ADITYA BIRLA
HINDALCO

Letter no.: HIL/JH/DUM/482

Date: 30.09.2021

To,
The Member Secretary,
Jharkhand State Pollution Control Board.
T.A. Division Building, Ground Floor,
HEC Complex, Dhurwa
Ranchi- 834004.

Sub: - Submission of Environment Statement in Form – V for the year 2020–21 of Dumri Coal Mine of M/s. Hindalco Industries Ltd.

Dear Sir,

Please find **Yearly Environment Statement** in Form – V, under rule – 14 of the Environment (Protection) Rule, 1986 for Dumri Coal Mine of M/s Hindalco Industries Ltd., Hazaribag, Jharkhand for the year 2020 - 2021.

Kindly acknowledge the receipt of the same.

Thanking you,
Sincerely Yours,

(Mainak Chakraborty)
VP & Head
Dumri Coal Mine
Hindalco Industries Ltd

Enclosures: -
1. Environment Statement in Form – V
2. AAQ, Ground Water, Surface Water & Noise Level report for FY 2020-21 ***(Reports of CSIR-CIMFR, Dhanbad)***

CC to:

1. The Regional Officer, JSPCB, Qtr. No.- E-1, C.T.I. Colony, HEC, Sector-III, Durwa, Ranchi- 834004
2. The Additional PCCF, MoEF&CC, Regional Office (ECZ), Bunglow no- A-2, Shyamali Colony, Ranchi-834002

HINDALCO INDUSTRIES LIMITED
Vasundhara Mega Mart, 2nd Floor
Near Argora Chowk, P.S. Argora
Ranchi-834002 (Jharkhand)

Telephone + 91 651 2247900/01
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Website www.hindalco.com
Corporate Identity No www.hindalco.com
L27020MH19589LC011238

FORM V

(See Rule 14)

Environment Statement for the financial year ending on 31st March, 2021

Part – A

i. Name and address of the Owner/Occupier of the: **Nominated Owner:**
Industry operation or process **Shri Kailash Nath Bhandari**
Hindalco Industries Ltd
5, New Power House Road
Jodhpur – 342003, Rajasthan

ii. Industry category – Primary/Secondary : **Primary**

iii. Production capacity – units : **1.0 MTPA**

iv. Year of establishment of Mine Operation : **Mine is not operational yet due to pending of statutory approvals**

v. Date of the last Environment Statement submitted: **NA**

PART – B

Water and Raw Material Consumption

i. **Water consumption – M^3/d**

Process

Water Sprinkling/spraying **NIL for FY 2020-21**

Domestic **NIL for FY 2020-21**

Name of Products	Process water consumption per unit of products	
	During the previous financial year	During the current financial year
NA	NA	NA

This is a coal mine and presently there is no mining activity within the ML area as all the statutory approvals has not yet received.

ii. **Raw Material consumption** :

Name of raw materials*	Name of Products	Consumption of raw material per unit of output	
		During the previous financial year (FY 2019-20)	During the current financial year (FY 2020-21)

NIL	Raw Coal production for FY 2020-21: NIL	NA	NA

*Industry may use codes if disclosing details of raw material would violate contractual Obligations, otherwise all industries have to name the raw materials used.

PART – C

Pollution discharged to environment/unit of output
(Parameters as specified in the consent issued)

Pollutants	Quantity of Pollutants discharged (mass/day)	Concentration of Pollutants discharged (mass/volume)	Percentage of variation from prescribed standards with reasons.
(a) Water	Presently there is no mining activity within the ML area as all the statutory approvals has not yet received. Test Report of surface water and groundwater from the core zone as well as buffer zone is attached. The survey is being carried out by *CSIR-CIMFR, Dhanbad.*		The analytical result reveal that most of the parameters are well below permissible limits.
(b) Air	Presently there is no mining activity within the ML area as all the statutory approvals has not yet received. Ambient Air Quality Report is Attached. The survey is being done by *CSIR-CIMFR, Dhanbad.*		Ambient air quality result shows that the values of RPM, SPM, SO_2 and NOx are well within prescribed standards.

PART – D

(Hazardous Wastes)

(As specified under Hazardous Wastes (Management and Handling) Rules, 1989 & Amendment Rules, 2002)

Hazardous Wastes	Total Quantity Barrel/Ltrs	
	During the previous financial year (FY 2019-20)	During the current financial year (FY 2020-21)

1. From Process	NA	NA
2. From Pollution Control Facilities	NA	NA

PART – E

(Solid Wastes)

Solid Wastes	Total Quantity (CUM/Kg)	
	During the previous financial year (FY 2019-20)	During the current financial year (FY 2020-21)
a. From process	NIL	NIL
b. From Pollution Control Facility	NIL	NIL
c. Quantity recycled or Reutilized within the unit.	NIL	NIL

PART – F

Please specify the characterization (in terms of composition and quantum) of Hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes:

Presently there is no mining activity within the ML area of Dumri coal mine as all the statutory approvals has not yet received.

Therefore, generation of Hazardous as well as solid wastes from Dumri Coal Mine for the year 2020-21 is nil.

PART – G

Impact of the pollution Control measures taken on conservation of natural resources and on the cost of production:

Presently there is no mining activity within the ML area of Dumri coal mine as all the statutory approvals has not yet received.

Though we are carrying out periodically Environmental Monitoring Survey by CSIR-CIMFR, Dhanbad and the report is being submitted regularly to MoEF&CC, Ranchi and JSPCB (Regional & Head office), Ranchi.

The level of AAQ is within the permissible limit. Water Quality Analysis also indicates that all the parameters are within the permissible limit.

Pollution control measures in Dumri Coal Mine will be taken up extensively as per the conditions stipulated in Environmental Clearance whenever the mines will be operational. Some of the proposed control measures are as follows: -

- **Air Pollution Control Measures:** - When the mine will be operational, dust suppression systems (like water spraying) will be adopted. Sprinklers would be installed along roads to suppress the dust. To prevent air pollution due to airborne dust, tree belts will be planted around the mine site. To ensure that NO_x level do not increase during mining operation good quality explosives will be used for which the oxygen balance will be checked from time to time. Apart from this AAQ will be done as per stipulated EC conditions and all the records will be maintained and kept for the purpose.
- **Water pollution control Measures: -** When the mine will be operational, mine pit water will be settled in settling ponds and the settled water will be further used for plantation and dust suppression. Workshop pollutants will be treated through ETP.
- **Noise Pollution Control Measures**: - When the mine will be operational, provision and maintenance of thick tree belts to screen noise will be kept. Proper maintenance and close monitoring of noise generating machinery including transport vehicles will be ensured.
- **Soil Pollution and Erosion control measures**: - When the mine will be operational, top soil will be kept separately and will be redistributed in a manner that achieves an approximate uniform. Stable thickness that is consistent with approved post-mining land use. Regular Plantation activity will be going on the slope and top of the dump to stop soil erosion. Proper garland drains around the dump will be maintained to catch the silts. Check dams will be also constructed wherever required.

PART – H

Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution -

Presently there is no mining activity within the ML area of Dumri coal mine as all the statutory approvals has not yet received. Proper and most suitable environmental control system will be fully

functional when the mine will start its operation. However, if necessary, we proposed to take up more additional measures.

PART – I

Miscellaneous

Any other particulars for improving the quality of the environment –

NIL

(Mainak Chakraborty)
VP & Head
Dumri Coal Mine
Hindalco Industries Ltd

ENVIRONMENTAL STUDY REPORT

ENVIRONMENTAL STUDY REPORT FOR DUMRI COAL MINE, HAZARIBAG, JHARKHAND

(MONSOON SEASON)
(JULY, 2020 TO SEPTEMBER, 2020)

Prepared

For

M/S HINDALCO INDUSTRIES LIMITED
Hazaribag - 825311
Jharkhand

Prepared

by

HYDRLOGY & GEOCHEMISTRY DIVISION
(NREM)
CSIR-CENTRAL INSTITUTE OF MINING & FUEL RESEARCH
BARWA ROAD, DHANBAD - 826 015

Report

On

Environmental Study Report for Dumri Coal Mine, Hazaribag, Jharkhand

(MONSOON SEASON)
(JULY,2020 TO SEPTEMBER,2020)

Project No.: SSP/474/2020-21

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1. This report is meant for the internal use of your organisation only and it should not be published in full or part by your organisation or staff. It should not be communicated/circulated to outside parties except the concerned government department.
2. CSIR-Central Institute of Mining and Fuel Research, Dhanbad reserves the right to publish the results of research for the benefit of the industry.

19/10/2020

(Gautam Ch. Mondal)
Principal Scientist/Project Leader
CSIR-CIMFR, Dhanbad

19/10/2020

(Abhay Kr. Singh)
Sr. Principal Scientist & HOS
CSIR-CIMFR, Dhanbad

19/10/2020

(K. K. K. Singh)
Chief Scientist & HORG
CSIR-CIMFR, Dhanbad

PROJECT PERSONNEL

Project Co-coordinator

Dr. K. K. K. Singh

Project Leader

Dr. Gautam Ch. Mondal

Team Members

Dr. Abhay Kr. Singh

Dr. D. B. Singh

Ms Pallabi Das

Dr. M. R. Mondal

Mr. Ranjit S. Rangari

Mr. Reddi Ganesh

Mr. A. S. Kumar

INDEX

1.0 INTRODUCTION

Mining is the extraction of valuable minerals or other geological materials from the Earth. It is a site specific and ecologically sensitive industry. For sustaining national development, mining of coal and minerals is of paramount importance for developed as well as developing countries. To meet the energy requirements of the country, increased coal production has been possible due to large-scale surface mining activities. Mining operations usually create a negative environmental impact, both during the mining activity and after the mine has closed. Surface mining causes environmental disturbance in the form of land degradation, removal of OB material which stress on air and water regime and finally interferes in the balance of the ecosystem. To meet these problems, sound environmental management system for pre-mining, active mining and post mining stages in the form of Environmental Impact Assessment, Environmental Management Practice for concurrent mining and Environmental Audit has been made necessary by the regulating state and central authorities. Regular monitoring of the different components of environment is made necessary for evaluating the requirements of environmental management system and its impact in the society. This report presents the study conducted by CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad for proposed Dumri Coal Mine belonging to M/s Hindalco Industries Ltd, Hazaribag, Jharkhand.

1.1 HISTORY OF DUMRI COAL MINE

"Dumri Block" in North Karanpura Coalfield situated in the District Hazaribag, State of Jharkhand, was previously allotted by Ministry of Coal and Mines vide their letter dated 13.01.2006, jointly to M/s Nilachal Iron and Power Ltd. as leader and M/s Bajrang Ispat (P) Ltd. as associate.

Honourable Supreme Court of India vide Judgement dated 25th August, 2014 and Order dated 24th Sept. 2014 cancelled the allocation of 204 coal blocks, which include Dumri coal block also.

Later the Office of Nominated Authority constituted under section 6 of the Coal Mines (Special Provision) Act, 2015, issued Vesting order under clause (b) of sub-rule 7 and sub-rule (1) of rule, Order no. 104/24/2015/NA dt. 22nd April, 2015 for Dumri Coal Mine in favour of M/s Hindalco Industries Ltd.

Further, vide Corrigendum No. 1, dated 30th January, 2018, the MOC issued the revised boundary Co-ordinates. As per approved Mining Plan (Revision-I) of Dumri Coal Mine of M/s Hindalco Industries Ltd., revised area of the mining lease is 259.64 ha.

Based on recommendation of EAC; Ministry of Environment, Forest and Climate Change revoke the abeyance on transfer of Environmental Clearance for Dumri Coal Mine project from M/s Nilachal Iron and Power Limited to M/s Hindalco Industries Limited for a production capacity of 1 MTPA in the ML area of 259.64 ha. The environmental clearance finally granted for opening of Dumri Coal Mine Project of M/s Hindalco Industries Ltd. vide letter no. J-11015/239/2008-IA-II (M) Pt., dated 6th November, 2019.

1.2 LOCATION

The lease area of Dumri coal mine covers land in villages: Pagar, Balia, Tunda and Pandu of Keredari Block of district Hazaribag (Jharkhand). The nearest township is Hazaribag located at a distance of about 40 KM from Dumri Coal Mine (DCM). The Hazaribag-Khelari State Highway-07 is about 3KM on the south of the coal block. The nearest railhead is "RAY" at about 40 KM on the Gomoh-Barkakana-Dehri-on-Sone loop line of South-Eastern railway. A new railway line connecting Hazaribag via mandu has been commissioned and block is at a distance of about 40 KM from the nearest offtake station which is Nawada/Khapariaon. The nearest airport of Ranchi is at distance of 120 KM. The project area is situated between the latitude 23^0 53' 31.998" N and 23^0 54' 30.848" N and longitude 85^0 03' 11.539" E & 85^0 05' 37.103" E. The site is well connected by road and about 8 KM away from Keredari Block Office. It is a barren area and coal mine has not yet operational.

1.3 SCOPE OF WORK

M/s Hindalco Industries Ltd, Hazaribag, approached CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad for conducting the environmental study for one year i.e. 2020-2021 having following objectives:

- Environmental study of Air, Water, Noise and Soil of the core and buffer zone.
- The Environmental monitoring will be conducted on seasonal basis.
- Advice into the adoption of necessary control measures.
- Land use pattern study will be done once in a year and report will be submitted separately.
- Preparation of Environmental Statement.

The detailed studies with respect to air, water and noise will be carried on seasonal basis in the year 2020-21 while soil samples, for the adjoining mining area, will be collected once in a year and analyzed in the CSIR-CIMFR laboratory.

2.0 REGIONAL GEOLOGY

The North Karanpura Coalfield forms a prominent east-west trending valley between Hazaribag plateau in the north and Ranchi plateau in the south. The Aswa pahar in the south-east separates in North and South Karanpura Coalfields by east west elongated metamorphic patch. However, they are interconnected near Bachra and Hindegir village by a narrow tongue of Talchir outcrops. On the eastern side, North Karanpura Coalfield is separated from the West Bokaro Coalfield by a narrow stretch of metamorphic rocks having several outliers of Talchir Formation. In the west, it is separated by a stretch of about 20kms wide metamorphic belt from Auranga Coalfield.

Out of 1230 Sq. Km area of North Karanpura Coalfield, the coal bearing Formations viz. Karharbari, Barakar and Raniganj crop-out over an area of about 500 Sq. Km. The Karharbari formation is well developed in the south-central and eastern part of the coalfield. It contains only one seam, which occurs often in two to three sections. It comprises of very coarse grained, gritty sandstone, and at times, has silicified sandstones. The Barakar formation contains a number of coal seams and contributes the major bulk reserves of this coalfield. Five persistent coal seams have been established in the coalfield. The total coal column is more or less around 35-40 m in major part of the coalfield. Raniganj formation contains three to four coal seams which are generally shaly in nature and often impersistent.

2.1 LOCAL GEOLOGY

The Dumri block is the up-dip extension of Chatti-Bariatu block and is located in the northern part of the North Karanpura Coalfield. It is contiguous to Chatti-Bariatu block in the south. Keredari 'A' block in the east, Pachra block on the west. The northern boundary of the block is defined by hilly terrain and dense forest cover which is a part of the inaccessible Dumri area.

The Dumri block comprises Talchir, Karharbari, Barakar and Barren measures Formations belonging to Damuda sub-group of lower Gondwana Group. The Talchir formation overlies metamorphic rocks with an unconformity. The Karharbari and Barakar are the main coal bearing formations contain four major coal seams i.e. Seam-I, II, III and IV in ascending order. Besides these, six more thin coal horizons are also developed in the block. The Karharbari Formation is essentially composed of conglomerates and coarse to gritty arkosic sandstone varying in thickness from 7 to 139m. The strata are very hard and compact at places on account of localized silicification. The thickness of this formation generally varies from 7m to 136m with coaly horizons. Among them, the topmost horizon (K5) is more persistent than the other horizons. The Barakar Formation lies comfortably over the Karharbari Formation. This is the main coal bearing formation in the block and contains four major coal seams i.e. Seam-1 to IV and four thin coal seams i.e. IVA, IVB, IVC, IVD in ascending order and two local seams L1 between Seam III Top & III Bottom and L2 below seam I Bottom. This formation is composed of gritty to conglomeratic sandstone (basal part), medium to coarse grained sandstone with siltstone, shale and carbonaceous shale. Among the four coal seams, seam-I Middle, II Bottom & IV Top are the thickest. The maximum thickness of Barakar Formation as intersected in boreholes is 129m. The Barren Measure Formation lie conformably over the Barakar Formation and is characterized by fine grained sandstone, shale and sandy shale. As per borehole records its thickness varies from 15m to 20m.

A dolerite dyke trending almost E-W and having roughly 4km length and a width of approximately 12-25m passes through the Dumri block. The presence of this dyke has also been reported in Pachra block lying west of Dumri block. Stratigraphic sequence of Dumri block is given below in **Table 1**.

Table 1: Stratigraphic Sequence of Dumri Block

(As per Borehole Intersection)

Period	Group	Sub-group	Formation	Thickness Range (m)	Lithology
Recent	Lower Gondwana	Damuda	Alluvium	3.50-14	Detrital and Alluvial soil and subsoil
			Barren Measures	15-20	Dark shale, sandy shale and Interbanded shale, sandstone
			Barakar	18-129	Fine to coarse grained sandstone, shale, conglomerate, carbonaceous shale and coal seams
			Karharbari	7-136	Medium to coarse grained sandstone shale, silicified quartzitic rock and thin coal seams.
			Talchir	10	Green coloured shale, Boulder and conglomerate
			Metamorphics		Granite, gneisses and Quartzite

2.2 MINING SCENARIO

The Dumri Block is the up-dip extension of Chatti-Bariatu Block and opencast mining method has been adopted for extraction of coal within the mining lease area. The mining plan for proposed Dumri Coal Mine was approved for two pit opencast working. The main part of the reserves lies in the eastern part of the mining lease and it was named as Quarry-2. Meager coal reserves are available in the western part in form of three small pits named Quarry-1A, Quarry-1B and Quarry-1C. In approved revised mining plan, the sequence of operation was suggested to work Quarry-2 first followed by Quarry-1(comprising of 3 small pits). The anticipated life of the mine with peak production rate of 1.0 MTPA will be 46 years. Prior to the advancing of 1st OB bench, land will be cleared with dozers/graders and topsoil removed in line with the Environmental Management Plan. Coal is extracted by shovel dumper combination after blasting off the coal faces. Excavators with 2.5 cum bucket capacity are planned to be used for coal mining which

will load into 35T coal dumpers. The over burden will be transported by 35T dumpers to surface dumps over the coal bearing area within mining lease and later used for backfilling. The coal will be transported by 35T coal trucks to the proposed coal stockyard at the pit head and later coal will be transported through weigh-bridge to the nearest railhead.

Total extractable reserve of Dumri Coal Mine is 45.22 MT with an average grade of G11. The open cast mine worked by Shovel-Dumper combination with an average stripping ratio of 2.36 Cum/Te.

3.0 ENVIRONMENTAL SCENARIO IN THE MINING AREA

3.1 AIR ENVIRONMENT

Air pollution includes one or more contaminants (pollutants), in the outdoor atmosphere in such quantities and of such duration that may be injurious to human, plant or animal life. Once these contaminants enter in the atmosphere, either in gaseous form or as particulate matter, these cannot escape and keep circulating and deteriorating the air quality. Air pollution effects encompass those that are health related as well as those associated with damage to property or which cause decrease in atmospheric aesthetic feature. Dispersion of air pollutants from the source depends on micro-meteorological parameters of the area.

3.1.1 SOURCES OF AIR POLLUTION

Coal transportation, OB removal, drilling, blasting, haul road and movements of mining equipments will be the major sources of air pollution in the proposed mining area. Generally, dust generation will be of major concern during mining operation. NO_2 will be liberated in the time of blasting and during the movement of mining machineries. This coal contains very less sulphur (<0.72%) and as such the concentration of SO_2. In Indian coal, it is low, except Assam where sulphur content is high.

3.1.2 METHODOLOGY AND INSTRUMENTS USED

The methodology and instruments used for air quality monitoring and analysis are given in **Table 2** as below:

Table 2: Methodology and Instrument Used for Air Quality Analysis

Parameters	Method	Instrument
$PM_{2.5}$	IS-5182 (Part 23):2006 Gravimetric Method	Fine Particulate Sampler
PM_{10}	IS-5182 (Part 23):2006 Gravimetric Method	Fine Particulate Sampler
SO_2	IS-5182 (Part 2):2001 (Improved West & Gaeke Method)	Fine Particulate Sampler with gaseous attachment
NO_x	IS-5182 (Part 6):2006 (Jacob & Hochheiser modified Method)	Fine Particulate Sampler with gaseous attachment

3.1.3 AIR QUALITY

Air quality monitoring in core and buffer zone of the Dumri coal mine has been carried out in monsoon season for the year 2020-21 to assess the impact of mining activities on the ambient air quality. During the study, two sampling locations for ambient air quality had been fixed in buffer zone and two sampling locations in core zone area of the proposed mine on the basis of wind direction and other meteorological parameters. Details of sampling stations along with the source of air pollution are given in **Table 3** and shown in **Fig. 1.** The air quality at these locations is presented in **Tables 4 & 5**. The results show that the ambient air quality of the villages, in and around the mining site, is least affected as the mine is not initiated during the study period.

Table 3: Details of Air monitoring Locations

Station Code	Location	Source of Air Pollution
CORE ZONE		
CA-1	Within Mining lease area	Kachha road and natural activity.
CA-2	Balia Village	Household coal burning and vehicular movement, etc.
BUFFER ZONE		
BA-1	Chatti-Bariatu Village	Household coal burning and vehicular movement, etc.
BA-2	Tunda Village	Household coal burning and vehicular movement, etc.

