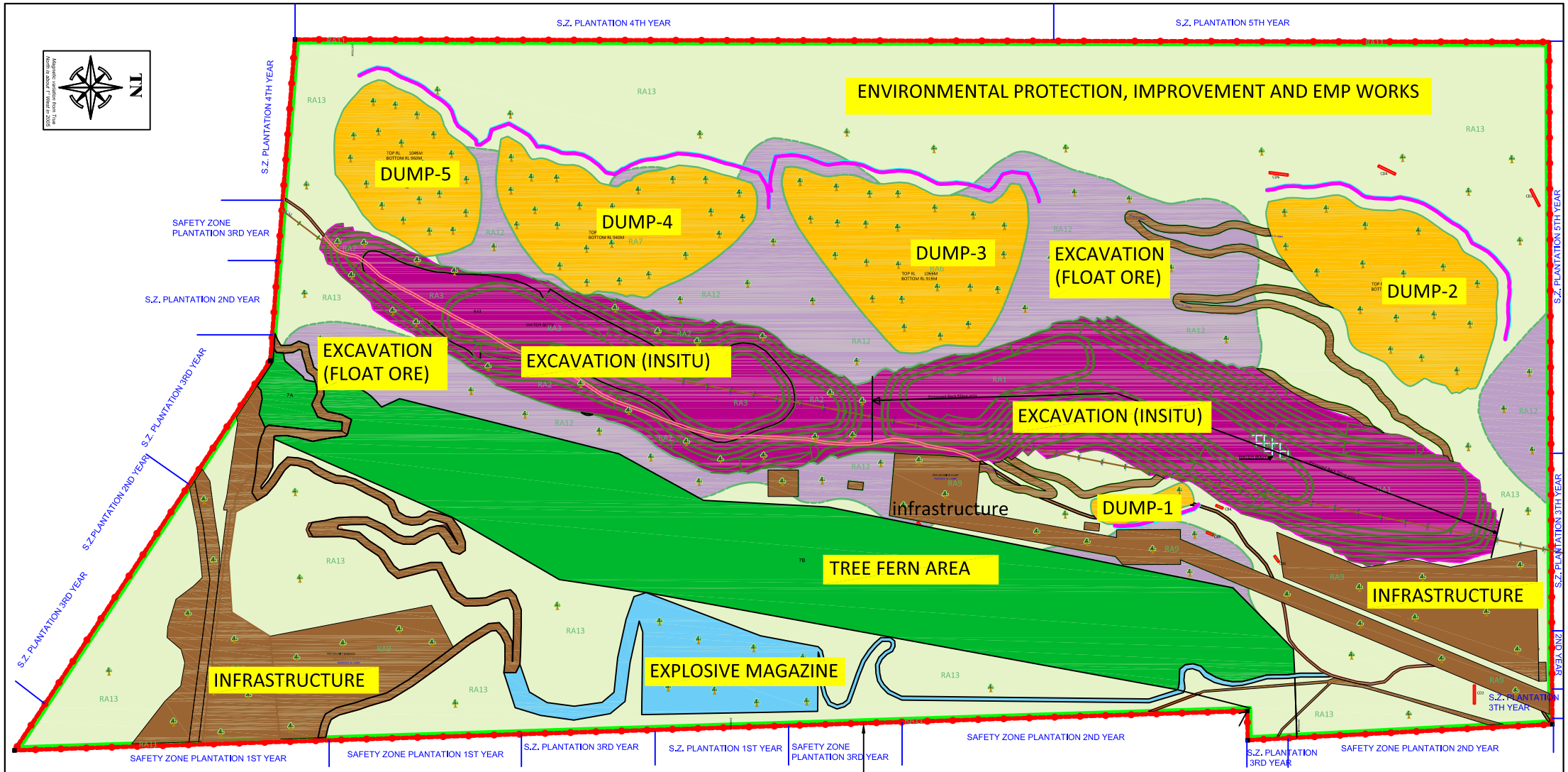
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

M/S NMDC-CMDC LIMITED

EXISTING LAND USE OF LEASE AREA

PLATE NO.-4.1



Sl. No	Particulars	
1	Excavation (Insitu)	
2	Excavation (Float ore)	
3	Overburden/Waste Dumping	
4	Infrastructure (Crushing Plant, Workshop, Administrative Building, Roads etc.)	
5	Area under Environmental protection, improvement and EMP works	
6	Area under explosive magazine & safety zone	
7	Tree fern area(None- diverted	
8	Safety zone Along The ML boundary	8.488

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SAFETY ZONE LINE WITH IN 7.5M OF ML	
LEASE BOUNDARY PILLAR	

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

M/S NMDC-CMDC LIMITED

PROPOSED LANDUSE PLAN OF LEASE AREA

PLATE NO.-4.2

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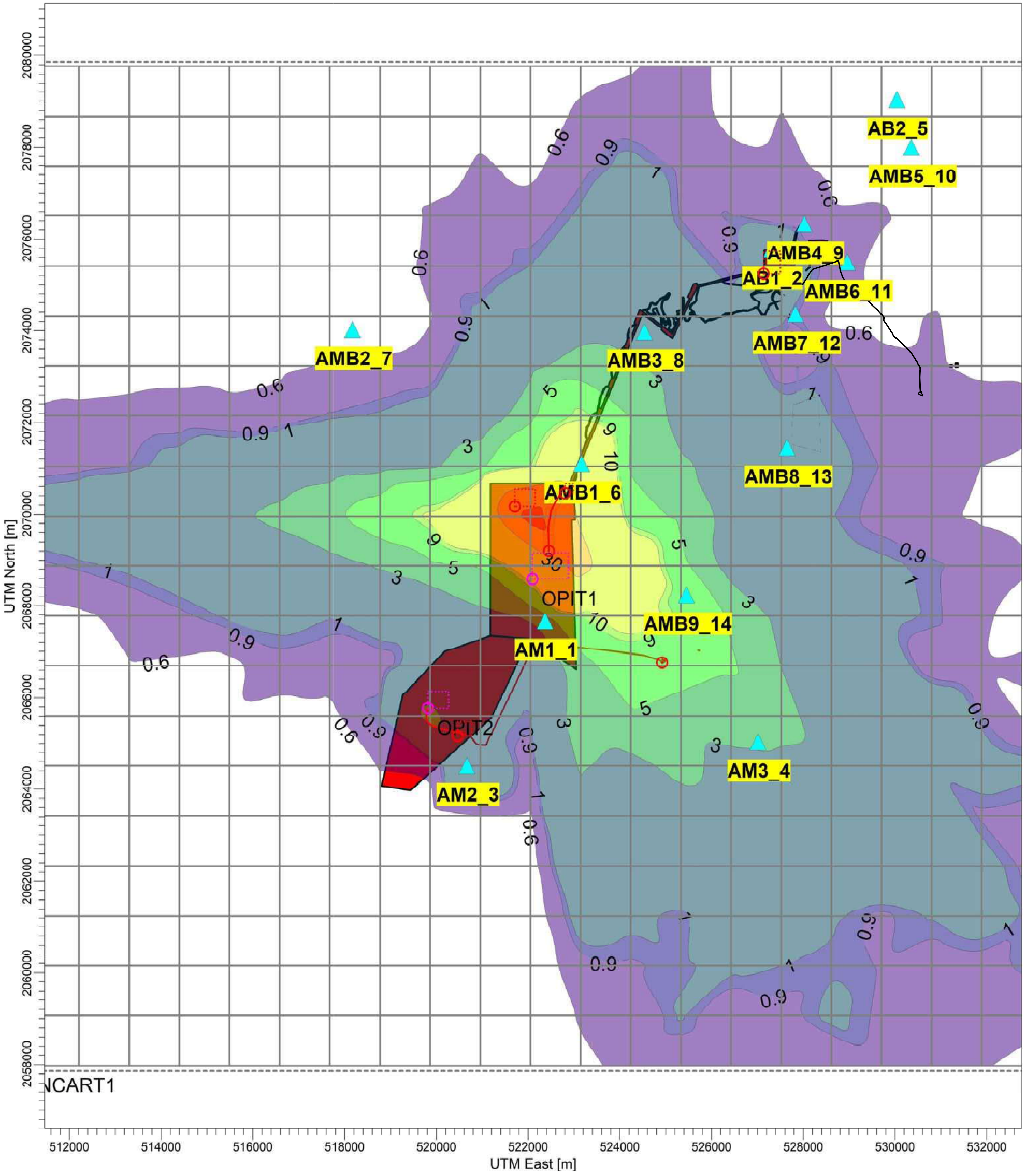


