ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENT MANAGEMENT PLAN

CLUSTER–3 MINE CONSTITUTED OF BAJABATI HILLOCKS OVER AN AREA OF 14.43 HECTARES

AT VILLAGE: BAJABATI

TAHASIL: DHARMASALA

DISTRICT: JAJPUR,

ODISHA

CATEGORY OF PROJECT: B1

FILE NO: SIA/OR/MIN/52502/2020

BASELINE MONITORING PERIOD: MARCH 2020 TO MAY 2020

PROJECT PROPOSED BY

TAHASILDAR, DHARMASALA, JAJPUR, ODISHA

ENVIRONMENT CONSULTANT

KALYANI LABORATORIES PVT.LTD.

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NABET ACC. NO: NABET/EIA/1922/RA0154

Document No. :KLPL-EIA(MM)B$_1$/2020-11		**Document Name: EIA/EMP Report For Bajabati hillocks (Cluster-3) over an area of 14.43 Hectares in Village Bajabati of DharmasalaTahasil, District JajpurOdisha**	
Issue. No.: 01	**Date: 11.06.2020**	**Copy No.: -**	**Copy Holders Name: -**

AMENDMENT PAGE
(F-0103)

SL	Page No.	Section / Clause / Para / Line (as Applicable	Date of Amendment	Amendment Made	Reasons of amendment	Signature of Person Authorizing Amendment
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ACKNOWLEDGEMENT

M/s Kalyani Laboratories Private Limited, Bhubaneswar is very much thankful to Dharmasala Tahasil, Jajpur for the confidence and trust placed on the organization for carrying out Environmental Impact Assessment (EIA) study For Bajabati Hillocks (Cluster 3) over an area of 35.66 acres/ 14.43 Ha in village Bajabati, Dist: Jajpur, Odisha and formulating the Environmental Management Plan (EMP).

We also gratefully acknowledge the cooperation and assistance provided by concerned government authorities for collection of secondary information for the preparation of EIA/ EMP report.

Our sincere thanks to the local people of Bajabati and the nearby villages for their whole hearted cooperation and constant involvement during the entire field study without which the study would not have been possible.

UNDERTAKING

In Line with MoEF OM no. J – 11013/41/2006-IA.II (I) dated 4th Aug. 2009, we hereby give our undertaking for owning the content and information provided in the EIA/EMP report submitted for Public hearing of for Bajabati Hillocks (Cluster 3) over an area of 35.66 acres/ 14.43 Ha in village Bajabati, Dist: Jajpur, Odisha.

Tahasildar

Dharmasala

UNDERTAKING

In Line with MoEF OM no. J – 11013/41/2006-IA.II (I) dated 4th Aug. 2009, we hereby confirm that all standard Terms of Reference issued by SEIAA, Odisha vide letter no. 8318/SEIAAdated03.06.2020 for preparation of EIA/EMP report for Environment ClearanceofFor Bajabati Hillocks (Cluster 3) over an area of 35.66 acres/ 14.43 Ha in village Bajabati, Dist: Jajpur, Odishahas been complied with and data provided in the EIA/EMP report is factually correct.

The EIA/EMP report has been prepared by M/s Kalyani Laboratories Pvt. Ltd. (KLPL), Bhubaneswar. KLPL is a NABET accredited consultant for preparation of EIA/EMP report of Mining of Minerals vide NABET certificate No. NABET/EIA/1922/RA0154 valid till 28th April 2022.

For M/s Kalyani Laboratories Pvt. Ltd.

Name: Dr.DebasisBiswal

EIA Co-ordinator (Mining of Minerals)

ANNEXURE – VII

Declaration by Experts contributing to the EIA of Bajabati Hillocks (Cluster 3) over an area of 35.66 acres/ 14.43 Ha in village Bajabati, Dist: Jajapur,Odisha

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

EIA coordinator:

Name: Dr.DebasisBiswal

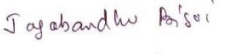
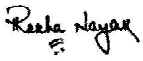
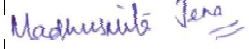
Signature and Date: .....

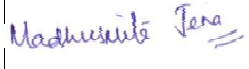
Period of involvement: December 2019 to May 2020

Contact information: Kalyani Laboratories Private Limited, Plot No.: 78/944, Millenium City, Pahala, Bhubaneswar

Functional area experts:

S. No.	Functional areas	Name of the expert/s	Involvement (period and task**)	Signature and date
1	AP*	Dr. DebasisBiswal	March 2020 to May 2020 Assessment of existing air quality, Impact of the project on ambient air, Suggested mitigation measures for air pollution	
2	WP*	Dr. RekhaNayak	March 2020 to May 2020 Assessment of existing water quality, Impact of the project on surface and ground water quality, Suggested mitigation measures for minimizing the impact	

3	ISW/HW	Dr. DebasisBiswal	March 2020 to May 2020 Assessment of waste generated from the project, Suggested waste management practices. Dumping of waste and dump management practices	
4	SE*	Mr. JagabandhuBisoi	March 2020 to May 2020 Baseline SE study, Data compilation and assessment. Impact of the project on SE status of the area. Formulation of CER plan,	
5	EB*	Dr. RekhaNayak	March 2020 to May 2020 Impact prediction and assessment of the project on biological environment. Comparisons of primary and secondary ecological data	
		Dr. Madhusmita Jena	March 2020 to May 2020 Baseline field data collection of related to ecology of the area.	
6	HG*	Mr. S.C. Nayak	March 2020 to May 2020 Hydrogeological feature of the area. Ground water depth and impact of project on ground water of the area.	
7	AQ*	Dr. DebasisBiswal	March 2020 to May 2020 Air quality modeling utilizing the area source model. Prediction of ground level concentration of the dust. Suggesting suitable mitigation measure.	
8	Noise*	Mr. S.C. Nayak	March 2020 to May 2020 Ambient noise study of the area. Incremental noise generation due to	

			plantoperation and impact of the noise due to the project.	
9	LU*	Mr. SahilSood	March 2020 to May 2020 Preparation of land use map based on satellite imagery. Land use classification and analysis. Impact prediction of the project on the surrounding land environment.	
10	RH*	Dr. DebasisBiswal	March 2020 to May 2020 Identification of the Risk related to the mining activities. Preparation of emergency disaster management plan. Plan for supply of safety equipment for the worker.	
11	SC	Dr. Madhusmita Jena	March 2020 to May 2020 Soil monitoring, Seconadary data collection on soil type, Soil management practices, Utilization of topsoil	

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

I, Dr.Debasis Biswal, hereby, confirm that the above mentioned experts prepared the EIA of Bajabati Hillocks (Cluster 3) over an area of 35.66acres/ 14.43 Ha in village Bajabati, Dist: Jajpur, Odisha. I also confirm that EIA Coordinator (EC) has gone through the report, and the consultant organization shall be fully accountable for any misleading information.

It is certified that no unethical practices, plagiarism involved in carrying out the work and external data / text has not been used without proper acknowledgement while preparing this EIA report.

Signature: .....

Name: Dr.DebasisBiswal

Designation: Managing Director

Name of the EIA consultant organization: **Kalyani Laboratories Private Limited**

NABET Certificate No.& Issue Date: NABET certificate No. NABET/EIA/1922/RA0154 valid till 28th April 2022.

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COMPLIANCE TO TERMS OF REFERENCE

Sl. No.	ToR points	Compliance
1	Year-wise production detail since 1993-94 should be given, clearly stating the highest production achieved in any one year prior to 1993-94.It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to1994. The production details need to submit since inception of mine duly authenticated by department of Mines & Geology ,State Government	1st EC required for the cluster
2	A copy of the document in support of the fact that the proponent is the rightful lessee of the mine should be given.	The lease area belongs Tahasil Administration of Dharmasala
3	All the document including approved mine plan.EIA and Public Hearing should be compatible with one another in terms of the mine lease area ,production levels, waste generation and its management ,mining technology etc and should be in the name of the lessee.	The EIA report prepared as per approved ToR
5	All corner coordinates of the mine lease area, superimposed on a high resolution imagery/Toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an imagery of the proposed area should clearly shows the land use and other ecological features of the study area (core and buffer zone).	Chapter 2, Section 2.2, Fig 2.1 & 2.2, Table 2.2
6	Information should be provided in survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and river and soil characteristics.	Chapter 3, Section 3.1, Fig 3.1
7	Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the state; land diversion for mining should have approval from state land use board or the concerned authority.	The mining area does not require any land diversion
8	It should be clearly stated whether the Proponent Company has a well laid down environment policy approved by its Board Of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed	Chapter10, Section 10.6

	operating process /procedures to bring into focus any infringement /deviation/violation of the environmental or forest norms/conditions? The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances/violations of environmental norms to the board of directors of the company and/or shareholder or stakeholders at large, may also be detailed in the proposed safeguard measures in each case should also be provided.	
9	Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study be detailed. The proposed safeguard measures in each case should also be provided	Chapter 7
10	The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc should be for the life of the mine/ lease period.	Chapter 3, Section 3.1
11	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, natural park, migratory routes of fauna, water bodies, human settlement and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phase and submitted impact, if any, of change of land use should be given.	Chapter 2, Section 2.4.5, Table 2.7 Chapter 3, Section 3.6Figure 3.5.
12	Detail of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R& R issues, if any, should be given.	No OB dumping will be carried out outside the lease area
13	A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area, In the event of any contrary claim by the Project Proponent regarding the status of forest, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forest, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.	No forest land involved within the cluster of mines

14	Status of forestry clearance for the broken up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. a copy of the forestry clearance should also be indicated	No forest land involved within the cluster of mines
15	Implementation status of recognition of forest right under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition Of Forest Right) Act, 2006 should be indicated.	No forest land involved within the cluster of mines
16	The vegetation in the RF/PF area in the study area with necessary details should be given	Chapter 3, Section 3.12, Table 3.26- 3.28
17	A study shall be got done to ascertain the impact of the Mining Project on Wildlife of the study area and details furnished. Impact of the project on wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implication and submitted.	Chapter 4, Section 4.5
18	Location of National parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/(existing as well as proposed), if any ,within 10 km of the mine lease should be clearly indicated, supported by a location map duly authenticated by chief wildlife warden. Necessary clearance as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the standing Committee of National Board of Wildlife and copy furnished.	Chapter 3, Section 3.12.7 Table 3.33
19	A detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the schedule of the fauna present, In case of any scheduled –I faunas found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Forest and Wildlife Department and detail furnished. Necessary allocation of funds for implementing the same should be made as per of the project cost.	Chapter 3, Section 3.11-3.13 Table 3.26 – 3.34
20	Proximity to area declared as 'Aravali Range', (attracting	No such area exists within

	court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed authorities, such as the SPCB or State Mining Department. Should be secured and furnished to the effect that the proposed mining activities could be considered.	the buffer zone of the project.
21	Similarly, for coastal project ,A CRZ map duly authenticated by one of the authorized agencies demarcating LTL,HTL,CRZ area ,location of the mine lease w.r.t CRZ ,coastal features such as mangroves ,if any should be furnished .(note : The Mining Projects Falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority)	No declared CRZ exists near the project
22	R&R Plan/compensation details for the project affected people (PAP) should be furnished. While preparing the R&R plan, the relevant State/National Rehabilitation &Resettlement Policy should be kept in view. In respect of SCs/STs and other weaker sections of the society in the study area ,a need based sample survey ,family-wise should be undertaken to assess their requirements and action programmes prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government . It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not .The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.	The project does not include any rehabilitation as no habitation exists within the cluster.
23	One season (non-monsoon) {i.e. March-May (Summer season); October-December (post monsoon season); December – February (winter season)]. Primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-wise in the EIA and EMP report .Site-specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downward direction and location of sensitive receptors. There should be at least one monitoring station within 500 m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.	Chapter 3, Section 3.7 – 3.13 Table 3.7 to 3.34

24	Air quality modelling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modelling should be provided. The air quality contour may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.	Chapter 4, Section 4.2.1, Table 4.4, 4.5, Figure 4.1
25	The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	Chapter 2, Section 2.6
26	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.	Water requirement for non domestic purpose will be sourced from the quarry stored water and drinking water will be sourced from ground water. Permission will be taken from CGWB, Odisha
27	Description of water conservation measures proposed to be adopted in the Project should be given, Details of rainwater harvesting proposed in the Project, if any, should be provided.	Chapter 4, Section 4.4.3
28	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required should be provided.	Chapter 4, Section 4.4
29	Based on actual monitored data, it may clearly be shown whether working will interest groundwater. Necessary data and documentation in this regard may be provided. In case the working will interest groundwater table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report inter-alia, shall include details of the aquifers present and Impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground and for pumping of ground water should also be obtained and copy furnished.	Chapter 2, Section 2.4.6
30	Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the	No seasonal or perennial nala passing through the project site.

	hydrology should be brought out.	
31	Information on site elevation, working depth, groundwater table etc. Should be provided both in AMSL and BGL. A schematic diagram may also be provided for the same.	Chapter 2, Section 2.4.6
32	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the Project. Phase-wise plan of plantation and compensatory attorestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and the species which are tolerant to pollution.	Chapter 4, Section 4.5.3, Table 4.9
33	Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, If contemplated (including action to be taken by other agencies such as State Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per India Road Congress Guidelines.	Chapter 4, Section 4.2.4, Table 4.6
34	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report..	Chapter 2, Section 2.8
35	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.	Chapter 2, Section 2.5.2
36	Occupational Health impacts of the Project should be anticipated and proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Chapter 4, Section 4.7

37	Public health implication of the Project and related activities for population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	Chapter 4, Section 4.7
38	Measures of socio economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Chapter 8, Table 8.1
39	Details environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any occupational health impacts besides other impacts specific to the proposed Project.	Chapter 10
40	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provision to implement the should be provide and incorporated in the final EIA/EMP Report of the Project.	Will be included after public hearing
41	Details of litigation pending against the project, if any, with direction / order passed by any Court of Law against the Project should be given.	No litigation is pending against the project
42	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Chapter 10, Section 10.8, Table 10.3
43	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Chapter 7
44	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	Chapter 8
45	Besides the above ,the below mentioned general points are also to be followed:- a) All documents to be properly referenced with index and continuous page numbering. b) Where data are presented in the Report especially in tables the period in which the data were collected and the sources should be indicated. c) Project Proponent shall enclose all the analysis/ testing reports of water, air soil, noise etc using the MoEF& CC / NABL accredited laboratories. All	Noted

	the original analysis/ testing report should be available during appraisal of the project. d) Where the documents provided are in a language other than English, an English translation should be provided. e) The Questionnaire for environmental appraisal of mining projects as devised earlier by the ministry shall also be filled and submitted. f) While preparing the EIA report, the instructions for the proponents and instructions for the Consultants issued by MoEF& CC vide O. M No J-11013/41/2006-IA. II (I) dated 4th August, 2009, which are available on the website of this ministry, should be followed. g) The consultant involved in the preparation of EIA/EMP report should be an accredited with Quality Council of India (QC)/ National Accreditation Board of Education and Training (NABET) and a certificate in this regard should be annexed in the EIA/EMP Report. Data provided by other organisation / laboratories including their status of approvals etc, should be specified .The consultant while presenting the project should be equipped with relevant data and information relating to the project and make a qualitative presentation. h) Changes, if any made in the basic scope and project parameters (as submitted in form-1 and the PFR for securing the TOR) should be brought to the attention of MoEF& CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing Changes in structure and content of the draft EIA/EMP (other than modification arising out of the P.H Process) will entail conducting the PH again with the revised documentation. i) As per the circular No. J-11011/618/2010-IA.II (I) dated 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the regional office of ministry of environment, forest	

	and climate change, as may be applicable. j) The EIA Report should also include (i) surface plan of the area indicating contour of main topographic features, drainage and mining area (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Building stone and road metals are the major requirement for construction industry. The mining of stone and road material comes under minor mineral mining. As per EIA Notification 2006 and subsequent amendments Environment clearance is mandatory for the entire mining project. As per the said notification the activities has been categories as Category B2 (lease area <25 Ha), B1 (Lease area 25-100 Ha) and A (>100 Ha). As per MoEF& CC notification S.O. 141(E) dt. 15th January, 2016 "A cluster shall be formed when the distance between the peripheries of one lease is less than 500 m from the periphery of other lease in a homogeneous mineral area.

The proposed project is a cluster of building stone and road material mines. The Cluster-3 mines consist of Bajabati hillocks located within a lateral distance of 500m from each other. This cluster comes under ownership of Tahasildar, Dharmasala. The cluster 3 mining lease for Buildng stone/ Road metal comprising 6nos. of lease areas covering a total mineralizedarea of 35.66Acres or 14.43Hectares located in village/Mouza Bajabati of TahasilDharmasala& District Jajpur, Odisha. It has been/ proposed that these quarry area are to be leased out to different intenders through auction. The auction process is in progress which includes the approval of Mining Plan and obtaining requisite statutory clearance from concerned authorities over each patch of lease area of the cluster.

1.2 PURPOSE OF THE REPORT

At present there are various quarry areas present within the cluster which were under operation. Now the mining operation has been closed due to requirement of Environment clearance. The present case comes under the purview of EIA notification, MoEF, Govt. of India, New Delhi dated 14th September 2006 and subsequent amendments.ThisEIA study has been carried out to assess the environmental, social and economic impacts of the project and formulate action plans to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options.

A systematic examination of both beneficial and adverse consequences of the project has been done and ensured that these impacts are taken into account during the project design.

1.3 IDENTIFICATION OF THE PROJECT & PROJECT PROPONENT

The Cluster-3 area belongs to the Sariat Sources under DharmasalaTahasil of Jajpur District. Small quarry leases within the Cluster-3 have either already been auctioned or to be auctioned by the Tahasildar, Dharmasala vide respective orders for each quarry lease area. The auction process is in progress over the cluster. The details of the quarry lease and project proponent has been given in the table below:

Table No.1.1 Details of the Project and Project Proponent

1. Name & Address of the Owner	Tahasildar, Dharmasala At: Dharmasala, Jajpur, Odisha
2. Particulars of the area	Name of the Quarry- Cluster-3 (Bajabati Hillocks) Building Stone/Road Metal Quarry. Area 35.66 acres or 14.43 hectares.
3. Period of Concession	10 years.
4. Mineral intended to be won	: Building stone/ Road metal.

1.4 BRIEF DESCRIPTION OF THE PROJECT (Nature, Size, Location of the Project and Its Importance to the Country, Region)

The cluster 3 lease consists of 6nos. of quarry leases of Bajabati hillock of village/Mouza Bajabati of TahasilDharmasala& District Jajpur, Odisha.Further Cluster-3 has been further sub divided to three sub-clusters, viz., Cluster-3 has been further sub divided to three sub-clusters, viz., Cluster- 3A comprising mineralised area over 9.18 Ha, Cluster-3B comprising mineralised area over 4.04 Ha and Cluster-3C comprising mineralised area over 1.21 Ha The total area is non-forest Govt. land as envisaged from the Land Schedule.

1.4.1 Accessibility:

The cluster is well accessible through NH 200 which is only 2 Km, SW from the boundary of the cluster area. NH-5 is located at a distance of 5 Km, E from the cluster. Haridashpur railway station is located at a distance of 4.5 Km, SSE from the cluster.

1.4.2 Location of the project:

The detail of the project location has been given in the table below:

Table No.1.2 Detail of the Project Location

<table>
<tr><th>Sl. No</th><th>Attributes</th><th>Details</th></tr>
<tr><td>1.</td><td>Plot / Survey / Khasra number</td><td>
<table>
<tr><th>Sl No</th><th>Khata No</th><th>Plot No.</th><th>Kisam</th></tr>
<tr><td>1</td><td>215</td><td>823(P)</td><td>Pahada</td></tr>
<tr><td>2</td><td>215</td><td>1050(P)</td><td>Pahada</td></tr>
<tr><td>3</td><td>215</td><td>823(P)</td><td>Pahada</td></tr>
<tr><td>4</td><td>215</td><td>75(P)</td><td>Pahada</td></tr>
<tr><td>5</td><td>215</td><td>823(P)</td><td>Patharachatana</td></tr>
<tr><td>6</td><td>215</td><td>1050(P)</td><td>Patharachatana</td></tr>
</table>
</td></tr>
<tr><td>2.</td><td>Village; Tehsil; District; State</td><td>Vill: Bajabati, Tahasil: Dharmasala, Dist: Jajpur, Odisha</td></tr>
<tr><td>3.</td><td>Surveyof India Topo Sheet number</td><td>73L/1 (Topomap attached)</td></tr>
<tr><td>4.</td><td>Latitude/ Longitude</td><td>Cluster 3 latitudes 20°45'46.74" N to 20°46'08.96" N and longitudes 86°06'04.77" E to 86°06'37.98" E.
Cluster-3A is bounded between the latitudes 20°45'46.74" N to 20°45'59.49" N and longitudes 86°06'25.03" E to 86°06'37.98" E,
Cluster-3B is bounded between latitudes 20°46'02.09" N to 20°46'08.96" N and longitudes 86°06'24.29" E to 86°06'36.77" E
Cluster-3C is bounded between latitudes 20°45'56.62" N to 20°46'00.72" N and longitudes 86°06'04.77" E to 86°06'09.42" E.
(Satelite Map attached)</td></tr>
<tr><td>5.</td><td>Maximum elevation above MSL</td><td>100 mRL</td></tr>
<tr><td>6.</td><td>Distance of nearest Highest Flood Level (HFL) from the project
boundary within the study area</td><td>3.0 Km</td></tr>
<tr><td>7.</td><td>Seismic Zone</td><td>Zone III</td></tr>
<tr><td>8.</td><td>Nearest railway station; Distance</td><td>Haridashpur railway station 4.5Km, SSE</td></tr>
<tr><td>9.</td><td>Nearest NH/SH</td><td>NH 200-2Km, SW,
NH -5, 5 Km, E</td></tr>
<tr><td>10.</td><td>Nearest Airport; Distance from nearest
Airport (in Km)</td><td>Bhubaneswar, 61 Km</td></tr>
<tr><td>11.</td><td>Nearest Town/City/District head quarter (Distance in Km)</td><td>Jajpur</td></tr>
<tr><td>12.</td><td>Village Panchayats, Zila Parishad, Municipal Corporation, Local Body</td><td>Dharmasala</td></tr>
</table>

13.	Reserved/ Protected Forest	Mahabinayak RF - 6.0 Km, S Kapilash RF - 17 Km, SW
14.	Nearest Eco-sensitive zone (Kapilash Sanctuary)	15Km, SW
15.	Nearest River	Brahamani River 2.5 Km, NNE
16.	State or national boundary	Nil
17.	Nearest Defense installation	Charbatia:29Km,S
18.	Nearest Habitation	Bajabati village:1.0Km, NE
19.	Near Hospital (Dharmasala Primary Health Centre): Nearest School (Bajabati Primary School):	3Km 0.5Km

1.4.3 Need of the Project and Importance to Country & Region

The proposed mining project is for excavation of building stone and road metal. This is the most important material for construction activities. The mining project will also provide employment to the local people. The applicant will allocate funds for the socio economic development of the area like medical facilities, domestic water supply & other social work. Further the state government will benefited from the project by collection of royalty from the lessee.

1.5 SCOPE OF STUDY AS PER THE REGULATORY SCOPING CARRIED OUT

The assignment for conducting Environment Impact Assessment / Environmental Management Plan Study (EIA/EMP) was awarded to M/s Kalyani Laboratories Pvt. Ltd., Bhubaneswar (QCI – NABET Accredited Consultant). The EIA/EMP report has been prepared based on the baseline data generated during the period of March 2020 to May 2020.

The study evaluates the prevailing baseline environmental conditions. The adverse impacts are identified and possible mitigation plan has been drawn in order to protect the ecological system.

1.6 SCOPE OF STUDY

The EIA/EMP study for Cluster 3 Mines is being prepared in accordance with the standard TOR issued by SEIAA, Odisha vide letter no. letter no 8318/SEIAA dated. 03.06.2020. Copy attached as **Annexure 1.** Preparation of a check list including the

details of type and class of information required developing an environmental impact assessment report.