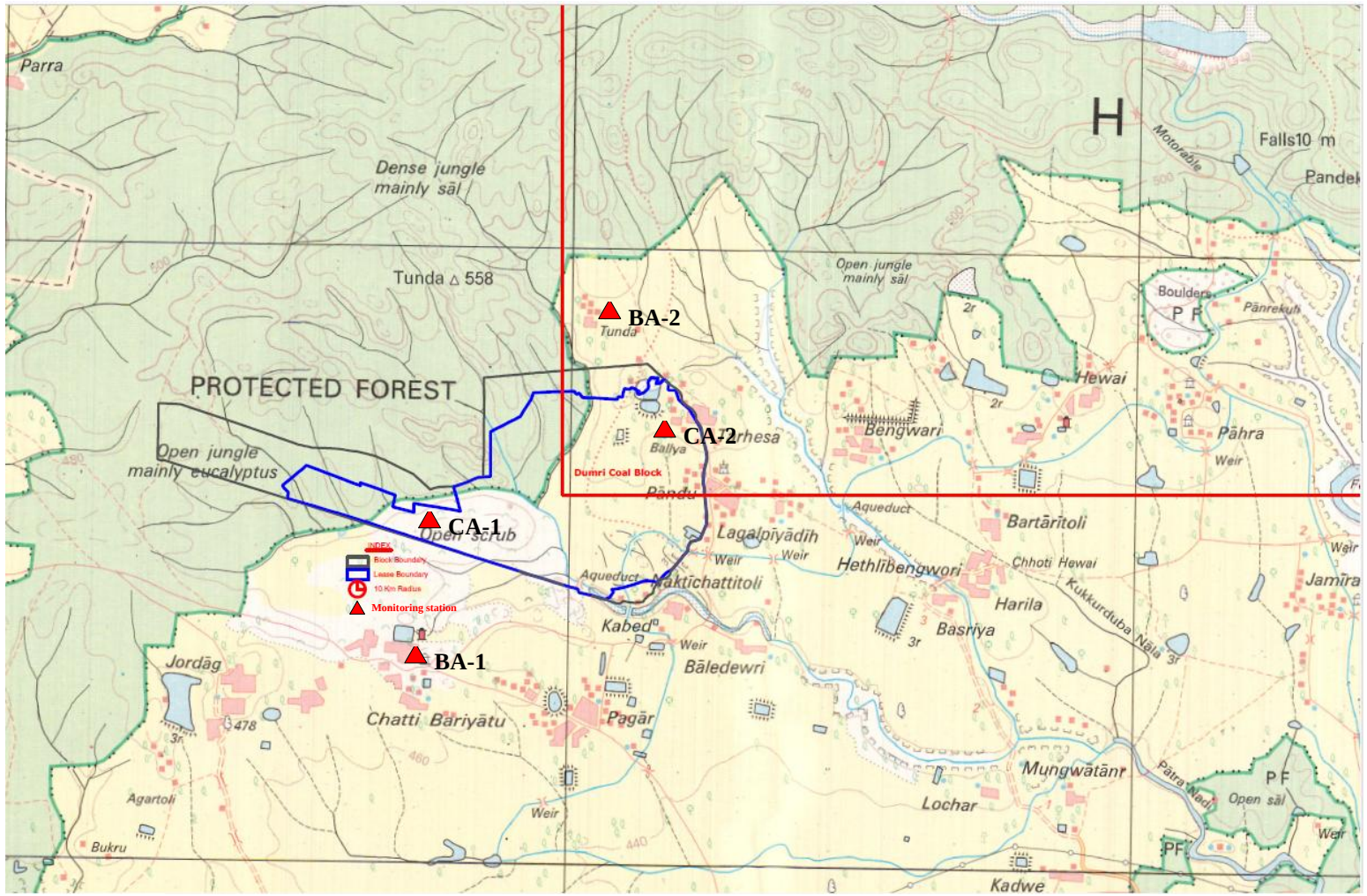

Fig. 1: Location of Air Monitoring Station in Core and Buffer Zone of Dumri Coal Mine

Table 4: Ambient Air Quality Report for Core Zone of Dumri Coal Mine

Sampling Code	Sampling Location	Season	Date of Sampling	Parameters (µg/m3)				Remarks
				$PM_{2.5}$	PM_{10}	SO_2	NO_2	
CA-1	Within Mining lease area	Monsoon	26/08/2020	27.7	45.0	12.6	12.9	
			27/08/2020	22.8	40.3	10.7	13.2	
CA-2	Balia Village	Monsoon	28/08/2020	28.3	44.1	12.3	14.1	
			29/08/2020	37.8	48.7	13.1	16.2	
Standards as per NAAQS-2009				**60**	**100**	**80**	**80**	

Table 5: Ambient Air Quality Report for Buffer Zone of Dumri Coal Mine

Sampling Code	Sampling Location	Season	Date of Sampling	Parameters (µg/m^3)				Remarks
				$PM_{2.5}$	PM_{10}	SO_2	NO_2	
BA-1	Chatti-Bariatu Village	Monsoon	24/08/2020	26.8	45.8	12.9	13.2	
			25/08/2020	31.2	47.3	13.3	14.4	
BA-2	Tunda Village	Monsoon	30/08/2020	32.5	43.7	10.8	12.5	
			31/08/2020	21.5	44.2	14.8	14.0	
Standards as per NAAQS-2009				**60**	**100**	**80**	**80**	

3.1.4 RESULTS AND DISCUSSIONS

During monsoon season (August, 2020), $PM_{2.5}$ concentration level at near proposed mine infrastructure area within core zone was found from 22.8 µg/m^3 to 27.7 µg/m^3 and concentration of PM_{10} was found from 40.3 µg/m^3 to 45.0 µg/m^3. At Balia Village, the $PM_{2.5}$ concentration was found from 28.3 µg/m^3 to 37.8 µg/m^3 and the concentration of PM_{10} was found from 44.1 µg/m^3 to 48.7 µg/m^3. In the core zone, all the $PM_{2.5}$ and PM_{10} values are within the threshold value i.e. 60 µg/m^3 for $PM_{2.5}$ and 100 µg/m^3 for PM_{10} as per the guideline of National Ambient Air Quality Standard (NAAQS), 2009 around the entire sampling sites. Concentration of SO_2 and NO_2 are also found

within the limit of 80 μg/m^{3}as per the guideline of NAAQS, 2009 in the sampling sites of core zone of the proposed mine.

During monsoon season (August, 2020), the $PM_{2.5}$ concentration at Chatti-Bariatu Village in buffer zone was found from 26.8 μg/m^3 to 31.2 μg/m^3 and the concentration of PM_{10} was found from 45.8 μg/m^3 to 47.3μg/m^3. At Tunda Village, the $PM_{2.5}$ concentration was found from 21.5 μg/m^3 to 32.5 μg/m^3 and the concentration of PM_{10} was found from 43.7 μg/m^3 to 44.2 μg/m^3. In the buffer zone both the concentration levels are within the threshold value i.e. 60 μg/m^3 for $PM_{2.5}$ & 100 μg/m^3 for PM_{10} as per the guideline of NAAQS, 2009. Concentration of SO_2 and NO_2 are also found within the limit 80 μg/m^{3}as per the guideline of NAAQS, 2009 in all the sampling sites of buffer zone of the proposed mine.

3.2 WATER ENVIRONMENT

Water is one of the most essential natural resources for sustaining life and it is likely to become critically scare in the coming decades, due to continuous increase in its demands, rapid increase in population and expanding economy of the country. Variation in climatic characteristics both in space and time are responsible for uneven distribution of precipitation in India.

The diversity of climates, ecosystems, land uses and topographies greatly influences the design of environmental monitoring programs. Social factors have also become important elements in environmental management. Best practice for each site is therefore governed by these regional physical and social factors.

3.2.1. SOURCES OF WATER POLLUTION

Mine Water

The mine water is to be a probable source of water pollution during the active mining operation. The mine water, which will be mainly rain water and ground water seepage, will used for industrial purposes like dust suppression by water tankers in haul roads, approach roads, stockyards and watering of plants in the overburden dumps & office premises.

Domestic Effluents/Sewage

There are minimum housing facilities within the mining lease (ML) area for essential services. The domestic wastes from these houses are led to septic tanks. As the domestic waste water is minimum, the possibility of pollution is remote/insignificant. However, proper care has been taken up in the shelters area of inhabitants for sewage discharge.

Surface water

The surface water quality is likely to be affected with higher load of suspended solids as wash off from active dumps, soil erosion from soil and roads, and pumping out mine water to water channels.

Ground water

Ground water pollution can take place only if dumps and stock piles contain harmful chemical substances, which may get leached by precipitation of water and percolate to the ground water table, thus causing pollution. The chemical analysis of active OB soil and their proper management will restrict the water pollution by the management.

3.2.2 INSTRUMENTS USED

a) pH and Conductivity meter (Thermo)
b) Ion Meter (Thermo),
c) COD Analyser (Hach),
d) BOD Analyser (WTW),
e) Water Analysis Kit, (HACH, DR - 2000)
f) Microwave Digestion (Anton-Paar)
g) UV-VIS Spectrophotometer (Simazdo)
h) Atomic Absorption Spectrophotometer (Varian)
i) Ion Chromatograph (Dionex/Metrohm)
j) Flame Photometer
k) ICP-MS (Perkin Elmer)

3.2.3 WATER QUALITY OF THE AREA

To assess the water quality of the proposed mine area ground water and surface water in the core and buffer zone were collected and analysed. There is no mine water effluent in the core zone as it is a proposed mine and mining operation is not started. To assess the water quality of the area water samples from nine locations were collected during monsoon season (August, 2020). Details of sampling locations for water quality monitoring in and around proposed Dumri coal mine are given in **Table 6 and** shown in **Fig. 2.**

Table 6: Sampling locations for water quality study

Sample Code	Sample Type	Description	Sampling Site	Remarks
GW-1	Ground water	Drinking water	Within mining lease	Core Zone
GW-2	Ground water	Drinking water	Chatti-Bariatu Village	Buffer Zone
GW-3	Ground water	Drinking water	Balia Village	Core Zone
GW-4	Ground water	Drinking water	Pandu Village	Buffer Zone
GW-5	Ground water	Drinking water	Pagar Village	Buffer Zone
GW-6	Ground water	Drinking water	Tunda Village	Buffer Zone
SW-1	Surface water	Baldeori Nala	Upstream of mine	Core Zone
SW-2	Surface water	Nala-A	Mine site	Core Zone
SW-3	Surface water	Baldeori Nala	Downstream of mine	Buffer Zone

The water samples were collected in one-liter narrow-mouthed pre-washed polyethylene bottles. For heavy metal analysis, 100 ml of samples were acidified with HNO_3 and preserved separately. Temperature, electrical conductivity (EC), pH and DO values were measured in the field using a portable conductivity and pH meter. The other parameters are measured in the geochemical laboratory at CSIR-CIMFR, Dhanbad following the standard methods prescribed in APHA (2017). The turbidity has been determined in pre-filtered sample by turbidity meter. In the laboratory, the water samples were filtered through 0.45 μm Millipore membrane filters to separate suspended particles. Acid titration method was used to determine the concentration of bicarbonate (APHA 2017). Major

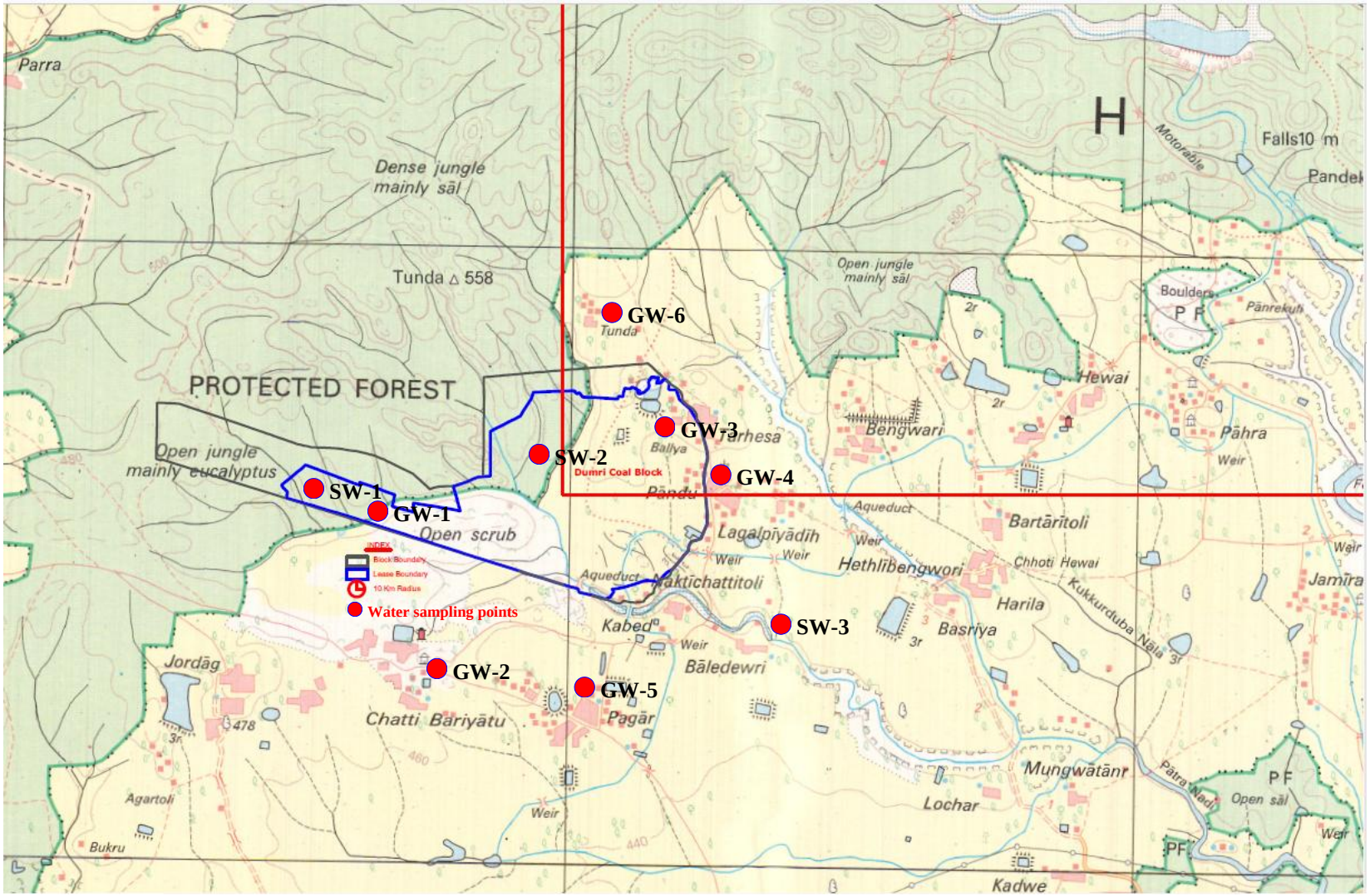

Fig. 2: Location of Water Sampling Points in Core and Buffer Zone of Dumri Coal Mine

anions (F, NO_3 and $SO_{4,}$) were analysed on UV-VIS spectrophotometer. Major cations (Ca and Mg) were measured by titrametric method and Na and K by flame photometer. The trace metals were analysed on ICP-AES.

3.2.4 RESULTS AND DISCUSSIONS

The physico-chemical characteristics of the analysed drinking and surface water is presented in **Table 7 to 10** along with the prescribed standards. The water quality of the area is discussed in the following paragraphs:

Drinking Water Quality Assessment:

To assess the status of drinking water quality of Dumri coal mine area, six ground water samples were collected from hand pump as well as dug well in August, 2020 and analysed for parameters as per the drinking water standards. The hydro-chemical parameters of the groundwater of the study area were compared with the prescribed limit of Indian Standard for drinking water (BIS 2012) to assess the suitability for drinking and public health purposes (**Table 7 to 9**). The analytical results show that most of the analysed parameters are well within desirable limits and water is potable for drinking uses. pH of the analysed groundwater are found well within the safe limit of 6.5-8.5, prescribed for drinking water by BIS (2012). The turbidity is one of the important physical parameters for water quality defining the presence of suspended solids in water, which causes the muddy or turbid appearance of water body. The consumption of high turbid water may cause a health risk as excessive turbidity can protect pathogenic microorganisms from effects of disinfectants and also stimulate the growth of bacteria during storage. In the study area the turbidity in the groundwater are found below the recommended value of 5 NTU. The total dissolve solids (TDS) value in all the samples (Except Tunda Village) is slightly higher than the acceptable limit of 500mg/l while lower than the permissible limit in the absence of alternate sources of 2000mg/l. The Total hardness (TH) value in all the samples (Except Tunda Village) is slightly higher than acceptable limit of 200mg/l but lower than the permissible limit in the absence of alternate sources i.e 600mg/l. In all of the samples, the concentration of Ca, Mg, SO_4 and F are also found well within the permissible limit for drinking uses. Heavy metal analysis in the groundwater samples indicated that all the analyzed heavy metals like As, Cd, Cr, Pb, Zn,

Mn and Fe are found either below the detection limit or less than the acceptable limit for drinking water.

Surface Water Quality:

The analytical results of physico-chemical analysis of surface water samples collected from Nala-A within the mine site as well as upstream and downstream of Baldeori Nala has been given in **Table 10**. To assess the quality of the surface water resource the results has been compared with the prescribed surface water standards IS-2296 for Class 'C' water (tolerance limit for stream water used drinking water sources with conventional treatment followed by disinfection). It can be seen that pH of the water is slightly alkaline in nature and found well within the prescribed limit of 8.5. In general, the total dissolved values and other analysed parameters are found well within the threshold values. Concentration of sulphate varies between 6.4 and 11.3 mg L^{-1} and is well below the prescribed value of 400 mg L^{-1} (IS-2296). The level of TSS, TDS and DO in the river water were found within threshold limit in comparison to IS:2296, surface waters Class-C. The concentrations of the analysed heavy metals in the surface water resource are also found within the prescribed limits. It shows that the surface water of the area is fit for its designated use as a drinking water source with conventional treatment followed by disinfection.

The calculated value of sodium adsorption ration (SAR) shows that the water is low saline and low alkali water (0.18 -0.66) and can be used for irrigation in most soils and crops with little danger of the development of harmful levels of exchangeable sodium. The percent sodium (%Na) is varying from 12.68 to 28.73 and also found below the 60% recommended limit for irrigation uses.

Table 7: Ground Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Monsoon**
Project: Dumri Coal Mine	**Date of Sampling: 30.08.2020**
Name of the Sampling Station:	
GW-1 - ***Ground Water, Mine site***	**GW-2 -** ***Ground Water, Chatti Bariatu Village***

Sl. No.	**Parameters**	**Station Code**		**IS-10500: 2012**	
		GW-1	**GW-2**	**Acceptable Limit**	**Permissible Limit in the Absence of Alternate**
1.	Colour, Hazen units, Max	<5	<5	5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	7.26	6.73	6.5-8.5	No relaxation
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
5.	Turbidity, NTU, Max	0.63	0.32	1.0	5.0
6.	Total Dissolved Solid, mg/l, Max	506	1019	500	2000
7.	Total Hardness (as $CaCO_3$)	240	348	200	600
8.	Chloride (as Cl), mg/l, Max	30	132	250	1000
9.	Calcium (as Ca), mg/l, Max	85.8	106.0	75	200
10.	Magnesium (as Mg), mg/l, Max	6.3	20.3	30	100
11.	Sodium (as Na), mg/l, Max	31.2	80.0	NS	NS
12.	Potassium (as K), mg/l, Max	1.5	83.0	NS	NS
13.	Sulphates (as SO_4), mg/l, Max	19.4	84.5	200	400
14.	Nitrate (as NO_3), mg/l, Max	16.1	96.0	45	No relaxation
15.	Fluorides (as F), mg/l, Max	0.72	4.33	1.0	1.5
16.	Total Alkalinity, mg/l, Max	324	276	200	600
17.	Mineral Oil, mg/l, Max	<0.001	<0.001	0.5	No relaxation
18.	Iron (as Fe), mg/l, Max	0.007	0.011	0.3	No relaxation
19.	Manganese (as Mn), mg/l, Max	0.002	0.013	0.10	0.30
20.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	0.01	0.05
21.	Cadmium (as Cd), mg/l, Max	<0.001	0.002	0.003	No relaxation
22.	Lead (as Pb), mg/l, Max	0.007	0.008	0.01	No relaxation
23.	Copper (as Cu), mg/l, Max	0.003	0.007	0.05	1.5
24.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	0.001	0.003	0.05	No relaxation
25.	Selenium (as Se), mg/l, Max	<0.001	0.002	0.01	No relaxation
26.	Silver (as Ag), mg/l, Max	<0.001	<0.001	-	-
27.	Zinc (as Zn), mg/l, Max	0.309	0.339	5	15
28.	Nickel (as Ni), mg/l, Max	<0.001	0.005	0.02	No relaxation

NS: *Not Specified,*

Table 8: Ground Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Monsoon**
Project: Dumri Coal Mine	**Date of Sampling: 30.08.2020**
Name of the Sampling Station:	
GW-3 - ***Ground Water, Balia Village***	**GW-4 -** ***Ground Water, Pandu Village***

Sl. No.	**Parameters**	**Station Code**		**IS-10500: 2012**	
		GW-3	**GW-4**	**Acceptable Limit**	**Permissible Limit in the Absence of Alternate**
1.	Colour, Hazen units, Max	<5	<5	5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	7.08	6.85	6.5-8.5	No relaxation
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
5.	Turbidity, NTU, Max	0.46	0.45	1.0	5.0
6.	Total Dissolved Solid, mg/l, Max	553	775	500	2000
7.	Total Hardness (as $CaCO_3$)	244	344	200	600
8.	Chloride (as Cl), mg/l, Max	44	106	250	1000
9.	Calcium (as Ca), mg/l, Max	60.6	112.7	75	200
10.	Magnesium (as Mg), mg/l, Max	22.7	15.2	30	100
11.	Sodium (as Na), mg/l, Max	21.9	61.2	NS	NS
12.	Potassium (as K), mg/l, Max	32.5	4.9	NS	NS
13.	Sulphates (as SO_4), mg/l, Max	40.9	55.6	200	400
14.	Nitrate (as NO_3), mg/l, Max	46.4	105.2	45	No relaxation
15.	Fluorides (as F), mg/l, Max	0.42	0.28	1.0	1.5
16.	Total Alkalinity, mg/l, Max	192	204	200	600
17.	Mineral Oil, mg/l, Max	<0.001	<0.001	0.5	No relaxation
18.	Iron (as Fe), mg/l, Max	0.065	0.008	0.3	No relaxation
19.	Manganese (as Mn), mg/l, Max	0.003	0.005	0.10	0.30
20.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	0.01	0.05
21.	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	0.003	No relaxation
22.	Lead (as Pb), mg/l, Max	0.007	0.009	0.01	No relaxation
23.	Copper (as Cu), mg/l, Max	0.005	0.003	0.05	1.5
24.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	0.001	<0.001	0.05	No relaxation
25.	Selenium (as Se), mg/l, Max	<0.001	<0.001	0.01	No relaxation
26.	Silver (as Ag), mg/l, Max	<0.001	<0.001	-	-
27.	Zinc (as Zn), mg/l, Max	0.294	0.308	5	15
28.	Nickel (as Ni), mg/l, Max	0.002	0.004	0.02	No relaxation