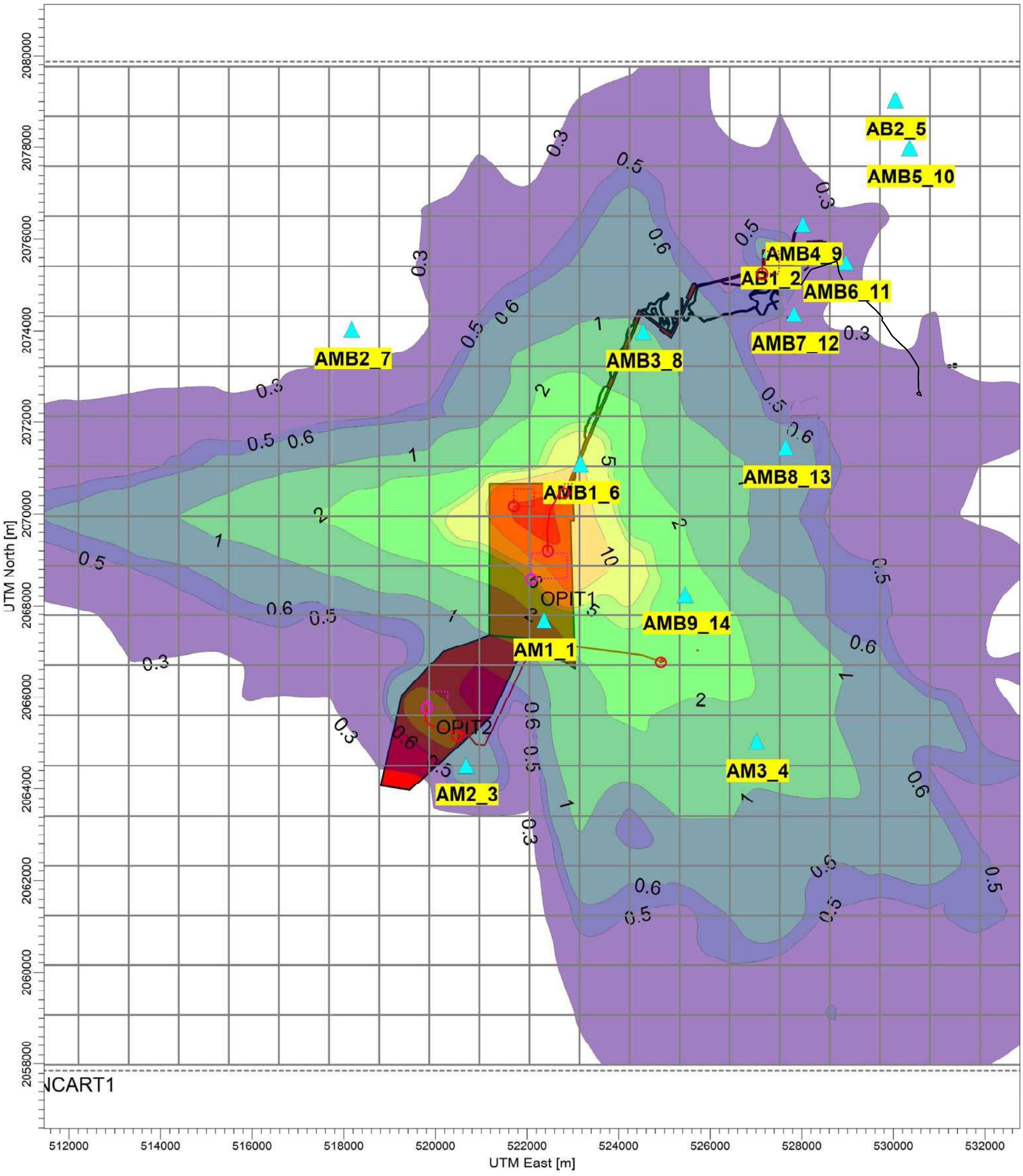
PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 57.5 [ug/m^3] at (522052.86, 2069958.16)

0.6 | 0.9 | 1.0 | 3.0 | 5.0 | 9.0 | 10.0 | 30.0 | 50.0 | 57.5

	9	
	455	
	Concentration	SCALE: 1:90,000 (0 — 3 km)
Isopleth of PM10 in worst case scenario	57.5 ug/m^3	PLATE NO.-4.3



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 27.0 [ug/m^3] at (522052.86, 2069958.16)

0.3 0.5 0.6 1.0 2.0 5.0 6.0 10.0 20.0 27.0

	9	
	455	
	Concentration	**SCALE:** 1:90,000 (0 — 3 km)
Isopleth of PM2.5 in worst case scenario	**27.0 ug/m^3**	PLATE NO.-4.4

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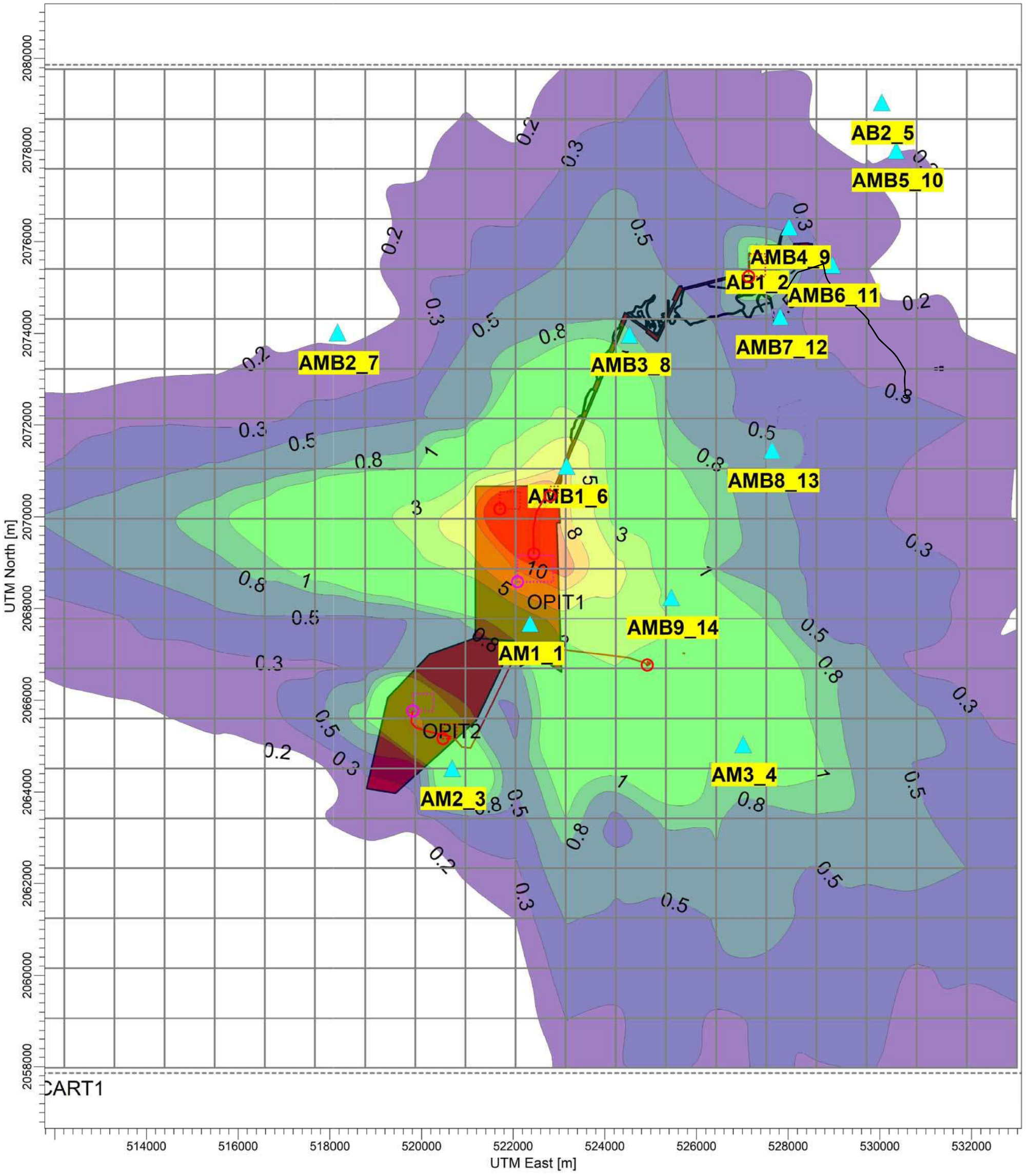

PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 18.0 [ug/m^3] at (522052.86, 2069958.16)

0.2 0.3 0.5 0.8 1.0 3.0 5.0 8.0 10.0 18.0

9		
455		
Concentration	SCALE: 1:90,000 (0 — 3 km)	
18.0 ug/m^3		PLATE NO.-4.5

Isopleth of PM10 in Controlled scenario

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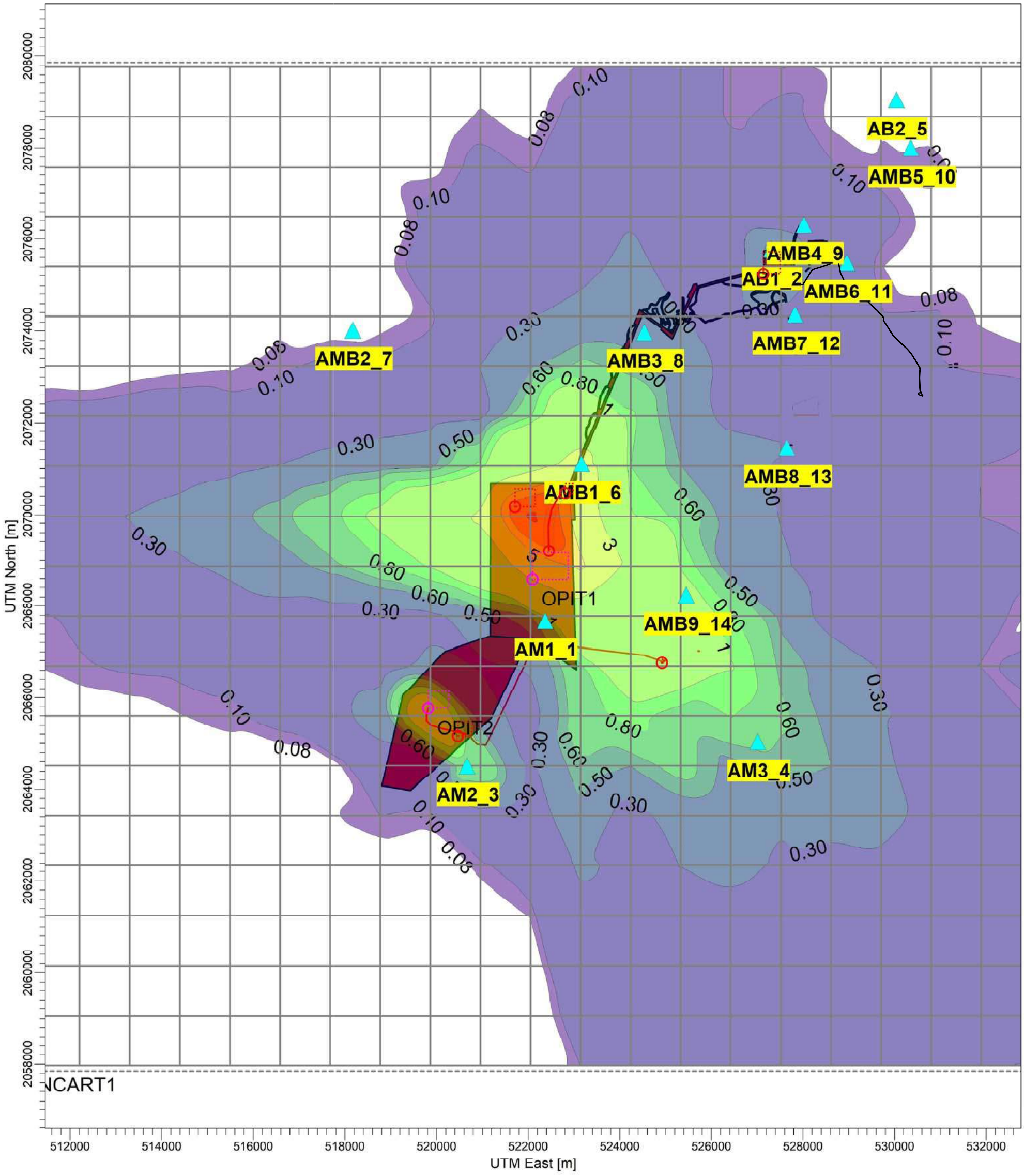

PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 8.46 [ug/m^3] at (522052.86, 2069958.16)

0.08 | 0.10 | 0.30 | 0.50 | 0.60 | 0.80 | 1.00 | 3.00 | 5.00 | 6.00 | 8.00 | 8.46

	9		
	455		
	Concentration	SCALE: 1:90,000 (0 — 3 km)	
Isopleth of PM2.5 in Controlled scenario	8.46 ug/m^3		PLATE NO.-4.6

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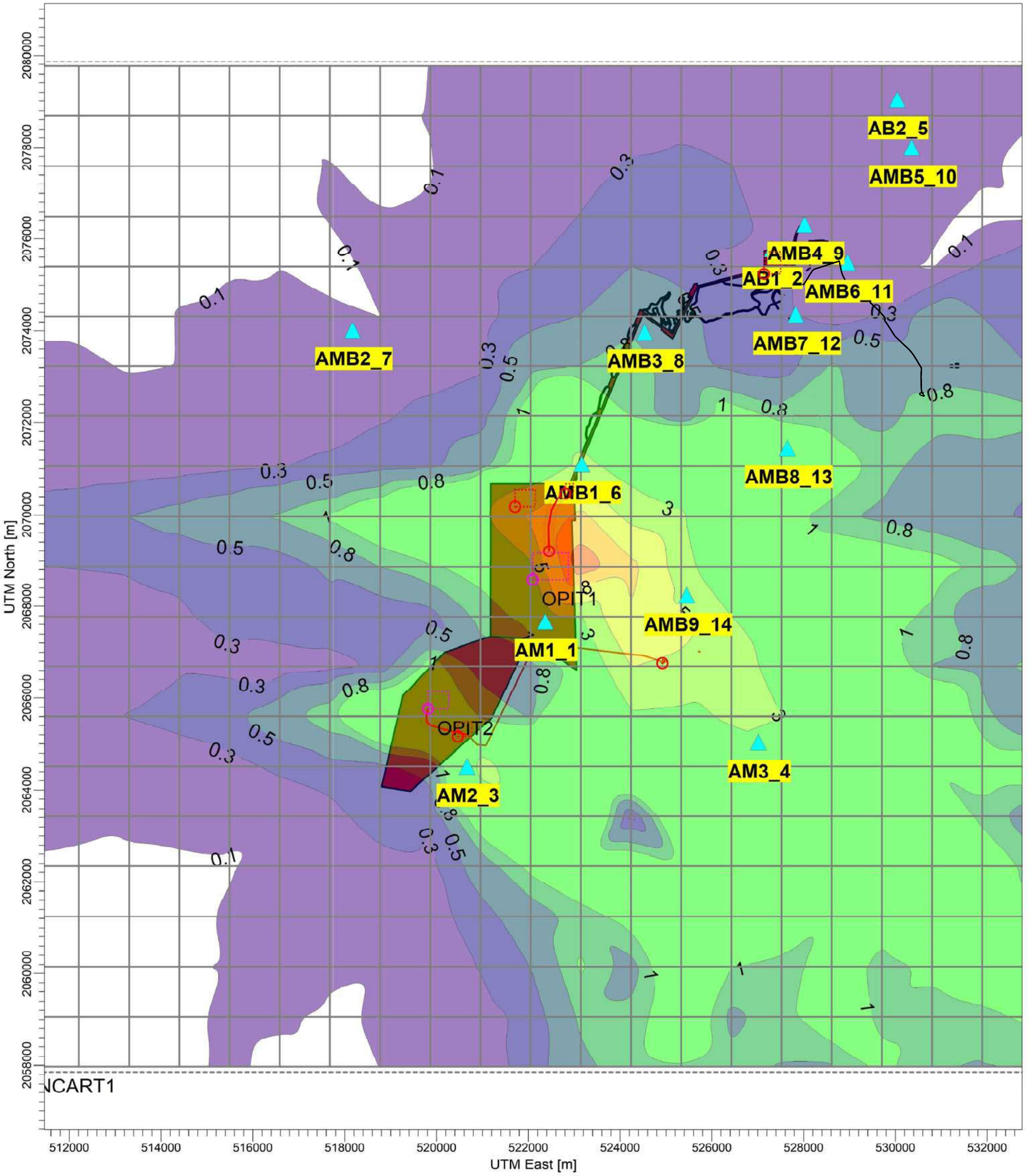

PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 11.4 [ug/m^3] at (523146.53, 2068868.64)

0.1 0.3 0.5 0.8 1.0 3.0 5.0 8.0 10.0 11.4

	9	
	455	
	Concentration	SCALE: 1:90,000 0 3 km
Isopleth of NO2 in Controlled scenario	11.4 ug/m^3	PLATE NO.-4.7

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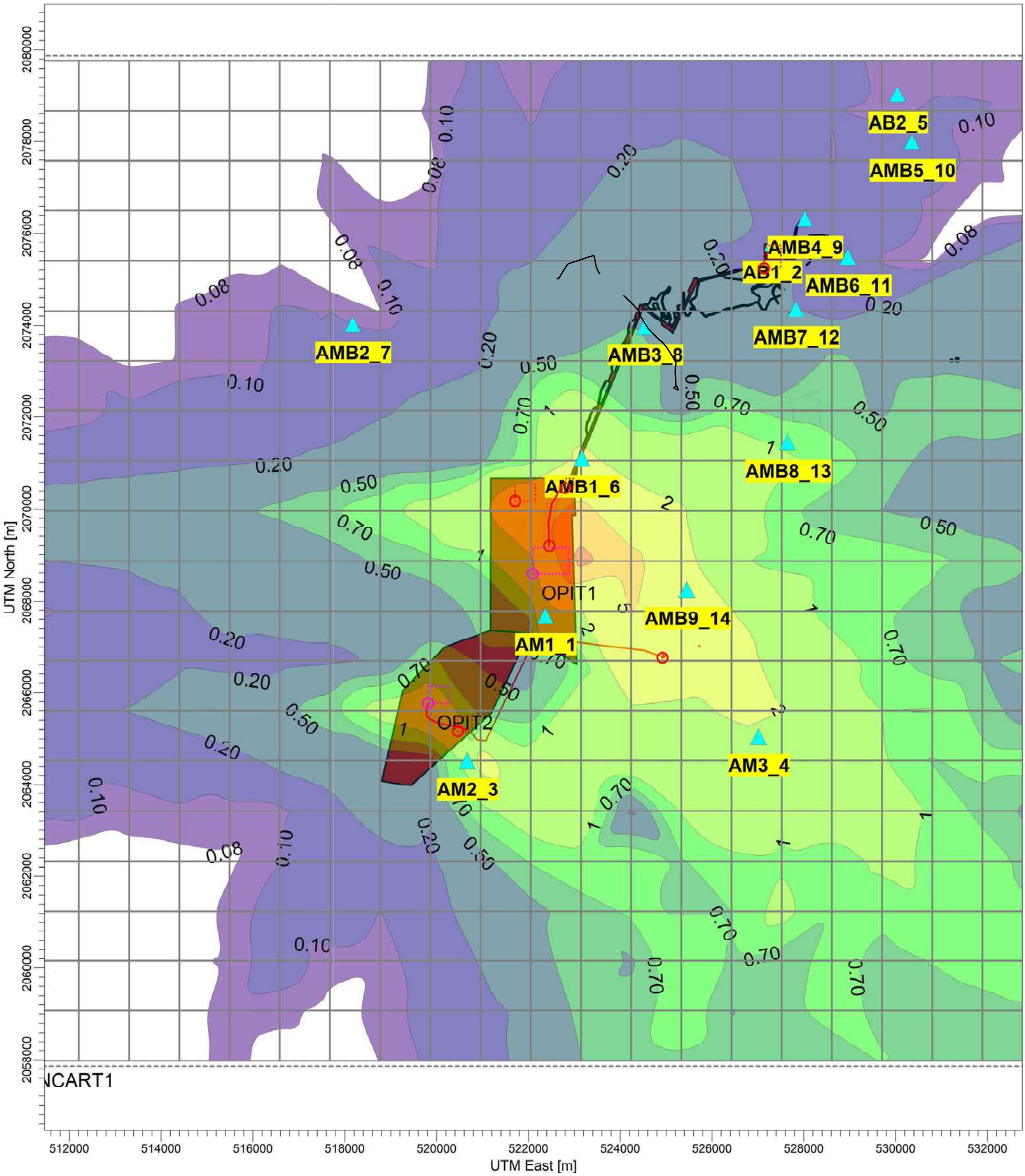


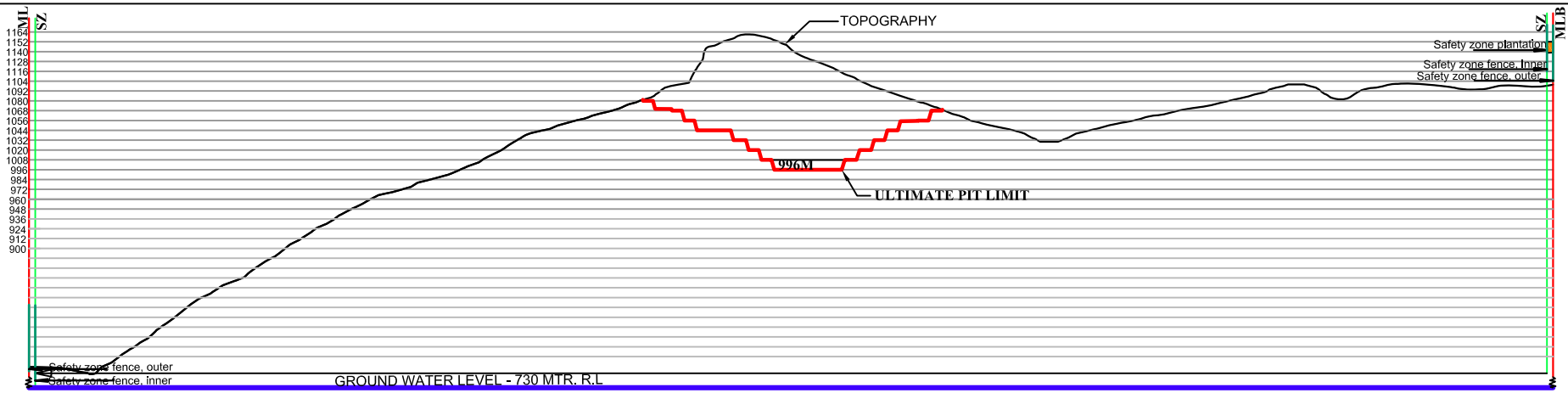
PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