1.7 STATUS OF LITIGATIONS

There are no litigations/ court cases pending against the project.

CHAPTER 2

PROJECT DESCRIPTION

2.1 TYPE OF PROJECT

The cluster 3mine of Dharmasala consists of Bajabati hillocks consists of 6nos of different mining leases located within a lateral distance of 500m from each other. This cluster 3 comes under ownership of Tahasildar, Dharmasala. Total mineralised area of 35.66Acres or 14.43 Hectares located in village/Mouza Bajabati of TahasilDharmasala& District Jajpur, Odisha. The individual lease area has been/ proposed to be leased out to different intenders through auction. The mining plan for Cluster-3 constituted Bajabati building stone quarry has been approved by The Deputy Directorate Mines, Jajpur Road Circle, Jajpur Road, vide memo no. 314 on dated 19.02.2020. (Copy attached **Annexure-2**)

The cluster 3 mines has been further sub divided to three sub-clusters, viz., Cluster-3A comprising mineralised area over 9.18 Ha, Cluster-3B comprising mineralised area over 4.04 Ha and Cluster-3C comprising mineralised area over1.21 Ha. The detail of individual lease area has been given in the table below.

Table 2.1: List of quarry leases of Cluster-3 (Bajabati Hillocks)

Name of sub-cluster	Sl. No	Name of Quarry lease	Village/Mouza	Area in Ac	Area in Ha
Cluster-3A	1	Bajabati Black Stone Quarry No.1	Bajabati	7.2	2.91
	3	Bajabati Black Stone Quarry No.3	Bajabati	6.5	2.63
	5	Bajabati Black Stone Quarry No.5	Bajabati	9	3.64
			Sub -Total	**22.7**	**9.18**
Cluster-3B	2	Bajabati Black Stone Quarry No.2	Bajabati	5	2.02
	6	Bajabati Black Stone Quarry No.6	Bajabati	5	2.02
			Sub -Total	**10.0**	**4.04**
Cluster-3C	4	Bajabati Black Stone Quarry No.4	Bajabati	3	1.21
			Sub -Total	**3.0**	**1.21**
			Total	**35.66**	**14.43**

The individual quarry lease areas of the hillocks under reference have either been auctioned or to be auctioned for long term quarry lease of 10 years for building stone/ Road metal by the Tahasildar, Dharmasala of Jajpur District, Odisha. Based on the auction and the surface plan provided by the auctioneer, the respective auction holders of individual quarry lease areas would obtain statutory clearances like approved mining plan and environmental clearance etc. from the concerned authorities before execution of the QL areas.

However, the quarry lease areas of Cluster-3 (Bajabti hillocks) are located within a distance of 500m. Therefore, as per Notification of MoEF&CC vide S.O. No. 3977(E), Appendix- XI, dated the 14th August, 2018; environmental clearance for the cluster is required to be obtained before getting Environmental clearances for individual auctioned quarry lease areas. As per the above Notification, Cluster- 3 (Bajabati hillocks) over total mineralized area of 35.66 Acres or 14.43 Hectares is categorized as 'B1' (>/= 25ha &</= 100ha) category for consideration of environmental clearance from State Environment Impact Assessment Authority, Odisha.

2.2 NEED OF THE PROJECT

The proposed project is for mining of minor minerals i.e. building stone and road material from the 6 nos of lease areas of Cluster 3. The building stone and road material is the major raw material for the civil construction work. The project will useful for excavation of stone in an environmental friendly manner. For construction purpose the total 1,80,000cum/annum building stone/road metal of the cluster-3 area will be dispatched to domestic end users.

2.3 LOCATION AND TOPOGRAPHY

Cluster-3 (Bajabati hillocks) is featured in the Survey of India Toposheet No. 73 L/1 and bounded between the latitudes 20°45'46.74" N to 20°46'08.96" N and longitudes 86°06'04.77" E to 86°06'37.98" E. Whereas, Cluster-3A is bounded between the latitudes 20°45'46.74" N to 20°45'59.49" N and longitudes 86°06'25.03" E to 86°06'37.98" E, Cluster-3B is bounded between latitudes 20°46'02.09" N to 20°46'08.96" N and longitudes 86°06'24.29" E to 86°06'36.77" E and Cluster-3C is bounded between latitudes 20°45'56.62" N to 20°46'00.72" N and longitudes 86°06'04.77" E to 86°06'09.42" E. The cluster-3 is located at a distance of 30 Km from District head quarters of Jajpur, and is at a distance of 82 Km from the state capital Bhubaneswar.

Cluster-3 (Bajabati Hillocks) is located within the revenue jurisdiction of Bajabati village under Dharmasala Tahasil of Jajpur district. The targeted area represents a hilly terrain comprising three Patches, viz., Cluster-3A, 3B & 3C with undulated topography. Cluster-3A

displays highest altitude of 80 mRL and lowest altitude of 35mRL, Cluster-3B displays highest altitude of 25mRL and lowest altitude of 20mRL & Cluster-3C displays highest altitude of 40mRL and lowest altitude of 35mRL. However, sparse vegetation exists within the Cluster-3 area with no human settlement.

The area has been surveyed through hand held GPS for obtaining the co-ordinates and RL's of the required points. However, the hillock/patch wise co-ordinates of the corner points featuring the targeted cluster-1 area arelisted in the satellite map and Surface Plan (**Figure 2.1& 2.2**).

Table No. 2.2 Co-ordination points of Cluster-3

Id	Longitude	Latitude
Cluster-3A (Bajabati)		
1	86°06'36.92"	20°45'56.88"
2	86°06'36.87"	20°45'56.58"
3	86°06'36.99"	20°45'55.91"
4	86°06'36.81"	20°45'55.82"
5	86°06'36.85"	20°45'55.27"
6	86°06'36.94"	20°45'54.91"
7	86°06'37.16"	20°45'54.45"
8	86°06'37.46"	20°45'54.04"
9	86°06'37.87"	20°45'53.61"
10	86°06'37.98"	20°45'52.87"
11	86°06'37.39"	20°45'53.02"
12	86°06'35.16"	20°45'50.30"
13	86°06'31.59"	20°45'46.74"
14	86°06'25.03"	20°45'48.13"
15	86°06'25.87"	20°45'52.99"
16	86°06'26.18"	20°45'52.90"
17	86°06'26.63"	20°45'55.77"
18	86°06'25.85"	20°45'55.97"
19	86°06'26.10"	20°45'56.29"
20	86°06'26.38"	20°45'56.52"
21	86°06'26.63"	20°45'56.89"
22	86°06'26.79"	20°45'57.27"
23	86°06'26.95"	20°45'57.68"
24	86°06'27.14"	20°45'58.21"
25	86°06'27.26"	20°45'58.74"
26	86°06'27.41"	20°45'59.49"
Cluster-3B (Bajabati)		
1	86°06'34.98"	20°46'06.63"
2	86°06'34.40"	20°46'06.44"
3	86°06'35.31"	20°46'05.77"

4	86°06'36.68"	20°46'04.95"
5	86°06'36.77"	20°46'04.52"
6	86°06'36.76"	20°46'04.16"
7	86°06'36.56"	20°46'04.14"
8	86°06'36.48"	20°46'03.66"
9	86°06'36.50"	20°46'03.40"
10	86°06'35.96"	20°46'02.52"
11	86°06'35.67"	20°46'02.16"
12	86°06'35.57"	20°46'02.22"
13	86°06'35.42"	20°46'02.48"
14	86°06'34.58"	20°46'02.14"
15	86°06'34.23"	20°46'02.09"
16	86°06'33.90"	20°46'02.12"
17	86°06'33.44"	20°46'02.21"
18	86°06'33.43"	20°46'02.42"
19	86°06'32.46"	20°46'03.07"
20	86°06'32.28"	20°46'02.97"
21	86°06'31.94"	20°46'03.15"
22	86°06'31.78"	20°46'03.21"
23	86°06'31.69"	20°46'03.31"
24	86°06'31.69"	20°46'03.61"
25	86°06'30.43"	20°46'03.90"
26	86°06'29.71"	20°46'04.03"
27	86°06'29.67"	20°46'04.42"
28	86°06'29.59"	20°46'04.75"
29	86°06'28.59"	20°46'04.90"
30	86°06'27.92"	20°46'04.83"
31	86°06'27.47"	20°46'05.05"
32	86°06'27.16"	20°46'05.50"
33	86°06'27.14"	20°46'05.64"
34	86°06'27.06"	20°46'05.70"
35	86°06'26.96"	20°46'05.73"
36	86°06'26.87"	20°46'05.61"
37	86°06'26.67"	20°46'05.74"
38	86°06'26.51"	20°46'05.83"
39	86°06'26.36"	20°46'05.90"
40	86°06'26.29"	20°46'05.94"
41	86°06'26.06"	20°46'06.05"
42	86°06'25.61"	20°46'06.25"
43	86°06'25.22"	20°46'06.41"
44	86°06'24.82"	20°46'06.44"
45	86°06'24.40"	20°46'06.91"
46	86°06'24.34"	20°46'07.49"
47	86°06'24.29"	20°46'07.97"

48	86°06'24.40"	20°46'08.24"
49	86°06'24.72"	20°46'08.96"
50	86°06'28.75"	20°46'08.85"
51	86°06'31.68"	20°46'07.80"
Cluster-3C (Bajabati)		
1	86°06'05.56"	20°46'00.72"
2	86°06'06.22"	20°46'00.71"
3	86°06'06.84"	20°46'00.63"
4	86°06'07.47"	20°46'00.49"
5	86°06'07.96"	20°46'00.34"
6	86°06'08.64"	20°46'00.05"
7	86°06'09.32"	20°45'59.67"
8	86°06'09.41"	20°45'59.19"
9	86°06'09.42"	20°45'58.39"
10	86°06'09.24"	20°45'58.06"
11	86°06'09.18"	20°45'57.86"
12	86°06'09.21"	20°45'57.21"
13	86°06'09.05"	20°45'56.96"
14	86°06'08.93"	20°45'56.66"
15	86°06'07.97"	20°45'56.62"
16	86°06'07.84"	20°45'56.75"
17	86°06'07.52"	20°45'56.94"
18	86°06'07.12"	20°45'57.08"
19	86°06'06.79"	20°45'56.88"
20	86°06'06.41"	20°45'57.02"
21	86°06'06.17"	20°45'57.21"
22	86°06'05.86"	20°45'57.55"
23	86°06'05.59"	20°45'57.88"
24	86°06'05.24"	20°45'58.21"
25	86°06'05.01"	20°45'58.34"
26	86°06'04.86"	20°45'58.46"
27	86°06'04.77"	20°45'59.00"
28	86°06'04.85"	20°45'59.62"
29	86°06'04.94"	20°46'00.06"
30	86°06'05.06"	20°46'00.46"
31	86°06'05.16"	20°46'00.49"
32	86°06'05.35"	20°46'00.62"

Figure 2.1 Satelite Map Showing Lease Areas

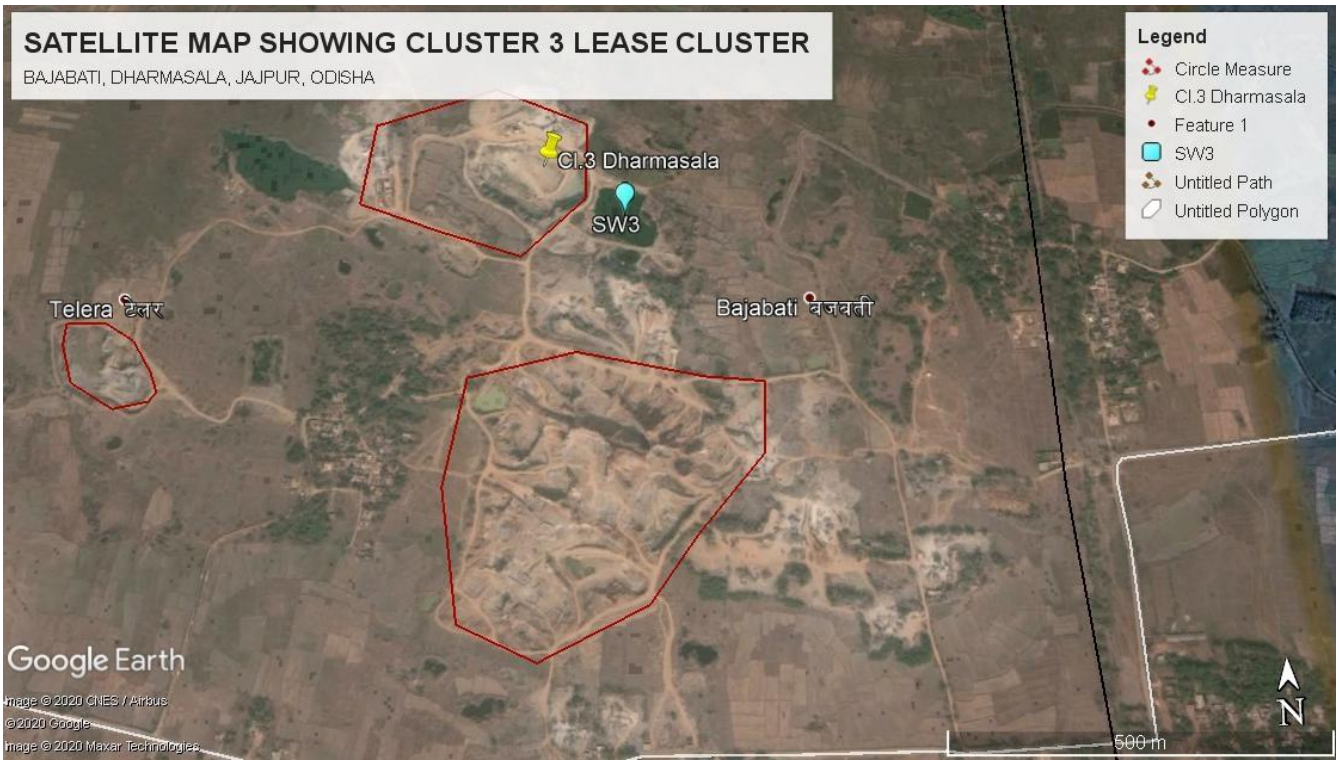
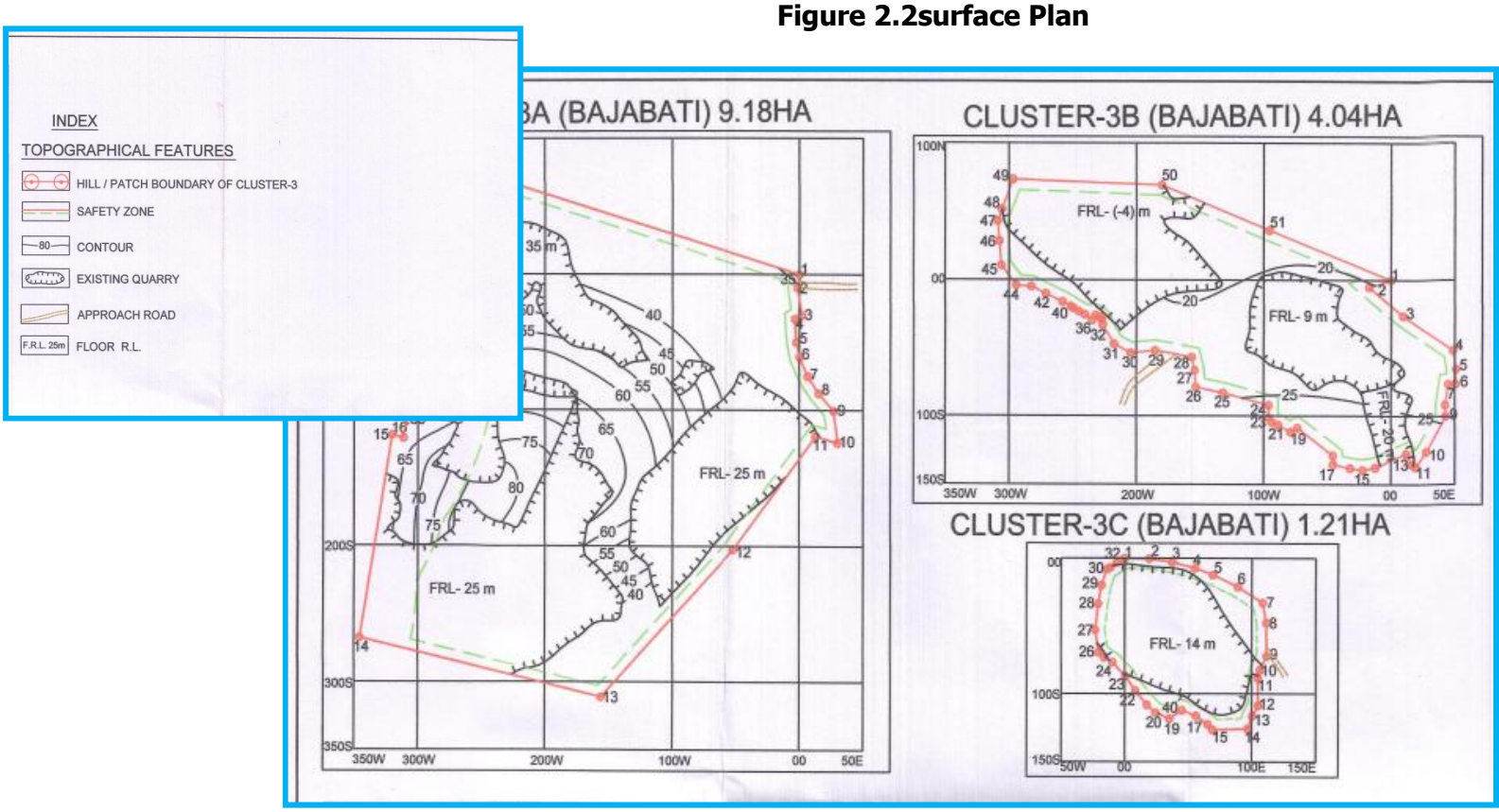


Figure 2.2surface Plan



2.4 SIZE OR MAGNITUDE OF OPERATION

2.4.1 Reserve (Estimation to be Based on the Exploration):

The reserve is estimated based on local parameters. Predominantly, the reserve is estimated on the basis of field geological mapping and observations of existing quarries over the cluster-3 area. As discussed, Cluster-3 consists of three sub-clusters, viz., Cluster-3A (Bajabati), Cluster-3B (Bajabati) & Cluster-3C (Bajabati). Separate hillock area boundary has been depicted following the mineralized area boundary of the respective hillocks of Cluster-3 (Bajabati Hillocks). Accordingly, hillock wise separate reserves have been estimated to arrive at the total reserve over the cluster-3 area under reference. Separate section lines for each hillock have been taken for estimation of the geological as well as mineable reserves in various categories of the respective hillock/ patch over the cluster-3.

However, the reserves of the cluster-3 have been estimated by considering the following parameters.

i) Based on the above consideration, site specificity & chosen local parameter, the reserve has been estimated in cum for building stone/ road metal by cross sectional area method, i.e., multiplying cross sectional area with length of influence and recovery factor to obtain the total volume of rock mass.

ii) The reserve has been calculated under probable & possible categories for Building stone/Road metal.

iii) Excavated quarries exist up to various depths over the cluster-3 area under reference. From the field study and observations of existing quarries, it is revealed that the area is partly covered with soil mixed rock boulders/pebbles of about 1.5m to 2m thickness followed by in-situ granite gneiss/charnockite/migmatite rock mass. Existing quarries over the area are worked out up to various depths and the rock mass is exposed up to a lowest extent of 25mRL in Cluster-3A (Bajabati), (-4mRL) in Cluster-3B (Bajabati) & 14mRL in Cluster-3C (Bajabati).

iv) Based on observation probable limit has been fixed 15 meter below the bottom most quarry floor RL in Cluster-3A, 6 meter below the bottom most quarry floor RL in Cluster-3B and 4 meter below the bottom most quarry floor RL in Cluster-3C as there is every possibilities of continuation of ore beneath. Hence, geological reserve under probable category having higher confidence level has been estimated up to of 10mRL in Cluster-3A (Bajabati), (-10mRL) in Cluster-3B (Bajabati) & 10mRL in Cluster-3C (Bajabati) from the top surface except the soil mixed rock pebbles/ boulder cover over the area.

v) Another 3m of the rock mass is expected below the probable limit up to 7mRL in

Cluster-3A (Bajabati), (-13mRL) in Cluster-3B (Bajabati) & 7mRL in Cluster-3C (Bajabati) over the area, which has been considered as possible category having less confidence level.

vi) In the Cluster-3 area, three cross sections i.e., G1 -G1', G2-G2' & G3-G3' have been drawn tentatively across the trend of the rock mass covering three hill patches, i.e., Cluster-3A (Bajabati), Cluster-3B (Bajabati) and Cluster-3C (Bajabati) respectively.

vii) The length of influence for geological and mineable reserve calculation has been given in respective reserve calculation tables for each hillock/patch of the Cluster-3 area.

viii) Excepting the top soil with rock pebbles/boulders cover, the total rock mass can be excavated. The rock mass over the area is partly weathered, fractured and soft. Therefore, as observed from the existing quarries the recovery factor of rock mass suitable for building stone/road metal has been taken as 70%. Rest 30% has been considered as waste material over the area.

ix) Based on the above parameters, the geological reserve (Probable & Possible) for building stone/road metal has been estimated as 22,63,388cum over the cluster-3A (Bajabati), 5,65,740cum over the cluster-3B (Bajabati) & 1,26,932cum over the cluster-3C (Bajabati). Hence, the total geological reserve over Cluster-3 mineralised area has been estimated as 29,56,060cum.

x) The mineable reserve has been estimated in similar manner as geological reserve leaving 7.5m safety zone barrier all along the respective hillock area boundary of the cluster-3 and the mineral blocked under benches to maintain safe quarry slope. Thus, the mineable reserve (Probable) for building stone/road metal worked out to be 15,22,433cum over the cluster-3A (Bajabati), 3,53,415cum over the cluster-3B (Bajabati) & 36,519cum over the cluster-3C (Bajabati). Hence, the total mineable reserve over Cluster-3 mineralised area has been estimated as 19,12,367cum.

Safety zone barrierof 7.5 m has been taken into account all along the mineralised area boundary of separate hillock patches of the cluster-3. So the mineable reserve has been estimated excluding the reserve coming within the safety zone and the mineral blocked under benches to maintain safe quarry slope of the respective hillock/patch. However, except the peripheral quarry lease areas of the respective hillock/patch, other safety zones of inner individual quarry lease areas are proposed to be excavated after obtaining permission from DGMS. The minable reserve for the safety zones of such inner individual quarry leases will be estimated subsequently as per requirement of the concerned authority and respective lease holders.

The hillock/patch wise geological and mineable reserve estimation over the cluster-3 (Bajabati hillocks) is given as follows. The geological map showing the lease area has been given in **Figure 2.3.**

Table.No.2.3: Geological Reserve of Black Stone: Cluster-3

Section Considered	Length of Influence (m)	X-Area of Rock Mass (m^2)	Volume of Excavation of Rock Mass(m^3)	Vol. of Recoverable Building Stone (m^3)	Vol. of Waste (m^3)	X-Area of Soil Zone (m^2)	Vol. of Soil Zone (m^3)	Category
A	**B**	**C**	**D=BXC**	**E=D X .70**	**E=D X .30**	**F**	**G=FXB**	**H**
Cluster-3A (Bajabati)	273	10782	2943486	2060440	883046	218	59514	Probable
	273	1062	289926	202948	86978	---	---	Possible
Total			**3233412**	**2263388**	**970024**	**---**	**59514**	**---**
Cluster-3B (Bajabati)	120	5711	685320	479724	205596	82	9840	Probable
	120	1024	122880	86016	36864	---	---	Possible
Total			**808200**	**565740**	**242460**	**---**	**9840**	**---**
Cluster-3C (Bajabati)	108	1320	142560	99792	42768	56	6048	Probable
	108	359	38772	27140	11632	---	---	Possible
Total			**181332**	**126932**	**54400**	**---**	**6048**	**---**

Table No.2.4 Mineable Reserve of Black Stone: Cluster-3

Section Considered	Length of Influence (m)	X-Area of Rock Mass (m^2)	Volume of Excavation of Rock Mass(m^3)	Vol. of Recoverable Building Stone (m^3)	Vol. of Waste (m^3)	X-Area of Soil Zone (m^2)	Vol. of Soil Zone (m^3)	Category
A	**B**	**C**	**D=BXC**	**E=D X .70**	**E=D X .30**	**F**	**G=FXB**	**H**
Cluster-3A (Bajabati)	216	10069	2174904	1522433	652471	202	43632	Probable
Cluster-3B(Bajabati)	106	4763	504878	353415	151463	71	7526	Probable
Cluster-3C(Bajabati)	94	555	52170	36519	15651	33	3102	Probable

The summary of total geological (probable & possible) and mineable (probable) reserves of building stone/road metal over the Cluster-3(Bajabati hillocks) area are as follows.