NS: *Not Specified,*

Table 9: Ground Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Monsoon**
Project: Dumri Coal Mine	**Date of Sampling: 30.08.2020**
Name of the Sampling Station:	
GW-5 - ***Ground Water, Pagar Village***	**GW-6** - ***Ground Water, Tunda Village***

Sl. No.	**Parameters**	**Station Code**		**IS-10500: 2012**	
		GW-5	**GW-6**	**Acceptable Limit**	**Permissible Limit in the Absence of Alternate**
1.	Colour, Hazen units, Max	<5	<5	5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	6.70	7.49	6.5-8.5	No relaxation
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
5.	Turbidity, NTU, Max	0.41	0.49	1.0	5.0
6.	Total Dissolved Solid, mg/l, Max	1149	412	500	2000
7.	Total Hardness (as $CaCO_3$)	352	184	200	600
8.	Chloride (as Cl), mg/l, Max	112	12.6	250	1000
9.	Calcium (as Ca), mg/l, Max	99.2	48.8	75	200
10.	Magnesium (as Mg), mg/l, Max	25.3	15.1	30	100
11.	Sodium (as Na), mg/l, Max	53.2	19.4	NS	NS
12.	Potassium (as K), mg/l, Max	162	1.3	NS	NS
13.	Sulphates (as SO_4), mg/l, Max	103.3	13.6	200	400
14.	Nitrate (as NO_3), mg/l, Max	89.7	21.5	45	No relaxation
15.	Fluorides (as F), mg/l, Max	1.34	1.0	1.0	1.5
16.	Total Alkalinity, mg/l, Max	332	200	200	600
17.	Mineral Oil, mg/l, Max	<0.001	<0.001	0.5	No relaxation
18.	Iron (as Fe), mg/l, Max	0.010	0.009	0.3	No relaxation
19.	Manganese (as Mn), mg/l, Max	0.003	0.001	0.10	0.30
20.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	0.01	0.05
21.	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	0.003	No relaxation
22.	Lead (as Pb), mg/l, Max	0.006	0.009	0.01	No relaxation
23.	Copper (as Cu), mg/l, Max	0.007	0.002	0.05	1.5
24.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	0.003	<0.001	0.05	No relaxation
25.	Selenium (as Se), mg/l, Max	<0.001	<0.001	0.01	No relaxation
26.	Silver (as Ag), mg/l, Max	<0.001	<0.001	-	-
27.	Zinc (as Zn), mg/l, Max	0.270	0.296	5	15
28.	Nickel (as Ni), mg/l, Max	0.001	0.001	0.02	No relaxation

NS: *Not Specified,*

Table 10: Surface Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Monsoon**
Project: Dumri Coal Mine	**Date of Sampling: 29.08.2020**
Name of the Sampling Station:	
SW-1 - Surface Water, Baldeori Nala U/S of mine site	
SW-2 - Surface Water, Nala-A of mine site	
SW-3 - Surface Water, Baldeori Nala D/s of mine site	

Sl. No.	Parameters	Station Code			(IS: 2296)* Surface Waters Class "C" Tolerance Limits
		SW-1	SW-2	SW-3	
1.	Colour, Hazen units, Max	<5	<5	<5	300
2.	Odour	#	#	#	#
3.	pH	8.31	7.84	7.84	6.5-8.5
4.	Dissolved Oxygen, mg/l, Min.	6.95	7.05	7.05	4
5.	BOD (3days at 27^{o}C), mg/l, Max	2.85	3.02	1.81	3
6.	Total Dissolved Solid, mg/l, Max	93	168	110	1500
7.	Oil & Grease, mg/l, Max	<0.1	<0.1	<0.1	0.1
8.	Total Hardness (as $CaCO_3$), mg/l, Max	52	80	56	NS
9.	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.005
10.	Chloride (as Cl^-), mg/l, Max	2.0	6.0	4.0	600
11.	Sulphates (as SO_4^{--}), mg/l, Max	6.4	11.3	6.4	400
12.	Nitrate (as NO_3), mg/l, Max	2.5	2.3	1.5	50
13.	Fluorides (as F), mg/l, Max	0.32	0.91	0.43	1.5
14.	Calcium (as Ca), mg/l, Max	16.8	23.5	18.5	NS
15.	Magnesium (as Mg), mg/l, Max	2.4	5.2	2.4	NS
16.	Sodium (as Na), mg/l, Max	3.0	13.5	7.0	NS
17.	Potassium (as K), mg/l, Max	0.8	1.8	1.5	NS
18.	Copper (as Cu), mg/l, Max	0.003	0.003	0.003	1.5
19.	Iron (as Fe), mg/l, Max	0.054	0.051	0.053	50
20.	Manganese (as Mn), mg/l, Max	0.002	0.002	0.003	NS
21.	Zinc (as Zn), mg/l, Max	0.351	0.319	0.332	15
22.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	<0.001	0.2
23.	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	<0.001	0.01
24.	Lead (as Pb), mg/l, Max	0.003	0.008	0.008	0.1
25.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	<0.001	0.002	0.001	0.05
26.	Selenium (as Se), mg/l, Max	<0.001	<0.001	<0.001	0.05
27.	Percent Sodium (%)	12.68	28.37	23.45	NS
28.	Sodium Absorption Ratio	0.18	0.66	0.41	NS

: *Unobjectionable*, ***NS:*** *Not Specified,*

**** : Class "C"-*** *Drinking water source with conventional treatment followed by disinfection.*

3.3 NOISE ENVIRONMENT

Noise is undesirable and unpleasant sound produced by the vibration of bodies or molecules of the medium and propagates as a pressure perturbation. It disturbs people's work, sleep and communication. Its damages hearing and evokes other physiological reactions. It also disturbs the habitat of animals and birds in the surroundings. Mining is the third largest industry in terms of employment and the recent trends of mechanization has changed the working environment to noisy environment leading to higher sound levels.

3.3.1 SOURCES OF NOISE

Noise will be produced during mining at different levels by different equipments in the open cast mine are summarized in the **Table 11.**

Table 11: Noise Generating Mining Equipments

S. N.	Equipment / Operation	Noise level dB(A)
1.	Feeder breaker	82-100
2.	Dumpers	100-115
3.	Shovels	80-107
4.	Dozers	84-107
5.	Front End loader	83-101
6.	Electric motors, gear drivers, hopers, drilling & main pump	85-95
7.	Belt conveyer	90-92
8.	Drill	110-115

3.3.2 AMBIENT NOISE MONITORING LOCATIONS

The main objective of noise monitoring in the study area is to assess the present ambient noise levels in proposed project site & buffer zone due to regular activities and vehicular movement. A preliminary reconnaissance survey has been undertaken to identify the major noise generating sources in the proposed mining area.

Ambient noise level study at Dumri Mine was carried out in core as well as buffer zone. Two noise level monitoring location in core zone followed by two noise level monitoring locations in buffer zone were fixed-up as given in **Table 12** and shown in **Fig.3.**

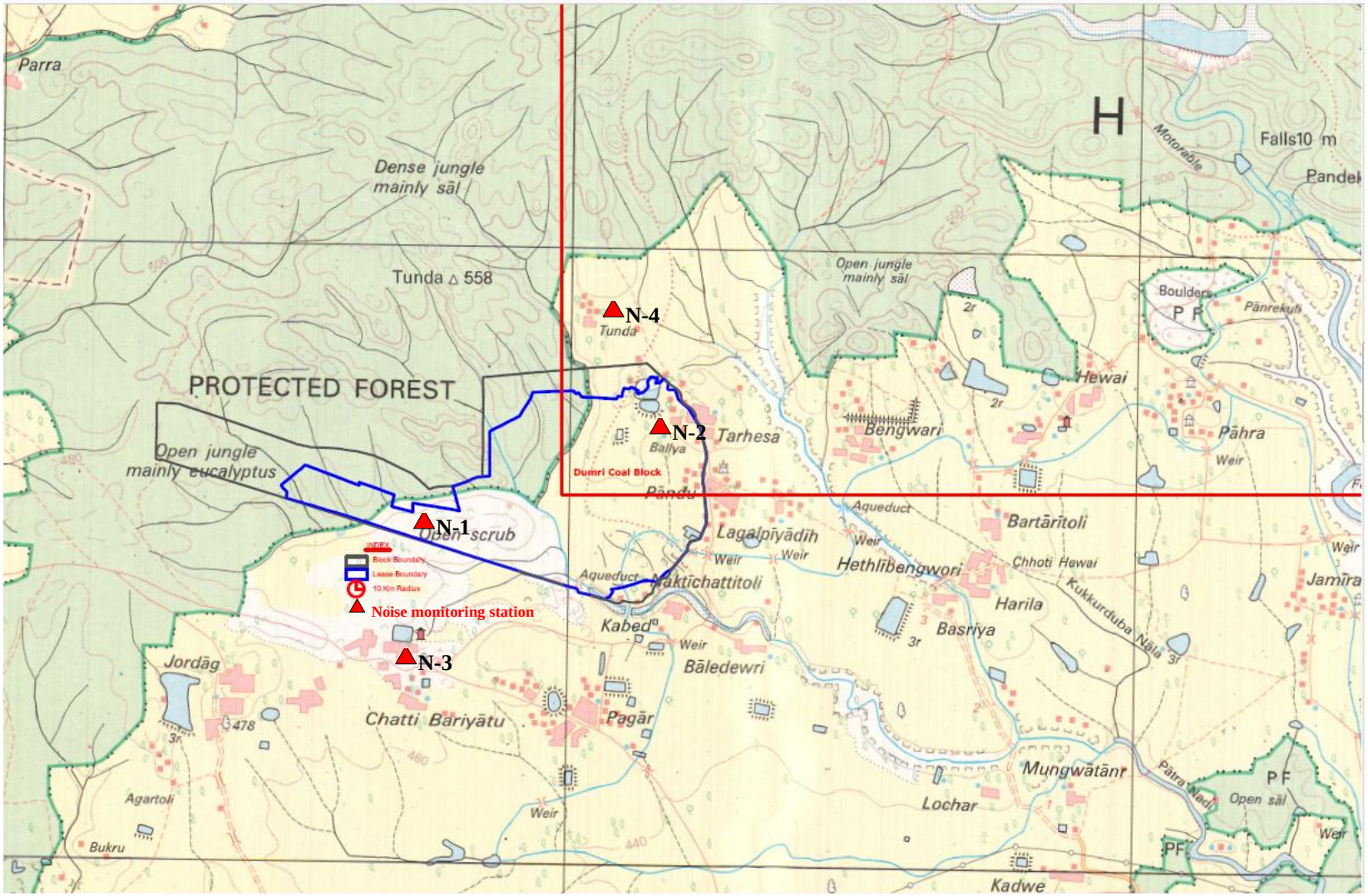

Fig. 3: Location of Noise Monitoring Station in Core and Buffer Zone of Dumri Coal Mine

Table 12: Details of Ambient Noise Monitoring Stations

S. No.	Location Code	Location Name/ Description	Present Land use
Core Zone			
1.	N-1	Within Mining lease area	Barren Land
2	N-2	Balia Village	Residential Area
Buffer Zone			
3.	N-3	Chatti Bariatu Village	Residential Area
4.	N-4	Tunda Village	Residential Area

3.3.3 INSTRUMENTS USED

Sound level study is carried by using Mip-oy Integrated Sound Level Meter Meeting IEC-179A measuring average peak and Low values in Day and Night time.

3.3.4 RESULTS AND DISCUSSION

Results are shown in **Table 13 and 14** for ambient noise levels of core and buffer zones during monsoon season. The average peak values at the nearby villages are found well below the residential areas standard values of 55 & 45 dB (A) for Day & Night respectively. In core zone maximum noise levels and average noise levels are also well within the prescribed limit of 75 & 70 dB (A) for Day & Night respectively.

Table 13: Noise Level in Core Zone of the Study Area

Date of Sampling:		**Noise level dB(A) average**					
24.08.2020 to 31.08.2020		**Day Time (6.00AM to 10.00PM)**			**Night Time (10.00PM to 6.00AM)**		
Stn. Code	**Location**	**Min.**	**Max.**	**Average**	**Min.**	**Max.**	**Average**
N-1	Within Mining lease area	31.9	49.1	42.8	28.1	44.1	36.2
N-2	Balia Village	36.3	56.8	48.7	28.6	46.6	39.1
Standards as per CPCB		**75**			**70**		

Table 14: Noise Level in Buffer Zone of the Study Area

Date of Sampling:		Noise level dB(A) average					
24.08.2020 to 31.08.2020		Day Time (6.00AM to 10.00PM)			Night Time (10.00PM to 6.00AM)		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N-3	Chatti Bariatu Village	35.4	54.6	48.1	29.6	48.8	38.8
N-4	Tunda Village	36.4	53.6	47.9	28.5	44.2	38.7
Standards as per CPCB		75			70		

4.0 CONCLUSION

On the basis of the data generated it has been found that the environmental scenario in and around mining area of proposed Dumri Coal Mine with respect to air, water and noise are well within the permissible limits.

5.0 MITIGATIVE MEASURES

Dumri Coal Mine has not commence its mining operation. Environmental monitoring data of Monsoon, 2020 suggest that all the studied parameters (air, water, noise) are within permissible limits. The mitigative measures to be adopted during mine operation is conferred below.

5.1 AIR POLLUTION CONTROL MEASURES

The mining operations and related activities are anticipated to increase the levels of particulate matter (PM) and gaseous pollutants to a limited extent. The proposed air pollution control measures are as follows-

I. Dust suppression systems (like water spraying) will be adopted where necessary at
   (a) Faces before and after blasting,
   (b) Faces while loading
II. Dust extraction systems will be used in drill machines, crushers/feeder breakers.
III. Dust suppression systems (like water spraying) would be adopted at roads used for transportation. Sprinklers would be installed along the roads to suppress the dust.

IV. Suitable dust extraction or suppression systems such as mist sprays with or without chemical will be provided at appropriate places for preventing dust pollution during handling and stockpiling of coal

V. Transfer points of coal will be provided with appropriate hoods/chutes to prevent fugitive dust emission.

VI. To prevent air pollution due to airborne dust, tree belts will be planted around the mine site.

VII. Dust masks will be provided as safety measure to the workers, engaged at dust generation points like drills, loading/unloading points, crushers etc.

VIII. To ensure that NO_X level do not increase during mining operation good quality explosives will be used for which the oxygen balance will be checked from time to time. The expired explosives will not be used for which a strict vigil will be kept on the date of manufacture.

5.2 WATER POLLUTION CONTROL MEASURES

Proposed mitigative measures related to water pollution is as below-

I. Any wash off from the oil/grease handling area of workshop will be treated to remove oil and grease using oil trap. Waste oil/grease will be stored in leak proof containers.

II. The sewage waste will be treated in properly designed septic tanks and soak pits.

III. Check dams will be provided to prevent solids from wash off and screen if any from the mine related activities.

IV. Construction of garland drains around freshly excavated and dumped areas so that flow of water with loose material is prevented.

V. The coal does not have high sulphur content (<0.72%). It is anticipated that the mine water discharge will have no acid drainage. However, the mine water will be monitored regularly to keep a vigil and will be kept below permissible limits before any discharge.

5.3 NOISE POLLUTION CONTROL MEASURES

The following control measures will be adopted to keep the ambient noise levels below permissible limits 75 dB (A)-

I. Provision and maintenance of thick belts to screen noise.
II. Avenue plantation within the project area to dampen the noise.
III. Proper maintenance of noise generating machinery including the transport vehicles will be ensured.
IV. To protect the workers from exposures to higher noise levels, the following measures will be adopted-
V. Provision of protective devices like ear muffs/ear plugs to those workers who cannot be isolated from the source of noise
VI. Confining the noise by isolating the source of noise
VII. Reducing the exposure time of workers to the higher noise levels.

6.0 RECOMMENDATIONS AND FOLLOW-UP ACTION

The study indicates that air quality around the proposed Dumri Coal Mine is found to be within the threshold limit as per the guideline of NAAQS, 2009. However, the mining activity was not in progress during the monitoring period. Water quality of the surrounding water resources are also not found polluted. For the best practice of proposed coal mining in future, Environmental Management System should always be considered with the following key recommendation and follow-up actions:

- Spraying of water on the haul roads for controlling the dust to its minimum level.
- Regular maintenance of the heavy earth moving machines.
- Mine water collection in settling tank before its discharge.
- Garland drainage should be made around the dumps.
- Reclamation and revegetation of overburden dumps should be done to control soil erosion, denudation of agricultural land and nearby riverine system, wetlands and to improves the aesthetics of the area.
- Dumps brought under biological reclamation should not be made active.
- The mine management would be implementing, these measures to make mining operation eco-friendly in this proposed Dumri coal mine of M/s Hindalco Industries Ltd, Hazaribag, Jharkhand.

ENVIRONMENTAL STUDY REPORT

ENVIRONMENTAL STUDY REPORT FOR DUMRI COAL MINE, HAZARIBAG, JHARKHAND

(POST-MONSOON SEASON)
(OCTOBER, 2020 TO DECEMBER, 2020)

Prepared

For

M/S HINDALCO INDUSTRIES LIMITED
Hazaribag - 825311
Jharkhand

Prepared

by

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Report

On

Environmental Study Report for Dumri Coal Mine, Hazaribag, Jharkhand

(POST-MONSOON SEASON)
(OCTOBER, 2020 TO DECEMBER, 2020)

Project No.: SSP/474/2020-21

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1.0 INTRODUCTION

Mining is the extraction of valuable minerals or other geological materials from the Earth. It is a site specific and ecologically sensitive industry. For sustaining national development, mining of coal and minerals is of paramount importance for developed as well as developing countries. To meet the energy requirements of the country, increased coal production has been possible due to large-scale surface mining activities. Mining operations usually create a negative environmental impact, both during the mining activity and after the mine has closed. Surface mining causes environmental disturbance in the form of land degradation, removal of OB material which stress on air and water regime and finally interferes in the balance of the ecosystem. To meet these problems, sound environmental management system for pre-mining, active mining and post mining stages in the form of Environmental Impact Assessment, Environmental Management Practice for concurrent mining and Environmental Audit has been made necessary by the regulating state and central authorities. Regular monitoring of the different components of environment is made necessary for evaluating the requirements of environmental management system and its impact in the society. This report presents the study conducted by CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad for proposed Dumri Coal Mine belonging to M/s Hindalco Industries Ltd, Hazaribag, Jharkhand.

1.1 HISTORY OF DUMRI COAL MINE

"Dumri Block" in North Karanpura Coalfield situated in the District Hazaribag, State of Jharkhand, was previously allotted by Ministry of Coal and Mines vide their letter dated 13.01.2006, jointly to M/s Nilachal Iron and Power Ltd. as leader and M/s Bajrang Ispat (P) Ltd. as associate.

Honourable Supreme Court of India vide Judgement dated 25th August, 2014 and Order dated 24th Sept. 2014 cancelled the allocation of 204 coal blocks, which include Dumri coal block also.

Later the Office of Nominated Authority constituted under section 6 of the Coal Mines (Special Provision) Act, 2015, issued Vesting order under clause (b) of sub-rule 7 and sub-rule (1) of rule, Order no. 104/24/2015/NA dt. 22nd April, 2015 for Dumri Coal Mine in favour of M/s Hindalco Industries Ltd.

Further, vide Corrigendum No. 1, dated 30th January, 2018, the MOC issued the revised boundary Co-ordinates. As per approved Mining Plan (Revision-I) of Dumri Coal Mine of M/s Hindalco Industries Ltd., revised area of the mining lease is 259.64 ha.

Based on recommendation of EAC; Ministry of Environment, Forest and Climate Change revoke the abeyance on transfer of Environmental Clearance for Dumri Coal Mine project from M/s Nilachal Iron and Power Limited to M/s Hindalco Industries Limited for a production capacity of 1 MTPA in the ML area of 259.64 ha. The environmental clearance finally granted for opening of Dumri Coal Mine Project of M/s Hindalco Industries Ltd. vide letter no. J-11015/239/2008-IA-II (M) Pt., dated 6th November, 2019.

1.2 LOCATION

The lease area of Dumri coal mine covers land in villages: Pagar, Balia, Tunda and Pandu of Keredari Block of district Hazaribag (Jharkhand). The nearest township is Hazaribag located at a distance of about 40 KM from Dumri Coal Mine (DCM). The Hazaribag-Khelari State Highway-07 is about 3KM on the south of the coal block. The nearest railhead is "RAY" at about 40 KM on the Gomoh-Barkakana-Dehri-on-Sone loop line of South-Eastern railway. A new railway line connecting Hazaribag via mandu has been commissioned and block is at a distance of about 40 KM from the nearest offtake station which is Nawada/Khapariaon. The nearest airport of Ranchi is at distance of 120 KM. The project area is situated between the latitude 23^0 53' 31.998" N and 23^0 54' 30.848" N and longitude 85^0 03' 11.539" E & 85^0 05' 37.103" E. The site is well connected by road and about 8 KM away from Keredari Block Office. It is a barren area and coal mine has not yet operational.

1.3 SCOPE OF WORK

M/s Hindalco Industries Ltd, Hazaribag, approached CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad for conducting the environmental study for one year i.e. 2020-2021 having following objectives:

- Environmental study of Air, Water, Noise and Soil of the core and buffer zone.
- The Environmental monitoring will be conducted on seasonal basis.
- Advice into the adoption of necessary control measures.
- Land use pattern study will be done once in a year and report will be submitted separately.
- Preparation of Environmental Statement.

The detailed studies with respect to air, water and noise will be carried on seasonal basis in the year 2020-21 while soil samples, for the adjoining mining area, will be collected once in a year and analyzed in the CSIR-CIMFR laboratory.

2.0 REGIONAL GEOLOGY

The North Karanpura Coalfield forms a prominent east-west trending valley between Hazaribag plateau in the north and Ranchi plateau in the south. The Aswa pahar in the south-east separates in North and South Karanpura Coalfields by east west elongated metamorphic patch. However, they are interconnected near Bachra and Hindegir village by a narrow tongue of Talchir outcrops. On the eastern side, North Karanpura Coalfield is separated from the West Bokaro Coalfield by a narrow stretch of metamorphic rocks having several outliers of Talchir Formation. In the west, it is separated by a stretch of about 20kms wide metamorphic belt from Auranga Coalfield.