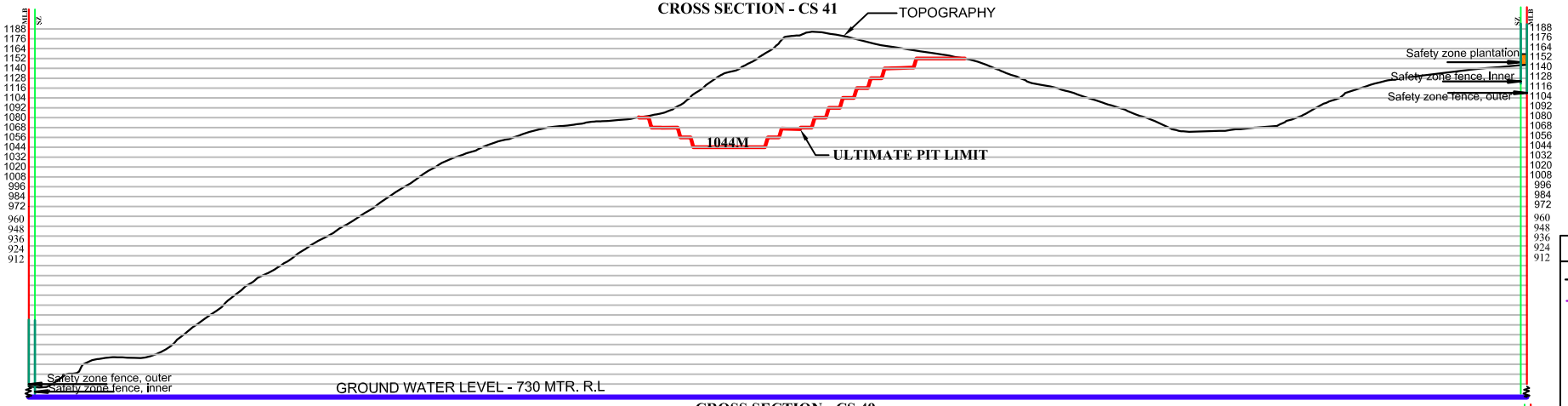
Max: 7.58 [ug/m^3] at (523146.53, 2068868.64)

0.08 0.10 0.20 0.50 0.70 1.00 2.00 5.00 7.00 7.58

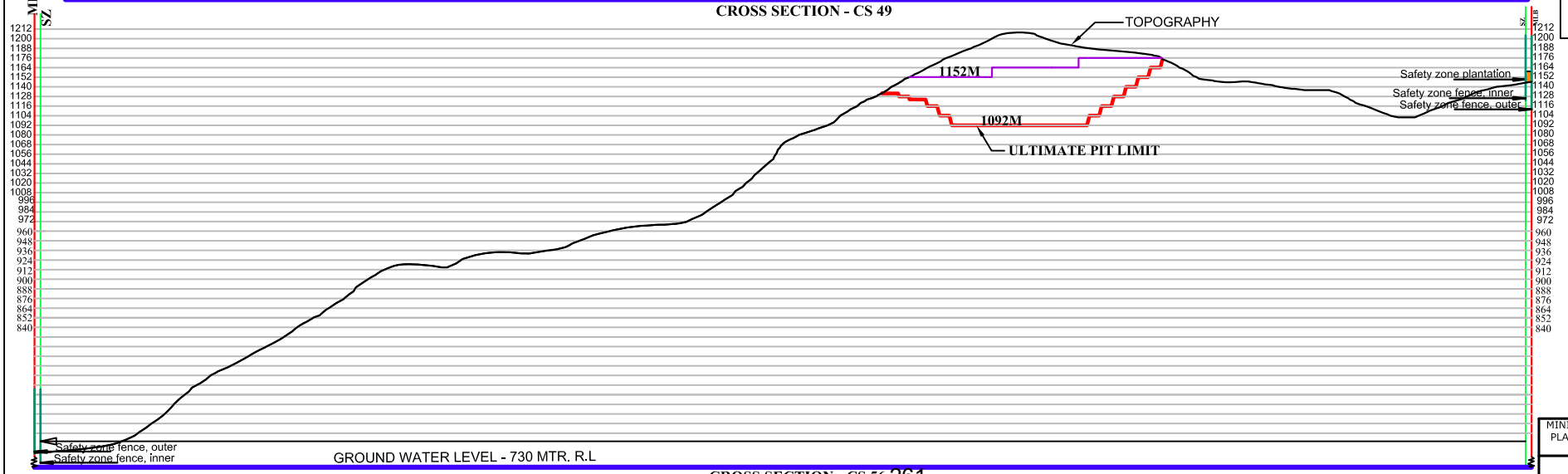
	9	
	455	
	Concentration	SCALE: 1:90,000 (0 — 3 km)
Isopleth of SO2 in Controlled scenario	7.58 ug/m^3	PLATE NO.-4.8



CROSS SECTION - CS 41



CROSS SECTION - CS 49



CROSS SECTION - CS 56

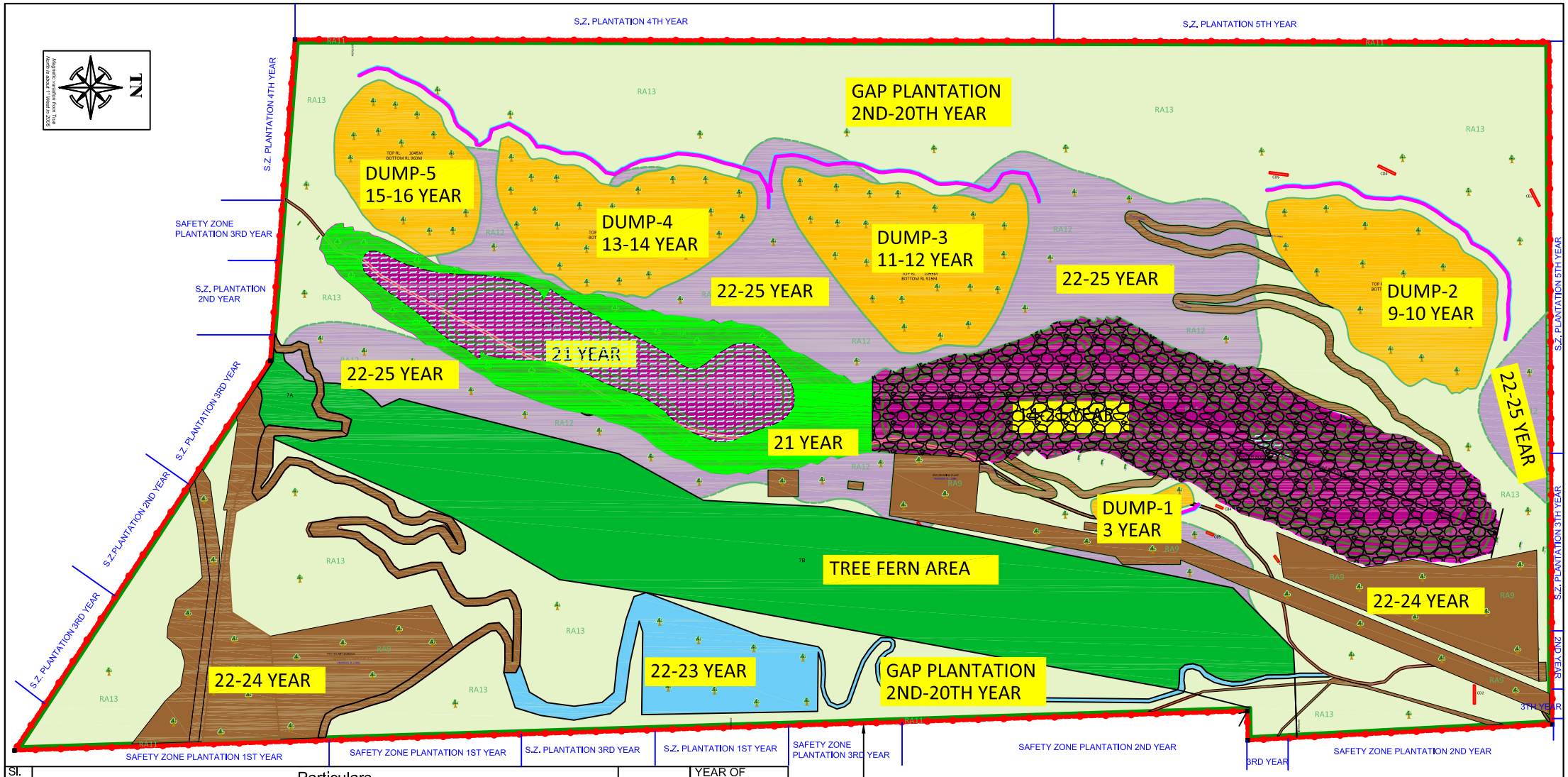
LEGEND

- TOPOGRAPHY
- PIT POSITION 5TH YEAR
- ULTIMATE PIT LIMIT
- GROUND WATER LEVEL
- GROUND LEVEL
- 7.5MTRS INSIDE LEASE BOUNDARY