Figure 2.3. Geological Plan

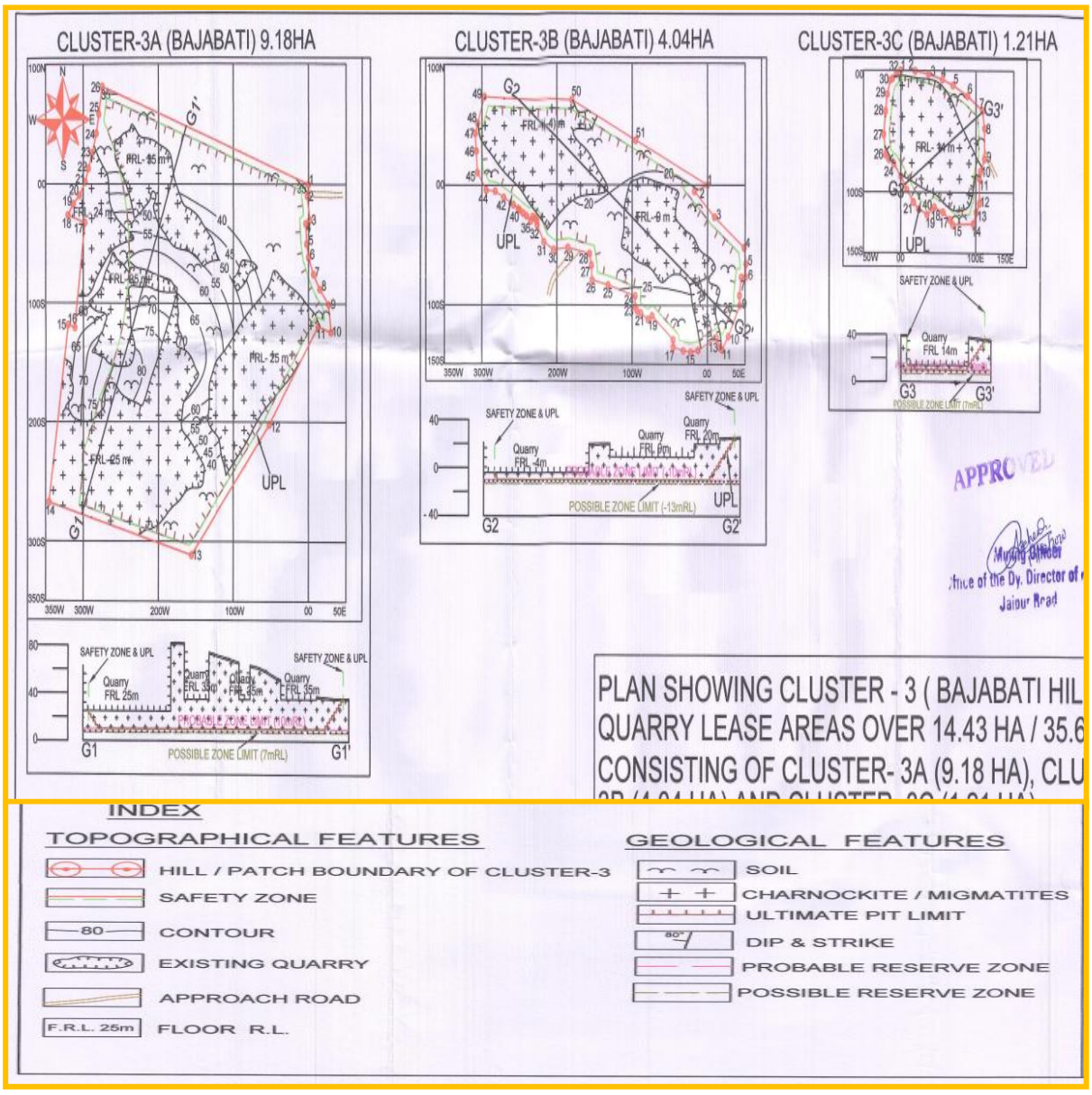


Table No. 2.5: Summary of Geological & Mineable Reserves of Cluster-3:

Type of Reserve	Category of Reserve	Cluster-3A (Bajabati) in cum	Cluster-3B (Bajabati) in cum	Cluster-3C (Bajabati) in cum	Total (cum)
Geological	Probable	2060440	479724	99792	**26,39,956**
	Possible	202948	86016	27140	**3,16,104**
Sub -Total	**---**	**2263388**	**565740**	**126932**	**29,56,060**
Mineable	Probable	1522433	353415	36519	**19,12,367**

2.4.2 Method of Mining

As discussed, Cluster-3 consists of three hillocks, viz., Cluster-3A (Bajabati), Cluster-3B (Bajabati) & Cluster-3C (Bajabati). Separate hillock area boundary has been deciphered/ considered following the mineralized area boundary of the respective hillocks. Accordingly, hillock wise separate reserves have been estimated to arrive at the total reserve over the cluster-3 area under reference. Separate section lines for each hillock/patch have been taken for estimation of the geological as well as mineable reserves in different categories of the respective hillock/ patch over the cluster-3 area.Each quarry lease represents different size, depth, benching pattern and other mining parameters as per the approved mining plan of respective quarry lease. Therefore, it is evident that no particular mine design over the cluster area is feasible to be envisaged/proposed as a whole. However, characteristic features of mining over the 3 area during ensuing plan period and conceptual (life of mine) period is described as follows.

In the cluster-3 area mining of rock mass will be worked out by opencast method of mining. Handling of rock mass will be done both manually and by excavators. Handpicks, spade, chisel, hammer will be used by manual labors for sorting and sizing. Loosening of rock mass will be done by drilling and blasting. The excavated rock mass will be loaded in to 10T/20T capacity tippers/trucks by excavators. As the loading, drilling and transportation will be partly achieved through use of machineries, the mines come under semi-mechanised category.

The mining activities will be carried out in the Cluster-3 area by semi- mechanized means with deploying Excavator/Loader of small capacity. The number and capacity of machines will vary as per the approved mining plan of the respective lease area of the cluster-3 area. However, considering the maximum production per annum over the cluster area the tentative number and capacity of machines to be used are as follows:

Name	Capacity	Number
Excavator/ Loader	0.9/2.1 m^3	10
Wagon drill	-	6
Jack hammer & compressor	-	20
Tippers /Trucks	10T/20T	40/60

2.4.2.1 Drilling and blasting

The loosening of rock mass will be done by drilling and blasting. Drilling will be done either by wagon drill or jack hammer taking in to consideration the bench height varying from 3 meter to 6m. Assuming 1,80,000m3(max) productions per annum of Cluster-3, the monthly production target will be around 15,000m^3. To produce 15,000m^3 of rock mass, tentatively 7500kg/month of explosive will be required assuming powder factor 2m^3/kg.

Deep hole blasting as well as jack hammer drilling and blasting will be practised in the Cluster-3 area. For the purpose, licensed contractors will be utilised by the respective auction holders/lessee. The nearest habitation is around 0.5Km away from the area.

Controlled blasting technique will be adopted to minimize the ground vibration and to avoid flying of rocks. Blasting will be undertaken when there will be least movement of people. Guards will be deployed at main access to the area at the time of blasting. Over charge of explosives would be avoided.

The explosives to be used for blasting purpose will be procured by hired licensed blasting contractors by individual lessees from authorised dealers and blasting will be performed by the contractor also. Daily requisition of explosives will be as per the same day requirement. At the end of the blasting surplus explosives will be refunded to the dealer. A daily register will be maintained for total use and refund of explosives.

2.4.2.2 Benching pattern

Conventional method of mining will be adopted in the Cluster-3 area. In the present plan period it is proposed to shape the quarry with bench heights of 3 m to 6m (max). The width of the benches will be kept either equal or more than the height. The slope of the individual bench will be maintained at around 800 to 850 with ultimate pit slope of less than 450. Mine road will be maintained between benches for easy movement of workers and vehicles. Suitable gradient of haul road will be maintained in between 1 in 16 to 1 in 20.

Proposed pit face lay out

As discussed, no particular pit lay out is feasible to be proposed over the Cluster-3 area as it comprises of small individual quarries. The development for the ensuing plan period would be proposed in the respective approved mining plan of the particular quarry in the cluster-3 area. However, the quarries in cluster 3 will have benches having height varying from 3m to 6m with

bench width equal or more than the height to facilitate smooth running of vehicles and machineries.

2.4.2.4 Quarry Floor Level (RL) at the end of plan period of the concession:

As no particular pit lay out is feasible to be followed over the Cluster-3 area, different quarry floor levels will be maintained as per the respective approved mining plan of that particular quarry lease. The development for the ensuing plan period has been proposed in the respective approved mining plan of the particular quarry in the cluster-3 area. However, after 10 years (plan period) of mining the tentative bottom RLs of Cluster 3A, 3B & 3C would be 10.5m, (-7.5m) & 14m respectively. Similarly, at the end of conceptual (life of mine) the bottom RLs of Cluster 3A, 3B & 3C would be 10m, (-10m) & 10m respectively. The quarries are proposed on the hill slope of the particular quarry lease. During monsoon the run-off water will flow from the quarry bottom along the natural slope.

2.4.2.5 Quantity of mineral to be won (Annual Level of Production)

Based on the demand of building stone/road metal as revealed by the respective lessees, a maximum of 1, 80,000m3 of building stone/road metal will be extracted per annum from the Cluster-3 area. As no particular pit lay out will be followed over the cluster-3 area, the detail calculation of year wise annual level production during the ensuing plan period is not possible. However, year wise proposed tentative maximum production of building stone/road metal during the plan period of ten years over the cluster-3 area is given as below the table.

Table No.2.6: Proposed Tentative Maximum Production of Building Stone/Road Metal during Plan Period (Ten Years)

Year	Cluster-3A (Bajabati) in cum	Cluster-3B (Bajabati) in cum	Cluster-3C (Bajabati) in cum	Total (cum)
First	1,50,000	30,000	0	1,80,000
Second	1,50,000	30,000	0	1,80,000
Third	1,50,000	30,000	0	1,80,000
Fourth	1,50,000	30,000	0	1,80,000
Fifth	1,50,000	30,000	0	1,80,000
Sixth	1,50,000	30,000	0	1,80,000
Seventh	1,50,000	30,000	0	1,80,000
Eighth	1,50,000	30,000	0	1,80,000
Ninth	1,50,000	30,000	0	1,80,000
Tenth	1,50,000	30,000	0	1,80,000
Total	**15,00,000**	**3,00,000**	**0**	**18,00,000**

2.4.3 Waste Generation

As the Cluster-3 area is for building stone, suitability of the rock is not dependant on

chemical parameters. The Cluster-3 area is partly covered with soil mixed rock boulders/pebbles followed by granite gneiss/charnockite/migmatite deposit. The soil to be generated will be stacked in the earmarked temporary soil stack of the individual QL holders and will be utilised for the plantation purpose to be undertaken around the respective hillock/patch and adjacent to haul roads of the same in Cluster-3. Moreover, as envisaged, waste to the tune of about 30% of excavation will be generated during mining part of which will be utilised by the respective Lessee for making of mine road and allied infrastructures. These are the portions of total excavation which are not suitable for construction purpose due to weathering and softness. It will not be possible to separate the total waste from the suitable building stone/road metal at the quarry head. It is assumed that around 2/3rd of the generated waste will be transported to the crusher site along with valuable building stone/road metal where these will be sorted out. The remaining 1/3rd of the total waste will be separated at the quarry head and will be stacked in the temporary waste dump of respective quarry lease and will be utilised by the lessee for making of mine road and allied infrastructures. If required, the portion of soil unsuitable for plantation and the wastes will be sold out to intending users for construction purpose after obtaining permission from concerned authority and payment of advance Royalty.

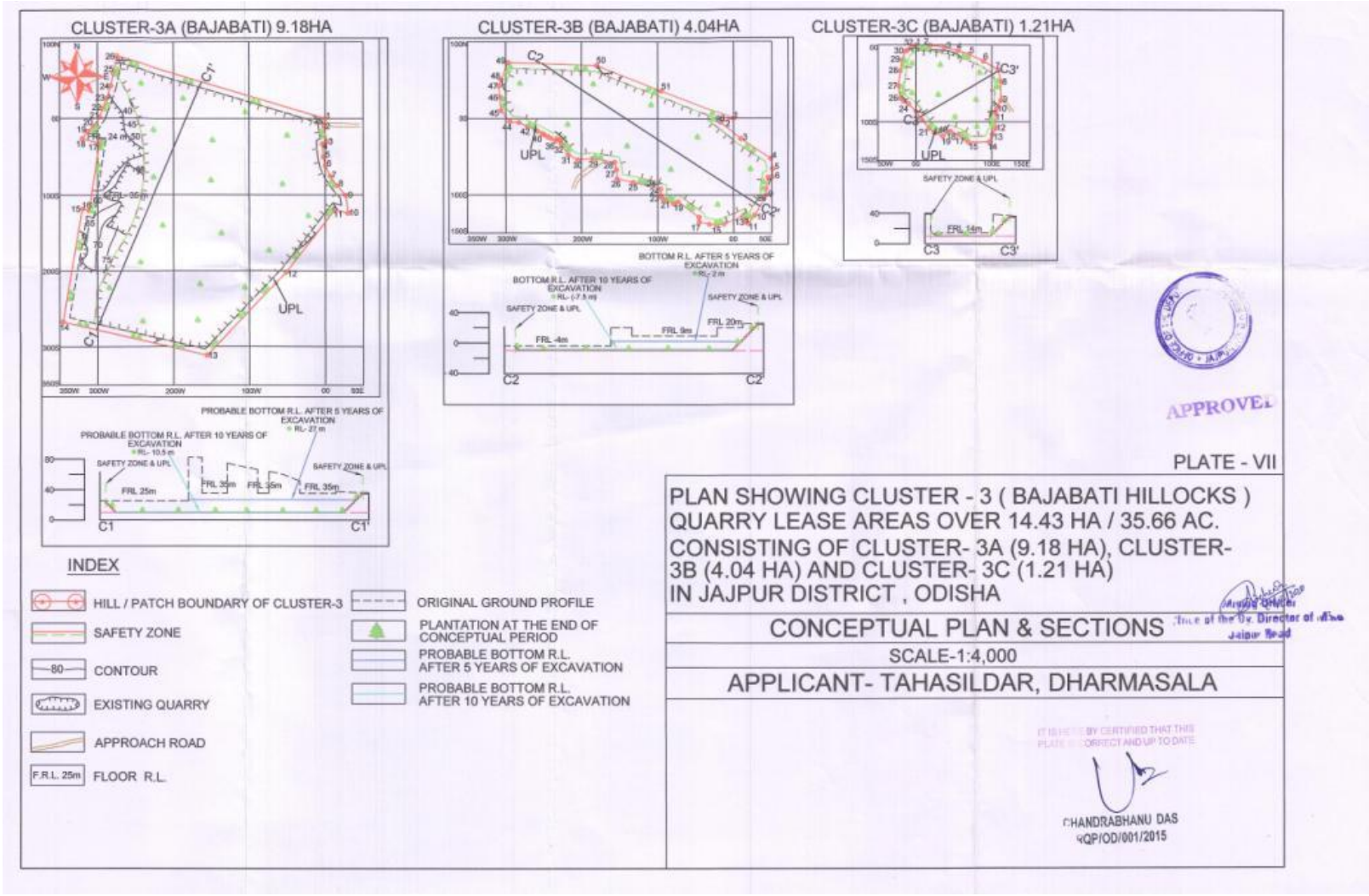
2.4.4 Conceptual Mining Plan

As on date, total mineable reserve of Building stone / Road metal over the Cluster-3 (Bajabati hillocks) area is of the order of 19,12,367cum. During the plan (lease) period of ten years, a total of about 18, 00,000cum is proposed to be excavated from the Cluster-3 area. Considering maximum production of 1,80,000 cum/annum the remaining reserve will be exhausted in 19,12,367cum – 18,00,000cum = 1,12,367cum/1,80,000cum = 0.62 say, 1 years beyond the plan period. Hence, the anticipated life of Cluster-3 area comes to be 11 years including the present plan period of ten (10) years.

2.4.4.1 Ultimate Extent and Size of the Quarry

Ultimate extent of the quarry will be confined to the area of 7.33 hectares in Cluster-3A (Bajabati), 3.37 hectares in Cluster-3B (Bajabati) & 0.98 hectares in Cluster-3C (Bajabati). As discussed, based upon the existing quarries as well as surface exposures total resource of the cluster has been estimated as the probable resource over the mineralized area of the respective hillock will be mined out during conceptual period. The ultimate quarry bottom will be at 10mRL in Cluster-3A (Bajabati), (-10mRL) in Cluster-3B (Bajabati) & 10mRL in Cluster-3C (Bajabati) as shown in the Conceptual Plan & Sections shown in the figure below.

Figure 2.4 Conceptual Plan



2.4.4.2 Final Slope Angle at the End of Conceptual (Life of Mine) Period

Height of the benches will be kept at 3m to 6m (max). The width of the benches will be kept either equal or more than the height. The slope of the individual bench will be maintained at around 800 to 850 with ultimate pit slope of less than 450 (Ref. Plate-VIII).

2.4.4.3 Ultimate Height & Area of Waste Dump

As discussed, the total generated waste at the quarry head will be stacked in the temporary waste dump of respective quarry leases which will be utilised by the lessee for making of mine road and allied infrastructures. If required, the wastes will be sold out to intending users for construction purpose after obtaining permission from concerned authority and payment of advance Royalty. Hence, at the end of life of mine no waste dump will be there in the quarry lease area of Cluster-3 (Bajabati hillocks).

2.4.5 Land Degradation

The aerial extent of the Cluster-3 (Bajabati hillocks) area is 6.41 hectares. Where-in, Cluster-3A (Bajabati) is over 3.64 Ha, Cluster-3B (Bajabati) is over 1.79 Ha & Cluster-3C (Bajabati) is over 0.98 Ha. As far as present exploration is concerned, conceptual quarry boundaries are delineated in Cluster-3A (Bajabati), Cluster-3B (Bajabati) and Cluster-3C (Bajabati). As discussed, hillock wise boundaries are delineated following the mineralized area boundaries of the respective hillock/patch. Safety zone of 7.5m all along the peripheral hillock/ patch boundary has been proposed/ considered for the respective hillock/patch of the Cluster-3 area. Except the peripheral quarry lease areas of the respective hillock/patch, other safety zones of inner individual quarry lease areas are proposed to be excavated after obtaining permission from DGMS. Moreover, as no particular pit lay out will be followed for all the quarries in the respective hillock/patch of the Cluster-3 area, land use at the end of the proposed plan period will be an irregular one for overall Cluster-3 area. However, as discussed, based upon the existing quarries as well as surface exposures total resource of the cluster has been estimated as the probable resource over the mineralized area of the respective hillock will be mined out during conceptual period. The hillock/patch wise breakup of the tentative land use over the cluster-3 area at present, after plan period of ten (10) years and at the end of conceptual (life of mine) period are given in table below,

Table –2.7Cluster-3(Bajabati) Land use at present, at the end of plan period and at the end of conceptual (life of mine) period

Cluster-3A (Bajabati)			
Description	**At present (Ha)**	**At the end of plan period of 10 yrs (Ha)**	**At the end of conceptual (life of mine) period (Ha)**
Quarry	3.64	7.33	7.33
Road	Temporary feature		Nil
Waste Dump Yard	Temporary feature		Nil
Soil stack yard	Temporary feature		Nil
Saleable stone stack-yard	Temporary feature		Nil
Safety zone	Nil	1.85	1.85
Total	**3.64**	**9.18**	**9.18**
Cluster-3B (Bajabati)			
Description	**At present (Ha)**	**At the end of plan period of 10 yrs (Ha)**	**At the end of conceptual (life of mine) period (Ha)**
Quarry	1.79	3.37	3.37
Road	Temporary feature		Nil
Waste Dump Yard	Temporary feature		Nil
Soil stack yard	Temporary feature		Nil
Saleable stone stack-yard	Temporary feature		Nil
Safety zone	Nil	0.67	0.67
Total	**1.79**	**4.04**	**4.04**
Cluster-3C (Bajabati)			
Description	**At present (Ha)**	**At the end of plan period of 10 yrs (Ha)**	**At the end of conceptual (life of mine) period (Ha)**
Quarry	0.98	0.98	0.98
Road	Temporary feature		Nil
Waste Dump Yard	Temporary feature		Nil
Soil stack yard	Temporary feature		Nil
Saleable stone stack-yard	Temporary feature		Nil
Safety zone	Nil	0.23	0.23
Total	**0.98**	**1.21**	**1.21**

2.4.6 Mine Drainage:

It is observed from the dug wells of the adjacent plain area and in the nearby villages that, the ground water table varies between 3 m to 8 m from the surface level depending upon seasonal variations. During dry season the water table falls to 8 m from the surface, whereas during rainy season the water table remains at around 3 m from the surface.

During the proposed plan period no particular pit lay out will be followed for all the quarries in the respective hill/patch of the Cluster-3 area. Therefore, at the end of the

plan (lease) period depth of the respective quarry over the Cluster-3 area is not possible to predict. However, after 10 years (plan period) of mining the tentative bottom RLs of Cluster 3A & 3B would be 10.5m and (-7.5m) respectively. Whereas, the ultimate quarry bottom over the Cluster-3 area will be at 10mRL in Cluster-3A (Bajabati), (-10mRL) in Cluster-3B (Bajabati) & 10mRL in Cluster-3C (Bajabati) at the end of the conceptual period. This is above the ground water table as the RL of ground water table is around 8 m except in sub-cluster-3B, where permission will be taken from the concerned authority to carry out the mining operation by dewatering the quarry floor, if ground water punctured. Therefore, it is proposed to keep one 5 HP diesel operated pump at each quarry site of sub-cluster 3B, particularly during monsoon to draw out the accumulated water from the quarry. Therefore such depth of working would not affect the ground water table.

There is chance that during monsoon the run-off water may find access to some of the quarries in the cluster-3. Therefore, it is proposed to keep one 5 HP diesel operated pump at each quarry site, particularly during monsoon to draw out the accumulated water from the quarry. The water so discharged will be routed to the natural drainage through series of drains and settling pits. Also, it is proposed to have a peripheral drain around the each pit of the individual QLs belonging to the cluster to restrict the surface runoff in to the quarry.

2.4.7 Mineral Processing:

The RoM of building stone/road metal raised from the quarries of Cluster-3 area will be subjected to manual sorting at the respective quarry site. The saleable road metal after sorting will be transported to the nearby crusher site for necessary crushing. After crushing and screening, the finished road metals will be dispatched to intending users.

2.4.8 Manpower:

As discussed, man power for each quarry lease of Cluster-3 will be as per the respective approved mining plan of the small quarry lease. However, considering the proposed maximum annual production over the cluster-3 the tentative maximum manpower will be as follows.

a) Supervisory (inclusive of statutory personnel's) :

Sl No	Designation	Qualification	Numbers
1	Mines Manager/Mine Permit Manager	Second class Manager's Certificate of Competency (DGMS)/ Permit Mine Manager's Certificate of Competency (DGMS)	5
Total			**5**

b) Non-supervisory (Skilled, semi-skilled and unskilled):

Skilled: 15

Semi-skilled-35

Unskilled-75

Sub Total: 115

Total (a + b):115 + 5 **= 120**

c) OMS:

Average ore production /annum	: 180000 cum
Working days per year	: 300 days (On an average)
Production per day	: 180000/300=600 cum

Overall output per man shift (OMS) : 600/120= 5cum.