Out of 1230 Sq. Km area of North Karanpura Coalfield, the coal bearing Formations viz. Karharbari, Barakar and Raniganj crop-out over an area of about 500 Sq. Km. The Karharbari formation is well developed in the south-central and eastern part of the coalfield. It contains only one seam, which occurs often in two to three sections. It comprises of very coarse grained, gritty sandstone, and at times, has silicified sandstones. The Barakar formation contains a number of coal seams and contributes the major bulk reserves of this coalfield. Five persistent coal seams have been established in the coalfield. The total coal column is more or less around 35-40 m in major part of the coalfield. Raniganj formation contains three to four coal seams which are generally shaly in nature and often impersistent.

2.1 LOCAL GEOLOGY

The Dumri block is the up-dip extension of Chatti-Bariatu block and is located in the northern part of the North Karanpura Coalfield. It is contiguous to Chatti-Bariatu block in the south. Keredari 'A' block in the east, Pachra block on the west. The northern boundary of the block is defined by hilly terrain and dense forest cover which is a part of the inaccessible Dumri area.

The Dumri block comprises Talchir, Karharbari, Barakar and Barren measures Formations belonging to Damuda sub-group of lower Gondwana Group. The Talchir formation overlies metamorphic rocks with an unconformity. The Karharbari and Barakar are the main coal bearing formations contain four major coal seams i.e. Seam-I, II, III and IV in ascending order. Besides these, six more thin coal horizons are also developed in the block. The Karharbari Formation is essentially composed of conglomerates and coarse to gritty arkosic sandstone varying in thickness from 7 to 139m. The strata are very hard and compact at places on account of localized silicification. The thickness of this formation generally varies from 7m to 136m with coaly horizons. Among them, the topmost horizon (K5) is more persistent than the other horizons. The Barakar Formation lies comfortably over the Karharbari Formation. This is the main coal bearing formation in the block and contains four major coal seams i.e. Seam-1 to IV and four thin coal seams i.e. IVA, IVB, IVC, IVD in ascending order and two local seams L1 between Seam III Top & III Bottom and L2 below seam I Bottom. This formation is composed of gritty to conglomeratic sandstone (basal part), medium to coarse grained sandstone with siltstone, shale and carbonaceous shale. Among the four coal seams, seam-I Middle, II Bottom & IV Top are the thickest. The maximum thickness of Barakar Formation as intersected in boreholes is 129m. The Barren Measure Formation lie conformably over the Barakar Formation and is characterized by fine grained sandstone, shale and sandy shale. As per borehole records its thickness varies from 15m to 20m.

A dolerite dyke trending almost E-W and having roughly 4km length and a width of approximately 12-25m passes through the Dumri block. The presence of this dyke has also been reported in Pachra block lying west of Dumri block. Stratigraphic sequence of Dumri block is given below in **Table 1**.

Table 1: Stratigraphic Sequence of Dumri Block

(As per Borehole Intersection)

Period	Group	Sub-group	Formation	Thickness Range (m)	Lithology
Recent	Lower Gondwana	Damuda	Alluvium	3.50-14	Detrital and Alluvial soil and subsoil
			Barren Measures	15-20	Dark shale, sandy shale and Interbanded shale, sandstone
			Barakar	18-129	Fine to coarse grained sandstone, shale, conglomerate, carbonaceous shale and coal seams
			Karharbari	7-136	Medium to coarse grained sandstone shale, silicified quartzitic rock and thin coal seams.
			Talchir	10	Green coloured shale, Boulder and conglomerate
			Metamorphics		Granite, gneisses and Quartzite

2.2 MINING SCENARIO

The Dumri Block is the up-dip extension of Chatti-Bariatu Block and opencast mining method has been adopted for extraction of coal within the mining lease area. The mining plan for proposed Dumri Coal Mine was approved for two pit opencast working. The main part of the reserves lies in the eastern part of the mining lease and it was named as Quarry-2. Meager coal reserves are available in the western part in form of three small pits named Quarry-1A, Quarry-1B and Quarry-1C. In approved revised mining plan, the sequence of operation was suggested to work Quarry-2 first followed by Quarry-1(comprising of 3 small pits). The anticipated life of the mine with peak production rate of 1.0 MTPA will be 46 years. Prior to the advancing of 1st OB bench, land will be cleared with dozers/graders and topsoil removed in line with the Environmental Management Plan. Coal is extracted by shovel dumper combination after blasting off the coal faces. Excavators with 2.5 cum bucket capacity are planned to be used for coal mining which

will load into 35T coal dumpers. The over burden will be transported by 35T dumpers to surface dumps over the coal bearing area within mining lease and later used for backfilling. The coal will be transported by 35T coal trucks to the proposed coal stockyard at the pit head and later coal will be transported through weigh-bridge to the nearest railhead.

Total extractable reserve of Dumri Coal Mine is 45.22 MT with an average grade of G11. The open cast mine worked by Shovel-Dumper combination with an average stripping ratio of 2.36 Cum/Te.

3.0 ENVIRONMENTAL SCENARIO IN THE MINING AREA

3.1 AIR ENVIRONMENT

Air pollution includes one or more contaminants (pollutants), in the outdoor atmosphere in such quantities and of such duration that may be injurious to human, plant or animal life. Once these contaminants enter in the atmosphere, either in gaseous form or as particulate matter, these cannot escape and keep circulating and deteriorating the air quality. Air pollution effects encompass those that are health related as well as those associated with damage to property or which cause decrease in atmospheric aesthetic feature. Dispersion of air pollutants from the source depends on micro-meteorological parameters of the area.

3.1.1 SOURCES OF AIR POLLUTION

Coal transportation, OB removal, drilling, blasting, haul road and movements of mining equipments will be the major sources of air pollution in the proposed mining area. Generally, dust generation will be of major concern during mining operation. NO_2 will be liberated in the time of blasting and during the movement of mining machineries. This coal contains very less sulphur (<0.72%) and as such the concentration of SO_2. In Indian coal, it is low, except Assam where sulphur content is high.

3.1.2 METHODOLOGY AND INSTRUMENTS USED

The methodology and instruments used for air quality monitoring and analysis are given in **Table 2** as below:

Table 2: Methodology and Instrument Used for Air Quality Analysis

Parameters	Method	Instrument
$PM_{2.5}$	IS-5182 (Part 23):2006 Gravimetric Method	Fine Particulate Sampler
PM_{10}	IS-5182 (Part 23):2006 Gravimetric Method	Fine Particulate Sampler
SO_2	IS-5182 (Part 2):2001 (Improved West & Gaeke Method)	Fine Particulate Sampler with gaseous attachment
NO_x	IS-5182 (Part 6):2006 (Jacob & Hochheiser modified Method)	Fine Particulate Sampler with gaseous attachment

3.1.3 AIR QUALITY

Air quality monitoring in core and buffer zone of the Dumri coal mine has been carried out in post-monsoon season for the year 2020-21 to assess the impact of mining activities on the ambient air quality. During the study, two sampling locations for ambient air quality had been fixed in buffer zone and two sampling locations in core zone area of the proposed mine on the basis of wind direction and other meteorological parameters. Details of sampling stations along with the source of air pollution are given in **Table 3** and shown in **Fig. 1.** The air quality at these locations is presented in **Tables 4 & 5**. The results show that the ambient air quality of the villages, in and around the mining site, is least affected as the mine is not initiated during the study period.

Table 3: Details of Air monitoring Locations

Station Code	Location	Source of Air Pollution
CORE ZONE		
CA-1	Within Mining lease area	Kachha road and natural activity.
CA-2	Balia Village	Household coal burning and vehicular movement, etc.
BUFFER ZONE		
BA-1	Chatti-Bariatu Village	Household coal burning and vehicular movement, etc.
BA-2	Tunda Village	Household coal burning and vehicular movement, etc.

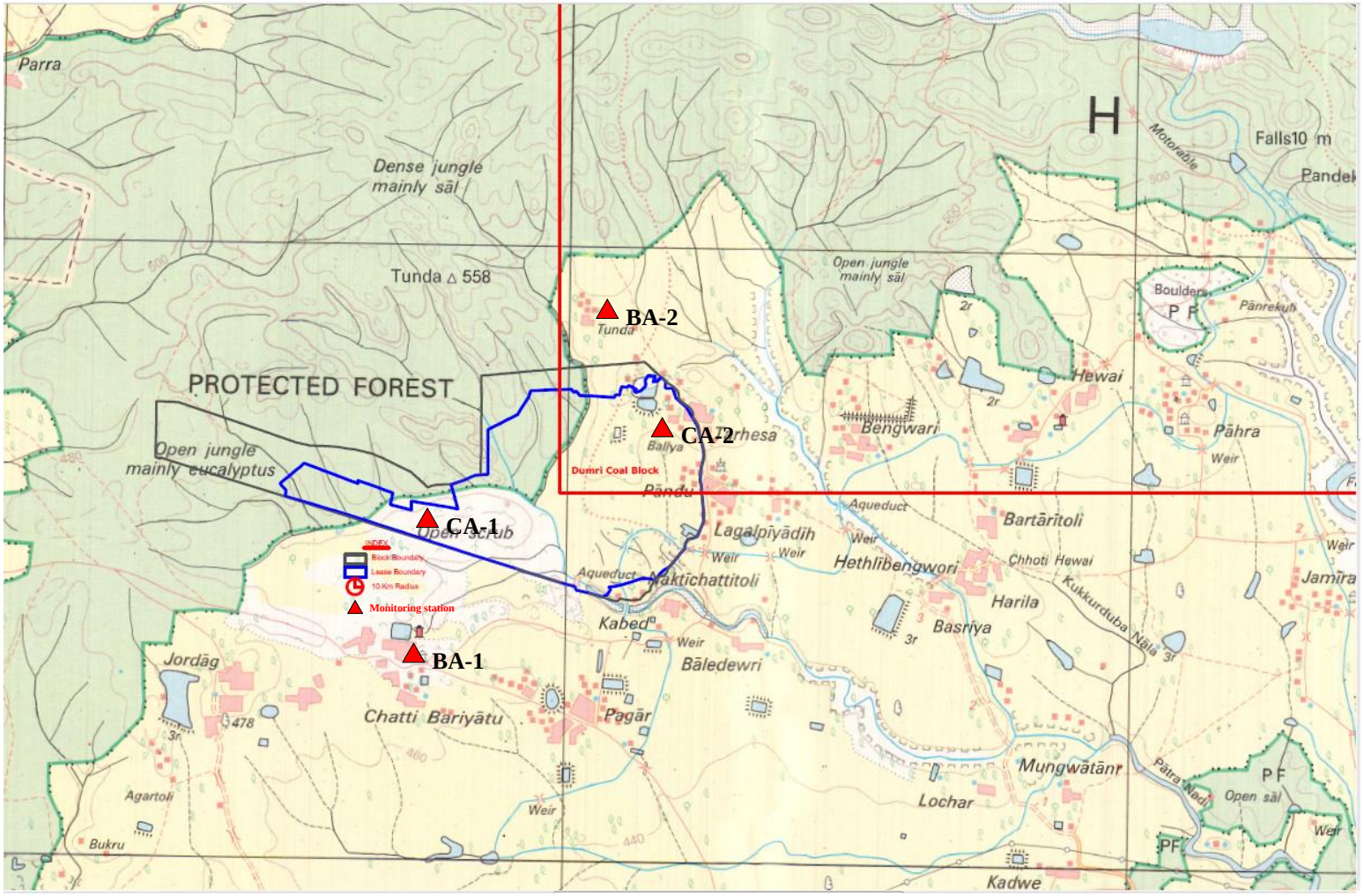

Fig. 1: Location of Air Monitoring Station in Core and Buffer Zone of Dumri Coal Mine

Table 4: Ambient Air Quality Report for Core Zone of Dumri Coal Mine

Sampling Code	Sampling Location	Season	Date of Sampling	Parameters (µg/m3)				Remarks
				$PM_{2.5}$	PM_{10}	SO_2	NO_2	
CA-1	Within Mining lease area	Post-monsoon	23/12/2020	35.3	49.7	14.4	15.2	
			24/12/2020	40.8	47.3	14.2	16.0	
CA-2	Balia Village	Post-monsoon	25/12/2020	43.5	60.3	18.0	19.0	
			26/12/2020	51.7	65.2	16.7	19.5	
Standards as per NAAQS-2009				**60**	**100**	**80**	**80**	

Table 5: Ambient Air Quality Report for Buffer Zone of Dumri Coal Mine

Sampling Code	Sampling Location	Season	Date of Sampling	Parameters (µg/m^3)				Remarks
				$PM_{2.5}$	PM_{10}	SO_2	NO_2	
BA-1	Chatti-Bariatu Village	Post-monsoon	21/12/2020	43.8	72.2	18.7	22.2	
			22/12/2020	48.0	66.3	19.6	23.9	
BA-2	Tunda Village	Post-monsoon	27/12/2020	47.4	61.5	16.1	17.5	
			28/12/2020	43.0	59.1	17.3	18.8	
Standards as per NAAQS-2009				**60**	**100**	**80**	**80**	

3.1.4 RESULTS AND DISCUSSIONS

During post-monsoon season (December, 2020), $PM_{2.5}$ concentration level at near proposed mine infrastructure area within core zone was found from 35.3 µg/m^3 to 40.8 µg/m^3 and concentration of PM_{10} was found from 47.3 µg/m^3 to 49.7 µg/m^3. At Balia Village, the $PM_{2.5}$ concentration was found from 43.5 µg/m^3 to 51.7 µg/m^3 and the concentration of PM_{10} was found from 60.3 µg/m^3 to 65.2 µg/m^3. In the core zone, all the $PM_{2.5}$ and PM_{10} values are within the threshold value i.e. 60 µg/m^3 for $PM_{2.5}$ and 100 µg/m^3 for PM_{10} as per the guideline of National Ambient Air Quality Standard (NAAQS), 2009 around the entire sampling sites. Concentration of SO_2 and NO_2 are also found

within the limit of 80 μg/m^{3}as per the guideline of NAAQS, 2009 in the sampling sites of core zone of the proposed mine.

During post-monsoon season (December, 2020), the $PM_{2.5}$ concentration at Chatti-Bariatu Village in buffer zone was found from 43.8 μg/m^3 to 48.0 μg/m^3 and the concentration of PM_{10} was found from 66.3 μg/m^3 to 72.2 μg/m^3. At Tunda Village, the $PM_{2.5}$ concentration was found from 43.0 μg/m^3 to 47.4 μg/m^3 and the concentration of PM_{10} was found from 59.1 μg/m^3 to 61.5 μg/m^3. In the buffer zone both the concentration levels are within the threshold value i.e. 60 μg/m^3 for $PM_{2.5}$ & 100 μg/m^3 for PM_{10} as per the guideline of NAAQS, 2009. Concentration of SO_2 and NO_2 are also found within the limit 80 μg/m^{3}as per the guideline of NAAQS, 2009 in all the sampling sites of buffer zone of the proposed mine.

3.2 WATER ENVIRONMENT

Water is one of the most essential natural resources for sustaining life and it is likely to become critically scare in the coming decades, due to continuous increase in its demands, rapid increase in population and expanding economy of the country. Variation in climatic characteristics both in space and time are responsible for uneven distribution of precipitation in India.

The diversity of climates, ecosystems, land uses and topographies greatly influences the design of environmental monitoring programs. Social factors have also become important elements in environmental management. Best practice for each site is therefore governed by these regional physical and social factors.

3.2.1. SOURCES OF WATER POLLUTION

Mine Water

The mine water is to be a probable source of water pollution during the active mining operation. The mine water, which will be mainly rain water and ground water seepage, will used for industrial purposes like dust suppression by water tankers in haul roads, approach roads, stockyards and watering of plants in the overburden dumps & office premises.

Domestic Effluents/Sewage

There are minimum housing facilities within the mining lease (ML) area for essential services. The domestic wastes from these houses are led to septic tanks. As the domestic waste water is minimum, the possibility of pollution is remote/insignificant. However, proper care has been taken up in the shelters area of inhabitants for sewage discharge.

Surface water

The surface water quality is likely to be affected with higher load of suspended solids as wash off from active dumps, soil erosion from soil and roads, and pumping out mine water to water channels.

Ground water

Ground water pollution can take place only if dumps and stock piles contain harmful chemical substances, which may get leached by precipitation of water and percolate to the ground water table, thus causing pollution. The chemical analysis of active OB soil and their proper management will restrict the water pollution by the management.

3.2.2 INSTRUMENTS USED

a) pH and Conductivity meter (Thermo)
b) Ion Meter (Thermo),
c) COD Analyser (Hach),
d) BOD Analyser (WTW),
e) Water Analysis Kit, (HACH, DR - 2000)
f) Microwave Digestion (Anton-Paar)
g) UV-VIS Spectrophotometer (Simazdo)
h) Atomic Absorption Spectrophotometer (Varian)
i) Ion Chromatograph (Dionex/Metrohm)
j) Flame Photometer
k) ICP-MS (Perkin Elmer)

3.2.3 WATER QUALITY OF THE AREA

To assess the water quality of the proposed mine area ground water and surface water in the core and buffer zone were collected and analysed. There is no mine water effluent in the core zone as it is a proposed mine and mining operation is not started. To assess the water quality of the area water samples from nine locations were collected during post-monsoon season (December, 2020). Details of sampling locations for water quality monitoring in and around proposed Dumri coal mine are given in **Table 6** and shown in **Fig. 2.**

Table 6: Sampling locations for water quality study

Sample Code	Sample Type	Description	Sampling Site	Remarks
GW-1	Ground water	Drinking water	Within mining lease	Core Zone
GW-2	Ground water	Drinking water	Chatti-Bariatu Village	Buffer Zone
GW-3	Ground water	Drinking water	Balia Village	Core Zone
GW-4	Ground water	Drinking water	Pandu Village	Buffer Zone
GW-5	Ground water	Drinking water	Pagar Village	Buffer Zone
GW-6	Ground water	Drinking water	Tunda Village	Buffer Zone
SW-1	Surface water	Baldeori Nala	Upstream of mine	Core Zone
SW-2	Surface water	Nala-A	Mine site	Core Zone
SW-3	Surface water	Baldeori Nala	Downstream of mine	Buffer Zone

The water samples were collected in one-liter narrow-mouthed pre-washed polyethylene bottles. For heavy metal analysis, 100 ml of samples were acidified with HNO_3 and preserved separately. Temperature, electrical conductivity (EC), pH and DO values were measured in the field using a portable conductivity and pH meter. The other parameters are measured in the geochemical laboratory at CSIR-CIMFR, Dhanbad following the standard methods prescribed in APHA (2017). The turbidity has been determined in pre-filtered sample by turbidity meter. In the laboratory, the water samples were filtered through 0.45 μm Millipore membrane filters to separate suspended particles. Acid titration method was used to determine the concentration of bicarbonate (APHA 2017). Major

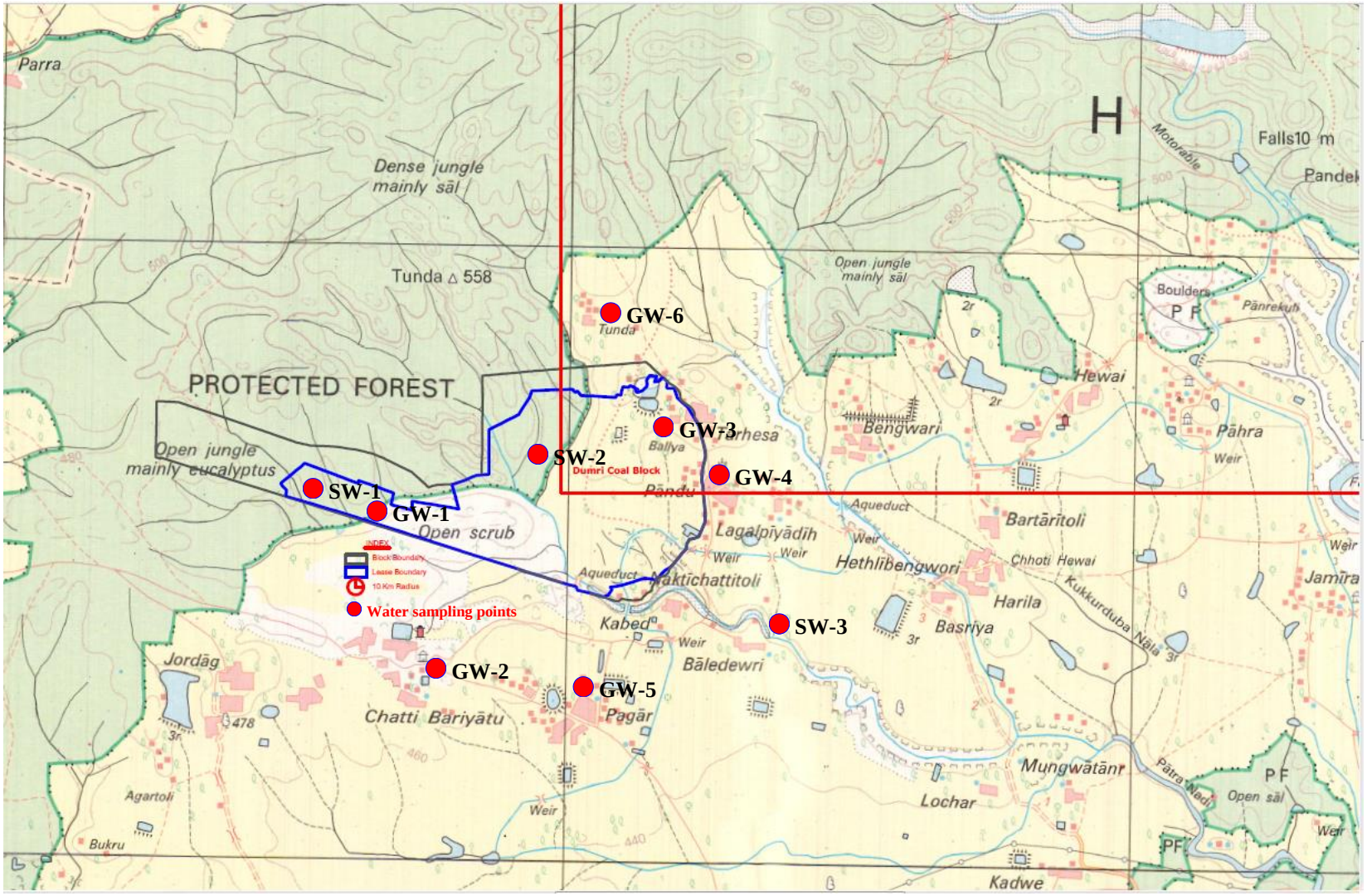

Fig. 2: Location of Water Sampling Points in Core and Buffer Zone of Dumri Coal Mine

anions (F, NO_3 and SO_4,) were analysed on UV-VIS spectrophotometer. Major cations (Ca and Mg) were measured by titrametric method and Na and K by flame photometer. The trace metals were analysed on ICP-AES.