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

MAP SHOWING GROUND WATER TABLE AND WORKING DEPTH

PLATE NO.-4.9



Sl. No	Particulars		YEAR OF RECLAMATION
1	Waste dump		3-16 YEAR
2	Excavation (Backfilling)		14-21 YEAR
	Excavation (Reservoir)		
3	Excavation (Float ore)		22-25 YEAR
4	Area under infrastructure facilities (Crushing Plant, PSP, Downhill Conveyor (part), internal roads, Service Centre, ETP, Mining Office, Canteen, Rest Shelter, Substation, Power Lines , pump house, pickup weir , water pipelines and Security barrack etc.)		22-24 YEAR
5	GAP PLANTATION		2-20 YEAR
6	Area under explosive magazine & safety zone		22-23 YEAR
7	Tree fern area not to be diverted		
8	Safety zone Along The ML boundary	8.488	1-5 YEAR

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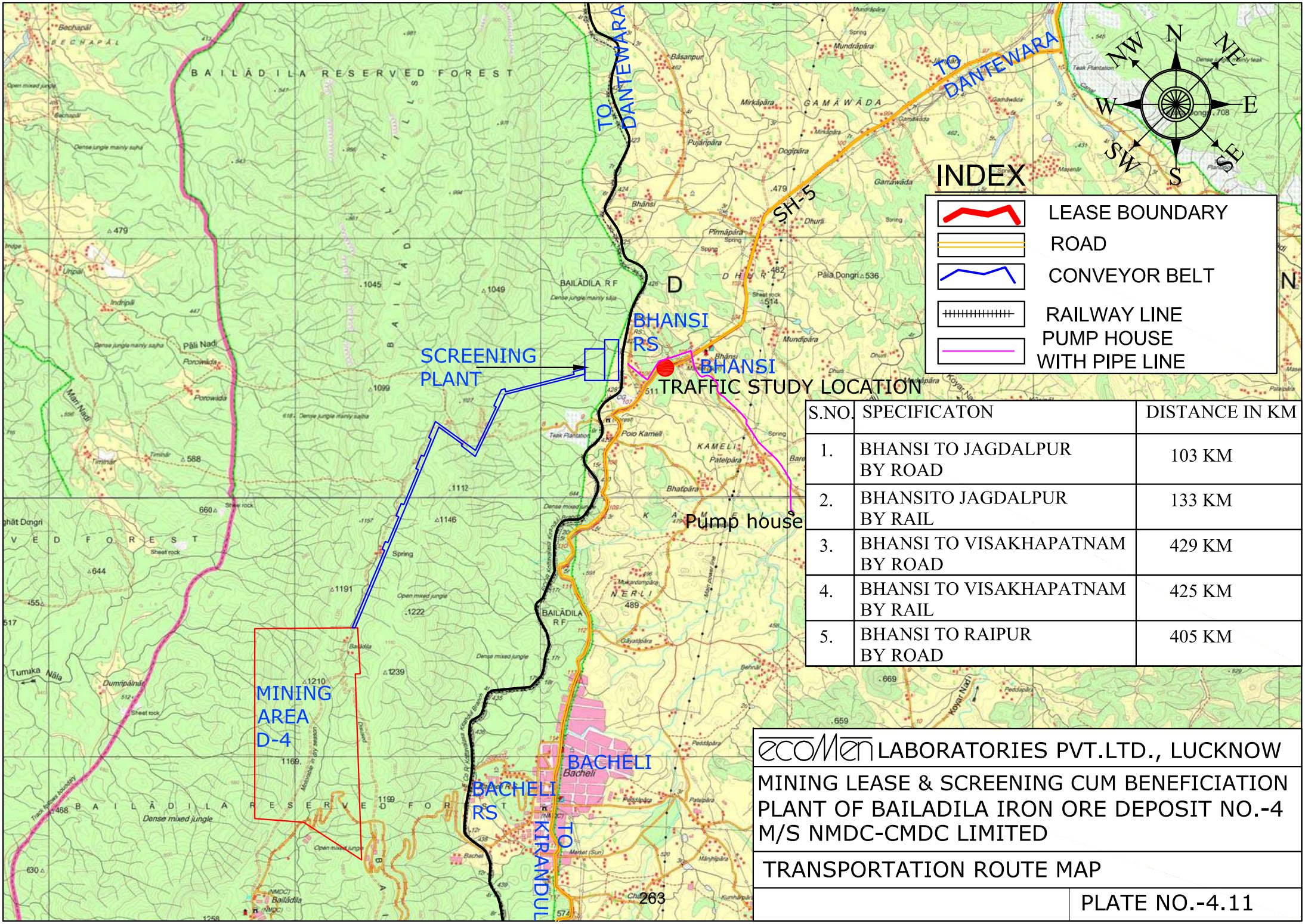
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

M/S NMDC-CMDC LIMITED

RECLAMATION/ AFFORESTATION PLAN

PLATE NO.-4.10



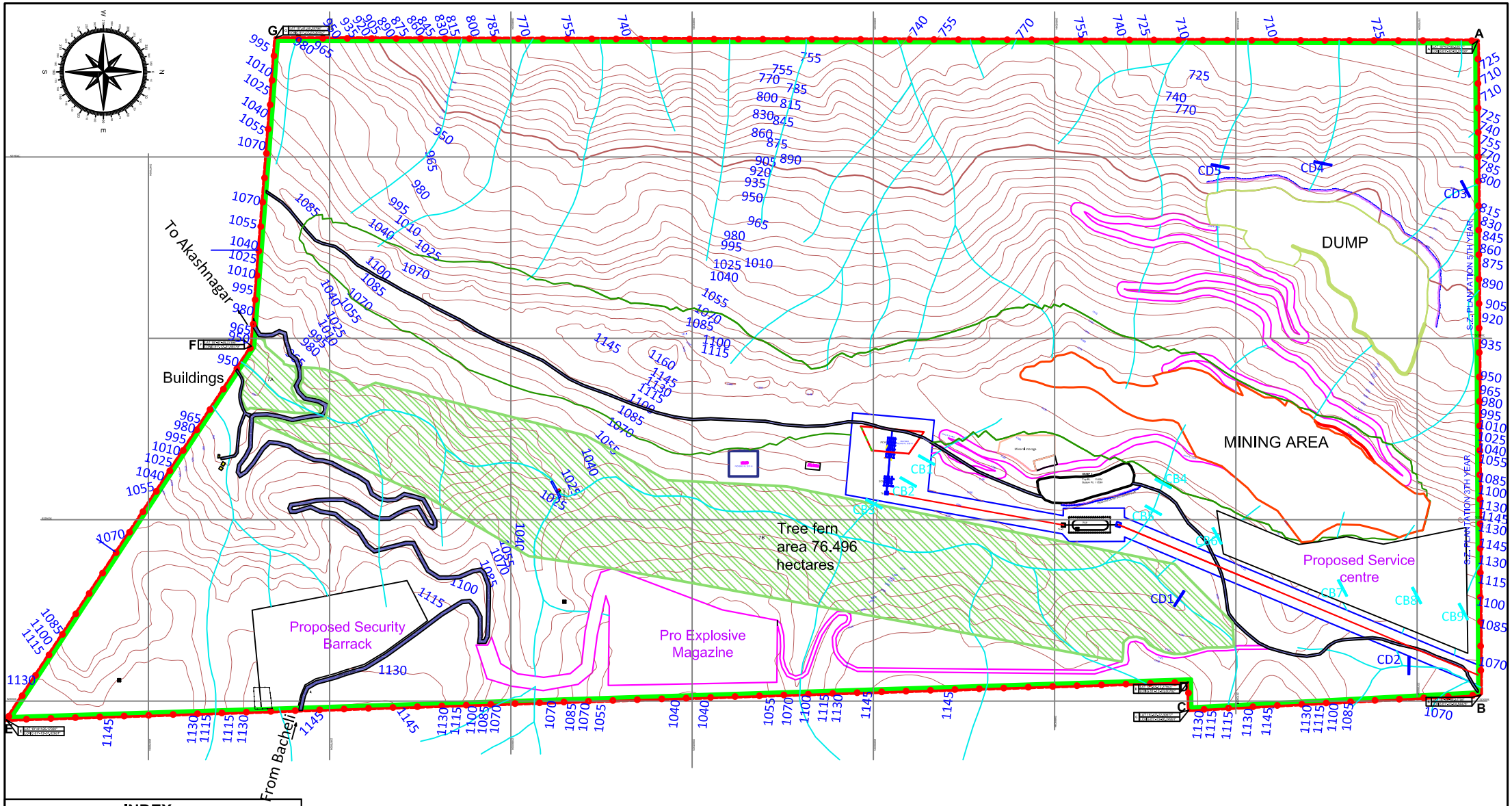
S.NO.	SPECIFICATON	DISTANCE IN KM
1.	BHANSI TO JAGDALPUR BY ROAD	103 KM
2.	BHANSITO JAGDALPUR BY RAIL	133 KM
3.	BHANSI TO VISAKHAPATNAM BY ROAD	429 KM
4.	BHANSI TO VISAKHAPATNAM BY RAIL	425 KM
5.	BHANSI TO RAIPUR BY ROAD	405 KM