2.5 FINAL MINE CLOSURE PLAN:

2.5.1 Reclamation and Rehabilitation in respect of the following:

As discussed, hillock wise boundaries are delineated following the mineralized area boundaries of the respective hillock/patch of Cluster-3 area. Safety zone of 7.5m all along the peripheral hillock/ patch boundary has been proposed/ considered for the respective hillock/patch of the Cluster-3 area. Except the peripheral quarry lease areas of the respective hillock/patch, other safety zones of inner individual quarry lease areas are proposed to be excavated after obtaining permission from DGMS. Moreover, as no particular pit lay out will be followed for all the quarries in the respective hillock/patch of the Cluster-3 area land use at the end of the proposed plan period cannot be predicted for overall Cluster-3 area. However, the hillock/patch wise breakup of the tentative land use over the cluster-3 area at present, at the end of plan period of ten (10) years and at the end of conceptual (life of mine) period will be as follows.

2.5.2 Mined out land:

During the plan period of ten (10) years the mined out land will be 7.33 ha in Cluster-3 A (Bajabati), 3.37ha in Cluster-3B (Bajabati) & 0.98 ha in Cluster-3 C (Bajabati).

Since, the individual quarries of cluster-3 are at development stage and the rock mass from the quarry area won't be exhausted at the end of conceptual period, proposal for reclamation of mined out land is not envisaged at this stage. As discussed, based upon the existing quarries as well as surface exposures total resource of the cluster has been estimated as the probable resource over the mineralized area of the respective hillock will be

mined out during conceptual period. Conceptually, the quarried out land along with the peripheral safety zone of 7.5m will be brought under plantation.

However, the hillock/patch wise breakup of the tentative land use over the cluster-3 area at present, at the end of plan period of ten (10) years and at the end of conceptual period will be as follows.

Table No. – 2.8 Cluster-3 Bajabati: Land use at present, at the end of plan period and at the end of conceptual (life of mine) period

Cluster-3A (Bajabati)			
Description	**At present (Ha)**	**At the end of plan period of 10 yrs (Ha)**	**At the end of conceptual (life of mine) period (Ha)**
Quarry	3.64	7.33	7.33
Road	Temporary feature		Nil
Waste Dump Yard	Temporary feature		Nil
Soil stack yard	Temporary feature		Nil
Saleable stone stack-yard	Temporary feature		Nil
Safety zone	Nil	1.85	1.85
Total	**3.64**	**9.18**	**9.18**
Cluster-3B (Bajabati)			
Quarry	1.79	3.37	3.37
Road	Temporary feature		Nil
Waste Dump Yard	Temporary feature		Nil
Soil stack yard	Temporary feature		Nil
Saleable stone stack-yard	Temporary feature		Nil
Safety zone	Nil	0.67	0.67
Total	**1.79**	**4.04**	**4.04**
Cluster-3C (Bajabati)			
Quarry	0.98	0.98	0.98
Road	Temporary feature		Nil
Waste Dump Yard	Temporary feature		Nil
Soil stack yard	Temporary feature		Nil
Saleable stone stack-yard	Temporary feature		Nil
Safety zone	Nil	0.23	0.23
Total	**0.98**	**1.21**	**1.21**

The individual lessees of the cluster-3 area would obtain permission of DGMS to quarry out the safety zone located in between adjoining leaseholds.

2.5.3 Topsoil stack and its utilization:

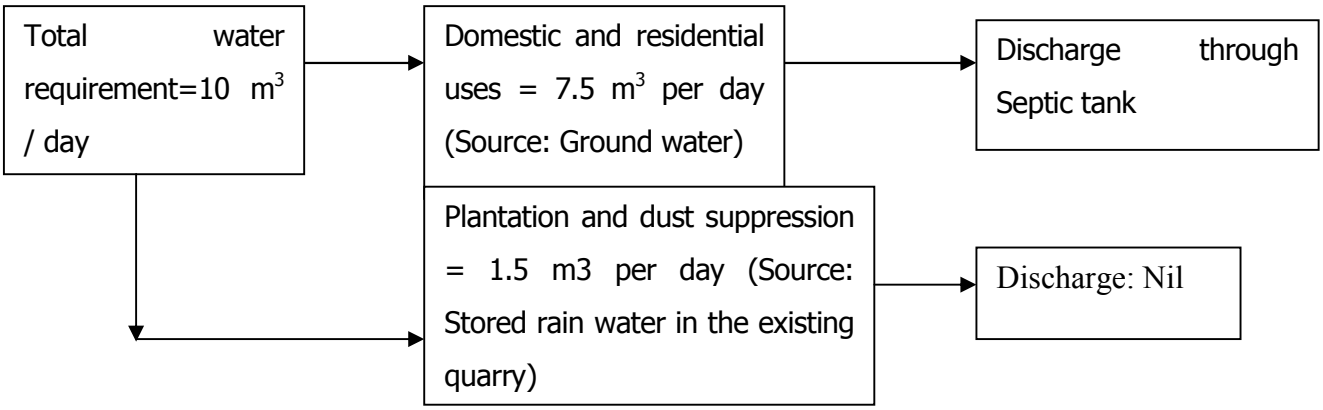
A total of 51,158m^3 (43632m^3 in Cluster3A + 7526m^3 in Cluster3B) of top-soil mixed with boulders and pebbles are envisaged to be generated during the plan period in course of mining. It is proposed to store this top-soil in the earmarked site and will be utilized for nearby avenue plantation purpose after separated out from the mixed rock boulders and

pebbles. If required, the portion of soil unsuitable for plantation will be sold out to intending users for construction purpose after obtaining permission from concerned authority and payment of advance Royalty. However, the process as above will be followed as per the respective approved mining plan of the quarry lease of Cluster-3 and as such no soil stack will be there in the cluster-3 area at the end of plan period of ten (10) years.

2.6 WATER REQUIREMENT

10 KLD of potable water will be required from which7.5 KLD of water will be required for drinking & domestic purpose1.5 KLD of water is suggested to be utilized for dust suppression and 1 KLD for plantation purpose. Water will be sourced from bore well.

2.6.1 Water Balance



2.7 POWER REQUIREMENT:

No electricity connection within ML area. However solar lights will be employed for day to day living purposes. Diesel requirement will be 6000 liters/month.

2.8 SITE SERVICES

A first aid station will be provided with all necessary medical kit. All the supervisors will be trained in first – aid treatment to take care of any emergency. Drinking water facilty, crèche and rest shed will be constructed within thecluster area.

2.9 DESCRIPTION OF MITIGATION MEASURES INCORPORATED INTO THE PROJECT TO MEET ENVIRONMENTAL STANDARDS, ENVIRONMENTAL OPERATING CONDITIONS, OR OTHER EIA REQUIREMENTS (ASREQUIRED BY THE SCOPE)

All possible mitigation measures to prevent any adverse incident during the process of mining, transportation and dumping will be taken care off. The details of the proposed actions are described in the Chapter 3 of this report.

2.10 ASSESSMENT OF NEW/UNTESTED TECHNOLOGY

In the process of mining, no new /untested technology will be employed and only open cast semi-mechanized method will be adopted which is in practice since last 60 years.

CHAPTER 3

DESCRIPTION OF THE ENVIRONMENT

3.0 STUDY AREA

For the description of baseline environmental scenario, the proposed mine cluster 3Dharmasala, Bajabati Hillocks, has been considered as the core zone. As the mine lease area exhibits an irregular shape, thus to arrive at a more reasonable study, the buffer area has been fixed at 10 km radius from the extremities of the proposed mines cluster. The location map of the study area has been given in **Figure 3.1.**

3.1COMPONENTS OF STUDY

Baseline survey was conducted to evaluate the following environmental component in the study area:

1.	**Land Environment**	Topography & Drainage
		Geology
		Land use
		Soil
2.	**Water Environment**	Ground water
		Surface Water
3.	**Air Environment**	Metrological Data (Wind speed and direction, Rainfall, Relative humidity, Temperature, Visibility,) Ambient Air Quality (AAQ)
4.	**Noise Environment**	Noise level Monitoring
5.	**Biological Environment**	Terrestrial Flora and Fauna
		Aquatic flora and Fauna

6. Socio-economic and Occupational Health Environment

3.2 STUDY METHODOLOGY

The baseline environmental quality for Pre monsoon season i.e. March to May 2020has been assessed based on primary data generated during field survey and secondary data collected from different sources available near the lease area. The study area has been given in **Figure 3.1.**

Figure3.1 Topo Map showing the lease area

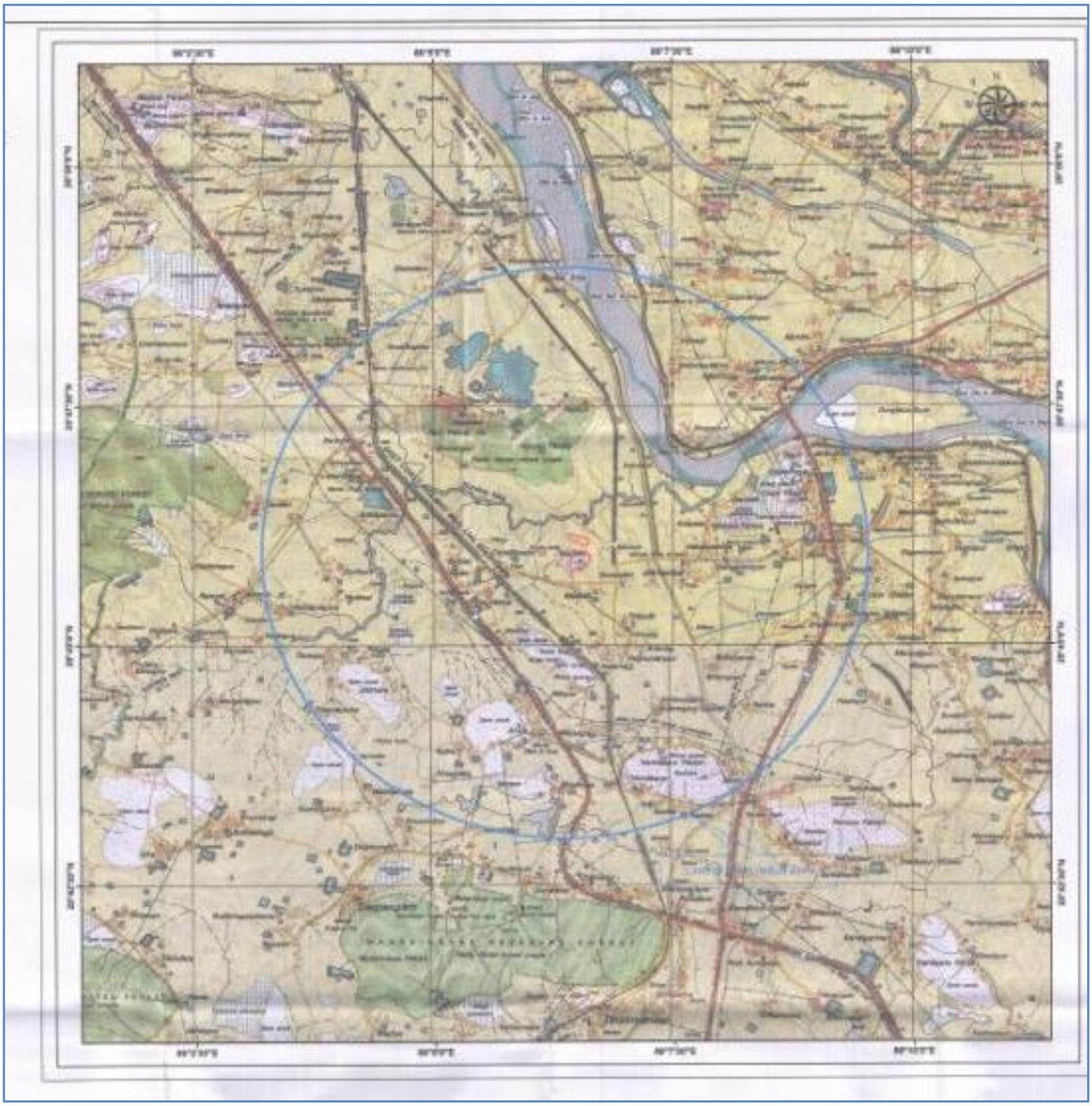


Table No. 3.1: Baseline data generation Matrix

Attribute	Parameters	Locations/Source
Land Environment	Topography & Drainage	Primary and Secondary information
	Geology	Primary and Secondary data
	Land use	Primary and secondary data
	Soil Quaity	7 Locations/ Primary data/ Secondary data
	Land use/ Landscape Based on Level III land use classification	10 Km Buffer Zone Secondary data
Air Environment	Sulphur Dioxide (SO2) in µg/m^3, Nitrogen Dioxide (NO2) in µg/m^3, PM10 in (µg/m^3),PM2.5 in (µg/m^3)	8 Locations Primary and Secondary data
Noise	Noise Level (dB Leq)	8 Locations/ Primary and Secondary data
Surface water	As per IS 2296: 1982	8 Locations/ Primary data/ Secondary data
Ground water	As per IS 10500: 2012	7 Locations/ Primary data/ Secondary data
Biological Environment	**Aquatic:** Aquatic vegetation Fishes & aquatic fauna **Terrestrial** Vegetation – species list. Economic importance, forest produce, medicinal value. Terrestrial Fauna, Avi fauna Rare and endnagered plant species	Core and Buffer Zone Primary data/ Secondary data
Socio-economic	Demographic structure Infrastructure resource base. Economic resource base. Cultural and aesthetic attributes, Health Education.	Core and Buffer Zone Primary data/ Secondary data

3.2.1 Sampling Location

The sampling locations for the baseline study have been decided based on the topographical features, wind flow pattern and location of the ecologically sensitive areas. The details of the sampling locations have been given in Table 3.2.

Table 3.2: Details of Sampling Location for Baseline study.

Sl. No	Sampling Location	Air	Soil	SW	GW	Noise
1	Lease Area	**				**
2	Makundapur	**				**
3	Jenapur	**				**
4	Aruha	**	**	**	**	**
5	Bajabati	**	**	**	**	**
6	Dankari	**	**	**	**	**
7	Lunibara	**	**	**	**	**
8	Sahanidiha	**	**	**	**	**
9	Rahadpur		**	**	**	
10	Brahamaniriver near Brundadeipur			**		
	Anjira		**	**	**	

3.3 GEOLOGY AND HYDROLOGY

3.3.1 Topography

Cluster-3 (Bajabati Hillocks) is located within the revenue jurisdiction of Bajabati village under Dharmasala Tahasil of Jajpur district. The targeted area represents a hilly terrain comprising three Patches, viz., Cluster-3A, 3B & 3C with undulated topography. Cluster-3A displays highest altitude of 80 mRL and lowest altitude of 35mRL, Cluster-3B displays highest altitude of 25mRL and lowest altitude of 20mRL & Cluster-3C displays highest altitude of 40mRL and lowest altitude of 35mRL. There is hardly any vegetation. There is no human settlement within the auction area.

3.3.2 Drainage

The drainage pattern of the district is of dendritic, radial and centripetal types. The drainage of the district is mainly controlled by rivers like Brahmani, Kharasuhan, Birupa, Baitarani&Kelua. The nearest river to the cluster area is Brahamani River which flows at a distance of 2.5 Km. There is a High level canal flows at a distance of about 2.0 Km from the cluster area.

3.3.3 Geology:

The Stratigraphic succession of the area on regional basis can be given as follow:

Resent to sub recent — Soil, sand and alluvium

Tertiary — Laterite

~~~~~~~~~~~~~~~~~~~~~~Un-conformity~~~~~~~~~~~~~~~~~~~~~~

Pegmatite and Quartz, veins

Archeans — Leptinyte gneiss

Granulitic rocks

Khondalite suite

Eastern Ghat — Garnetiferous quartzite

Super Group — Calc silicate rocks

Base unknown

Regionally the area forms a part of the Archean complex with deformed meta-sediments belonging to Easternghat Group of Pre-cambrian age. Variants of granite gneisses and khondalite suite of rocks constitute the main litho-units in the area. The area is intruded intensively by pegmatite and quartz veins. It has been observed that 100 sq.km areas in the valley do contain 150 numbers variable sizes of pegmatite and quartz veins. This implies that the area has suffered several episodes of granitic intrusion. The granite gneiss and their variants present in the area are the product of several episodes of granitic activities followed by regional thermal metamorphism. Such acivities are responsible for the development of porphyroblastic gneiss, migmatites, and augen gneiss in the area. The concluding phases of intrusion in this tract have been marked by a very coarse grained often porphyroblastic granite with the accompanying pegmatite facies. The khondalite suite of rocks i.e garnetiferous quartzo-felspathic sillimanite bearing gneiss with or without Quartz is the next dominate rock unit. Often they are garnetiferous in the sense of gem quality, but mostly fractured. Quartz veins are seen to have been emplaced along structural weak planes. The quartz veins of variable dimensions are observed, which varies from a meter to as long as 100 metres with an
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average width of 2 meter. The quartz core and the veins are milky white to greyish white in colour. Sometimes translucent varieties do occur in the core of the pegmatite. General attitude in the area is NE-SW with moderate to steep dip due westerly.

c. Local Geology

The total area represents granite gneiss/chanockite/migmatite throughout the hillock. The trend of the granite gneiss is NW-SE. The trend of the rock swings from NW-SE to NE-SW with almost vertical (80^0 - 85^0) dip towards NE/SW. The exposed rock is hard, compact & highly fractured with fine to medium grain texture. Close spacing joints of two sets are noticed, one set almost parallel to the trend of the rock mass and other set being perpendicular to it. Based on the physical characteristics and the close spacing joints, the rock is suitable to be used as building stone/road metal and unsuitable for decorative stone.

d. Lithology:

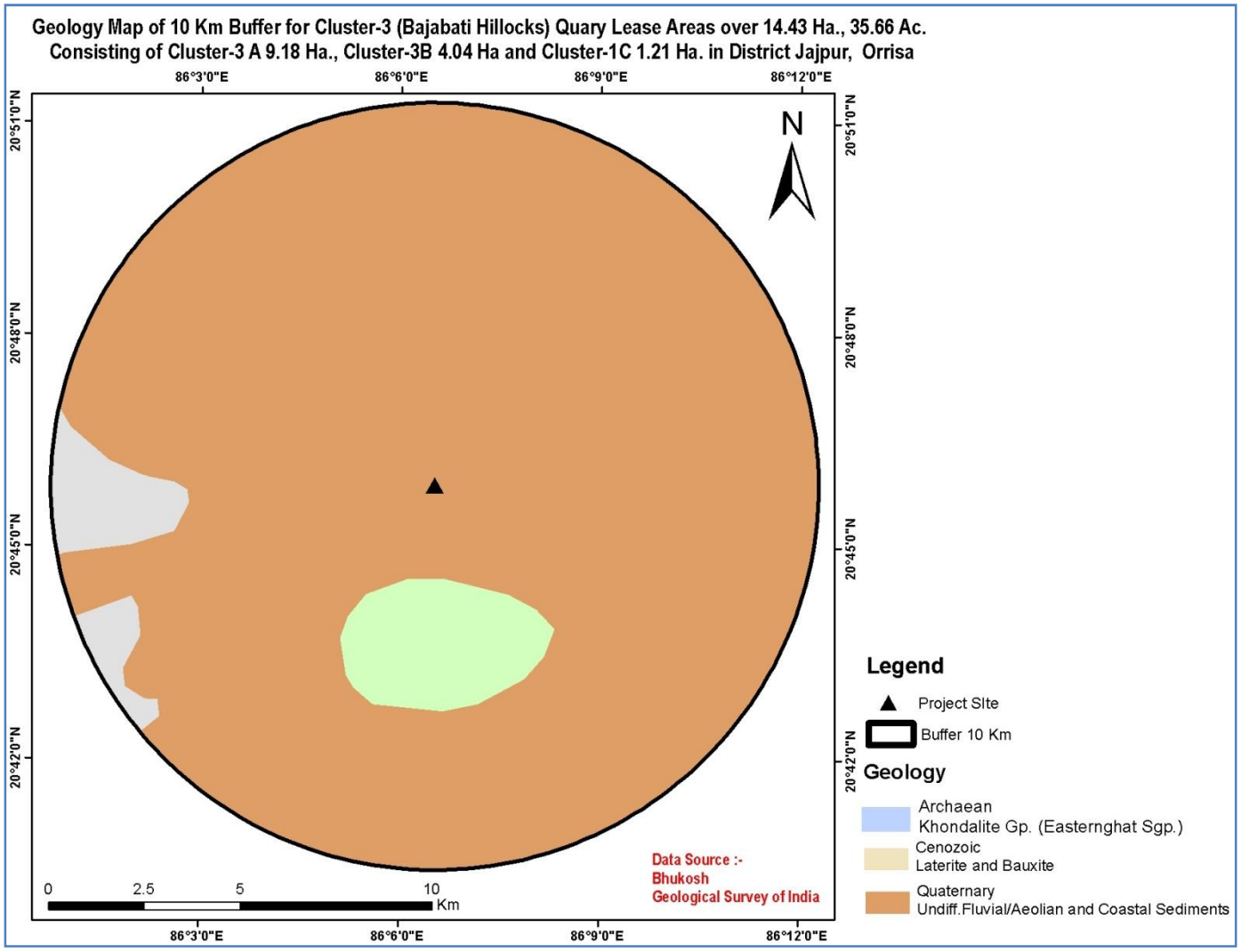
The characteristic features of the litho units of the area are described below:

Soil mixed rock boulders/pebbles

Granite gneiss/Charnockite/Migmatite

Base unknown

Figure 3.2: Geological map of the study area



3.4. SOIL TYPES:

Generally, four types of soils, viz. Alfisols, Utisols, Vertisols and Entisols occur in the district. As per agro-climatic classification, the district falls under North Eastern Coastal plain and Dharmasala block comes under agro ecological situation of alluvial rainfed.

3.4.1 Alfisols: These soils include deltaic old alluvia soils and red sandy soils. These deltaic soils are found in river valley and the sandy soils are seen in the areas underlain by crystalline rocks. The red sandy soils are light textured usually devoid of lime concretions.

3.4.2 Ultisols: These include lateritic soils which are found in the western upland areas and these are poor in nitrogen, phosphorous, potassium and organic matters.

3.4.3 Vertisols: These are medium black soils occurring in the northern part of the district. These are rich in iron, calcium, magnesium, potash and lime but poor in organic matters, nitrogen and phosphorous. These soils are fertile.

3.4.4 Entisols: These soils include younger alluvial soils occurring in the central -eastern and south eastern blocks of the district. These are deficient in nitrogen, phosphorous and humus but not in potash. These soils are fertile. The major soil type of Dharmasala block is as below:

Table 3.3: Soil Tye of Jajpur District

Sl. No	Block	Soil Types		Land Slope			
		Major Soil Classes	**Area (Ha)**	**0-3%**	**3-8%**	**8-25%**	**>25%**
1	Dharmasala	Matured Red & Laterite Soil (alfisols)	1703.00	1404.58	192.24	106.19	
2		Mixed Grey soil (Inceptisols)	21604.60	20578.07	622.85	403..69	
3		Unaltered soil with Coasrse parent materials (Entisols)	2652.18	721.06	413.64	1506.26	11.21
4		Unclassified soil (Like Mud flats)	4.09	4.09			
5		Settlement	3958.98				
6		Water Body	2293.09				
7		**Total**	**31855.94**				
Ref:District Irrigation Plan of Jajpur Odisha, March 2016 (District level implementation committeeJajpur, Odisha)							

3.5 GROUND WATER SCENARIO

(***Ref: Ground water information Booklet of Jajpur District, Odisha, May 2013)***

3.5.1 Hydrogeology

The water bearing formation of the district has been divided into 4 groups

(a) Crystalline and meta sedimentary formation

(b) Alluvium

(c) Laterite capping highly weathered limonitised-cherty ultramafics

(d) Laterite capping the crystalline and meta sedimentary sedimentary formation.

3.5.1.1 Crystalline and meta sedimentary formation :

Ground water in the hard granitic rocks or meta sedimentary khondalites and schistose quartzites formations occurs under unconfined conditions within the weathered residuum whereas in the bed rocks (fractured) aquifer it occurs in semi confined to confined conditions. The top weathered saprolite horizon is tapped by dug wells while the fractured basement rocks are tapped by bore wells.

The yield potential of weathered and fractured aquifer in these formation are limited as compared to alluvium. The yield of dug wells in khondalites varies from 5 m3 /day to 25 m3 /day while in schistose quartzites, it varies from 6 m 3 /day to 30 m3 /day and in granite, it ranges from 6 to 15 m3 /day. The specific capacity of dug well in these three hard formations vary from 0.0034 to 0.0054 m 3 /min/metre, 0.004 to 0.008 m3 /min/metre and 0.0037 to 0.007 m3 /min/metre of draw down respectively. The yield of bore wells in these formations is up to 5 lps

3.5.1.2 Alluvial formation:

In the unconsolidated alluvial formation ground water occurs under unconfined conditions in shallow aquifers and semi-confined to confined conditions in deeper aquifers.

The yield of shallow and filter point tubewells in the alluvium varies 5 to 15 lps within a depth range of 25 to 60 metre below ground level. The transmissivity of shallow and deep aquifer varies from 234 m 2 /day to 3112 m 2 /day and 393 m 2 /day to 4650 m 2 /day. The yield of medium deep well in older alluvium varies from 20 to 40 lps where as in younger alluvium the yield of medium to deep tube well may go beyond 40 lps and the transmissivity varies from 393 to 4600 m 2/day.

3.5.1.3 Laterites capping weathered ultramafics:

Laterite occurs in two types of settings. In one type of setting which is found in Sukinda valley the laterites are 5 underlain by highly weathered ultramafics composed of limonites,

cherts and weathered ultramafics. In these formation ground water occurs under unconfined conditions in shallow aquifers and semi-confined to confined condition in deeper aquifers.

The yield of dug wells in such formations varies from 118 to 373 m 3 /day. The specific capacity of the dug well varies from 0.82 m3 /min/metre to 0.260 m3 /min/metre draw down. The transmissivity of shallow aquifer constituted by laterites-limonites and chert varies from 40 m 2 /day to 234 m 2 /day . The yield of the bore wells/ tube well tapping the deeper aquifers varies from 1.5 to 12 lps. and the transmissivity of deep aquifer varies from 74 m 2 /day to 91 m 2 /day . From the exploration data of two exploratory wells drilled in these tract by C.G.W.B. ,it is revealed that zone of saturation extent down to a depth of 66 m below which the highly limonitised and ultramafic rocks do not hold water.

3.5.1.4 Laterites capping crystalline and metasedimentary:

In this type of setting the laterites cap the schistose quartzites. The laterites have high degree of effective porosity and form potential aquifer which are commonly tapped by dug wells. In these formation ground water occurs under unconfined conditions in shallow aquifers. The specific capacity of the dug well in laterites varies from 0.0016 m 3 /min/metre to 0.2214 m3 /min/metre of draw down and the transmissivity varies from 3.2m 2 /day to 506m 2 /day. The specific capacity of the dug wells in laterites varies from 0.0016 m 3 /min/metre to 0.2214 m3 /min/metre of draw down and the transmissivity varies from 3.2 m 2 /day to 506 m2 /day.

3.5.1.5 Depth to water level:

Pre & post monsoon 2011 : The depth to water level map for pre and post monsoon periods 2011 are prepared based on the ground water monitoring data of 23 Nos of National Hydrograph Stations of C.G.W.B. monitored during the month of April and November 2011 and are presented in Map 2 and 3 respectively **.** The pre and post monsoon depth to water levels in the district range from 0.98 m to 9.85 m below ground level and 0.33 to 5.36 m below ground level respectively.

Seasonal Fluctuation: The seasonal fluctuation of water levels with respect to pre and post monsoon periods (2011) varies from –2.75m (Fall) at Saruabill to 5.83 m (Rise) at Hatibari.

Long term water level trend in last 10 years:

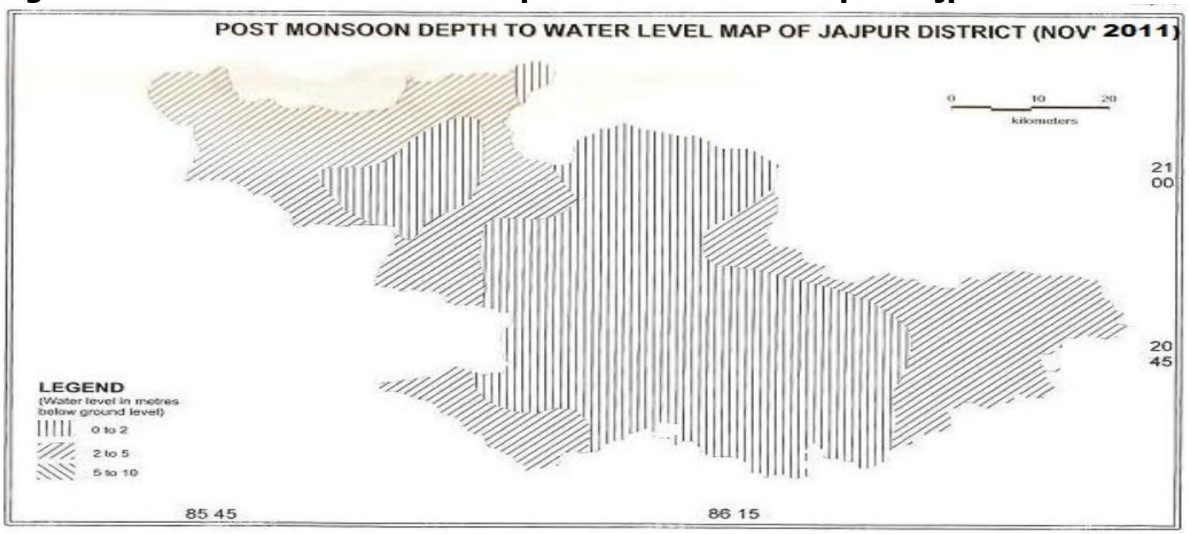
Long-term trend analysis (2001 - 2011) of phreatic water levels indicate that the water level in three-fourth of the dug wells show rising trend varying from 0.002 to 1.743 m/year, while the rest of the dug wells have declining trend ranging from 0.426 to 1.54 m/year.

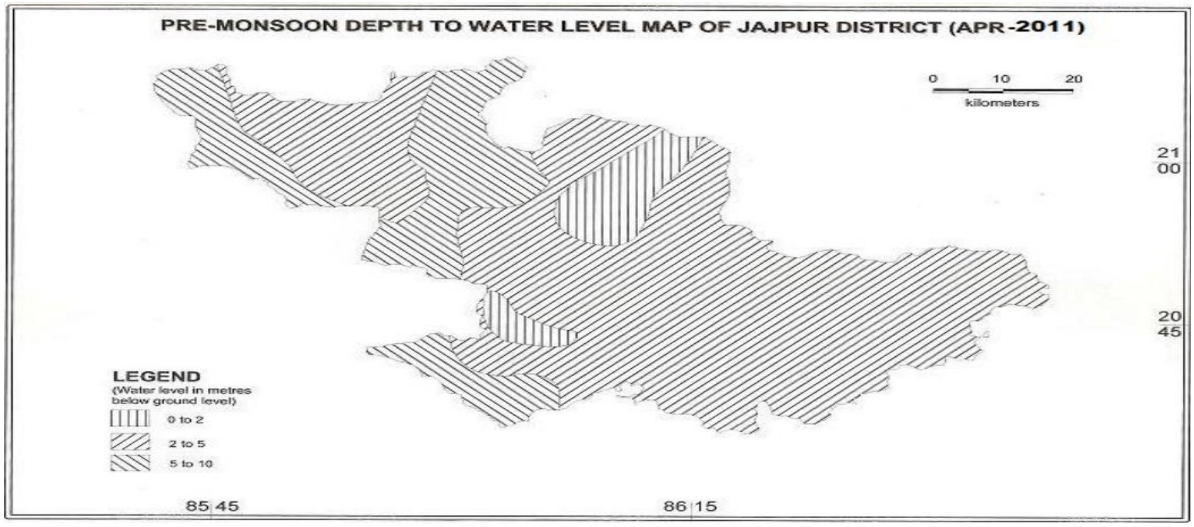
3.5.2 Ground Water Resources:

As per the ground water resources assessed during 2009, the total annual replenishable ground water resources in the district is 56933ham. The block wise ground water resources are given in Table-1. 15 % of the total ground water resources i.e. 8850 ham is reserved for domestic and industrial uses.