3.2.4 RESULTS AND DISCUSSIONS

The physico-chemical characteristics of the analysed drinking and surface water is presented in **Table 7 to 10** along with the prescribed standards. The water quality of the area is discussed in the following paragraphs:

Drinking Water Quality Assessment:

To assess the status of drinking water quality of Dumri coal mine area, six ground water samples were collected from hand pump as well as dug well in December, 2020 and analysed for parameters as per the drinking water standards. The hydro-chemical parameters of the groundwater of the study area were compared with the prescribed limit of Indian Standard for drinking water (BIS 2012) to assess the suitability for drinking and public health purposes (**Table 7 to 9**). The analytical results show that most of the analysed parameters are well within desirable limits and water is potable for drinking uses. pH of the analysed groundwater are found well within the safe limit of 6.5-8.5, prescribed for drinking water by BIS (2012). The turbidity is one of the important physical parameters for water quality defining the presence of suspended solids in water, which causes the muddy or turbid appearance of water body. The consumption of high turbid water may cause a health risk as excessive turbidity can protect pathogenic microorganisms from effects of disinfectants and also stimulate the growth of bacteria during storage. In the study area the turbidity in the groundwater are found below the recommended value of 5 NTU. The total dissolve solids (TDS) value in all the samples (Except GW-1, GW-2 and GW-6) is slightly higher than the acceptable limit of 500mg/l while lower than the permissible limit in the absence of alternate sources of 2000mg/l. The Total hardness (TH) value in all the samples (Except GW-1, GW-2 and GW-6) is slightly higher than acceptable limit of 200mg/l but lower than the permissible limit in the absence of alternate sources i.e 600mg/l. In all of the samples, the concentration of Ca, Mg, SO_4 and F are also found well within the permissible limit for drinking uses (Except Ca in GW-5). Heavy metal analysis in the groundwater samples indicated that all the analyzed

heavy metals like As, Cd, Cr, Pb, Zn, Mn and Fe are found either below the detection limit or less than the acceptable limit for drinking water.

Surface Water Quality:

The analytical results of physico-chemical analysis of surface water samples collected from Nala-A within the mine site as well as upstream and downstream of Baldeori Nala has been given in **Table 10**. To assess the quality of the surface water resource the results has been compared with the prescribed surface water standards IS-2296 for Class 'C' water (tolerance limit for stream water used drinking water sources with conventional treatment followed by disinfection). It can be seen that pH of the water is slightly alkaline in nature and found well within the prescribed limit of 8.5. In general, the total dissolved values and other analysed parameters are found well within the threshold values. Concentration of sulphate varies between 10.3 and 14.2 mg L^{-1} and is well below the prescribed value of 400 mg L^{-1} (IS-2296). The level of TSS, TDS and DO in the river water were found within threshold limit in comparison to IS:2296, surface waters Class-C. The concentrations of the analysed heavy metals in the surface water resource are also found within the prescribed limits. It shows that the surface water of the area is fit for its designated use as a drinking water source with conventional treatment followed by disinfection.

The calculated value of sodium adsorption ration (SAR) shows that the water is low saline and low alkali water (0.51 - 0.69) and can be used for irrigation in most soils and crops with little danger of the development of harmful levels of exchangeable sodium. The percent sodium (%Na) is varying from 18.13 to 24.42 and also found below the 60% recommended limit for irrigation uses.

Table 7: Ground Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Post-monsoon**
Project: Dumri Coal Mine	**Date of Sampling: 22.12.2020**
Name of the Sampling Station:	
GW-1: ***Ground Water, Mine site***	**GW-2:** ***Ground Water, Chatti Bariatu Village***

Sl. No.	**Parameters**	**Station Code**		**IS-10500: 2012**	
		GW-1	**GW-2**	**Acceptable Limit**	**Permissible Limit in the Absence of Alternate**
1.	Colour, Hazen units, Max	<5	<5	5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	7.22	6.60	6.5-8.5	No relaxation
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
5.	Turbidity, NTU, Max	0.01	4.28	1.0	5.0
6.	Total Dissolved Solid, mg/l, Max	476	179	500	2000
7.	Total Hardness (as $CaCO_3$)	244	96	200	600
8.	Chloride (as Cl), mg/l, Max	24	12	250	1000
9.	Calcium (as Ca), mg/l, Max	77.4	25.2	75	200
10.	Magnesium (as Mg), mg/l, Max	12.3	8.0	30	100
11.	Sodium (as Na), mg/l, Max	26.4	7.4	NS	NS
12.	Potassium (as K), mg/l, Max	0.5	5.2	NS	NS
13.	Sulphates (as SO_4), mg/l, Max	21.2	10.3	200	400
14.	Nitrate (as NO_3), mg/l, Max	13.9	0.59	45	No relaxation
15.	Fluorides (as F), mg/l, Max	0.86	3.21	1.0	1.5
16.	Total Alkalinity, mg/l, Max	347	296	200	600
17.	Mineral Oil, mg/l, Max	<0.001	<0.001	0.5	No relaxation
18.	Iron (as Fe), mg/l, Max	0.005	0.015	0.3	No relaxation
19.	Manganese (as Mn), mg/l, Max	0.004	0.009	0.10	0.30
20.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	0.01	0.05
21.	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	0.003	No relaxation
22.	Lead (as Pb), mg/l, Max	0.003	0.004	0.01	No relaxation
23.	Copper (as Cu), mg/l, Max	0.005	0.009	0.05	1.5
24.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	0.001	0.001	0.05	No relaxation
25.	Selenium (as Se), mg/l, Max	<0.001	<0.001	0.01	No relaxation
26.	Silver (as Ag), mg/l, Max	<0.001	<0.001	-	-
27.	Zinc (as Zn), mg/l, Max	0.256	0.302	5	15
28.	Nickel (as Ni), mg/l, Max	0.002	0.004	0.02	No relaxation

NS: *Not Specified,*

Table 8: Ground Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Post-monsoon**
Project: Dumri Coal Mine	**Date of Sampling: 22.12.2020**
Name of the Sampling Station:	
GW-3: ***Ground Water, Balia Village***	**GW-4:** ***Ground Water, Pandu Village***

Sl. No.	**Parameters**	**Station Code**		**IS-10500: 2012**	
		GW-3	**GW-4**	**Acceptable Limit**	**Permissible Limit in the Absence of Alternate**
1.	Colour, Hazen units, Max	<5	<5	5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	6.98	6.83	6.5-8.5	No relaxation
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
5.	Turbidity, NTU, Max	0.79	0.44	1.0	5.0
6.	Total Dissolved Solid, mg/l, Max	568	530	500	2000
7.	Total Hardness (as $CaCO_3$)	232	232	200	600
8.	Chloride (as Cl), mg/l, Max	58	116	250	1000
9.	Calcium (as Ca), mg/l, Max	52.2	72.4	75	200
10.	Magnesium (as Mg), mg/l, Max	24.8	12.5	30	100
11.	Sodium (as Na), mg/l, Max	36.0	87.4	NS	NS
12.	Potassium (as K), mg/l, Max	42.5	3.3	NS	NS
13.	Sulphates (as SO_4), mg/l, Max	62.1	60.1	200	400
14.	Nitrate (as NO_3), mg/l, Max	91.5	85.4	45	No relaxation
15.	Fluorides (as F), mg/l, Max	0.62	0.24	1.0	1.5
16.	Total Alkalinity, mg/l, Max	186	218	200	600
17.	Mineral Oil, mg/l, Max	<0.001	<0.001	0.5	No relaxation
18.	Iron (as Fe), mg/l, Max	0.042	0.013	0.3	No relaxation
19.	Manganese (as Mn), mg/l, Max	0.004	0.002	0.10	0.30
20.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	0.01	0.05
21.	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	0.003	No relaxation
22.	Lead (as Pb), mg/l, Max	0.004	0.005	0.01	No relaxation
23.	Copper (as Cu), mg/l, Max	0.007	0.004	0.05	1.5
24.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	0.003	0.004	0.05	No relaxation
25.	Selenium (as Se), mg/l, Max	<0.001	<0.001	0.01	No relaxation
26.	Silver (as Ag), mg/l, Max	<0.001	<0.001	-	-
27.	Zinc (as Zn), mg/l, Max	0.258	0.312	5	15
28.	Nickel (as Ni), mg/l, Max	0.002	0.003	0.02	No relaxation

NS: *Not Specified,*

Table 9: Ground Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Post-monsoon**
Project: Dumri Coal Mine	**Date of Sampling: 22.12.2020**
Name of the Sampling Station:	
GW-5: ***Ground Water, Pagar Village***	**GW-6:** ***Ground Water, Tunda Village***

Sl. No.	**Parameters**	**Station Code**		**IS-10500: 2012**	
		GW-5	**GW-6**	**Acceptable Limit**	**Permissible Limit in the Absence of Alternate**
1.	Colour, Hazen units, Max	<5	<5	5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	6.73	6.91	6.5-8.5	No relaxation
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
5.	Turbidity, NTU, Max	0.18	0.01	1.0	5.0
6.	Total Dissolved Solid, mg/l, Max	573	329	500	2000
7.	Total Hardness (as $CaCO_3$)	288	180	200	600
8.	Chloride (as Cl), mg/l, Max	34	32	250	1000
9.	Calcium (as Ca), mg/l, Max	84.1	48.8	75	200
10.	Magnesium (as Mg), mg/l, Max	19.0	14.2	30	100
11.	Sodium (as Na), mg/l, Max	40.5	13.8	NS	NS
12.	Potassium (as K), mg/l, Max	45.0	1.1	NS	NS
13.	Sulphates (as SO_4), mg/l, Max	92.5	26.8	200	400
14.	Nitrate (as NO_3), mg/l, Max	48.5	34.7	45	No relaxation
15.	Fluorides (as F), mg/l, Max	1.45	1.29	1.0	1.5
16.	Total Alkalinity, mg/l, Max	324	218	200	600
17.	Mineral Oil, mg/l, Max	<0.001	<0.001	0.5	No relaxation
18.	Iron (as Fe), mg/l, Max	0.018	0.014	0.3	No relaxation
19.	Manganese (as Mn), mg/l, Max	0.001	0.002	0.10	0.30
20.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	0.01	0.05
21.	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	0.003	No relaxation
22.	Lead (as Pb), mg/l, Max	0.004	0.003	0.01	No relaxation
23.	Copper (as Cu), mg/l, Max	0.005	0.003	0.05	1.5
24.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	0.003	0.002	0.05	No relaxation
25.	Selenium (as Se), mg/l, Max	<0.001	<0.001	0.01	No relaxation
26.	Silver (as Ag), mg/l, Max	<0.001	<0.001	-	-
27.	Zinc (as Zn), mg/l, Max	0.284	0.263	5	15
28.	Nickel (as Ni), mg/l, Max	0.002	0.001	0.02	No relaxation

NS: *Not Specified,*

Table 10: Surface Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Post-monsoon**
Project: Dumri Coal Mine	**Date of Sampling: 22.12.2020**
Name of the Sampling Station:	
SW-1 - Surface Water, Baldeori Nala U/S of mine site	
SW-2 - Surface Water, Nala-A of mine site	
SW-3 - Surface Water, Baldeori Nala D/s of mine site	

Sl. No.	**Parameters**	**Station Code**			**(IS: 2296)* Surface Waters Class "C" Tolerance Limits**
		SW-1	**SW-2**	**SW-3**	
1.	Colour, Hazen units, Max	<5	<5	<5	300
2.	Odour	#	#	#	#
3.	pH	8.08	7.80	7.27	6.5-8.5
4.	Dissolved Oxygen, mg/l, Min.	7.05	7.95	7.95	4
5.	BOD (3days at 27^{o}C), mg/l, Max	3.05	2.85	2.73	3
6.	Total Dissolved Solid, mg/l, Max	266	291	274	1500
7.	Oil & Grease, mg/l, Max	<0.1	<0.1	<0.1	0.1
8.	Total Hardness (as $CaCO_3$), mg/l, Max	140	136	124	NS
9.	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.005
10.	Chloride (as Cl^-), mg/l, Max	12.0	14.0	24.0	600
11.	Sulphates (as SO_4^{--}), mg/l, Max	14.2	10.3	13.2	400
12.	Nitrate (as NO_3), mg/l, Max	5.4	1.2	4.1	50
13.	Fluorides (as F), mg/l, Max	1.95	1.07	0.82	1.5
14.	Calcium (as Ca), mg/l, Max	32.0	37.0	30.3	NS
15.	Magnesium (as Mg), mg/l, Max	14.6	10.6	11.8	NS
16.	Sodium (as Na), mg/l, Max	13.9	15.0	17.6	NS
17.	Potassium (as K), mg/l, Max	0.6	1.7	1.4	NS
18.	Copper (as Cu), mg/l, Max	0.004	0.003	0.005	1.5
19.	Iron (as Fe), mg/l, Max	0.048	0.072	0.066	50
20.	Manganese (as Mn), mg/l, Max	0.003	0.004	0.004	NS
21.	Zinc (as Zn), mg/l, Max	0.314	0.287	0.325	15
22.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	<0.001	0.2
23.	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	<0.001	0.01
24.	Lead (as Pb), mg/l, Max	0.005	0.009	0.006	0.1
25.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	0.003	0.005	0.003	0.05
26.	Selenium (as Se), mg/l, Max	<0.001	<0.001	<0.001	0.05
27.	Percent Sodium (%)	18.13	20.38	24.42	NS
28.	Sodium Absorption Ratio	0.51	0.56	0.69	NS

: *Unobjectionable,* ***NS:*** *Not Specified,*

**** : Class "C"-*** *Drinking water source with conventional treatment followed by disinfection.*

3.3 NOISE ENVIRONMENT

Noise is undesirable and unpleasant sound produced by the vibration of bodies or molecules of the medium and propagates as a pressure perturbation. It disturbs people's work, sleep and communication. Its damages hearing and evokes other physiological reactions. It also disturbs the habitat of animals and birds in the surroundings. Mining is the third largest industry in terms of employment and the recent trends of mechanization has changed the working environment to noisy environment leading to higher sound levels.

3.3.1 SOURCES OF NOISE

Noise will be produced during mining at different levels by different equipments in the open cast mine are summarized in the **Table 11.**

Table 11: Noise Generating Mining Equipments

S. N.	Equipment / Operation	Noise level dB(A)
1.	Feeder breaker	82-100
2.	Dumpers	100-115
3.	Shovels	80-107
4.	Dozers	84-107
5.	Front End loader	83-101
6.	Electric motors, gear drivers, hopers, drilling & main pump	85-95
7.	Belt conveyer	90-92
8.	Drill	110-115

3.3.2 AMBIENT NOISE MONITORING LOCATIONS

The main objective of noise monitoring in the study area is to assess the present ambient noise levels in proposed project site & buffer zone due to regular activities and vehicular movement. A preliminary reconnaissance survey has been undertaken to identify the major noise generating sources in the proposed mining area.

Ambient noise level study at Dumri Mine was carried out in core as well as buffer zone. Two noise level monitoring location in core zone followed by two noise level monitoring locations in buffer zone were fixed-up as given in **Table 12** and shown in **Fig.3.**

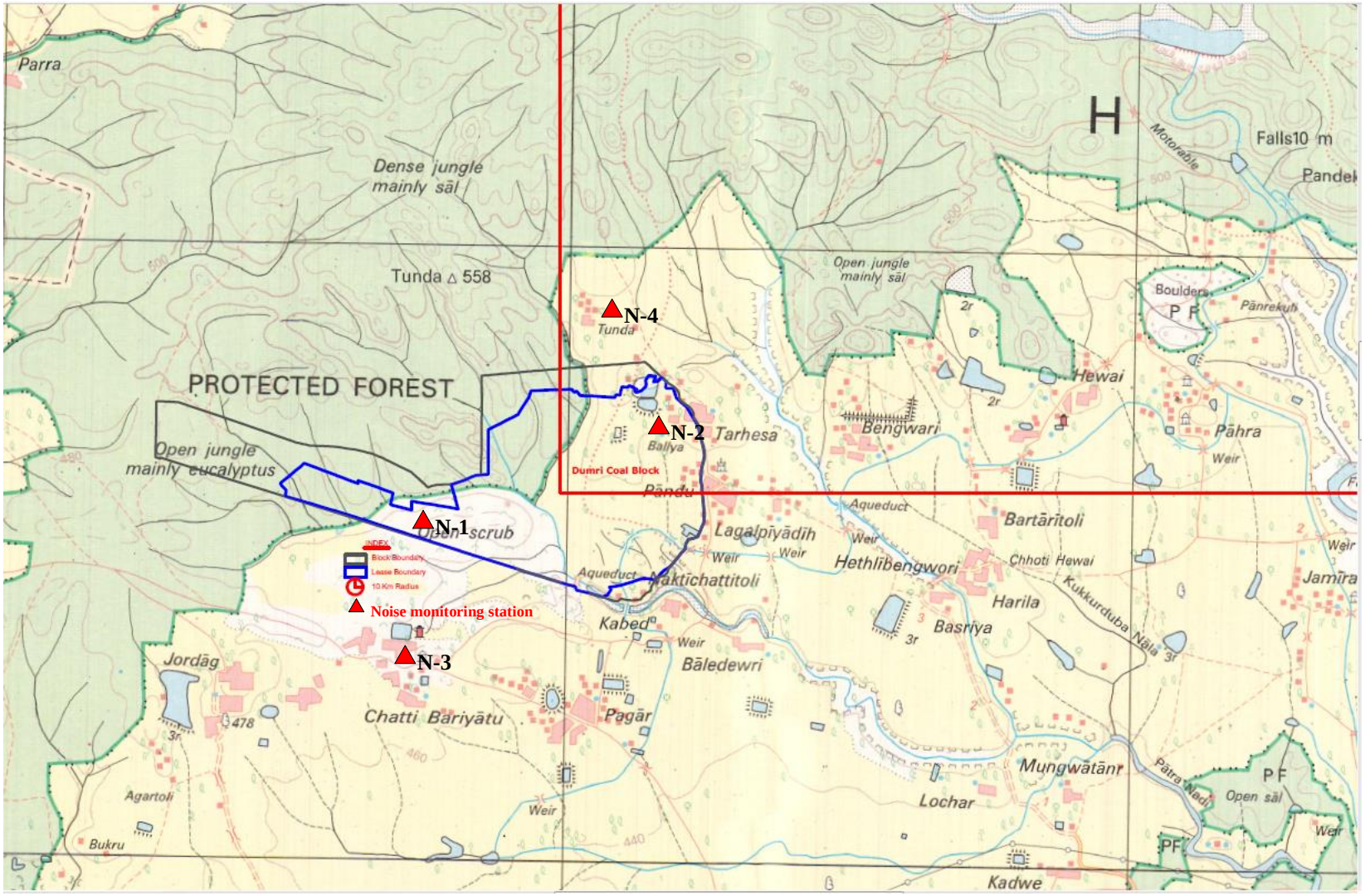

Fig. 3: Location of Noise Monitoring Station in Core and Buffer Zone of Dumri Coal Mine

Table 12: Details of Ambient Noise Monitoring Stations

S. No.	Location Code	Location Name/ Description	Present Land use
Core Zone			
1.	N-1	Within Mining lease area	Barren Land
2	N-2	Balia Village	Residential Area
Buffer Zone			
3.	N-3	Chatti Bariatu Village	Residential Area
4.	N-4	Tunda Village	Residential Area

3.3.3 INSTRUMENTS USED

Sound level study is carried by using Mip-oy Integrated Sound Level Meter Meeting IEC-179A measuring average peak and Low values in Day and Night time.

3.3.4 RESULTS AND DISCUSSION

Results are shown in **Table 13 and 14** for ambient noise levels of core and buffer zones during post-monsoon season. The average peak values at the nearby villages are found well below the residential areas standard values of 55 & 45 dB (A) for Day & Night respectively. In core zone maximum noise levels and average noise levels are also well within the prescribed limit of 75 & 70 dB (A) for Day & Night respectively.

Table 13: Noise Level in Core Zone of the Study Area

Date of Sampling:		**Noise level dB(A) average**					
21.12.2020 to 28.12.2020		**Day Time (6.00AM to 10.00PM)**			**Night Time (10.00PM to 6.00AM)**		
Stn. Code	**Location**	**Min.**	**Max.**	**Average**	**Min.**	**Max.**	**Average**
N-1	Within Mining lease area	29.2	54.6	44.2	27.4	42.8	34.3
N-2	Balia Village	31.5	62.2	49.2	28.3	52.6	40.2
Standards as per CPCB		**75**			**70**		

Table 14: Noise Level in Buffer Zone of the Study Area

Date of Sampling:		Noise level dB(A) average					
21.12.2020 to 28.12.2020		Day Time (6.00AM to 10.00PM)			Night Time (10.00PM to 6.00AM)		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N-3	Chatti Bariatu Village	31.8	65.3	48.7	29.0	54.2	37.6
N-4	Tunda Village	30.1	54.2	45.5	28.1	46.7	36.8
Standards as per CPCB		75			70		

3.4 SOIL ENVIRONMENT

Topsoil is an essential component of land reclamation in mining area. The topsoil is very seriously damaged if is not mined out separately in the beginning with a view to replacement in the area.

During mining huge amount of overburden is being generated and stored as dumps. To know the impact of mining on soils of surrounding area as well as effect of overburden dumping on agricultural field due to run off from soil heaps during rainy season, the soil quality of surrounding area has been evaluated with respect to physico-chemical parameters.

The physical properties of soil, which is important in its utility, are texture, bulk density, specific gravity, moisture content and water holding capacity. The chemical properties, which govern the best use of soil for crops and plants, are pH, N, P, K and organic matter. For assessment of soil quality, five sampling points were fixed which comprise agricultural soil within mining lease area, forest area near Mining lease and agricultural field of nearby villages.

3.4.1 SAMPLING LOCATIONS

The soil sampling points are described below and in **Figure 4**:

S_1	Agricultural soil near Chatti Bariatu Village
S_2	Agricultural soil within mining lease area
S_3	Agricultural soil at BaliyaVillage
S_4	Agricultural soil at Tunda Village
S_5	Agricultural soil at forest area within mining lease

3.4.2 METHODOLOGY

The standard procedure was followed in sampling and all the samples were taken from 0-20 cm depth from all the sites. The sampling was done in the month of December 2020. Standard methods were followed for soil analysis and are appended in **Table 15**. The results reported are average of three replicate analyses.