ecoMen LABORATORIES PVT.LTD., LUCKNOW

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4
M/S NMDC-CMDC LIMITED

TRANSPORTATION ROUTE MAP

PLATE NO.-4.11



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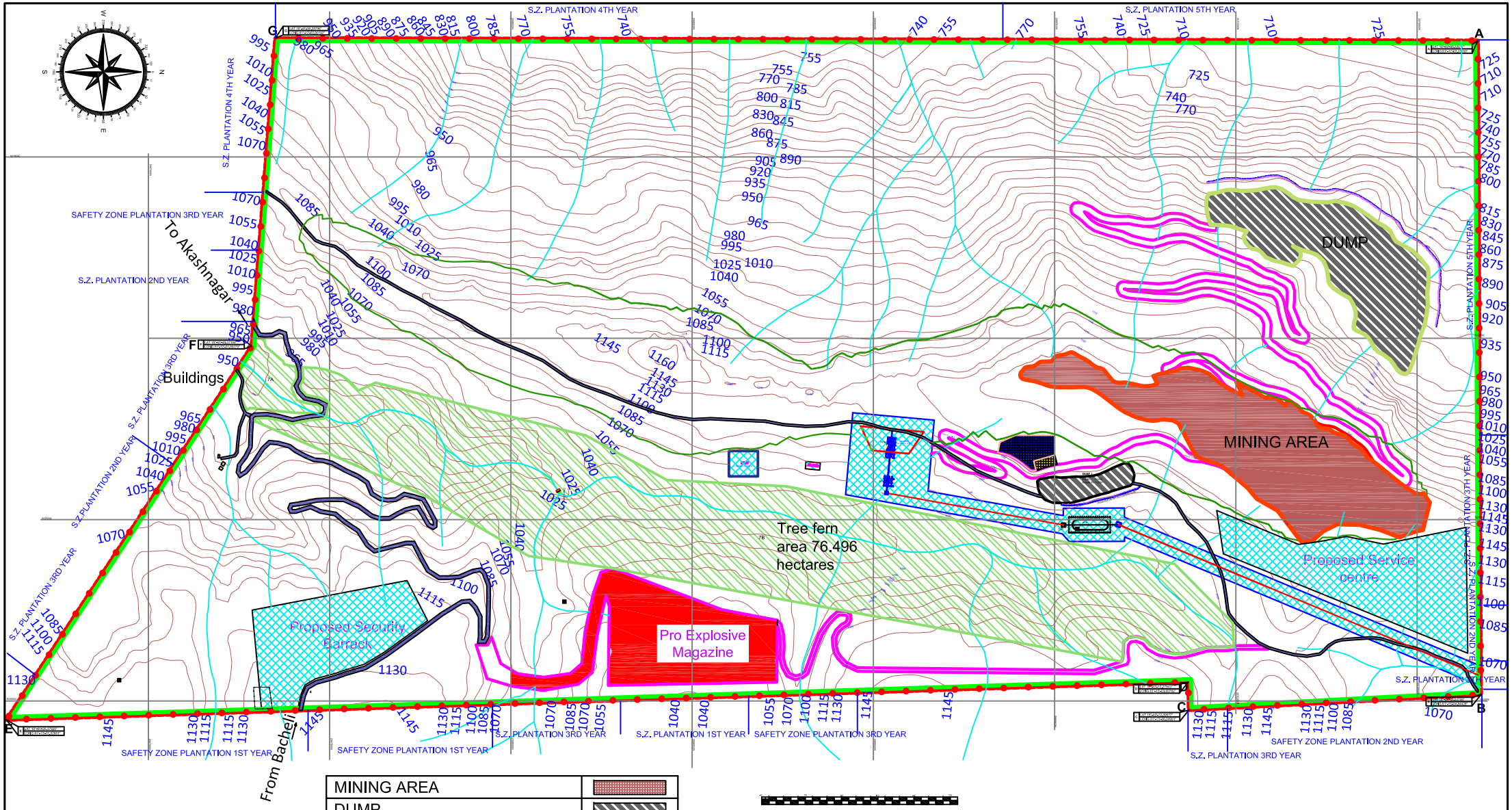
MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

M/S NMDC-CMDC LIMITED

DRAINAGE MAP IN CORE ZONE

PLATE NO.-4.12



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INFRASTRUCTURE(WORKSHOP, ADMIN. BUILDING ETC.	
EXPLOSIVE MAGAZINE	
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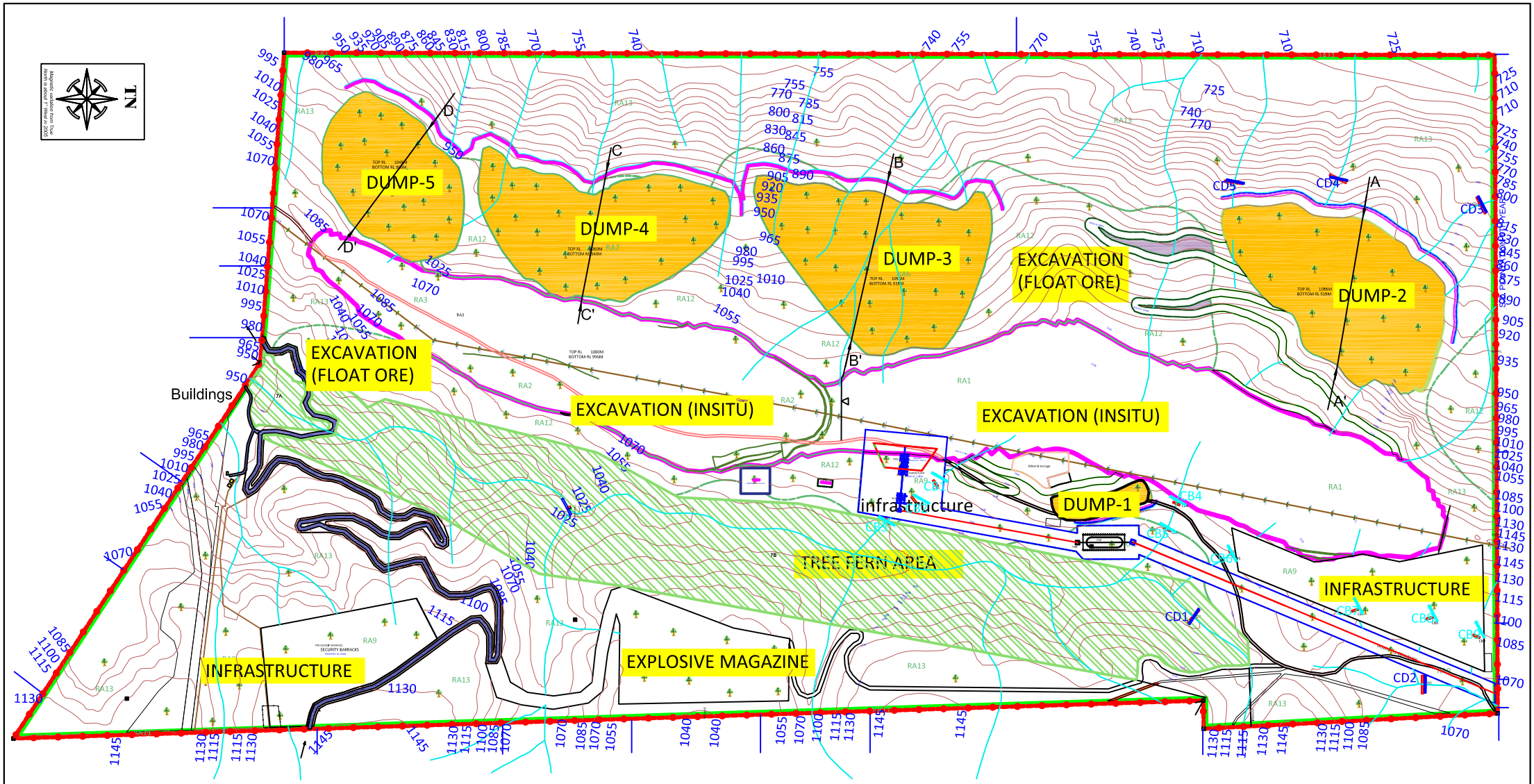
SAFETY ZONE PLANTATION	
VIRGIN LAND	