The annual ground water draft for irrigation in the district is only 22441 ham leaving the balance ground water resource available for irrigation is 31538 ham. Over all the present level of ground water development is only 43.09 percent in the district with the maximum of 64.9% in Rasulpur block and minimum of 27.48 % in Sukinda block. The ground water development in Dharmasala Block is 44.31% which comes under safe category. Hence the whole district as well as all the blocks comes under the safe category from ground water development point of view. Pre and post monsoon water level of the district given in **Figure 3.3.**

Figure : 3.3 Pre & Post Monsoon Depth to Water level map of Jajpur district



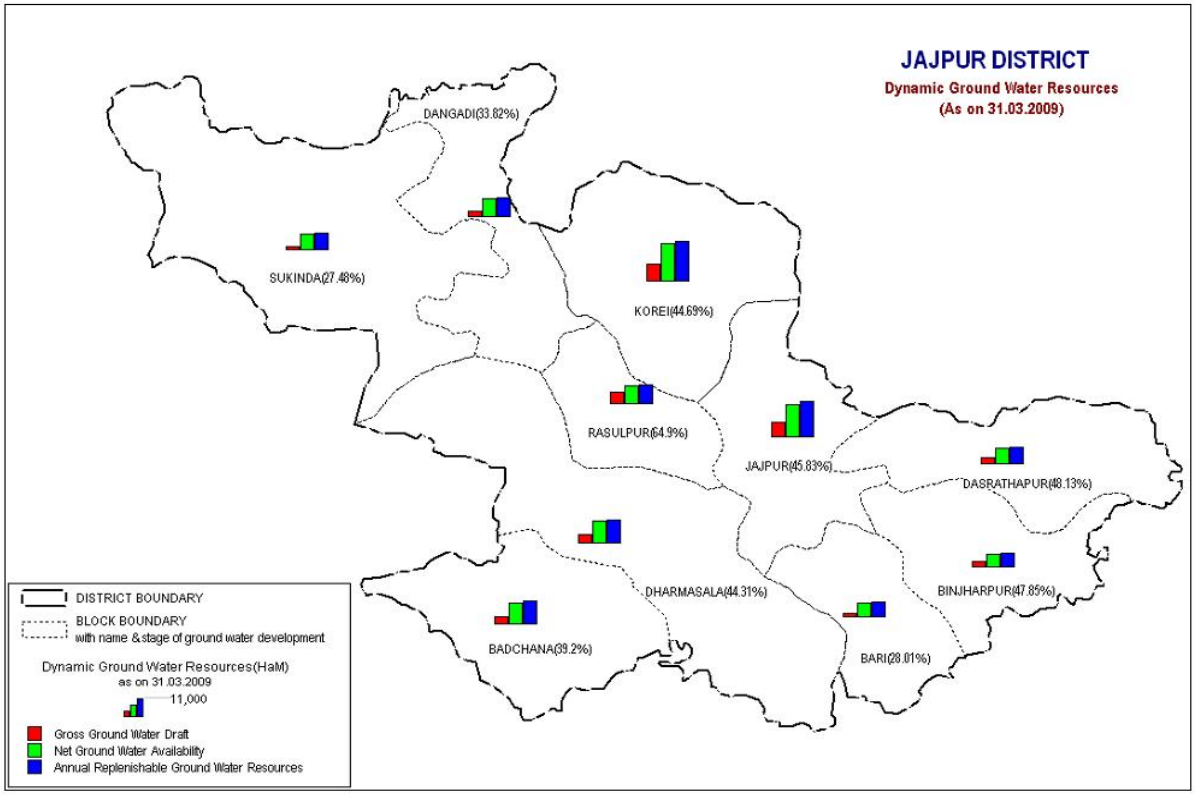


(***Ref: Ground water information Booklet of Jajpur District, Odisha, May 2013)***

Table:3.4 Ground water Resource Potential of Dharmasala Block As on 31.03.2009

Net annal Ground water Availability	Existing gross ground water draft for irrigation	Existing gross ground water draft for domestic and industrial water supply	Existing gross ground water draft for all uses	Allocation for domestic and industrial requirement for next 25 years	Net ground water availability for future irrigation development	Stage of ground water development
						All Figure in Ham
6087	2640	56.82	2967	79	3368	44.31
Ref: Ground water information Booklet of Jajpur District, Odisha, May 2013						

Figure 3.4 Dynamics of Ground water resource of Jajpur District

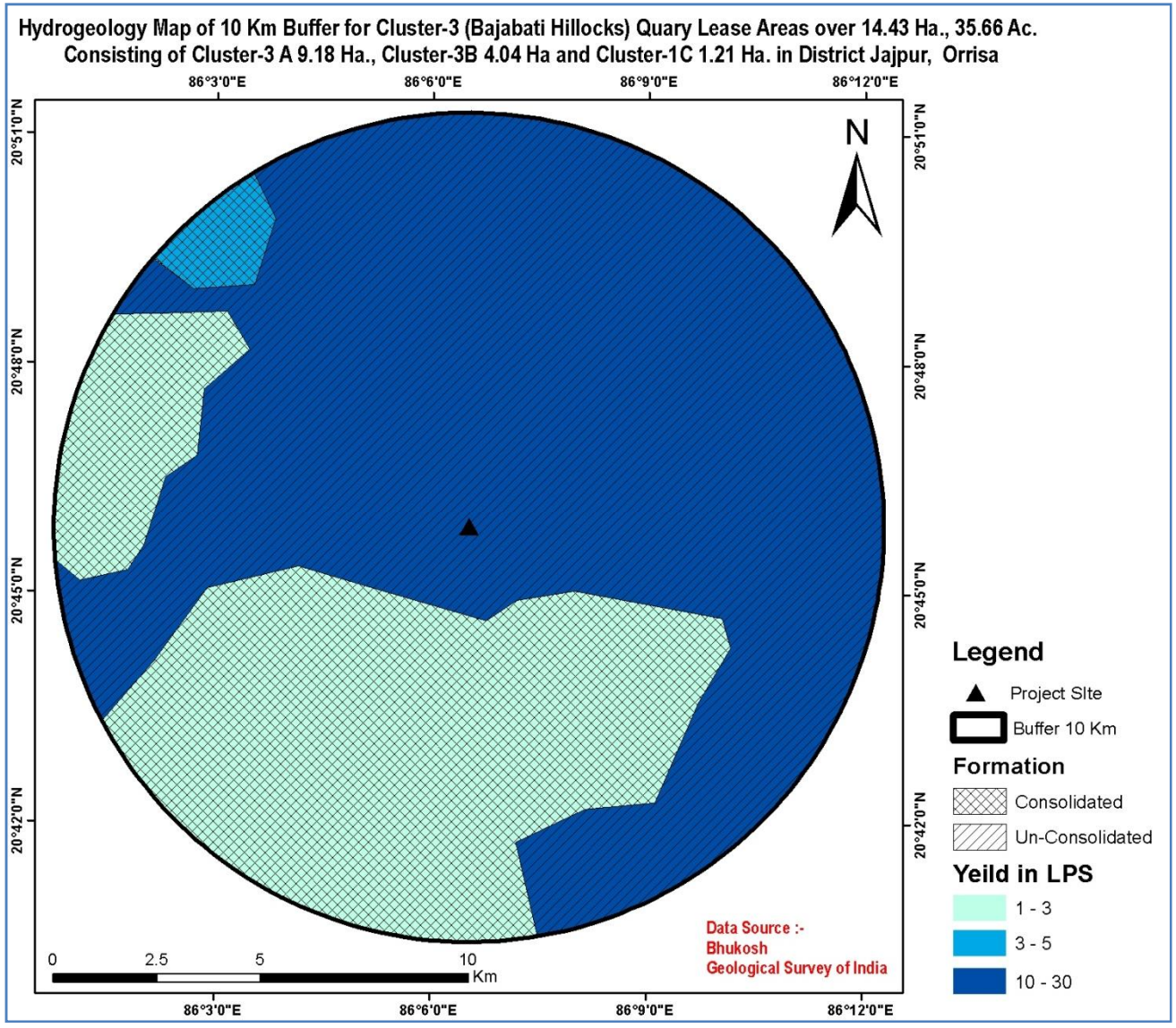


3.5.2.1. Details of over exploited, critical and semi critical areas:

Stage of ground water development shows that Dharmasala blocks fall under safe category.Hydrogeological map of the buffer zone of study area given in **Figure 3.5.**

(***Ref: Ground water information Booklet of Jajpur District, Odisha, May 2013)***

Figure 3.5 Hydrogeological map of the buffer zone of study area



3.6 LAND ENVIRONMENT

The objective of this section is to define the present baseline status, so that temporary changes due to the mining activities on the surroundings can be assessed in future. The objectives of land use studies are:

- To determine the present land use pattern.
- To analyze the impacts on land use due to industrialization activities in the study area.
- To give recommendations for optimizing the future land use pattern vis-à-vis growth of industrial activities in the study area and its associated impacts.

3.6.1 Land Use & Land Cover of buffer zone

The present Land use / Land cover map for the proposed project activity is prepared by latest satellite image. This report thus will enable assessing the impact on land use pattern in the study area due to the proposed project activity.

(A)Data Used

Current vintage data of Sentinel-2 FCC (False Color Composite) downloaded from USGS Earth Explorer has been used for preparation of Land use/ Land cover thematic map of study area. The downloaded satellite data is already georeferenced and terrain corrected. A total number of four bands have been stacked and resampled at 10 m resolution. Google earth was used as reference for the preparation of base layer data like road, rail net work, and plant site.

Table 3.5 shows technical details of land cover

Satellite Image	Sentinel-2
Imagery Date	2nd May 2020
Satellite Data Source	USGS Earth Explorer
Software used	ArcGIS 10.1 and e-Cognition 9.2

(B) Methodology

Landuse/ Land cover map preparation, base map creation; Layer Stacking of satellite image has been processed using ArcGIS 10.1Software. The methodology used for present LU/LC study area is given below:- The LULC maps were generated using Sentinel-2 satellite data for the date 08-Jan-2018, the bands used were blue, green, red and Near Infra-Red (NIR); these were stacked at 10 m of spatial resolution. Object oriented classification method was implemented in e-Cognition 9.2 software. In this classification approach the image is divided into objects by using multi-resolution segmentation. As this is a supervised classification algorithm sample objects are selected for all the classes from

the segmented image. The mean of the selected bands are used as object features for differentiating classes from each other. Finally, nearest neighbourhood classification algorithm is applied. Certain anomalies in classified output are removed using manual editing tool. The results were then exported as ESRI shape files into ArcGIS 10.1 and area calculation for different classes was done. The final map was prepared using ArcGIS layout view by adding all the layers and map information like North arrow, scale bar, legend and the title for the map. The Land use map of the buffer zone given in **Figure 3.5 &**the graph showing the land use distribution of the buffer zone has been given in **Figure 3.6.**

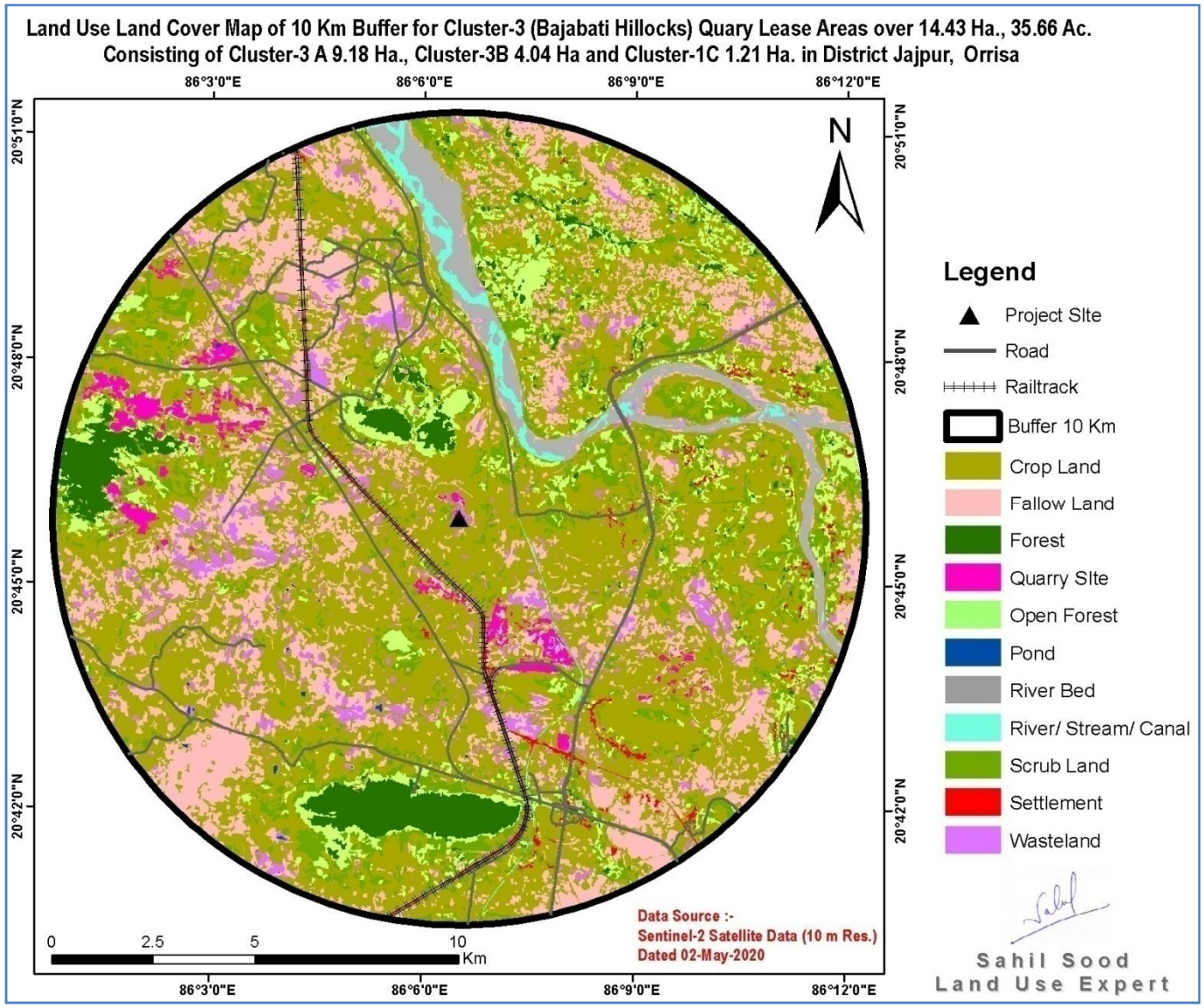
3.6.2 Land Use & Land Cover in Buffer zone

The land use pattern of the area around 10 km radius of core zone is presented in table given below.

Table 3.6: Land Use planning of buffer zone

Sl. No	Classes	Area (sq. km)	Area (Hectares)	Percentage Area (%)
1	Agriculture	153.13	15313.41	48.71
2	Fallow Land	60.38	6038.30	19.21
3	Forest	12.32	1232.11	3.92
5	Open Forest	22.08	2207.92	7.02
6	Pond	0.16	15.52	0.05
7	River Bed	9.40	940.23	2.99
8	River/ Stream/ Canal	2.66	265.95	0.85
9	Scrub Land	33.13	3313.20	10.54
10	Settlement	2.84	284.32	0.90
11	Wasteland	13.58	1357.79	4.32
12	Mining SIte	4.73	473.05	1.50
Total		**314.417**	**31441.79**	**100**

Fig No.3.6: Land Use Map of the Buffer Zone



3.6.3 Discussion

As per the land use pattern of the buffer zone of the proposed project area it has been observed that about 48% of the land is used for agricultural purpose, fallow land 19% of the land use. The agriculture of the district is found to be good due to good quantity of rain fall, highly fertile soil and irrigation facility. Scrub land covers about 10% of the buffer zone and 10% of the area comes under forest land. Forest in the buffer zone mainly scrub and open forest. The mining area covers under 1.5% of the total land use.

3.7 SOIL QUALITY

3.7.1 Soil Quality Monitoring

Seven nos of Soil sampling locations has been identified based on wind direction, soil utilization pattern of the area, cropping pattern of the area and topography.The soil samples were collected in the selected locations are analysed for physico-chemical parameters.

3.7.2 Methodology

Soil samples were collected from the agricultural fields by digging pits of 6-10 cm depth for soil texture and classification. Soil sampling from three different strata i.e. 0-10 cm, 10-20 cm and 20-30 cm were collected. Samples were analyzed for various physic chemical characteristics, macronutrients and micronutrients. The sample was packed in a polyethylene bag, sealed and brought to the laboratory. After drawing sample for moisture content, the remaining samples were air-dried. For chemical characteristics, air-dried samples were ground in an agate mortar and sieved.

The standard soil classification details as per Indian council of agricultural research have been tabulated as below to assess the soil quality of the study area.

Table 3.7: Standard soil classification

Sl. No	Parameters	Classification
01	pH	<4.6 Extremely acidic 4.6- 5.50 Strongly acidic 5.6-6.5 moderately acidic 6.6 – 6.9 slightly acidic 7.0 Neutral 7.1-8.5 Moderately alkaline >8.5 strongly alkaline
02	Salinity Electrical Conductivity (µmhos/cm) (1ppm = 640 µmho/cm)	Up to 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (sensitive to salts)
03	Organic carbon (%)	< 0.5 - Low 0.5-0.75 - Medium >0.75- High

04	Nitrogen (kg/Ha)	<280 low 280– 560 Medium >560 High
05	Phosphorus as P2O5 (Kg/Ha)	<10 low 10 – 24.6 Medium >24.6 High
06	Potassium as K_2O (Kg/Ha)	<108 low 108 – 280 Medium >280 High
Ref: Department of Agriculture & Cooperation Ministry of Agriculture Government of India New Delhi, January, 2011		

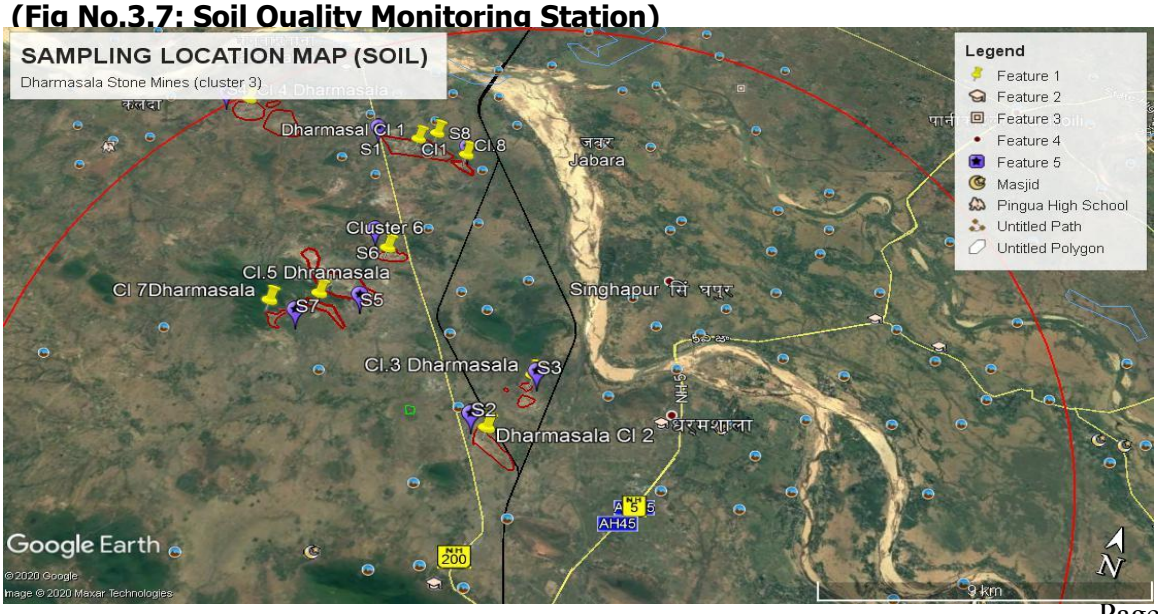
3.7.3 Sampling Locations

A total of 6 sampling locations were selected for soil quality analysis. The sampling location for soil quality has been given in the **table no.3.7** below and **Figure 3.7**.

Table No. 3.8: Location of soil Sampling Stations

Sample Code	Sampling Location	Distance / Direction	Coordinates	Land use pattern
S1	Makundapur	6.59 Km, NE	20°50'26.79" N 86°01'45.81" E	Agricultural Land
S2	Aruha	1.5 Km,SE	20°45'1.41" N 86°05'50.25" E	Agricultural land
S3	Bajabati	0.5 Km,E	20°46'6.10" N 86°06'37.25" E	Agricultural land
S5	Dankari	3.7 Km,NW	20°46'41.864" N 86°03'03.828"E	Agricultural land
S6	Lunibar	4.5 Km, NW	20°48'7.22"N 86°02'43.98"E	Agricultural land
S7	Rahadpur	4.5 Km, NSW	20°46'5.04"N 86°02'6.15"E	Agricultural land
S8	Sahanidiha	6.0 Km,N	20°50'27.846"N 86°03'37.78"E	Non Agricultural Fallow land

(Fig No.3.7: Soil Quality Monitoring Station)



The analysis result of soil from 8no.s of sampling stations is given in **table no.3.8** below:

Table 3.9: Soil Quality Analysis Results

Location	S1	S2	S3	S5	S6	S7	S8
Colour	Grey	Reddish Brown	Brown	Grey	Brown	Brown	Brown
PH	8.2	7.0	7.9	8.35	7.2	7.5	6.0
Texture	Clay Loam	Sandy Loam	Sandy Loam	Clay Loam	Sandy Loam	Silty Clay Loam	Silty Clay Loam
BULK DENSITY (G/Cc)	1.36	1.15	1.25	1.07	1.07	1.15	1.36
Electrical Conductivity (µs/Cm)	323	97	192	167	290	87	48
Available Nitrogen (Kg/Ha)	1814	1389	1658	1590	1747	1299	1210
Available Phosphrous (Kg/Ha)	31.38	25.94	41.75	36.69	49.99	18.97	13.91
Sodium (mg/kg)	425	135	170	135	160	185	110
Potassium (Kg/Ha)	482	134	168	314	336	179	235
Total Organic Carbon	1.13	2.37	0.36	1.84	0.78	1.88	0.36
Moisture (%)	13.15	10.83	5.96	8.49	7.8	16.47	5.23
Ref: Soil Analysis Result by KLPL							

3.7.4 Discussion

The soil analysis result shows that, the pH of the soil samples collected are mostly alkaline except the soil of Bichakhandi and Sahanidih which are slightly acidic. Texture of the soil varies from silt loam to sandy clay loam. Electrical conductivity ranges from 48 to 323 µs/Cm. Nitrogen content of soil varies from 1210 to 1747 Kg/Ha, Phosphorous content varies from 13.91 to 49.99 Kg/Ha and Potassium content 134 to 482 Kg/Ha. Total organic carbon of the soil varies from 0.36 to 2.37 %. From the soil analysis result it can be concluded that the soil of the area is highly fertile and suitable for agricultural purpose.

3.7.5 Secondary data for soil quality studies