Table 15: Standard Methods of Soil Analysis

Parameters	Methods
Physical Parameters	
a) Bulk Density	IS: 2720 (Part VII) - 1980
b) Water Holding Capacity	It is determined by the Keen - Raczkowski box experiment using the circular shaped boxes described by Coutts J.R.H. (1930). It is the amount of water taken up by unit weight of dry soil when immersed in water under standardized condition i.e. Weight of water held in box ---------- x 100 Weight of dry soil in box
c) Specific gravity	It is the ratio of total mass of the soil particles to their total volume excluding pore space .IS 2720 (Part III) - Section 1 & Section 2 -1980
d) Moisture content	IS 2720 (Part II) - 1973, IS 2720 (Part IX) - 1971
e) Texture	IS 1498 - 1970;
Chemical Parameters	
f) pH	It is measured by Systronics Digital pH meter using soil water ratio 1:2.5 IS 2720 (Part XXVI) - 1973
g) Organic carbon	This is measured by Walkleyand Black (1934) rapid titration methods. Organic carbon is oxidized by Potassium dichromate solution i.e. presence of concentrated sulfuric acid. The excess dichromate ion is back titrated and measured. The quality of Organic matter is calculated from the amount of dichromate ion reduced. IS 2720 (Part XXII) - 1972
h) Nitrogen	Micro Kjeldahl method is used for the estimation of total nitrogen (Jackson 1958).
i) Available Phosphorous	Olsen's (1954) methods were followed for the determination of available P in soil.
j) Available Potassium	Ammonium acetate extractable K is determined by Atomic absorption Spectrophotometer.

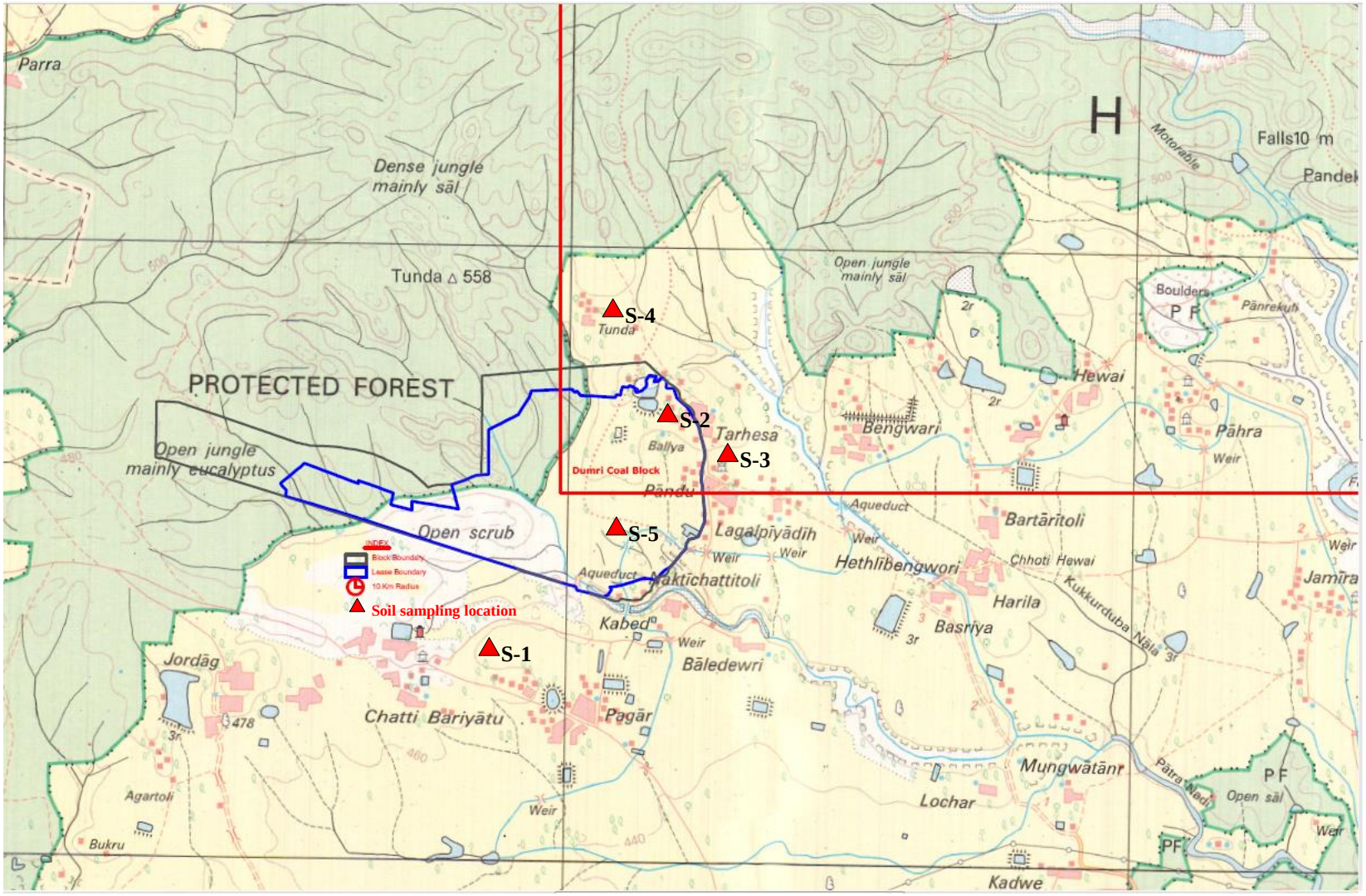

Fig. 4: Location of Soil sampling location in Core and Buffer Zone of Dumri Coal Mine

3.4.3 SOIL QUALITY

Agricultural and forest soil were collected in post-monsoon season (December 2020) and had been analysed for physico-chemical parameters and results are presented in **Table 15**.

3.4.4 RESULTS AND DISCUSSION

3.4.4.1. Physical Properties of Soil Samples

The bulk density of the soil samples varies in the range of 0.85 gm/cm^3 to 0.93 gm/cm^3, which indicates favorable physical condition. The particle density varies from 1.28 gm/cm^3 to 1.43 gm/cm^3. The moisture contents are found to vary from 0.76 to 1.95%. The water holding capacity also varies from 38.95% to 45.87% being maximum in the case of agricultural soil, which may be due to its clay content.

3.4.4.2. Chemical Properties

All the soil samples are analysed for the chemical parameters namely pH, organic carbon, available nitrogen, phosphorous, potassium content and the results are presented in **Table 15.**

The pH of the soil samples ranged from 6.07 to 7.43, which clearly indicates that soil samples are slightly acidic to basic in nature. Organic carbon content ranges from 0.29% to 1.29%. The organic matter content ranges from 0.49% to 2.22%. The available Nitrogen, Phosphorous and Potassium content of the soil samples varies from 45 to 145 Kg/ha; 4.4 to 10.8 Kg/ha and 25 to 170 Kg/ha respectively. The values indicate that the soil within mining lease area and forest area near mining lease are deficient in N, P & K that requires addition of farmyard manure, bio fertilizer and other soil amendments to make the top soil suitable for vegetation. The value for agricultural soil of nearby village clearly indicates that the soil is not polluted with respect to chemical constituents.

Table 15: Physico-chemical Properties of Soil of Mine Area

S. N.	Parameters	S_1	S_2	S_3	S_4	S_5
1.	Texture	SS	SS	SS	SS	SS
2.	pH	6.90	6.07	6.75	7.43	6.43
3.	EC (µmhos/cm)	95.5	169.5	178.6	478	89.6
4.	Moisture Content (%)	1.22	0.76	1.12	1.95	1.85
5.	Bulk Density (gm/cm^3)	0.85	0.92	0.92	0.88	0.93
6.	Particle density (gm/cm^3)	1.28	1.43	1.39	1.36	1.43
7.	Water Holding Capacity (%)	45.29	41.45	40.76	45.87	38.95
8.	Organic Carbon (%)	0.29	0.60	1.29	0.97	0.83
9.	Organic Matter (%)	0.49	1.03	2.22	1.67	1.43
10.	Avail N (kg/ha)	45	38	92	145	42
11.	Avail P (kg/ha)	4.4	5.1	7.2	10.8	4.6
12.	Avail K (kg/ha)	31	25	88	170	20

Note: SS- Silty Sand

Sampling Sites:

S_1 - Agricultural soil near Chatti Bariatu Village
S_2 - Agricultural soil within Mining lease area
S_3 - Agricultural soil at BaliyaVillage
S_4 - Agricultural soil at Tunda Village
S_5 - Agricultural soil at Forest area within mining lease

4.0 CONCLUSION

On the basis of the data generated it has been found that the environmental scenario in and around mining area of proposed Dumri Coal Mine with respect to air, water, noise and soil are well within the permissible limits.

5.0 MITIGATIVE MEASURES

Dumri Coal Mine has not commenced its mining operation. Environmental monitoring data of Post-monsoon season, 2020 suggest that all the studied parameters (air, water, noise and soil) are within permissible limits. The mitigative measures to be adopted during mine operation is conferred below.

5.1 AIR POLLUTION CONTROL MEASURES

The mining operations and related activities are anticipated to increase the levels of particulate matter and gaseous pollutants to a limited extent. The proposed air pollution control measures are as follows:

I. Dust suppression systems (like water spraying) will be adopted where necessary at
   (a) Faces before and after blasting,
   (b) Faces while loading
II. Dust extraction systems will be used in drill machines, crushers/feeder breakers.
III. Dust suppression systems (like water spraying) would be adopted at roads used for transportation. Sprinklers would be installed along the roads to suppress the dust.
IV. Suitable dust extraction or suppression systems such as mist sprays with or without chemical will be provided at appropriate places for preventing dust pollution during handling and stockpiling of coal.
V. Transfer points of coal will be provided with appropriate hoods/chutes to prevent fugitive dust emission.
VI. To prevent air pollution due to airborne dust, tree belts will be planted around the mine site.
VII. Dust masks will be provided as safety measure to the workers, engaged at dust generation points like drills, loading/unloading points, crushers etc.
VIII. To ensure that NO_X level do not increase during mining operation good quality explosives will be used for which the oxygen balance will be checked from time to time. The expired explosives will not be used for which a strict vigil will be kept on the date of manufacture.

5.2 WATER POLLUTION CONTROL MEASURES

Proposed mitigative measures related to water pollution is as below-

I. Any wash off from the oil/grease handling area of workshop will be treated to remove oil and grease using oil trap. Waste oil/grease will be stored in leak proof containers.
II. The sewage waste will be treated in properly designed septic tanks and soak pits.
III. Check dams will be provided to prevent solids from wash off and screen if any from the mine related activities.
IV. Construction of garland drains around freshly excavated and dumped areas so that flow of water with loose material is prevented.
V. The coal does not have high sulphur content (<0.72%). It is anticipated that the mine water discharge will have no acid drainage. However, the mine water will be monitored regularly to keep a vigil and will be kept below permissible limits before any discharge.

5.3 NOISE POLLUTION CONTROL MEASURES

The following control measures will be adopted to keep the ambient noise levels below permissible limits 75 dB (A):

I. Provision and maintenance of thick belts to screen noise.
II. Avenue plantation within the project area to dampen the noise.
III. Proper maintenance of noise generating machinery including the transport vehicles will be ensured.
IV. To protect the workers from exposures to higher noise levels, the following measures will be adopted.
V. Provision of protective devices like ear muffs/ear plugs to those workers who cannot be isolated from the source of noise.
VI. Confining the noise by isolating the source of noise.
VII. Reducing the exposure time of workers to the higher noise levels.

5.4 SOIL POLLUTION CONTROL MEASURES

This is particularly necessary to save topsoil for later use to protect the primary root medium from contamination and erosion, and hence its productivity. The systematic handling and storage practices can protect the physical and chemical characteristics of topsoil while in storage and also after it has been redistributed onto the areas. The following control measures will be adopted:

I. The topsoil should be kept properly.
II. Topsoil should be redistributed in a manner that achieves an approximate uniform, stable thickness that is consistent with approved post-mining land use.
III. Soil should be protected from excess compaction, wind and water erosion.
IV. An appropriate concurrent and post-mining reclamation strategy can also be determined.

6.0 RECOMMENDATIONS AND FOLLOW-UP ACTION

The study indicates that air quality around the proposed Dumri Coal Mine is found to be within the threshold limit as per the guideline of NAAQS, 2009. However, the mining activity was not in progress during the monitoring period. Water quality of the surrounding water resources are also not found polluted. For the best practice of proposed coal mining in future, Environmental Management System should always be considered with the following key recommendation and follow-up actions:

- ❖ Spraying of water on the haul roads for controlling the dust to its minimum level.
- ❖ Regular maintenance of the heavy earth moving machines.
- ❖ Mine water collection in settling tank before its discharge.
- ❖ Garland drainage should be made around the dumps.
- ❖ Reclamation and revegetation of overburden dumps should be done to control soil erosion, denudation of agricultural land and nearby riverine system, wetlands and to improves the aesthetics of the area.
- ❖ Dumps brought under biological reclamation should not be made active.
- ❖ The mine management would be implementing, these measures to make mining operation eco-friendly in this proposed Dumri coal mine of M/s Hindalco Industries Ltd, Hazaribag, Jharkhand.

ENVIRONMENTAL STUDY REPORT

ENVIRONMENTAL STUDY REPORT FOR DUMRI COAL MINE, HAZARIBAG, JHARKHAND

(WINTER SEASON)
(JANUARY, 2021 TO MARCH, 2021)

Prepared

For

M/S HINDALCO INDUSTRIES LIMITED
Hazaribag - 825311
Jharkhand

Prepared

by

HYDRLOGY & GEOCHEMISTRY DIVISION
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Report

On

Environmental Study Report for Dumri Coal Mine, Hazaribag, Jharkhand

(WINTER SEASON)
(JANUARY, 2021 TO MARCH, 2021)

Project No.: SSP/474/2020-21

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INDEX

1.0 INTRODUCTION

Mining is the extraction of valuable minerals or other geological materials from the Earth. It is a site specific and ecologically sensitive industry. For sustaining national development, mining of coal and minerals is of paramount importance for developed as well as developing countries. To meet the energy requirements of the country, increased coal production has been possible due to large-scale surface mining activities. Mining operations usually create a negative environmental impact, both during the mining activity and after the mine has closed. Surface mining causes environmental disturbance in the form of land degradation, removal of OB material which stress on air and water regime and finally interferes in the balance of the ecosystem. To meet these problems, sound environmental management system for pre-mining, active mining and post mining stages in the form of Environmental Impact Assessment, Environmental Management Practice for concurrent mining and Environmental Audit has been made necessary by the regulating state and central authorities. Regular monitoring of the different components of environment is made necessary for evaluating the requirements of environmental management system and its impact in the society. This report presents the study conducted by CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad for proposed Dumri Coal Mine belonging to M/s Hindalco Industries Ltd, Hazaribag, Jharkhand.

1.1 HISTORY OF DUMRI COAL MINE

"Dumri Block" in North Karanpura Coalfield situated in the District Hazaribag, State of Jharkhand, was previously allotted by Ministry of Coal and Mines vide their letter dated 13.01.2006, jointly to M/s Nilachal Iron and Power Ltd. as leader and M/s Bajrang Ispat (P) Ltd. as associate.

Honourable Supreme Court of India vide Judgement dated 25th August, 2014 and Order dated 24th Sept. 2014 cancelled the allocation of 204 coal blocks, which include Dumri coal block also.

Later the Office of Nominated Authority constituted under section 6 of the Coal Mines (Special Provision) Act, 2015, issued Vesting order under clause (b) of sub-rule 7 and sub-rule (1) of rule, Order no. 104/24/2015/NA dt. 22nd April, 2015 for Dumri Coal Mine in favour of M/s Hindalco Industries Ltd.

Further, vide Corrigendum No. 1, dated 30th January, 2018, the MOC issued the revised boundary Co-ordinates. As per approved Mining Plan (Revision-I) of Dumri Coal Mine of M/s Hindalco Industries Ltd., revised area of the mining lease is 259.64 ha.

Based on recommendation of EAC; Ministry of Environment, Forest and Climate Change revoke the abeyance on transfer of Environmental Clearance for Dumri Coal Mine project from M/s Nilachal Iron and Power Limited to M/s Hindalco Industries Limited for a production capacity of 1 MTPA in the ML area of 259.64 ha. The environmental clearance finally granted for opening of Dumri Coal Mine Project of M/s Hindalco Industries Ltd. vide letter no. J-11015/239/2008-IA-II (M) Pt., dated 6th November, 2019.

1.2 LOCATION

The lease area of Dumri coal mine covers land in villages: Pagar, Balia, Tunda and Pandu of Keredari Block of district Hazaribag (Jharkhand). The nearest township is Hazaribag located at a distance of about 40 KM from Dumri Coal Mine (DCM). The Hazaribag-Khelari State Highway-07 is about 3KM on the south of the coal block. The nearest railhead is "RAY" at about 40 KM on the Gomoh-Barkakana-Dehri-on-Sone loop line of South-Eastern railway. A new railway line connecting Hazaribag via mandu has been commissioned and block is at a distance of about 40 KM from the nearest offtake station which is Nawada/Khapariaon. The nearest airport of Ranchi is at distance of 120 KM. The project area is situated between the latitude 23^0 53' 31.998" N and 23^0 54' 30.848" N and longitude 85^0 03' 11.539" E & 85^0 05' 37.103" E. The site is well connected by road and about 8 KM away from Keredari Block Office. It is a barren area and coal mine has not yet operational.

1.3 SCOPE OF WORK

M/s Hindalco Industries Ltd, Hazaribag, approached CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad for conducting the environmental study for one year i.e. 2020-2021 having following objectives:

- Environmental study of Air, Water, Noise and Soil of the core and buffer zone.
- The Environmental monitoring will be conducted on seasonal basis.
- Advice into the adoption of necessary control measures.
- Land use pattern study will be done once in a year and report will be submitted separately.
- Preparation of Environmental Statement.

The detailed studies with respect to air, water and noise will be carried on seasonal basis in the year 2020-21 while soil samples, for the adjoining mining area, will be collected once in a year and analyzed in the CSIR-CIMFR laboratory.

2.0 REGIONAL GEOLOGY

The North Karanpura Coalfield forms a prominent east-west trending valley between Hazaribag plateau in the north and Ranchi plateau in the south. The Aswa pahar in the south-east separates in North and South Karanpura Coalfields by east west elongated metamorphic patch. However, they are interconnected near Bachra and Hindegir village by a narrow tongue of Talchir outcrops. On the eastern side, North Karanpura Coalfield is separated from the West Bokaro Coalfield by a narrow stretch of metamorphic rocks having several outliers of Talchir Formation. In the west, it is separated by a stretch of about 20kms wide metamorphic belt from Auranga Coalfield.

Out of 1230 Sq. Km area of North Karanpura Coalfield, the coal bearing Formations viz. Karharbari, Barakar and Raniganj crop-out over an area of about 500 Sq. Km. The Karharbari formation is well developed in the south-central and eastern part of the coalfield. It contains only one seam, which occurs often in two to three sections. It comprises of very coarse grained, gritty sandstone, and at times, has silicified sandstones. The Barakar formation contains a number of coal seams and contributes the major bulk reserves of this coalfield. Five persistent coal seams have been established in the coalfield. The total coal column is more or less around 35-40 m in major part of the coalfield. Raniganj formation contains three to four coal seams which are generally shaly in nature and often impersistent.

2.1 LOCAL GEOLOGY

The Dumri block is the up-dip extension of Chatti-Bariatu block and is located in the northern part of the North Karanpura Coalfield. It is contiguous to Chatti-Bariatu block in the south. Keredari 'A' block in the east, Pachra block on the west. The northern boundary of the block is defined by hilly terrain and dense forest cover which is a part of the inaccessible Dumri area.

The Dumri block comprises Talchir, Karharbari, Barakar and Barren measures Formations belonging to Damuda sub-group of lower Gondwana Group. The Talchir formation overlies metamorphic rocks with an unconformity. The Karharbari and Barakar are the main coal bearing formations contain four major coal seams i.e. Seam-I, II, III and IV in ascending order. Besides these, six more thin coal horizons are also developed in the block. The Karharbari Formation is essentially composed of conglomerates and coarse to gritty arkosic sandstone varying in thickness from 7 to 139m. The strata are very hard and compact at places on account of localized silicification. The thickness of this formation generally varies from 7m to 136m with coaly horizons. Among them, the topmost horizon (K5) is more persistent than the other horizons. The Barakar Formation lies comfortably over the Karharbari Formation. This is the main coal bearing formation in the block and contains four major coal seams i.e. Seam-1 to IV and four thin coal seams i.e. IVA, IVB, IVC, IVD in ascending order and two local seams L1 between Seam III Top & III Bottom and L2 below seam I Bottom. This formation is composed of gritty to conglomeratic sandstone (basal part), medium to coarse grained sandstone with siltstone, shale and carbonaceous shale. Among the four coal seams, seam-I Middle, II Bottom & IV Top are the thickest. The maximum thickness of Barakar Formation as intersected in boreholes is 129m. The Barren Measure Formation lie conformably over the Barakar Formation and is characterized by fine grained sandstone, shale and sandy shale. As per borehole records its thickness varies from 15m to 20m.

A dolerite dyke trending almost E-W and having roughly 4km length and a width of approximately 12-25m passes through the Dumri block. The presence of this dyke has also been reported in Pachra block lying west of Dumri block. Stratigraphic sequence of Dumri block is given below in **Table 1**.

Table 1: Stratigraphic Sequence of Dumri Block

(As per Borehole Intersection)

Period	Group	Sub-group	Formation	Thickness Range (m)	Lithology
Recent	Lower Gondwana	Damuda	Alluvium	3.50-14	Detrital and Alluvial soil and subsoil
			Barren Measures	15-20	Dark shale, sandy shale and Interbanded shale, sandstone
			Barakar	18-129	Fine to coarse grained sandstone, shale, conglomerate, carbonaceous shale and coal seams
			Karharbari	7-136	Medium to coarse grained sandstone shale, silicified quartzitic rock and thin coal seams.
			Talchir	10	Green coloured shale, Boulder and conglomerate
			Metamorphics		Granite, gneisses and Quartzite

2.2 MINING SCENARIO

The Dumri Block is the up-dip extension of Chatti-Bariatu Block and opencast mining method has been adopted for extraction of coal within the mining lease area. The mining plan for proposed Dumri Coal Mine was approved for two pit opencast working. The main part of the reserves lies in the eastern part of the mining lease and it was named as Quarry-2. Meager coal reserves are available in the western part in form of three small pits named Quarry-1A, Quarry-1B and Quarry-1C. In approved revised mining plan, the sequence of operation was suggested to work Quarry-2 first followed by Quarry-1(comprising of 3 small pits). The anticipated life of the mine with peak production rate of 1.0 MTPA will be 46 years. Prior to the advancing of 1st OB bench, land will be cleared with dozers/graders and topsoil removed in line with the Environmental Management Plan. Coal is extracted by shovel dumper combination after blasting off the coal faces. Excavators with 2.5 cum bucket capacity are planned to be used for coal mining which

will load into 35T coal dumpers. The over burden will be transported by 35T dumpers to surface dumps over the coal bearing area within mining lease and later used for backfilling. The coal will be transported by 35T coal trucks to the proposed coal stockyard at the pit head and later coal will be transported through weigh-bridge to the nearest railhead.