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

M/S NMDC-CMDC LIMITED

LAND USE PLAN END OF THE 5TH YEAR

PLATE NO.-4.13



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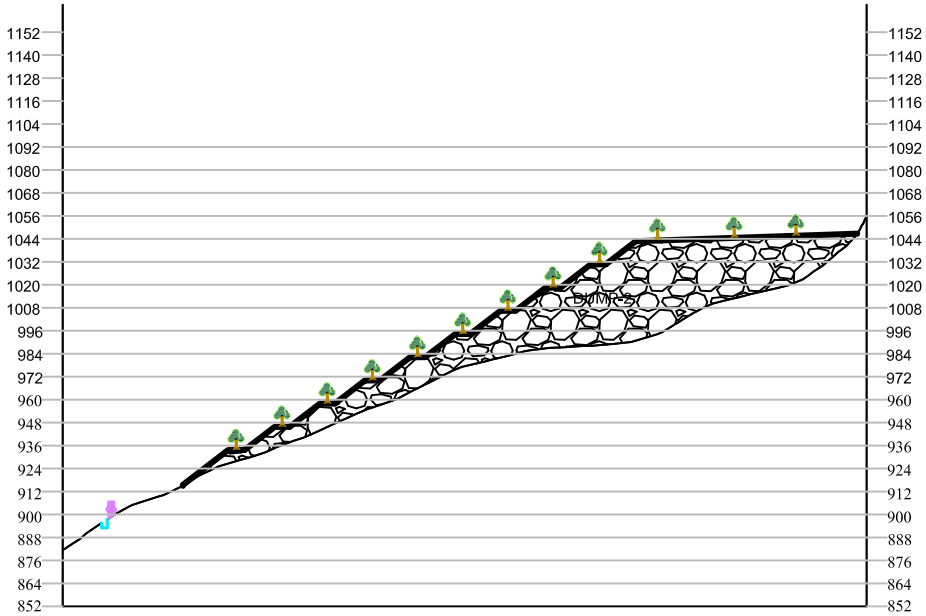
RETAINING WALL	
GARLAND DRAIN	

MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

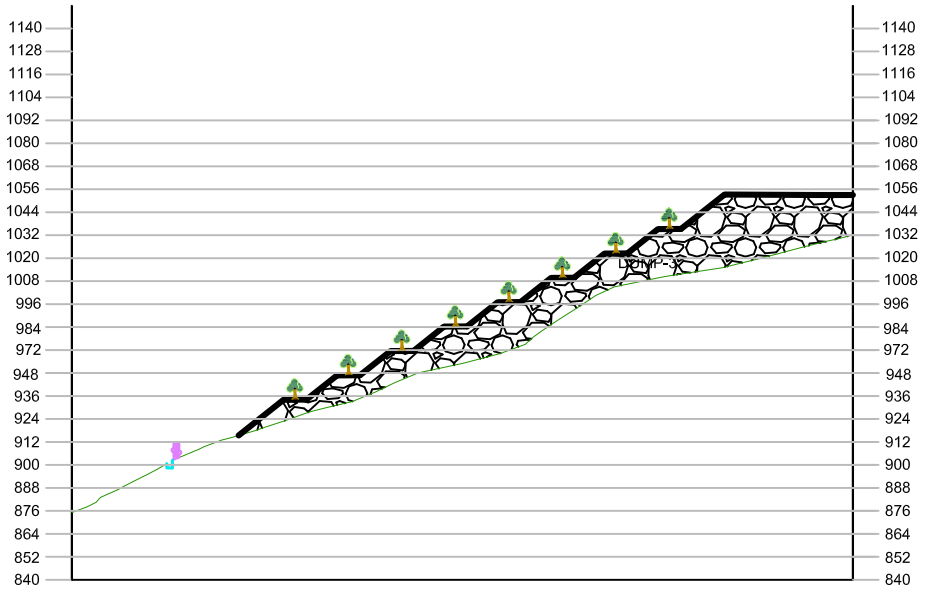
M/S NMDC-CMDC LIMITED

DUMP PLAN AT THE END OF LIFE OF THE MINE

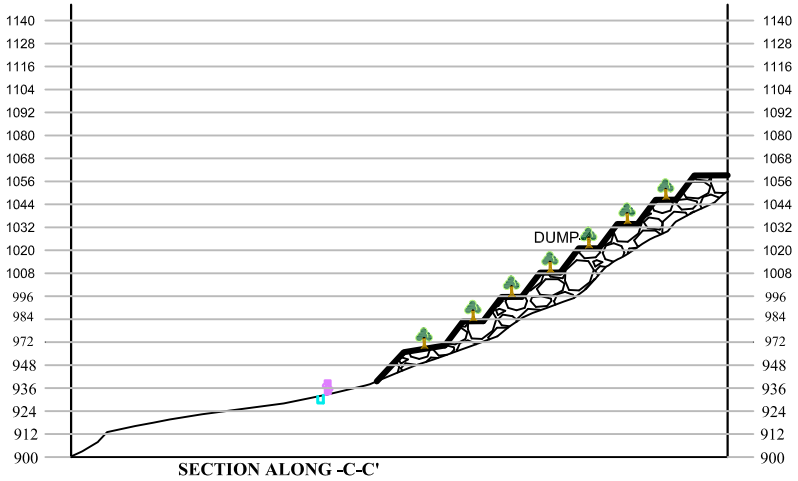
PLATE NO.-4.14



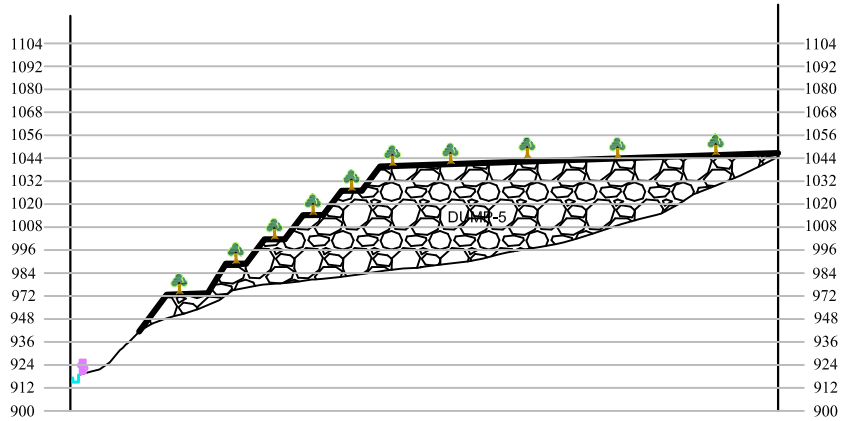
SECTION ALONG -A-A'



SECTION ALONG -B-B'

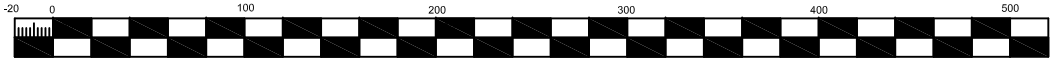


SECTION ALONG -C-C'



SECTION ALONG -D-D'

INDEX	
DUMP	
RETAINING WALL	
GARLAND DRAIN	
PLANTATION	



MINING LEASE & SCREENING CUM BENEFICIATION PLANT OF BAILADILA IRON ORE DEPOSIT NO.-4

M/S NMDC-CMDC LIMITED

DUMP SECTION END OF THE LIFE OF THE MINE

PLATE NO.-4.15