The soil type of Dharmasala block is Alluvial red laterite soil. As per the district irrigation plan of Jajpur District, March 2016, the pH content is imperative for farmers as the alkaline and acidic condition of the soil may thrive some diseases and also affects the availability of nutrients content of the soil. It is evident that in Jajpur district almost all blocks has more acid content in the soil. More rainfall also affects soil pH value as water passing through the soil percolates the nutrient content from the soil and is replaced by the acidic content. Therefore, in the flood affected area soil is more acidic. Since, Jajpur is a flood prone area the soil in most of the blocks is more acidic. It is also evident from the table that in most of

the blocks of Jajpur district, soil contains low EC, medium organic carbon, low phosphorus and low potash. The soil of the district is acidic in nature i.e. up to 91.0% and rest of the soils is normal with few saline pockets. The fertility status is medium in respect to organic carbon, phosphorus, and potassium content.

3.8 AIR ENVIRONMENT

The air environment consists of

(a) Meteorological parameters like wind direction, Wind speed, Temperature, Atmospheric pressure, humidity and Rainfall

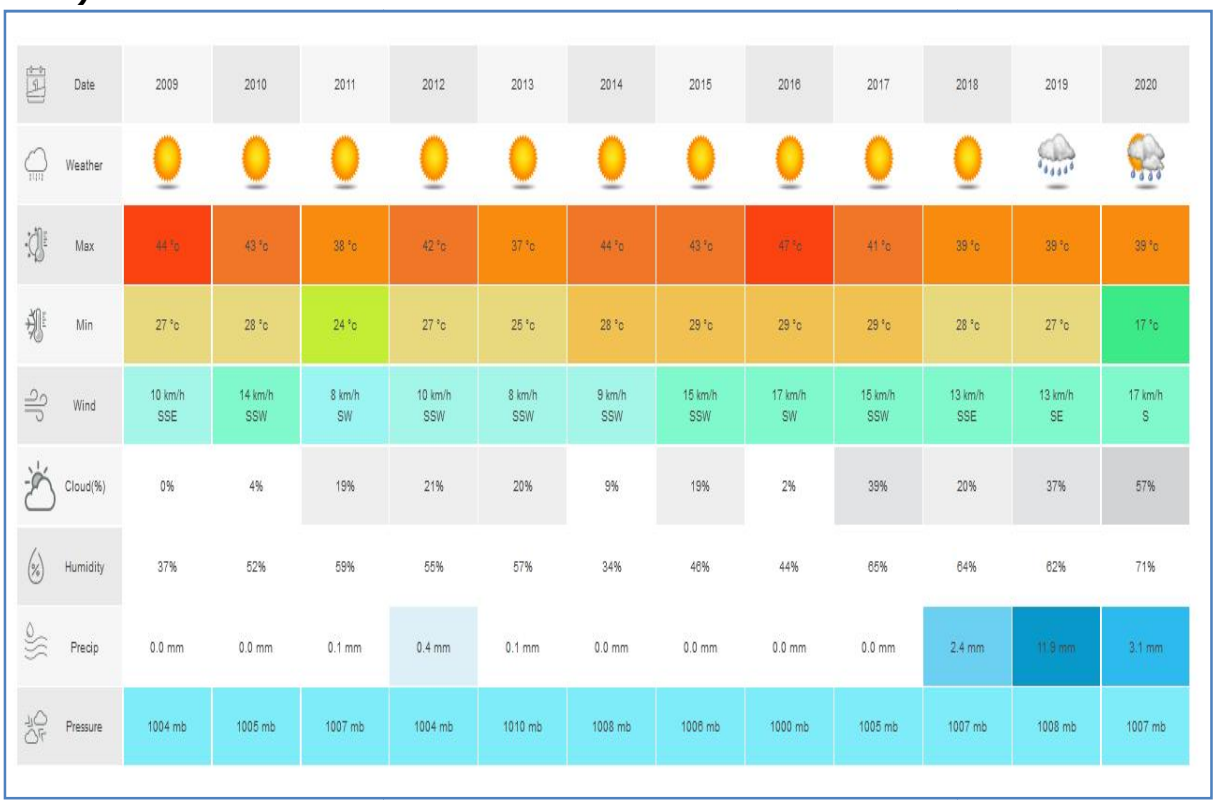
(b) Ambient air quality parameters includes Particulate Matter (PM10), Particulate Matter (PM2.5) and Gaseous Pollutants (SOx& NOx)

3.8.1 Meteorology

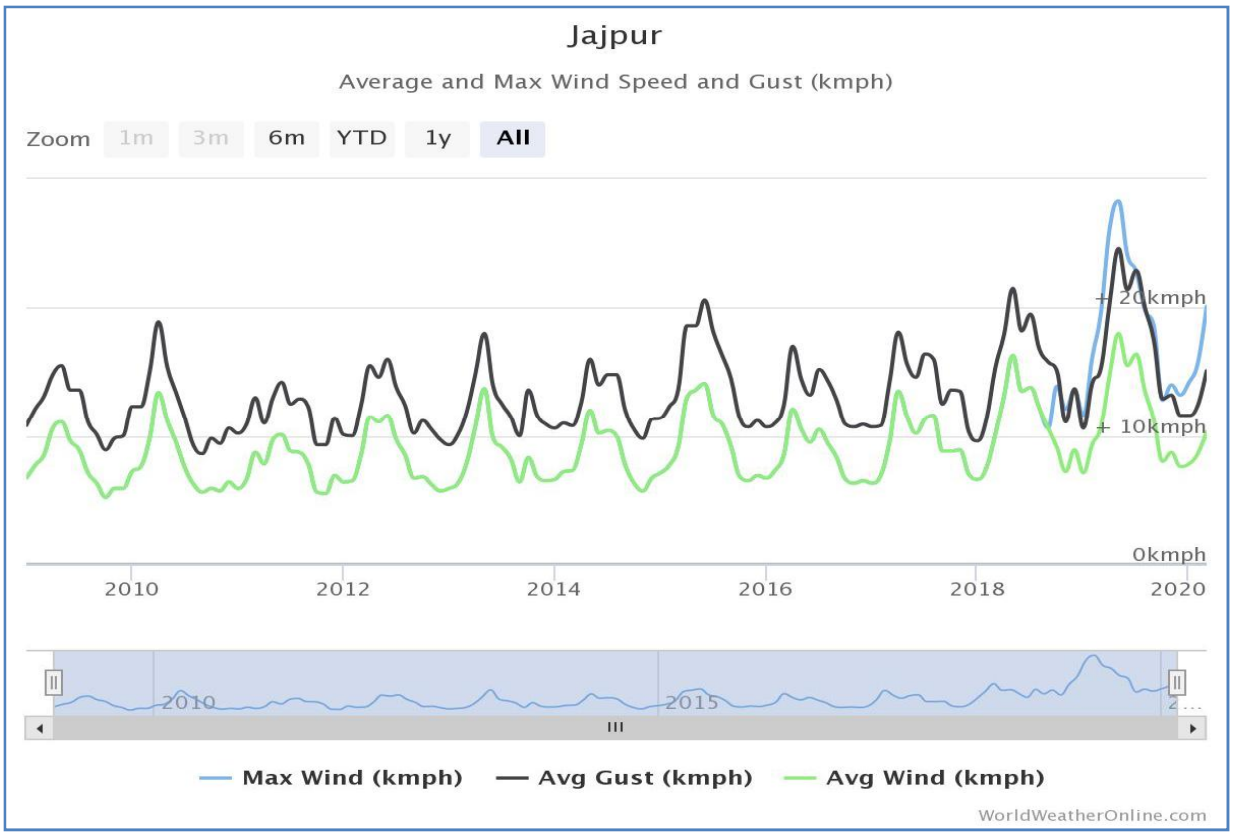
3.8.1.1Climate of the district

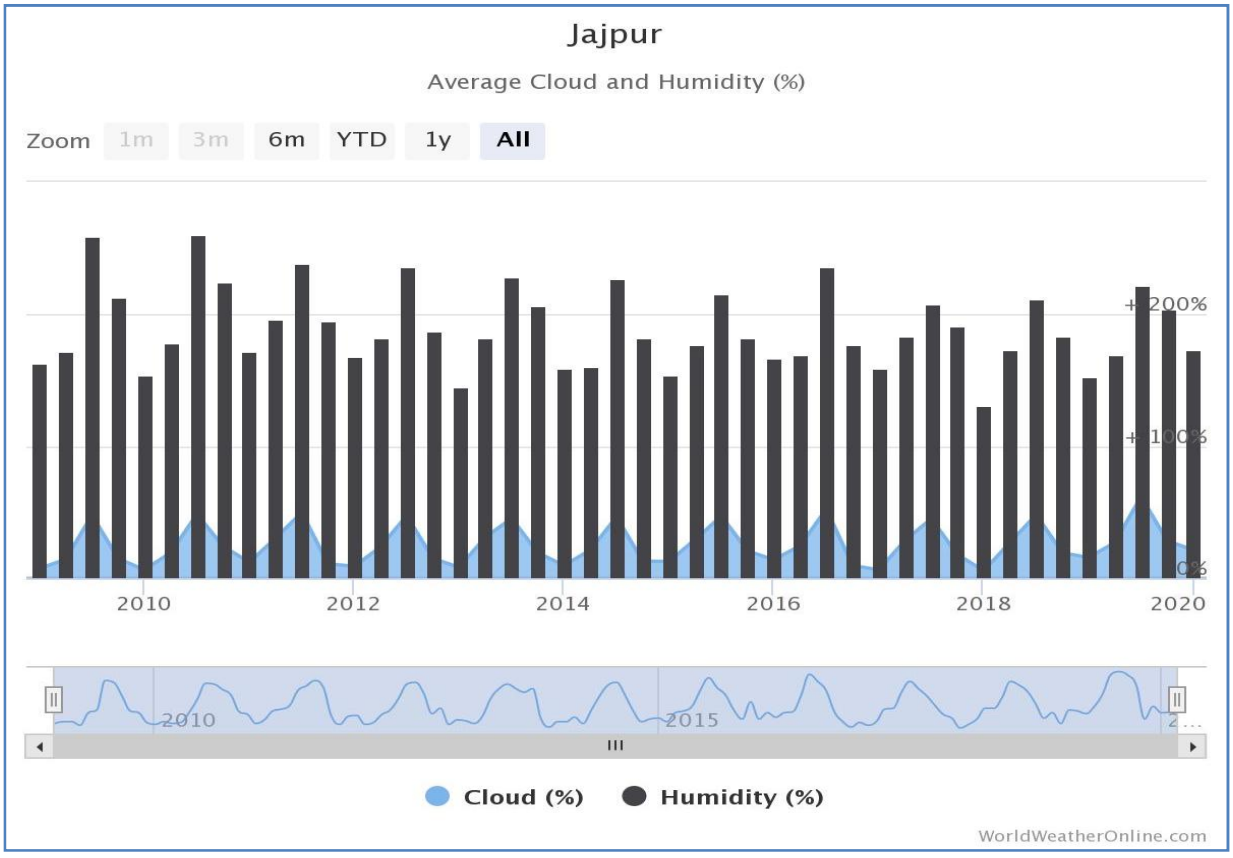
The district is characterized by humid sub - tropical monsoon climate having three distinct seasons in a year, i.e. winter, summer and rainy seasons. Winter commenced from late November and continues till end of February. Winter is followed by the summer season, which extends uptomid June. The rainy season sets in the district with the onset of the southwest monsoon, generally from the middle of June and continues till end of September. The maximum temperature in the district rises up to 46˚C in the summer and falls to a minimum of 14˚C in winter. The December and January are the coldest and May is the hottest month. The relative humidity is high, on an average, varies from 40 to 90% during the year. The average rainfall of the district is1550mm. Maximum rainfall generally occurs in the month of August. Average nos. of rainy days in a year is 72. The western, south-western, eastern southern tract s receive a fairly high rainfall (>1500 mm.) which gradually decreases to 1300mm towards north-east. The meterological profile of sukinda block during last 10 years (2009-2020) has been given in the table below. The graph showing the variation of temperature, pressure, humidity and wind speed has been given in Figure below.

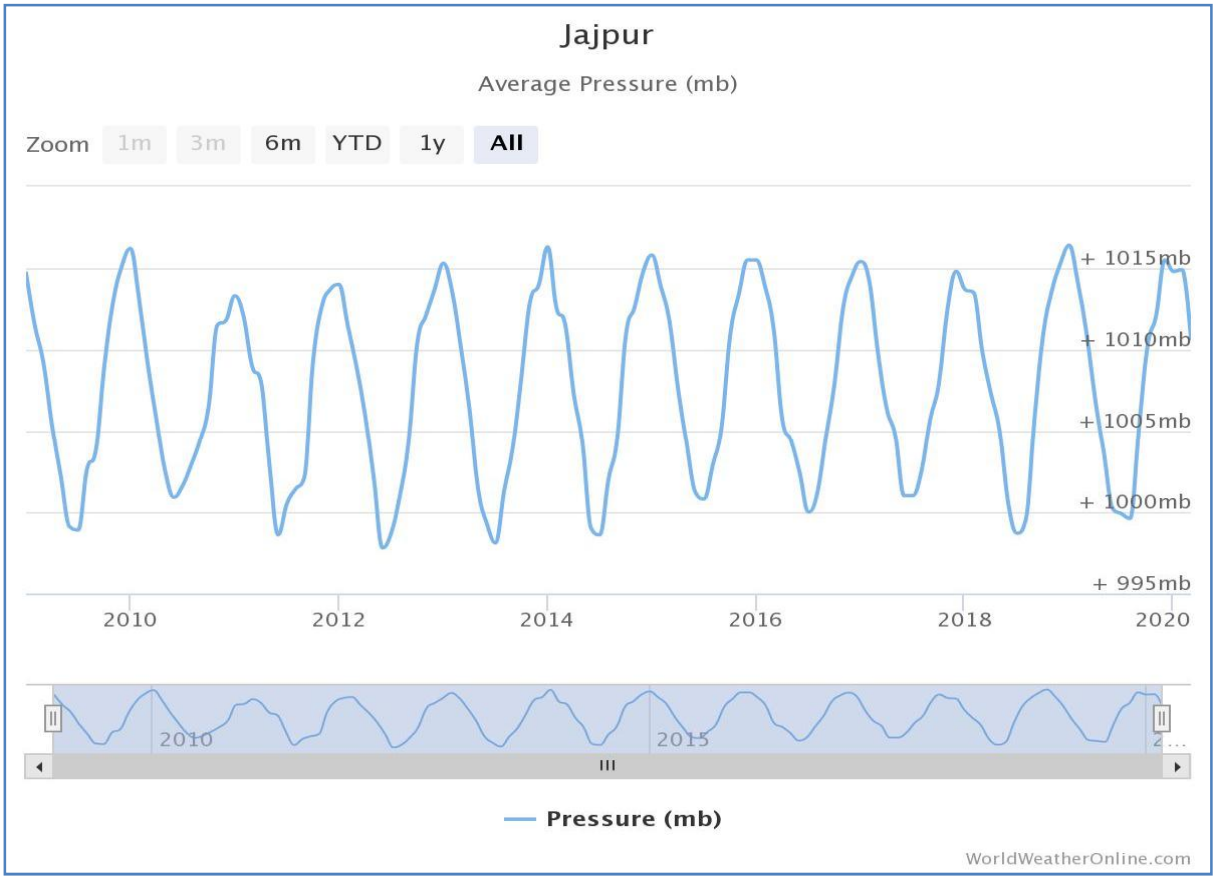
Figure 3.8 Graphical Representation of Climate data of Jajpur district (2010-2020)

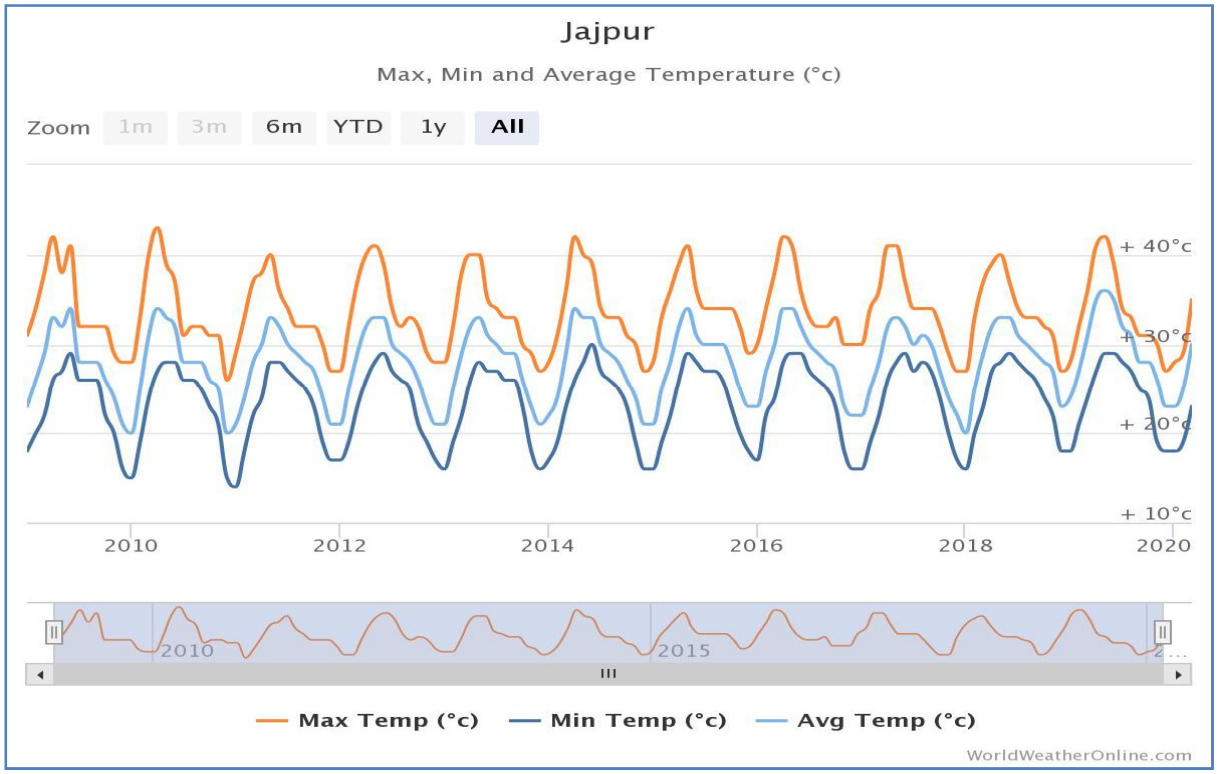


Date	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Weather												
Max	44 °c	43 °c	38 °c	42 °c	37 °c	44 °c	43 °c	47 °c	41 °c	39 °c	39 °c	39 °c
Min	27 °c	28 °c	24 °c	27 °c	25 °c	28 °c	29 °c	29 °c	29 °c	28 °c	27 °c	17 °c
Wind	10 km/h SSE	14 km/h SSW	8 km/h SW	10 km/h SSW	8 km/h SSW	9 km/h SSW	15 km/h SSW	17 km/h SW	15 km/h SSW	13 km/h SSE	13 km/h SE	17 km/h S
Cloud(%)	0%	4%	19%	21%	20%	9%	19%	2%	39%	20%	37%	57%
Humidity	37%	52%	59%	55%	57%	34%	46%	44%	65%	64%	62%	71%
Precip	0.0 mm	0.0 mm	0.1 mm	0.4 mm	0.1 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	2.4 mm	11.9 mm	3.1 mm
Pressure	1004 mb	1005 mb	1007 mb	1004 mb	1010 mb	1008 mb	1006 mb	1000 mb	1005 mb	1007 mb	1008 mb	1007 mb


Jajpur
Average and Max Wind Speed and Gust (kmph)
Zoom 1m 3m 6m YTD 1y All
+ 20kmph
+ 10kmph
0kmph
2010
2012
2014
2016
2018
2020
2010
2015
Max Wind (kmph)
Avg Gust (kmph)
Avg Wind (kmph)
WorldWeatherOnline.com


Jajpur
Average Cloud and Humidity (%)
Zoom 1m 3m 6m YTD 1y All
+ 200%
0%
2010
2012
2014
2016
2018
2020
2010
2015
Cloud (%)
Humidity (%)
WorldWeatherOnline.com


Jajpur
Average Pressure (mb)
Zoom 1m 3m 6m YTD 1y All
+ 1015mb
+ 1010mb
+ 1005mb
+ 1000mb
+ 995mb
2010 2012 2014 2016 2018 2020
2010 2015
Pressure (mb)
WorldWeatherOnline.com


Jajpur
Max, Min and Average Temperature (°c)
Zoom 1m 3m 6m YTD 1y All
+ 40°c
+ 30°c
+ 20°c
+ 10°c
2010 2012 2014 2016 2018 2020
2010 2015
Max Temp (°c)
Min Temp (°c)
Avg Temp (°c)
WorldWeatherOnline.com

3.8.6 Rainfall

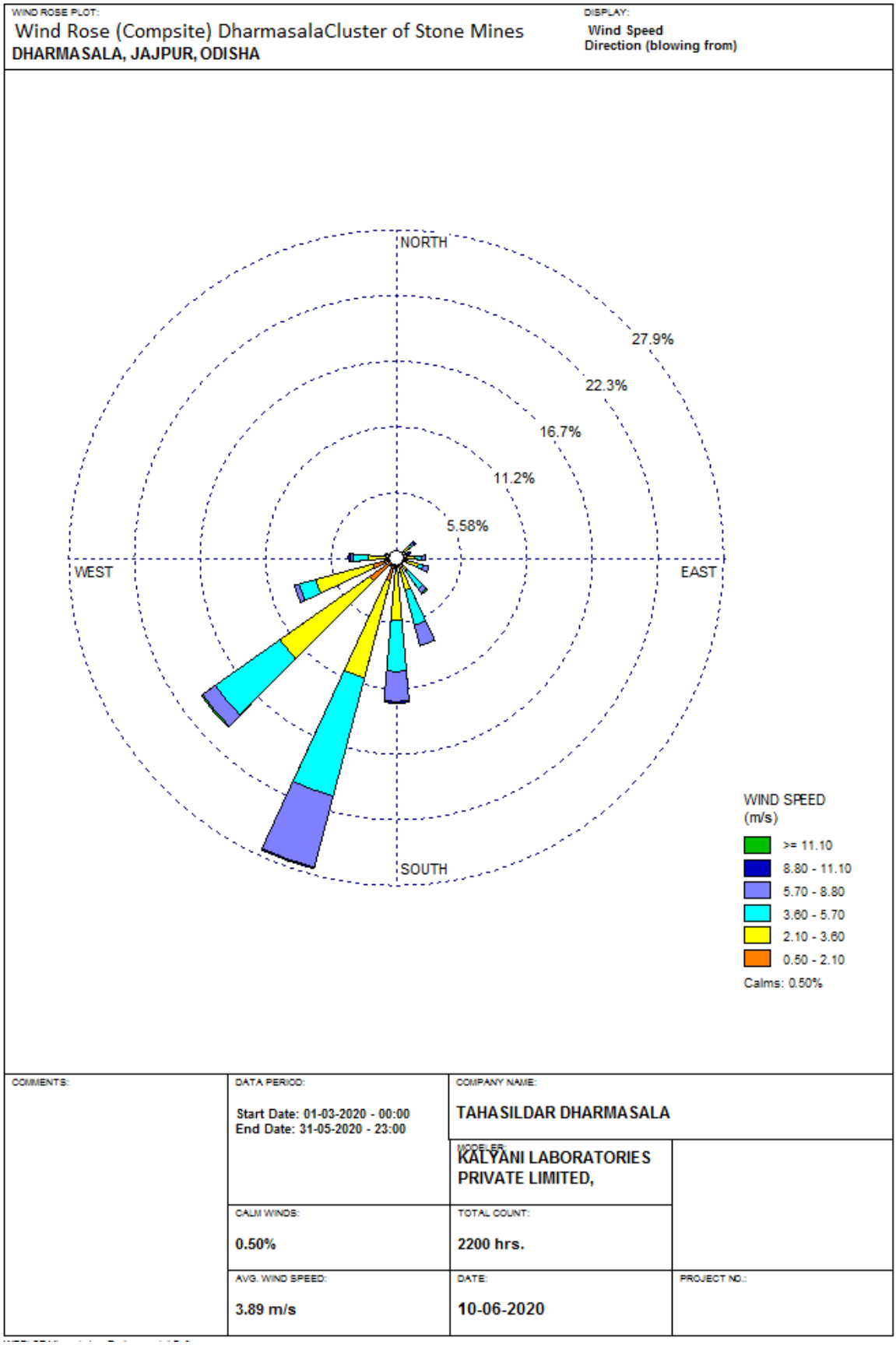
The average annual rainfall based on the 10 years (2009 – 2019) IMD data of Jajpur district, was observed to be 1557 mm distributed in 154 rainy days. The monsoon sets in the month of June and continues till September and sometime extends up to mid October. The maximum number of rainy days was observed in the month of July and August. Monthly variations in the rainfall are given in **Table No. 3.10** and **Figure No. 3.9.**

Table no.3.10 Monthly rainfall in the study area

Months	2009		2010		2011		2012		2013	
	Rainfall	Days	Rainfall	Days	Rainfall	Days	Rainfall	Days	Rainfall	Days
Jan	0	0	4.3	2	0	0	40.11	9	1.72	3
Feb	0.69	1	8.3	3	36.71	4	0.2	0	0.71	2
March	0	0	1.7	1	4.52	4	6.73	2	0.5	1
April	10.2	2	0.56	1	47.4	8	3.37	2	60.02	6
May	99.1	11	248.82	9	52.69	7	46.54	6	72.47	9
June	184.08	10	225.25	24	160.31	23	159.89	16	175.31	23
July	844.22	31	813	30	190.83	29	398.48	29	329.59	31
Aug	682.4	30	587.05	30	349.95	31	317.68	31	323.79	30
Sept	596.44	29	493.97	28	213.78	25	262.94	26	232.52	29
Oct	317.93	8	142.26	26	60.68	15	64.49	12	265.2	22
Nov	117.77	14	57.42	14	0.51	0	63.68	7	3.81	3
Dec	0	0	38.72	6	1.82	2	6.61	3	0.39	0
Total	**2852.8**	**136**	**2621.3**	**174**	**1119.2**	**148**	**1370.7**	**143**	**1466.03**	**159**

Months	2014		2015		2016		2017		2018		2019	
	Rainfall	Days	Rainfall	Days	Rainfall	Days	Rainfall	Days	Rainfall	Days	Rainfall	Days
Jan	0.6	1	13.76	6	4.49	4	1.1	2	0	0	0	0
Feb	13.71	3	3.9	2	6.9	9	0.4	2	0	0	14.81	5
March	7.49	3	8.48	7	2.5	6	83.6	9	28.5	5	30.48	6
April	3	2	57.8	12	2.7	3	2.1	4	91.2	11	58.71	13
May	92.09	6	11.29	6	107.82	10	67.2	12	153.2	16	185.22	7
June	117.97	14	107.95	24	162.8	25	305.1	26	187.7	19	253.72	14
July	388.48	27	217.86	28	192.53	31	323.2	31	582.3	30	183.66	22
Aug	278.4	30	162.02	30	340.5	30	164.9	28	261	26	446.85	24
Sept	233.8	22	107.56	18	249.63	30	215	25	604	18	307.16	22
Oct	140.8	18	29.25	15	100.92	15	271	15	239	7	236.54	16
Nov	1.21	4	7.71	3	80.4	3	322	6	0	0	30.97	2
Dec	26.13	1	25.99	6	0	0	34.8	4	6.84	1	0	0
Total	**1303**	**159**	**753.5**	**131**	**1251**	**157**	**1790.4**	**166**	**2153.7**	**133**	**1748.1**	**131**

Fig. 3.9: Wind Rose Diagram (Composite)



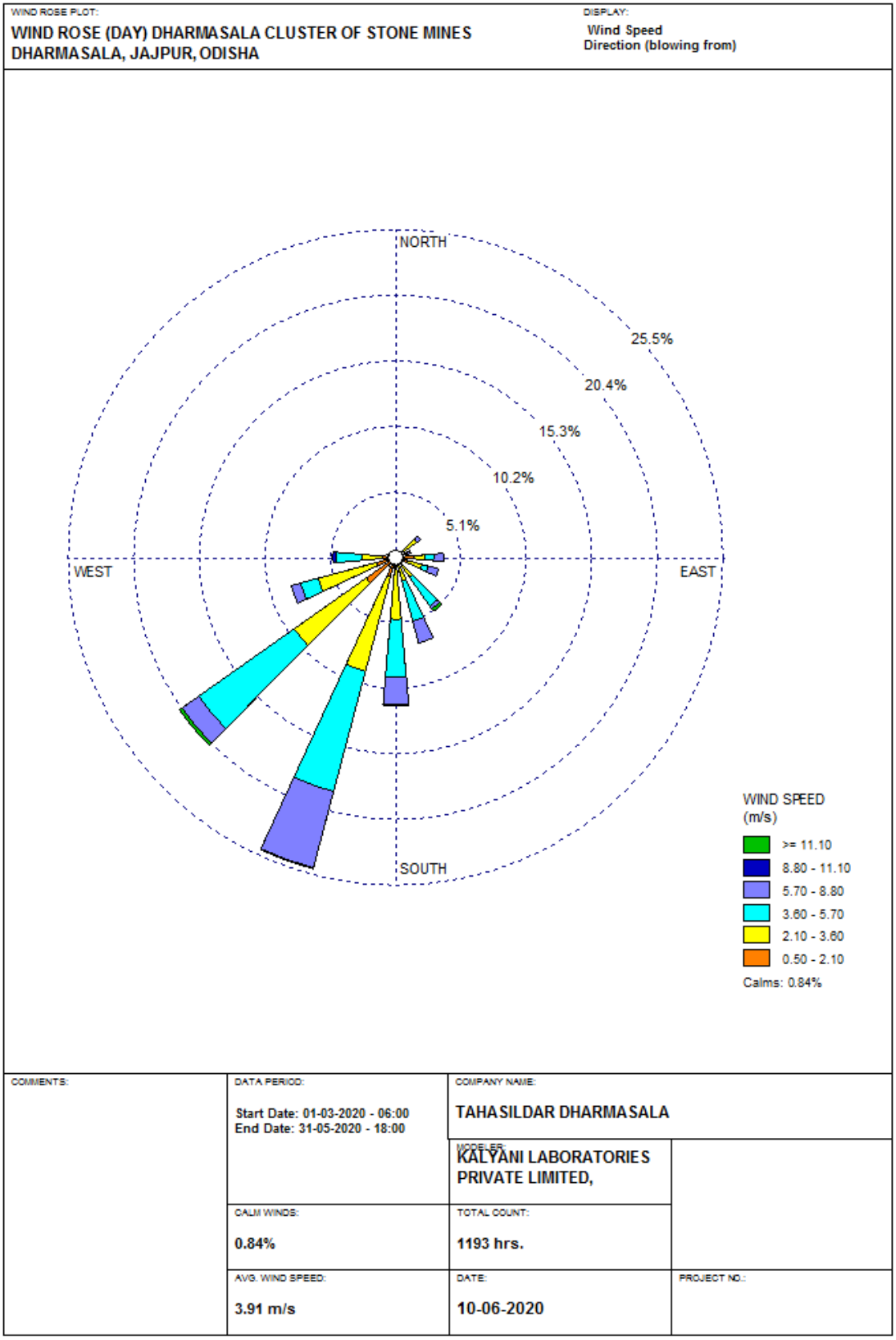


Fig. 3.10: Wind Rose Diagram (Day)

Fig.3.11 Wind Rose Diagram (Night)

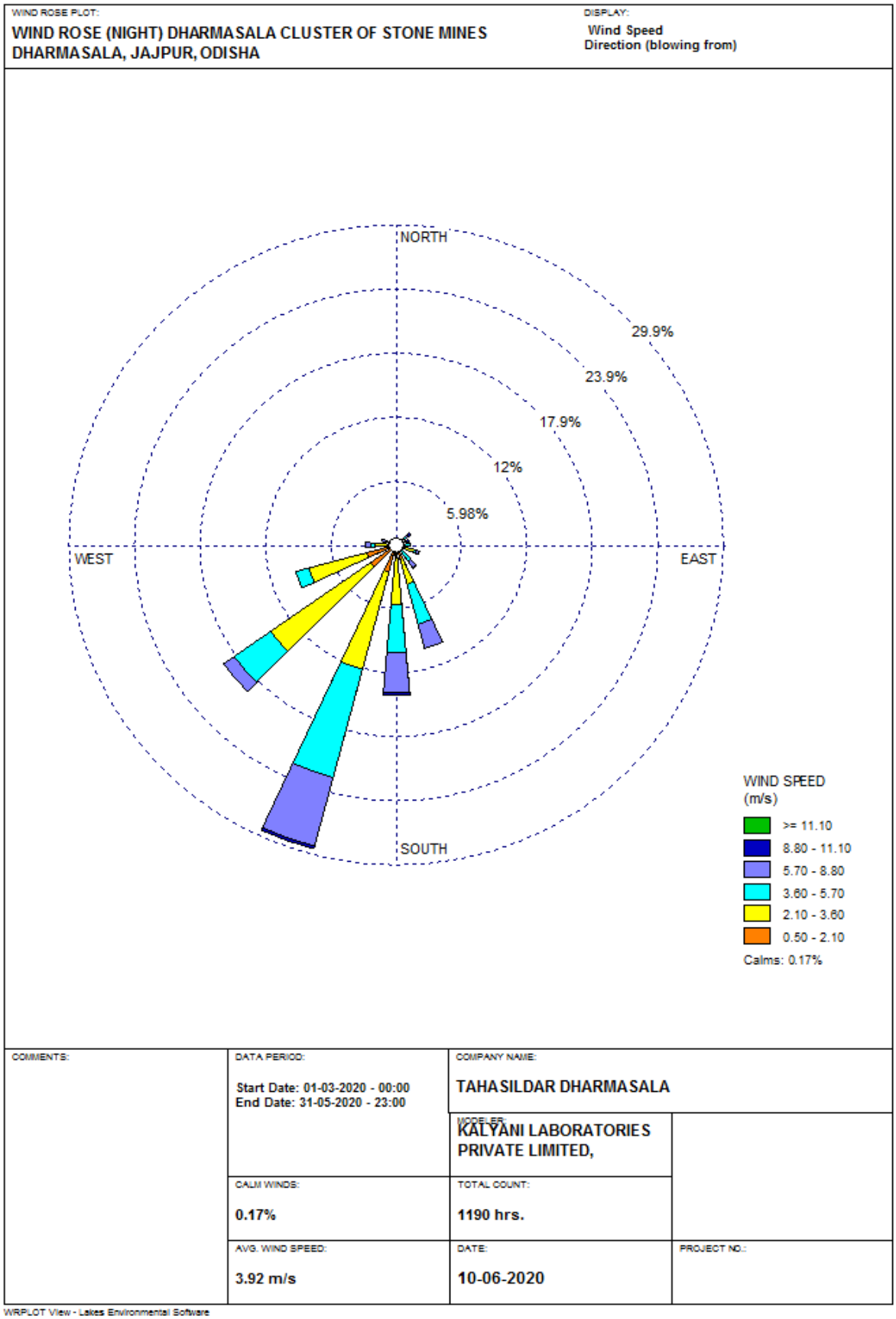


Table no. 3.11 Frequency Distribution Table (Composite)

	Directions / Wind Classes (m/s)	0.50 - 2.10	2.10 - 3.60	3.60 - 5.70	5.70 - 8.80	8.80 - 11.10	>= 11.10	Total
1	348.75 - 11.25	0	0	0	0	0	0.00181	0.00181
2	11.25 - 33.75	0	0.00272	0	0	0	0	0.00272
3	33.75 - 56.25	0.00408	0.00997	0.00272	0.00272	0.00136	0	0.02084
4	56.25 - 78.75	0.00227	0.00453	0.00136	0.00272	0.00272	0	0.01359
5	78.75 - 101.25	0.00952	0.00725	0.00544	0.00408	0	0	0.02628
6	101.25 - 123.75	0.00952	0.01042	0.00408	0.00544	0	0	0.02945
7	123.75 - 146.25	0.00136	0.01269	0.01948	0.00408	0	0.00136	0.03897
8	146.25 - 168.75	0.01087	0.02175	0.03308	0.01812	0	0	0.08382
9	168.75 - 191.25	0.01314	0.0444	0.0444	0.02537	0.00136	0	0.12868
10	191.25 - 213.75	0.0222	0.08564	0.10331	0.06253	0.00136	0	0.27503
11	213.75 - 236.25	0.03444	0.09651	0.06797	0.01314	0	0.00136	0.21341
12	236.25 - 258.75	0.02311	0.05437	0.0145	0.00408	0	0	0.09606
13	258.75 - 281.25	0.01087	0.01541	0.01223	0.00272	0.00136	0	0.04259
14	281.25 - 303.75	0.00362	0.00408	0.00136	0.00272	0	0	0.01178
15	303.75 - 326.25	0.00136	0.00045	0	0	0.00136	0.00136	0.00453
16	326.25 - 348.75	0.00045	0.00045	0	0	0	0.00136	0.00227
	Sub-Total	0.14681	0.37064	0.30992	0.14771	0.00952	0.00725	0.99184
	Calms							0.00498
	Missing/Incomplete							0.00317
	Total							1

Table no.3.12 Frequency Distribution Table (Day)

	Directions / Wind Classes (m/s)	0.50 - 2.10	2.10 - 3.60	3.60 - 5.70	5.70 - 8.80	8.80 - 11.10	>= 11.10	Total
1	348.75 - 11.25	0	0	0	0	0	3	3
2	11.25 - 33.75	0	3	0	0	0	0	3
3	33.75 - 56.25	9	16	0	4	0	0	29
4	56.25 - 78.75	3	7	3	3	0	0	16
5	78.75 - 101.25	18	11	8	9	0	0	46
6	101.25 - 123.75	12	14	6	10	0	0	42
7	123.75 - 146.25	3	20	33	3	0	3	62
8	146.25 - 168.75	7	17	44	21	0	0	89
9	168.75 - 191.25	12	51	56	25	1	0	145
10	191.25 - 213.75	20	92	115	73	1	0	301
11	213.75 - 236.25	40	89	108	19	0	3	259
12	236.25 - 258.75	20	61	17	9	0	0	107
13	258.75 - 281.25	13	19	24	0	3	0	59
14	281.25 - 303.75	3	7	0	1	0	0	11
15	303.75 - 326.25	0	1	0	0	3	3	7

16	326.25 - 348.75	0	1	0	0	0	3	4
	Sub-Total	160	409	414	177	8	15	1183
	Calms							10
	Missing/Incomplete							3
	Total							1196

Table no.3.13 Frequency Distribution Table (Night)

	Directions / Wind Classes (m/s)	0.50 - 2.10	2.10 - 3.60	3.60 - 5.70	5.70 - 8.80	8.80 - 11.10	>= 11.10	Total
1	348.75 - 11.25	0	0	0	0	0	1	1
2	11.25 - 33.75	0	3	0	0	0	0	3
3	33.75 - 56.25	0	8	6	3	3	0	20
4	56.25 - 78.75	2	3	1	3	6	0	15
5	78.75 - 101.25	5	6	6	0	0	0	17
6	101.25 - 123.75	10	11	3	3	0	0	27
7	123.75 - 146.25	0	8	16	9	0	1	34
8	146.25 - 168.75	18	35	46	28	0	0	127
9	168.75 - 191.25	18	52	54	45	3	0	172
10	191.25 - 213.75	34	112	124	79	3	0	352
11	213.75 - 236.25	43	133	50	14	0	0	240
12	236.25 - 258.75	37	69	15	0	0	0	121
13	258.75 - 281.25	11	16	4	6	0	0	37
14	281.25 - 303.75	6	3	3	6	0	0	18
15	303.75 - 326.25	3	0	0	0	0	0	3
16	326.25 - 348.75	1	0	0	0	0	0	1
	Sub-Total	188	459	328	196	15	2	1188
	Calms							2
	Missing/Incomplete							
	Total							1195

3.9 AMBIENT AIR QUALITY

Ambient air quality monitoring was carried out at 8 locations within the study area including the project site. This section of the report describes the selection of sampling locations, methodology adopted for sampling, analytical techniques and frequency of sampling for ambient air quality monitoring. The ambient air quality in terms of Particulate Matter (PM_{10} &$PM_{2.5}$), Sulphur Dioxide (SO_2) Oxides of Nitrogen (NO_X), Ozone (O3) and COhas been measured through a planned field monitoring.

3.9.1 Selection of Sampling Stations