Total extractable reserve of Dumri Coal Mine is 45.22 MT with an average grade of G11. The open cast mine worked by Shovel-Dumper combination with an average stripping ratio of 2.36 Cum/Te.

3.0 ENVIRONMENTAL SCENARIO IN THE MINING AREA

3.1 AIR ENVIRONMENT

Air pollution includes one or more contaminants (pollutants), in the outdoor atmosphere in such quantities and of such duration that may be injurious to human, plant or animal life. Once these contaminants enter in the atmosphere, either in gaseous form or as particulate matter, these cannot escape and keep circulating and deteriorating the air quality. Air pollution effects encompass those that are health related as well as those associated with damage to property or which cause decrease in atmospheric aesthetic feature. Dispersion of air pollutants from the source depends on micro-meteorological parameters of the area.

3.1.1 SOURCES OF AIR POLLUTION

Coal transportation, OB removal, drilling, blasting, haul road and movements of mining equipments will be the major sources of air pollution in the proposed mining area. Generally, dust generation will be of major concern during mining operation. NO_2 will be liberated in the time of blasting and during the movement of mining machineries. This coal contains very less sulphur (<0.72%) and as such the concentration of SO_2. In Indian coal, it is low, except Assam where sulphur content is high.

3.1.2 METHODOLOGY AND INSTRUMENTS USED

The methodology and instruments used for air quality monitoring and analysis are given in **Table 2** as below:

Table 2: Methodology and Instrument Used for Air Quality Analysis

Parameters	Method	Instrument
$PM_{2.5}$	IS-5182 (Part 23):2006 Gravimetric Method	Fine Particulate Sampler
PM_{10}	IS-5182 (Part 23):2006 Gravimetric Method	Fine Particulate Sampler
SO_2	IS-5182 (Part 2):2001 (Improved West & Gaeke Method)	Fine Particulate Sampler with gaseous attachment
NO_x	IS-5182 (Part 6):2006 (Jacob & Hochheiser modified Method)	Fine Particulate Sampler with gaseous attachment

3.1.3 AIR QUALITY

Air quality monitoring in core and buffer zone of the Dumri coal mine has been carried out in winter season for the year 2020-21 to assess the impact of mining activities on the ambient air quality. During the study, two sampling locations for ambient air quality had been fixed in buffer zone and two sampling locations in core zone area of the proposed mine on the basis of wind direction and other meteorological parameters. Details of sampling stations along with the source of air pollution are given in **Table 3** and shown in **Fig. 1.** The air quality at these locations is presented in **Tables 4 - 6**. The results show that the ambient air quality of the villages, in and around the mining site, is least affected as the mine is not initiated during the study period.

Table 3: Details of Air monitoring Locations

Station Code	Location	Source of Air Pollution
CORE ZONE		
CA-1	Within Mining lease area	Kachha road and natural activity.
CA-2	Balia Village	Household coal burning and vehicular movement, etc.
BUFFER ZONE		
BA-1	Chatti-Bariatu Village	Household coal burning and vehicular movement, etc.
BA-2	Tunda Village	Household coal burning and vehicular movement, etc.

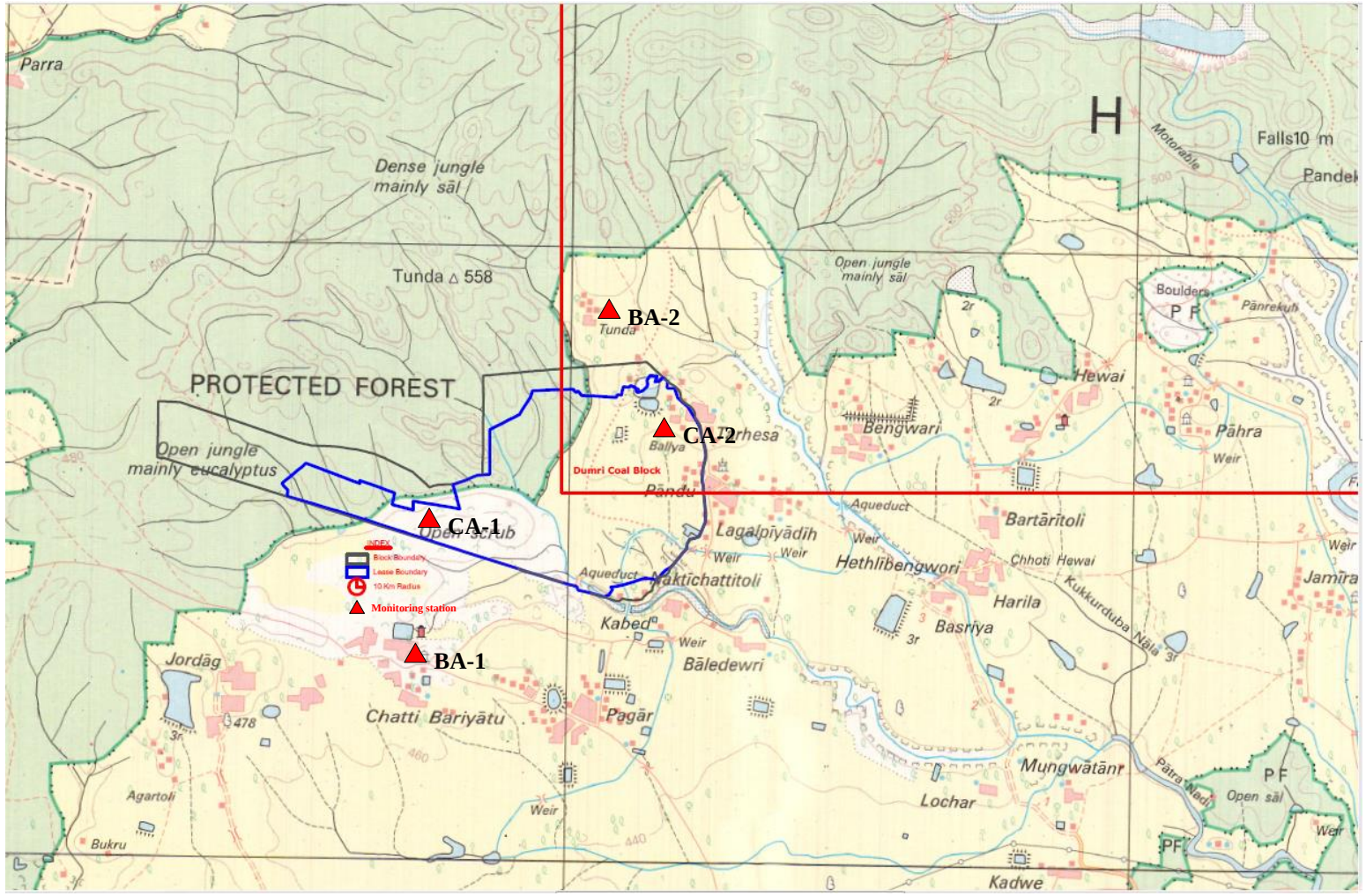

Fig. 1: Location of Air Monitoring Station in Core and Buffer Zone of Dumri Coal Mine

Table 4: Ambient Air Quality Report for Core Zone of Dumri Coal Mine

Sampling Code	Sampling Location	Season	Date of Sampling	Parameters (µg/m3)				Remarks
				$PM_{2.5}$	PM_{10}	SO_2	NO_2	
CA-1	Within Mining lease area	Winter	11/03/2021	33.6	58.6	12.5	20.8	
			12/03/2021	41.9	59.9	14.1	19.5	
CA-2	Balia Village	Winter	15/03/2021	53.3	87.7	17.9	22.9	
			16/03/2021	52.9	81.7	20.6	27.6	
Standards as per NAAQS-2009				**60**	**100**	**80**	**80**	

Table 5: Ambient Air Quality Report for Buffer Zone of Dumri Coal Mine

Sampling Code	Sampling Location	Season	Date of Sampling	Parameters (µg/m^3)				Remarks
				$PM_{2.5}$	PM_{10}	SO_2	NO_2	
BA-1	Chatti-Bariatu Village	Winter	09/03/2021	50.0	85.2	23.3	28.2	
			10/03/2021	47.0	74.4	22.0	29.2	
BA-2	Tunda Village	Winter	13/03/2021	51.4	67.8	19.7	20.4	
			14/03/2021	40.2	64.9	18.1	21.5	
Standards as per NAAQS-2009				**60**	**100**	**80**	**80**	

Table 6: Heavy Metal Concentration in PM_{10}

Sampling Code	Station	Pb	As	Ni	Cr	Hg
Core Zone		**(µg/m^3)**				
CA-1	Within Mining lease area	0.105	0.002	0.011	0.009	BDL
CA-2	Balia Village	0.136	0.003	0.012	0.012	BDL
Buffer Zone						
BA-1	Chatti-Bariatu Village	0.126	0.004	0.018	0.018	BDL
BA-2	Tunda Village	0.118	0.002	0.012	0.015	BDL
Standard		**1.000***	**0.006****	**0.020****	**-**	**-**

**** 24 hours ** Yearly Average BDL – Below Detection Limit***

3.1.4 RESULTS AND DISCUSSIONS

During winter season, $PM_{2.5}$ concentration level at near proposed mine infrastructure area within core zone was found from 33.6 $\mu g/m^3$ to 41.9 $\mu g/m^3$ and concentration of PM_{10} was found from 58.6 $\mu g/m^3$ to 59.9 $\mu g/m^3$. At Balia Village, the $PM_{2.5}$ concentration was found from 52.9 $\mu g/m^3$ to 53.3 $\mu g/m^3$ and the concentration of PM_{10} was found from 81.7 $\mu g/m^3$ to 87.7 $\mu g/m^3$. In the core zone, all the $PM_{2.5}$ and PM_{10} values are within the threshold value i.e. 60 $\mu g/m^3$ for $PM_{2.5}$ and 100 $\mu g/m^3$ for PM_{10} as per the guideline of National Ambient Air Quality Standard (NAAQS), 2009 around the entire sampling sites. Concentration of SO_2 and NO_2 are also found within the limit of 80 $\mu g/m^3$as per the guideline of NAAQS, 2009 in the sampling sites of core zone of the proposed mine.

During winter season, the $PM_{2.5}$ concentration at Chatti-Bariatu Village in buffer zone was found from 47.0 $\mu g/m^3$ to 50.0 $\mu g/m^3$ and the concentration of PM_{10} was found from 74.4 $\mu g/m^3$ to 85.2 $\mu g/m^3$. At Tunda Village, the $PM_{2.5}$ concentration was found from 40.2 $\mu g/m^3$ to 51.4 $\mu g/m^3$ and the concentration of PM_{10} was found from 64.9 $\mu g/m^3$ to 67.8 $\mu g/m^3$. In the buffer zone both the concentration levels are within the threshold value i.e. 60 $\mu g/m^3$ for $PM_{2.5}$ & 100 $\mu g/m^3$ for PM_{10} as per the guideline of NAAQS, 2009. Concentration of SO_2 and NO_2 are also found within the limit 80 $\mu g/m^3$as per the guideline of NAAQS, 2009 in all the sampling sites of buffer zone of the proposed mine.

The concentration of Lead (Pb), Arsenic (As), Nickel (Ni), Chromium (Cr) and Mercury (Hg) in PM_{10} are found below the permissible limit in core and buffer zone of the proposed mine.

3.2 WATER ENVIRONMENT

Water is one of the most essential natural resources for sustaining life and it is likely to become critically scare in the coming decades, due to continuous increase in its demands, rapid increase in population and expanding economy of the country. Variation in climatic characteristics both in space and time are responsible for uneven distribution of precipitation in India.

The diversity of climates, ecosystems, land uses and topographies greatly influences the design of environmental monitoring programs. Social factors have also become important elements in environmental management. Best practice for each site is therefore governed by these regional physical and social factors.

3.2.1. SOURCES OF WATER POLLUTION

Mine Water

The mine water is to be a probable source of water pollution during the active mining operation. The mine water, which will be mainly rain water and ground water seepage, will used for industrial purposes like dust suppression by water tankers in haul roads, approach roads, stockyards and watering of plants in the overburden dumps & office premises.

Domestic Effluents/Sewage

There are minimum housing facilities within the mining lease (ML) area for essential services. The domestic wastes from these houses are led to septic tanks. As the domestic waste water is minimum, the possibility of pollution is remote/insignificant. However, proper care has been taken up in the shelters area of inhabitants for sewage discharge.

Surface water

The surface water quality is likely to be affected with higher load of suspended solids as wash off from active dumps, soil erosion from soil and roads, and pumping out mine water to water channels.

Ground water

Ground water pollution can take place only if dumps and stock piles contain harmful chemical substances, which may get leached by precipitation of water and percolate to the ground water table, thus causing pollution. The chemical analysis of active OB soil and their proper management will restrict the water pollution by the management.

3.2.2 INSTRUMENTS USED

a) pH and Conductivity meter (Thermo)
b) Ion Meter (Thermo),
c) COD Analyser (Hach),
d) BOD Analyser (WTW),
e) Water Analysis Kit, (HACH, DR - 2000)
f) Microwave Digestion (Anton-Paar)
g) UV-VIS Spectrophotometer (Simazdo)
h) Atomic Absorption Spectrophotometer (Varian)
i) Ion Chromatograph (Dionex/Metrohm)
j) Flame Photometer
k) ICP-MS (Perkin Elmer)

3.2.3 WATER QUALITY OF THE AREA

To assess the water quality of the proposed mine area ground water and surface water in the core and buffer zone were collected and analysed. There is no mine water effluent in the core zone as it is a proposed mine and mining operation is not started. To assess the water quality of the area water samples from nine locations were collected during winter season (March, 2021). Details of sampling locations for water quality monitoring in and around proposed Dumri coal mine are given in **Table 6** and shown in **Fig. 2.**

Table 6: Sampling locations for water quality study

Sample Code	Sample Type	Description	Sampling Site	Remarks
GW-1	Ground water	Drinking water	Within mining lease	Core Zone
GW-2	Ground water	Drinking water	Chatti-Bariatu Village	Buffer Zone
GW-3	Ground water	Drinking water	Balia Village	Core Zone
GW-4	Ground water	Drinking water	Pandu Village	Buffer Zone
GW-5	Ground water	Drinking water	Pagar Village	Buffer Zone
GW-6	Ground water	Drinking water	Tunda Village	Buffer Zone
SW-1	Surface water	Baldeori Nala	Upstream of mine	Core Zone
SW-2	Surface water	Nala-A	Mine site	Core Zone
SW-3	Surface water	Baldeori Nala	Downstream of mine	Buffer Zone

The water samples were collected in one-liter narrow-mouthed pre-washed polyethylene bottles. For heavy metal analysis, 100 ml of samples were acidified with HNO_3 and preserved separately. Temperature, electrical conductivity (EC), pH and DO values were measured in the field using a portable conductivity and pH meter. The other parameters are measured in the geochemical laboratory at CSIR-CIMFR, Dhanbad following the

standard methods prescribed in APHA (2017). The turbidity has been determined in pre-filtered sample by turbidity meter. In the laboratory, the water samples were filtered through 0.45 μm Millipore membrane filters to separate suspended particles. Acid titration method was used to determine the concentration of bicarbonate (APHA 2017). Major anions (F, NO_3 and SO_4,) were analysed on UV-VIS spectrophotometer. Major cations (Ca and Mg) were measured by titrametric method and Na and K by flame photometer. The trace metals were analysed on ICP-AES.

3.2.4 RESULTS AND DISCUSSIONS

The physico-chemical characteristics of the analysed drinking and surface water is presented in **Table 7 to 10** along with the prescribed standards. The water quality of the area is discussed in the following paragraphs:

Drinking Water Quality Assessment:

To assess the status of drinking water quality of Dumri coal mine area, six ground water samples were collected from hand pump as well as dug well in March, 2021 and analysed for parameters as per the drinking water standards. The hydro-chemical parameters of the groundwater of the study area were compared with the prescribed limit of Indian Standard for drinking water (BIS 2012) to assess the suitability for drinking and public health purposes (**Table 7 to 9**). The analytical results show that most of the analysed parameters are well within desirable limits and water is potable for drinking uses. pH of the analysed groundwater are found well within the safe limit of 6.5-8.5, prescribed for drinking water by BIS (2012). The turbidity is one of the important physical parameters for water quality defining the presence of suspended solids in water, which causes the muddy or turbid appearance of water body. The consumption of high turbid water may cause a health risk as excessive turbidity can protect pathogenic microorganisms from effects of disinfectants and also stimulate the growth of bacteria during storage. In the study area the turbidity in the groundwater are found below the recommended value of 5 NTU. The total dissolve solids (TDS) value in all the samples is lower than the acceptable limit of 500mg/l and the permissible limit in the absence of alternate sources of 2000mg/l.

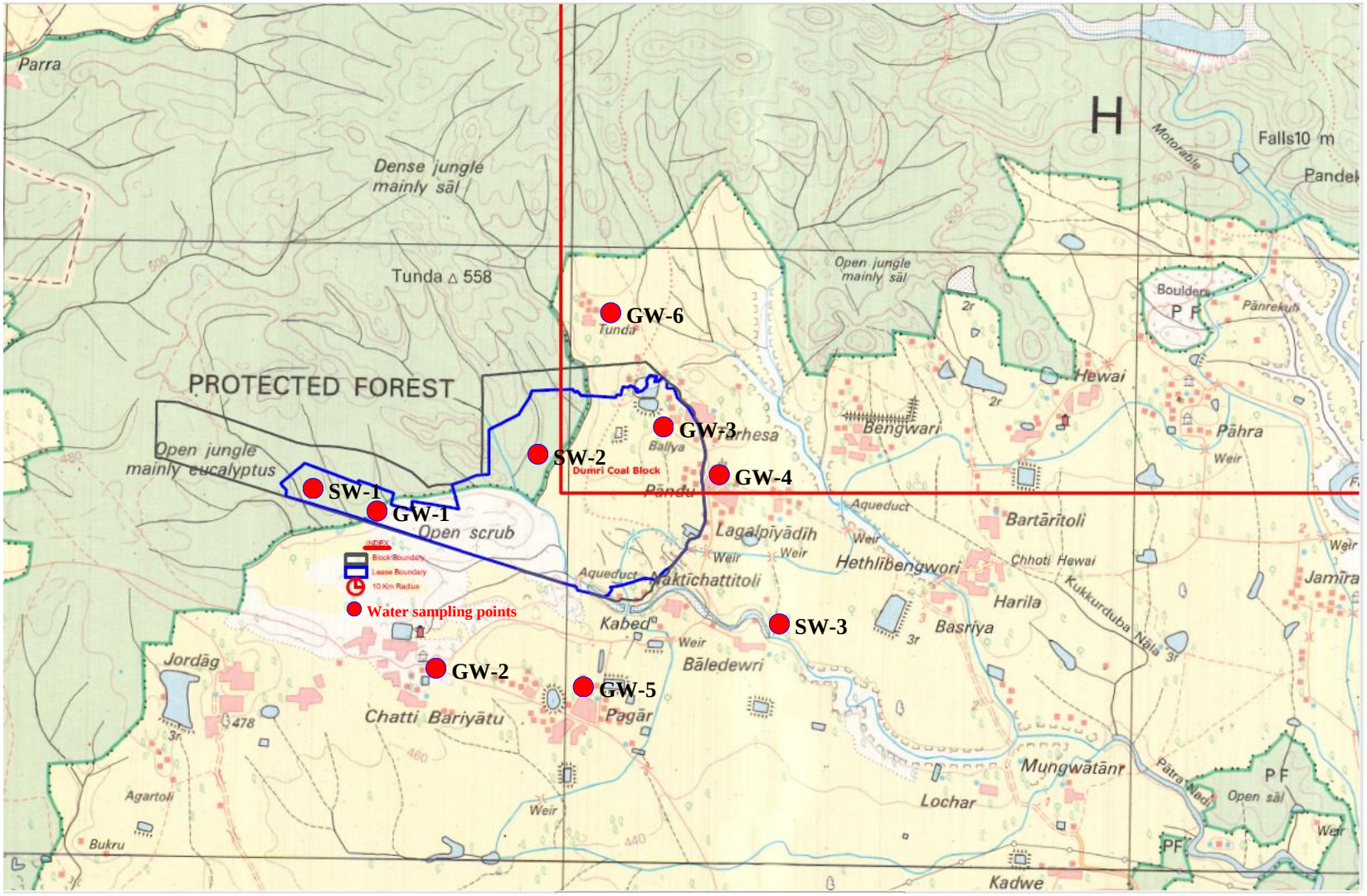

Fig. 2: Location of Water Sampling Points in Core and Buffer Zone of Dumri Coal Mine

The Total hardness (TH) value in all the samples (Except GW-1 and GW-5) is slightly higher than acceptable limit of 200mg/l but lower than the permissible limit in the absence of alternate sources i.e 600mg/l. In all of the samples, the concentration of Ca, Mg, SO_4 and F are also found well within the permissible limit for drinking uses (Except Ca in GW-1). In all of the samples, the concentration of NO_3 are also found well within the permissible limit for drinking uses (Except in GW-3 & GW-5). Heavy metal analysis in the groundwater samples indicated that all the analyzed heavy metals like As, Cd, Cr, Pb, Zn, Mn and Fe are found either below the detection limit or less than the acceptable limit for drinking water.

Surface Water Quality:

The analytical results of physico-chemical analysis of surface water samples collected from Nala-A within the mine site as well as upstream and downstream of Baldeori Nala has been given in **Table 10**. To assess the quality of the surface water resource the results has been compared with the prescribed surface water standards IS-2296 for Class 'C' water (tolerance limit for stream water used drinking water sources with conventional treatment followed by disinfection). It can be seen that pH of the water is slightly alkaline in nature and found well within the prescribed limit of 8.5. In general, the total dissolved solids values and other analysed parameters are found well within the threshold values. Concentration of sulphate varies between 9.0 and 14.3 mg L^{-1} and is well below the prescribed value of 400 mg L^{-1} (IS-2296). The level of TSS, TDS and DO in the river water were found within threshold limit in comparison to IS:2296, surface waters Class-C. The concentrations of the analysed heavy metals in the surface water resource are also found within the prescribed limits. It shows that the surface water of the area is fit for its designated use as a drinking water source with conventional treatment followed by disinfection.

The calculated value of sodium adsorption ration (SAR) shows that the water is low saline and low alkali water (0.04 - 0.28) and can be used for irrigation in most soils and crops with little danger of the development of harmful levels of exchangeable sodium. The percent sodium (%Na) is varying from 17.46 to 38.09 and also found below the 60% recommended limit for irrigation uses.

Table 7: Ground Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Winter**
Project: Dumri Coal Mine	**Date of Sampling: 16.03.2021**
Name of the Sampling Station:	
GW-1: ***Ground Water, Mine site***	**GW-2:** ***Ground Water, Chatti Bariatu Village***

Sl. No.	**Parameters**	**Station Code**		**IS-10500: 2012**	
		GW-1	**GW-2**	**Acceptable Limit**	**Permissible Limit in the Absence of Alternate**
1.	Colour, Hazen units, Max	<5	<5	5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	6.96	6.30	6.5-8.5	No relaxation
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
5.	Turbidity, NTU, Max	0.29	7.29	1.0	5.0
6.	Total Dissolved Solid, mg/l, Max	426	280	500	2000
7.	Total Hardness (as $CaCO_3$)	216	146	200	600
8.	Chloride (as Cl), mg/l, Max	14	29	250	1000
9.	Calcium (as Ca), mg/l, Max	81.6	40.4	75	200
10.	Magnesium (as Mg), mg/l, Max	3.0	11.0	30	100
11.	Sodium (as Na), mg/l, Max	28.0	19.6	NS	NS
12.	Potassium (as K), mg/l, Max	0.9	10.2	NS	NS
13.	Sulphates (as SO_4), mg/l, Max	15.5	36.9	200	400
14.	Nitrate (as NO_3), mg/l, Max	13.6	1.45	45	No relaxation
15.	Fluorides (as F), mg/l, Max	0.56	3.50	1.0	1.5
16.	Total Alkalinity, mg/l, Max	324	276	200	600
17.	Mineral Oil, mg/l, Max	<0.001	<0.001	0.5	No relaxation
18.	Iron (as Fe), mg/l, Max	0.004	0.07	0.3	No relaxation
19.	Manganese (as Mn), mg/l, Max	0.003	0.009	0.10	0.30
20.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	0.01	0.05
21.	Cadmium (as Cd), mg/l, Max	<0.001	0.002	0.003	No relaxation
22.	Lead (as Pb), mg/l, Max	0.005	0.006	0.01	No relaxation
23.	Copper (as Cu), mg/l, Max	0.002	0.005	0.05	1.5
24.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	0.002	0.003	0.05	No relaxation
25.	Selenium (as Se), mg/l, Max	<0.001	0.002	0.01	No relaxation
26.	Silver (as Ag), mg/l, Max	<0.001	<0.001	-	-
27.	Zinc (as Zn), mg/l, Max	0.154	0.207	5	15
28.	Nickel (as Ni), mg/l, Max	<0.001	0.002	0.02	No relaxation

NS: *Not Specified,*

Table 8: Ground Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Winter**
Project: Dumri Coal Mine	**Date of Sampling: 16.03.2021**
Name of the Sampling Station:	
GW-3: ***Ground Water, Balia Village***	**GW-4:** ***Ground Water, Pandu Village***

Sl. No.	**Parameters**	**Station Code**		**IS-10500: 2012**	
		GW-3	**GW-4**	**Acceptable Limit**	**Permissible Limit in the Absence of Alternate**
1.	Colour, Hazen units, Max	<5	<5	5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	6.73	6.90	6.5-8.5	No relaxation
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
5.	Turbidity, NTU, Max	0.18	4.79	1.0	5.0
6.	Total Dissolved Solid, mg/l, Max	452	346	500	2000
7.	Total Hardness (as $CaCO_3$)	194	188	200	600
8.	Chloride (as Cl), mg/l, Max	40	58	250	1000
9.	Calcium (as Ca), mg/l, Max	47.9	62.3	75	200
10.	Magnesium (as Mg), mg/l, Max	18.1	7.9	30	100
11.	Sodium (as Na), mg/l, Max	30.0	21.6	NS	NS
12.	Potassium (as K), mg/l, Max	38.0	6.1	NS	NS
13.	Sulphates (as SO_4), mg/l, Max	33.2	13.6	200	400
14.	Nitrate (as NO_3), mg/l, Max	68.5	9.0	45	No relaxation
15.	Fluorides (as F), mg/l, Max	0.17	0.41	1.0	1.5
16.	Total Alkalinity, mg/l, Max	192	204	200	600
17.	Mineral Oil, mg/l, Max	<0.001	<0.001	0.5	No relaxation
18.	Iron (as Fe), mg/l, Max	0.032	0.011	0.3	No relaxation
19.	Manganese (as Mn), mg/l, Max	0.004	0.002	0.10	0.30
20.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	0.01	0.05
21.	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	0.003	No relaxation
22.	Lead (as Pb), mg/l, Max	0.005	0.006	0.01	No relaxation
23.	Copper (as Cu), mg/l, Max	0.006	0.002	0.05	1.5
24.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	<0.001	<0.001	0.05	No relaxation
25.	Selenium (as Se), mg/l, Max	<0.001	<0.001	0.01	No relaxation
26.	Silver (as Ag), mg/l, Max	<0.001	<0.001	-	-
27.	Zinc (as Zn), mg/l, Max	0.232	0.217	5	15
28.	Nickel (as Ni), mg/l, Max	0.003	0.001	0.02	No relaxation

NS: *Not Specified,*

Table 9: Ground Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Winter**
Project: Dumri Coal Mine	**Date of Sampling: 16.03.2021**
Name of the Sampling Station:	
GW-5: ***Ground Water, Pagar Village***	**GW-6:** ***Ground Water, Tunda Village***

Sl. No.	**Parameters**	**Station Code**		**IS-10500: 2012**	
		GW-5	**GW-6**	**Acceptable Limit**	**Permissible Limit in the Absence of Alternate**
1.	Colour, Hazen units, Max	<5	<5	5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
3.	pH	6.44	6.45	6.5-8.5	No relaxation
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
5.	Turbidity, NTU, Max	0.17	0.01	1.0	5.0
6.	Total Dissolved Solid, mg/l, Max	471	258	500	2000
7.	Total Hardness (as $CaCO_3$)	238	138	200	600
8.	Chloride (as Cl), mg/l, Max	88	8	250	1000
9.	Calcium (as Ca), mg/l, Max	71.5	40.4	75	200
10.	Magnesium (as Mg), mg/l, Max	14.5	9.1	30	100
11.	Sodium (as Na), mg/l, Max	37.5	13.9	NS	NS
12.	Potassium (as K), mg/l, Max	28.5	0.7	NS	NS
13.	Sulphates (as SO_4), mg/l, Max	53.1	18.2	200	400
14.	Nitrate (as NO_3), mg/l, Max	61.4	21.4	45	No relaxation
15.	Fluorides (as F), mg/l, Max	2.06	1.07	1.0	1.5
16.	Total Alkalinity, mg/l, Max	332	200	200	600
17.	Mineral Oil, mg/l, Max	<0.001	<0.001	0.5	No relaxation
18.	Iron (as Fe), mg/l, Max	0.024	0.012	0.3	No relaxation
19.	Manganese (as Mn), mg/l, Max	0.002	0.003	0.10	0.30
20.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	0.01	0.05
21.	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	0.003	No relaxation
22.	Lead (as Pb), mg/l, Max	0.002	0.003	0.01	No relaxation
23.	Copper (as Cu), mg/l, Max	0.005	0.003	0.05	1.5
24.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	0.004	<0.001	0.05	No relaxation
25.	Selenium (as Se), mg/l, Max	<0.001	<0.001	0.01	No relaxation
26.	Silver (as Ag), mg/l, Max	<0.001	<0.001	-	-
27.	Zinc (as Zn), mg/l, Max	0.252	0.224	5	15
28.	Nickel (as Ni), mg/l, Max	0.002	0.004	0.02	No relaxation

NS: *Not Specified,*

Table 10: Surface Water Quality Data of Dumri Coal Mine

Area: Core Zone/Buffer Zone	**Season: Winter**
Project: Dumri Coal Mine	**Date of Sampling: 16.03.2021**
Name of the Sampling Station:	
SW-1 - Surface Water, Baldeori Nala U/S of mine site	
SW-2 - Surface Water, Nala-A of mine site	
SW-3 - Surface Water, Baldeori Nala D/s of mine site	

Sl. No.	Parameters	Station Code			(IS: 2296)* Surface Waters Class "C" Tolerance Limits
		SW-1	SW-2	SW-3	
1.	Colour, Hazen units, Max	<5	<5	<5	300
2.	Odour	#	#	#	#
3.	pH	7.56	7.44	7.45	6.5-8.5
4.	Dissolved Oxygen, mg/l, Min.	7.65	9.46	8.28	4
5.	BOD (3days at 27°C), mg/l, Max	6.85	0.81	4.62	3
6.	Total Dissolved Solid, mg/l, Max	242	308	318	1500
7.	Oil & Grease, mg/l, Max	<0.1	<0.1	<0.1	0.1
8.	Total Hardness (as $CaCO_3$), mg/l, Max	124	126	120	NS
9.	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.005
10.	Chloride (as Cl^-), mg/l, Max	10.0	28.0	32.0	600
11.	Sulphates (as SO_4^{--}), mg/l, Max	9.7	9.0	14.3	400
12.	Nitrate (as NO_3), mg/l, Max	0.9	0.9	1.1	50
13.	Fluorides (as F), mg/l, Max	0.67	1.50	0.87	1.5
14.	Calcium (as Ca), mg/l, Max	32.0	32.0	31.1	NS
15.	Magnesium (as Mg), mg/l, Max	10.8	11.2	10.3	NS
16.	Sodium (as Na), mg/l, Max	18.8	40.1	45.8	NS
17.	Potassium (as K), mg/l, Max	1.0	5.3	7.0	NS
18.	Copper (as Cu), mg/l, Max	0.002	0.003	0.004	1.5
19.	Iron (as Fe), mg/l, Max	0.032	0.035	0.046	50
20.	Manganese (as Mn), mg/l, Max	0.002	0.003	0.003	NS
21.	Zinc (as Zn), mg/l, Max	0.278	0.284	0.294	15
22.	Arsenic (as AS), mg/l, Max	<0.001	<0.001	<0.001	0.2
23.	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	<0.001	0.01
24.	Lead (as Pb), mg/l, Max	0.004	0.007	0.006	0.1
25.	Hexavalent Chromium (as Cr^{6+}), mg/l, Max	<0.001	0.003	0.002	0.05
26.	Selenium (as Se), mg/l, Max	<0.001	<0.001	<0.001	0.05
27.	Percent Sodium (%)	17.46	33.27	38.09	NS
28.	Sodium Absorption Ratio	0.04	0.21	0.28	NS

: *Unobjectionable,* ***NS:*** *Not Specified,*

**** : Class "C"-*** *Drinking water source with conventional treatment followed by disinfection.*

3.3 NOISE ENVIRONMENT

Noise is undesirable and unpleasant sound produced by the vibration of bodies or molecules of the medium and propagates as a pressure perturbation. It disturbs people's work, sleep and communication. Its damages hearing and evokes other physiological reactions. It also disturbs the habitat of animals and birds in the surroundings. Mining is the third largest industry in terms of employment and the recent trends of mechanization has changed the working environment to noisy environment leading to higher sound levels.

3.3.1 SOURCES OF NOISE

Noise will be produced during mining at different levels by different equipments in the open cast mine are summarized in the **Table 11.**

Table 11: Noise Generating Mining Equipments

S. N.	Equipment / Operation	Noise level dB(A)
1.	Feeder breaker	82-100
2.	Dumpers	100-115
3.	Shovels	80-107
4.	Dozers	84-107
5.	Front End loader	83-101
6.	Electric motors, gear drivers, hopers, drilling & main pump	85-95
7.	Belt conveyer	90-92
8.	Drill	110-115

3.3.2 AMBIENT NOISE MONITORING LOCATIONS

The main objective of noise monitoring in the study area is to assess the present ambient noise levels in proposed project site & buffer zone due to regular activities and vehicular movement. A preliminary reconnaissance survey has been undertaken to identify the major noise generating sources in the proposed mining area.

Ambient noise level study at Dumri Mine was carried out in core as well as buffer zone. Two noise level monitoring location in core zone followed by two noise level monitoring locations in buffer zone were fixed-up as given in **Table 12** and shown in **Fig.3.**

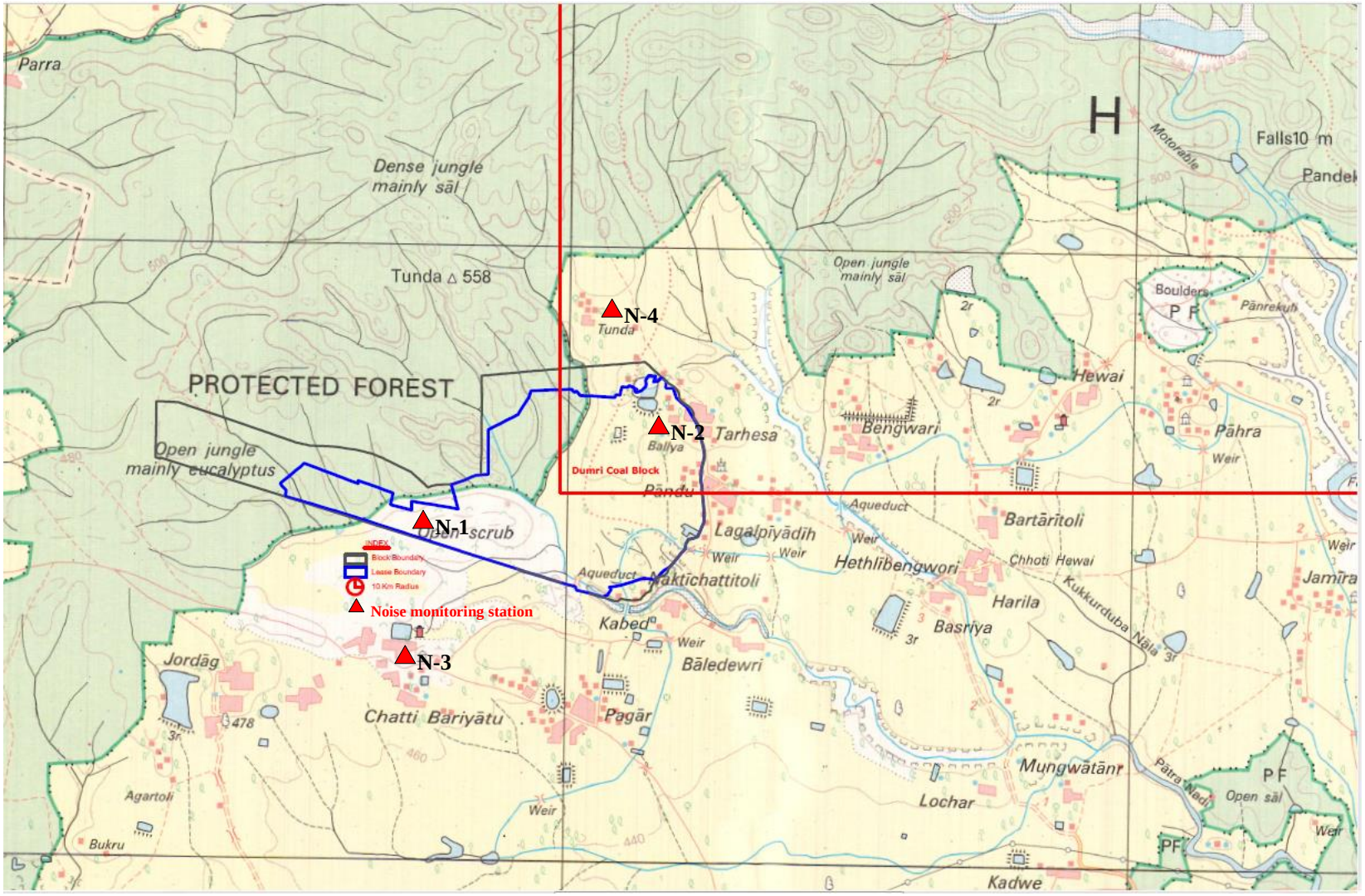

Fig. 3: Location of Noise Monitoring Station in Core and Buffer Zone of Dumri Coal Mine

Table 12: Details of Ambient Noise Monitoring Stations

S. No.	Location Code	Location Name/ Description	Present Land use
Core Zone			
1.	N-1	Within Mining lease area	Barren Land
2	N-2	Balia Village	Residential Area
Buffer Zone			
3.	N-3	Chatti Bariatu Village	Residential Area
4.	N-4	Tunda Village	Residential Area

3.3.3 INSTRUMENTS USED

Sound level study is carried by using Mip-oy Integrated Sound Level Meter Meeting IEC-179A measuring average peak and Low values in Day and Night time.

3.3.4 RESULTS AND DISCUSSION

Results are shown in **Table 13 and 14** for ambient noise levels of core and buffer zones during winter season. The average peak values at the nearby villages are found well below the residential areas standard values of 55 & 45 dB (A) for Day & Night respectively. In core zone maximum noise levels and average noise levels are also well within the prescribed limit of 75 & 70 dB (A) for Day & Night respectively.

Table 13: Noise Level in Core Zone of the Study Area

Date of Sampling:		Noise level dB(A) average					
09.03.2021 to 15.03.2021		Day Time (6.00AM to 10.00PM)			Night Time (10.00PM to 6.00AM)		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N-1	Within Mining lease area	30.5	52.1	43.3	27.8	42.0	34.6
N-2	Balia Village	32.4	65.5	52.6	28.1	50.8	42.1
Standards as per CPCB		75			70		

Table 14: Noise Level in Buffer Zone of the Study Area

Date of Sampling:		Noise level dB(A) average					
09.03.2021 to 15.03.2021		Day Time (6.00AM to 10.00PM)			Night Time (10.00PM to 6.00AM)		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N-3	Chatti Bariatu Village	32.7	68.6	50.5	31.2	52.1	38.7
N-4	Tunda Village	30.5	51.6	46.2	28.4	45.2	37.6
Standards as per CPCB		55			45		

4.0 CONCLUSION

On the basis of the data generated it has been found that the environmental scenario in and around mining area of proposed Dumri Coal Mine with respect to air, water and noise are well within the permissible limits.

5.0 MITIGATIVE MEASURES

Dumri Coal Mine has not commence its mining operation. Environmental monitoring data of winter season, suggest that all the studied parameters (air, water and noise) are within permissible limits. The mitigative measures to be adopted during mine operation is conferred below.

5.1 AIR POLLUTION CONTROL MEASURES

The mining operations and related activities are anticipated to increase the levels of particulate matter and gaseous pollutants to a limited extent. The proposed air pollution control measures are as follows:

I. Dust suppression systems (like water spraying) will be adopted where necessary at
   (a) Faces before and after blasting,
   (b) Faces while loading
II. Dust extraction systems will be used in drill machines, crushers/feeder breakers.
III. Dust suppression systems (like water spraying) would be adopted at roads used for transportation. Sprinklers would be installed along the roads to suppress the dust.

IV. Suitable dust extraction or suppression systems such as mist sprays with or without chemical will be provided at appropriate places for preventing dust pollution during handling and stockpiling of coal.

V. Transfer points of coal will be provided with appropriate hoods/chutes to prevent fugitive dust emission.

VI. To prevent air pollution due to airborne dust, tree belts will be planted around the mine site.

VII. Dust masks will be provided as safety measure to the workers, engaged at dust generation points like drills, loading/unloading points, crushers etc.

VIII. To ensure that NO_X level do not increase during mining operation good quality explosives will be used for which the oxygen balance will be checked from time to time. The expired explosives will not be used for which a strict vigil will be kept on the date of manufacture.

5.2 WATER POLLUTION CONTROL MEASURES

Proposed mitigative measures related to water pollution is as below-

I. Any wash off from the oil/grease handling area of workshop will be treated to remove oil and grease using oil trap. Waste oil/grease will be stored in leak proof containers.

II. The sewage waste will be treated in properly designed septic tanks and soak pits.

III. Check dams will be provided to prevent solids from wash off and screen if any from the mine related activities.

IV. Construction of garland drains around freshly excavated and dumped areas so that flow of water with loose material is prevented.

V. The coal does not have high sulphur content (<0.72%). It is anticipated that the mine water discharge will have no acid drainage. However, the mine water will be monitored regularly to keep a vigil and will be kept below permissible limits before any discharge.

5.3 NOISE POLLUTION CONTROL MEASURES

The following control measures will be adopted to keep the ambient noise levels below permissible limits 75 dB (A):

I. Provision and maintenance of thick belts to screen noise.
II. Avenue plantation within the project area to dampen the noise.
III. Proper maintenance of noise generating machinery including the transport vehicles will be ensured.
IV. To protect the workers from exposures to higher noise levels, the following measures will be adopted.
V. Provision of protective devices like ear muffs/ear plugs to those workers who cannot be isolated from the source of noise.
VI. Confining the noise by isolating the source of noise.
VII. Reducing the exposure time of workers to the higher noise levels.

6.0 RECOMMENDATIONS AND FOLLOW-UP ACTION

The study indicates that air quality around the proposed Dumri Coal Mine is found to be within the threshold limit as per the guideline of NAAQS, 2009. However, the mining activity was not in progress during the monitoring period. Water quality of the surrounding water resources are also not found polluted. For the best practice of proposed coal mining in future, Environmental Management System should always be considered with the following key recommendation and follow-up actions:

- ❖ Spraying of water on the haul roads for controlling the dust to its minimum level.
- ❖ Regular maintenance of the heavy earth moving machines.
- ❖ Mine water collection in settling tank before its discharge.
- ❖ Garland drainage should be made around the dumps.
- ❖ Reclamation and revegetation of overburden dumps should be done to control soil erosion, denudation of agricultural land and nearby riverine system, wetlands and to improves the aesthetics of the area.
- ❖ Dumps brought under biological reclamation should not be made active.
- ❖ The mine management would be implementing, these measures to make mining operation eco-friendly in this proposed Dumri coal mine of M/s Hindalco Industries Ltd, Hazaribag, Jharkhand.