The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality-monitoring network. The design of monitoring network in the air quality surveillance program has been based on the following considerations:

- Meteorological conditions on synoptic scale.
- Topography of the study area
- Representatives of regional background air quality for obtaining baseline status.
- Representatives of likely impact areas
- Major human settlements in the area

3.9.2 Methodology:

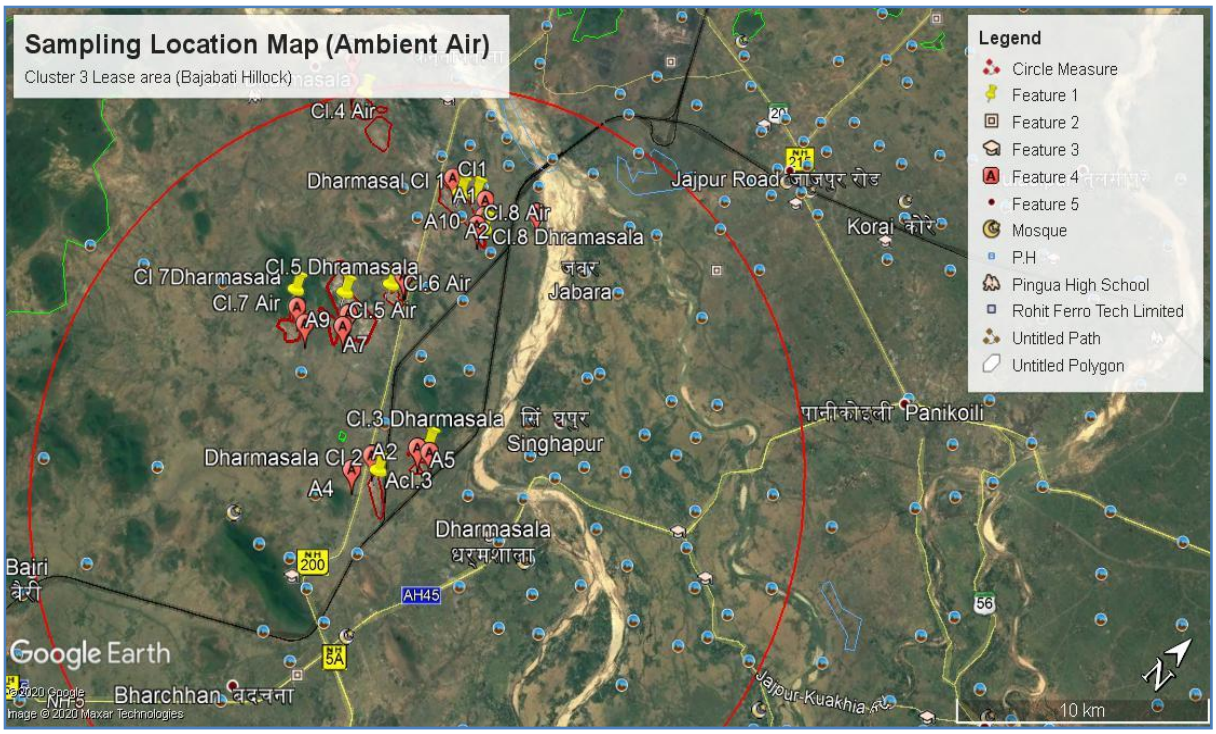
The details of these Ambient Air quality-sampling stations are given in **Table No. 3.13.**

Table 3.14: Details of Ambient Air quality Sampling Locations

Station Code	Sampling Location	Distance / Direction	Coordinates	Area details	Wind Direction
A1	Lease Area	--	20°45'50.482"N 86° 06'35.1561" E	Industrial Area	--
A2	MakundPur	6.2 Km, N	20° 50'44.37" N 86° 3' 20.37" E	Village Area	1st Predominant Wind Direction
A3	Jena Pur	6.4 Km, NE	20° 51'23.64" N 86° 4'28.51"E	Village Area	1st Predominant Wind Direction
A4	Aruha	1.8 Km, SE	20°44'28.99"N 86° 5'51.26" E	Village Area	2nd Predominant Wind Direction
A5	Bajabati	0.5 Km, SE	20°45'58.36"N 86° 6'51.98" E		2nd Predominant Wind Direction
A7	Dankri	3.5 Km, NW	20° 46'24.69"N 86° 3'10.46"E	Village Area	Down Wind direction
A8	Luni Bara	4.0 Km, N	20° 48'12.79"N 86° 3' 19.37"E	Village Area	2nd Predominant

					Wind Direction
A10	Sahanidiha	5.5 Km, NE	20° 50'11.85"N 86° 3'39.09"E	Village Area	1st Predominant Wind Direction

Fig. 3.12: Ambient Air Quality Monitoring Stations (Satellite Map)



Frequency & Duration of Sampling

Ambient air quality monitoring was carried out at a frequency of two days per week at each location during the study period.

Method of Sampling

Ambient Air monitoring stations were established at 8 sampling locations at a height of 3 meter above the ground on a platform erected with outcrops at the base. The station represents approximately the highest ground level of the area and practically having no obstruction. The ambient air quality monitoring was done at a particular site taken twice a week. The Methods followed, Instruments used and standards for Ambient Air Quality Monitoring has been given in the **Table no.3.14** below.

Table No.3.15: Methods Followed, Instruments Used and standards for Air Quality Monitoring

Sl. No	Parameters	Time weighted Average	Concentration in Ambient Air		
			Industrial/ residential/ Rural & other areas	Ecologically sensitive area (Notified by Central Govt.)	Methods of Measurement
1	Sulphur Dioxide (SO_2), µg/m^3	Annual	50 µg/m^3	20 µg/m^3	Improved West &Gaeke
		24 Hours	80 µg/m^3	80 µg/m^3	
2	Nitrogen Dioxide (NO_2), µg/m^3	Annual	40 µg/m^3	30 µg/m^3	Modified Jacob &Hochheiser (Na – Arsenite)
		24 Hours	80 µg/m^3	80 µg/m^3	
3	Particulate Matter(PM_{10}), µg/m^3	Annual	60 µg/m^3	60 µg/m^3	Gravimetric
		24 Hours	100 µg/m^3	100 µg/m^3	
4	Particulate Matter($PM_{2.5}$), µg/m^3	Annual	40 µg/m^3	40 µg/m^3	Gravimetric
		24 Hours	60 µg/m^3	60 µg/m^3	
5.	Carbon Monoxide (CO), mg/m3	8 hours	02	02	CPCB guideline for Measurementof Ambient Air Pollutant (Vol 1 & 2)
		1 Hour	04	04	
6.	Ozone (O3)	8 hours	100	100	
		1 Hour	180	180	
Ref: National Ambient air quality standards, 2009					

The summarized AAQ monitoring result carried out in eight sampling locations is given in table below:

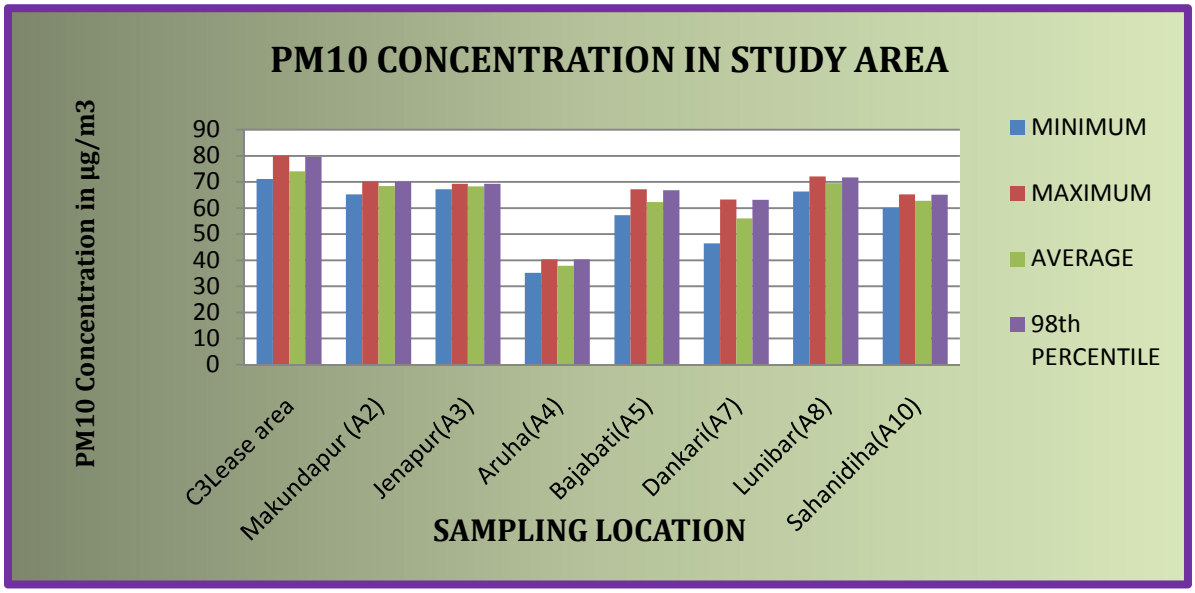
Table 3.16: Summarized AAQ monitoring result

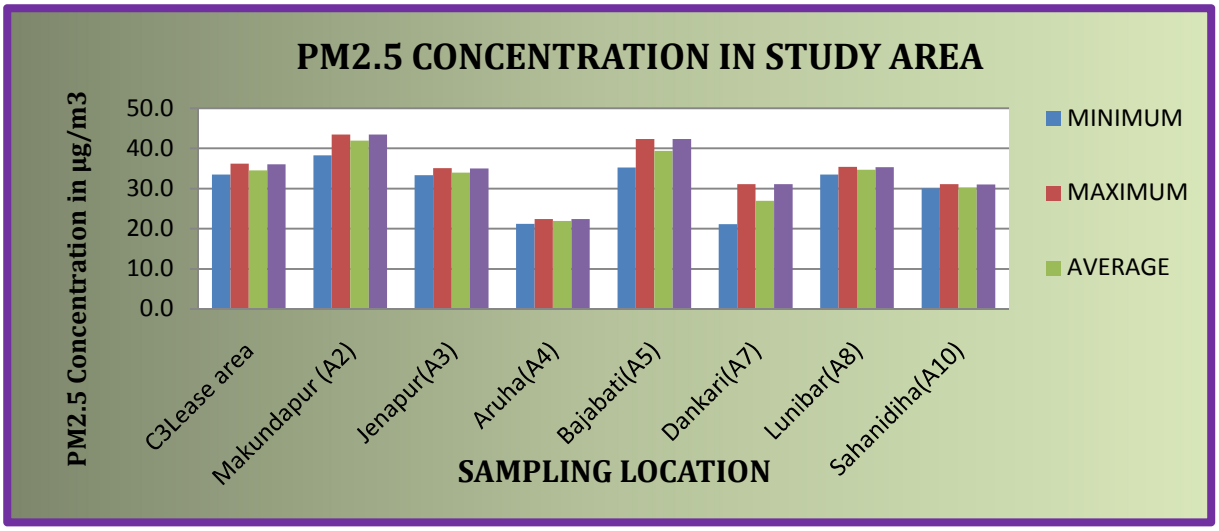
Sl. No	Location	PM_{10}(µg/m^3)				$PM_{2.5}$(µg/m^3)				SO_2(µg/m^3)				NO_X(µg/m^3)			
		Min	Max	Avg	98th perc	Min	Max	Avg	98th perc	Min	Max	Avg	98th perc	Min	Max	Avg	98th perc
1	A1	71.1	80.0	74.1	79.6	33.5	36.2	34.5	36.1	9.0	10.4	9.8	10.3	18.2	19.5	19.0	19.5
2	A2	65.2	70.2	68.4	70.2	38.3	43.5	41.9	43.5	7.1	8.4	7.6	8.3	12.4	14.4	13.5	14.3
3	A3	67.2	69.3	68.3	69.3	33.3	35.1	33.9	35.0	8.0	10.3	9.1	10.2	19.2	20.4	20.1	20.4

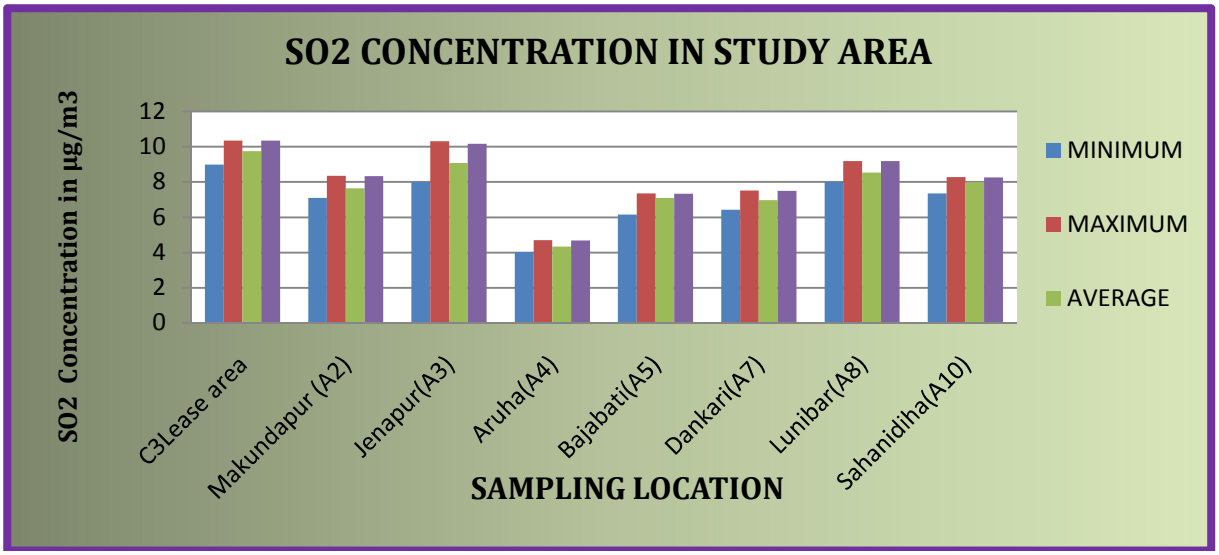
4	A4	35.2	40.4	37.9	40.3	21.2	22.4	21.9	22.4	4.0	4.7	4.3	4.7	9.1	9.6	9.2	9.5
5	A5	57.3	67.2	62.3	66.8	35.2	42.4	39.4	42.4	6.2	7.4	7.1	7.3	14.3	16.5	15.6	16.4
6	A7	46.4	63.3	56.0	63.1	21.1	31.1	27.0	31.1	6.4	7.5	7.0	7.5	16.2	18.5	17.3	18.4
7	A8	66.4	72.0	69.5	71.8	33.5	35.4	34.7	35.4	8.0	9.2	8.5	9.2	16.1	17.4	16.7	17.4
8	A10	60.1	65.2	62.7	65.1	30.0	31.1	30.3	31.0	7.4	8.3	8.0	8.3	17.2	18.4	18.1	18.4

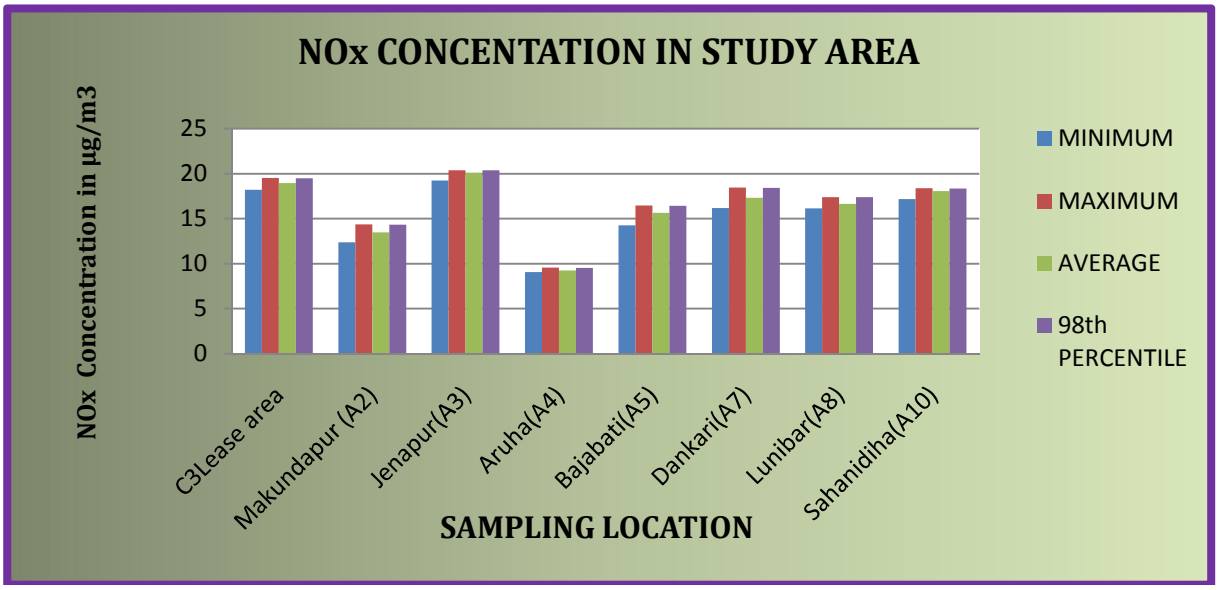
The graphical presentation of AAQ monitoring result in eight sampling locations is given in figure below:

Fig. 3.13: Graphs showing variations of Air Quality Parameters









The analysis result of all AAQ measurements in all monitoring stations has been attached as **Annexure 3.**

3.9.3 Secondary information of ambient air quality studies

As per the ambient air quality monitoring carried out by different industries and mines in Sukinda valley and also by State pollution control Board, it is observed that the area is known to be polluted with respect to hexavalent chromium pollution. The dust pollution in the mining and industrial area is comparatively higher. The air pollutant like Particulate matter conc. varies from 62 to 280 µg/cu.m in the mining and industrial area and 46 to 87 µg/cu.m in residential area. The SOx concentration is below detection limit and NOx concentration varies from 13-37 µg/cu.m.

3.10 WATER ENVIRONMENT

3.10.1 Surface-Water Quality Monitoring

The surface water samples are collected from nine different sampling locations including Brahmani River, analyzed for physical, chemical, and biological characteristics as per CPCB guidelines and the ground water samples are collected from eight different sampling locations The monitoring and analysis of surface water and ground water was carried out to assess the quality of water body and the impact of the proposed industrial development in the area.

3.10.2 Methodology

Reconnaissance survey was undertaken and monitoring locations were selected based on:

- Location of the major water bodies
- Location of project site, their water intake and effluent disposal locations
- Likely areas that can represent baseline conditions
- The water samples were collected and were analyzed for physical, chemical and biological characteristics as per IS code No.10500, 3025 & 2296.

Table No. 3.17 Surface Water Quality Criteria as per Central Pollution Control Board (Designated best Use Classification)

Parameters	Class A	Class B	Class C	Class D	Class E
pH	6.5-8.5	6.5-8.5	6.5-8.5	6.0-8.5	6.5-8.5
Dissolved oxygen (as O_2) , mg/l, min	6	5	4	4	-
BOD, 3 days at 27^0 C, Max	2	3	3	-	-
Total coliform organism, MPN/100 ml, Max	50	500	5000	-	-
Free ammonia (as N), mg/l, Max	-	-	-	1.2	-
Electrical conductivity, µmhos/cm, Max	-	-	-	-	2250
Sodium absorption ratio	-	-	-	-	26
Boron (as B), mg/l, Max	-	-	-	-	2
Below-E	**Not Meeting A, B, C, D & E Criteria**				

Class A: Drinking water source without conventional treatment but after disinfection

Class B: Outdoor bathing (Organized)

Class C: Drinking water source after conventional treatment & after disinfections

Class D: Propagation of Wild Life and Fisheries

Class E: Irrigation, Industrial Cooling, and Controlled Waste Disposal

Samples for chemical analysis were collected in polyethylene carboys. Samples collected for metal content were acidified with 1 ml HNO_3. Samples for bacteriological analysis were collected in sterilized glass bottles. Selected physico-chemical and bacteriological parameters

have been analyzed for projecting the existing water quality status in the study area. Parameters like Temperature, Total dissolved solid, dissolved oxygen (DO) and pH was analyzed on spot at the time of sample collection. The sampling and analysis for surface water was carried out as per the standard procedure of M/s Kalyani Laboratories Pvt. Ltd., Bhubaneswar.

Table 3.18: Standard Operating Procedure (SOP) for Water & Waste water Sampling & Analysis

Sl. No.	Parameter	Type & Container for Sample Collection	Quantity in ml	Storage/ Preservation
1	pH	Grab Sampling Platic Bottle (Polyethelene)	50	On site analysis
2	Electrical Conductivity	Grab Sampling Platic Bottle (Polyethelene)	50	On site analysis
3	Total Suspended Solids	Grab Sampling Platic Bottle (Polyethelene)	250	Refrigeration, can be stored for 7 days
4	Total Dissolved Solids	Grab Sampling Platic Bottle (Polyethelene)	250	Refrigeration, can be stored for 7 days
5	Biochemical Oxygen Demand	BOD Bottle/glass	1000	Refrigeration, 48 Hours
6	Chemical Oxygen Demand	Grab Sampling Platic Bottle (Polyethelene)	100	Add H_2SO_4 to pH>2, Refrigeration , 28 days
7	Residual Chlorine	Grab Sampling Platic Bottle (Polyethelene)	50	On site analysis
8	Hardness	Grab Sampling Platic Bottle (Polyethelene)	100	Add HNO_3 to pH<2 Refrigeration, 6 Months
9	Chlorides	Grab Sampling Platic Bottle (Polyethelene)	50	Not required, 28 days
10	Sulphates	Grab Sampling Platic Bottle (Polyethelene)	100	Refrigeration, 28 days
11	Sodium, Potassium	Plastic	100	Not required, 28 days
12	Nitrates	Plastic	100	Refrigeration, 48 Hrs
13	Fluorides	Plastic	100	Not required, 28 days
14	Alkalinity	Plastic / glass	200	Refrigeration, 14 days
15	Ammonia	Plastic / glass	100	Add H_2SO_4 to pH>2, Refrigeration ,28 days
16	Hexavalent Chromium (Cr^{+6})	Plastic / glass rinse with 1 + 1 HNO_3	250	Refrigeration, 24 Hours
17	Heavy Metals (Hg, Cd, Cr, Cu, Fe, Zn, Ars, Se, Pb, Mn, Ag)	Plastic / glass rinse with 1 + 1 HNO_3	500	Filter, add HNO_3 to pH<2, 6 months
18	Dissolved oxygen	BOD Bottle/glass	300	Analysed immediately, Titration may be delayed after acidification,8hours
19	Turbidity	plastic/glass	100	analyse same day store in dark

		Floropolymer		upto 24 hours, cool,<= 6ºC
20	Cyanide	Grab sampling plastic bottle	1000	analyse within 15 min add NaOH to> 12,store in cool <=6ºC
[Source: Standard methods for the examination of Water & Wastewater, Published by APHA, 23rd edition 2017]				

Table No. 3.19 Location of Surface Water Sampling Stations

S.l. No	Locations	Distance/ Direction in km	Latitude & Longitude	Station No.	Details
1.	Anjira	7.5 Km, NW	20°50'38.25" N 86°01'38.79" E	SW1	Pond
2.	Aruha	1.0 Km,, SW	20°44'56.20" N 86°05'49.70" E	SW2	Pond
3.	Bajabati	0.2Km, NE	20°46'05.24" N 86°06'32.57" E	SW3	Pond
5.	Dankari	3.6 Km, NWW	20°46'14.42" N 86°03'05.79" E	SW5	Pond
6.	Lunibara	4.3 Km, W	20°47'50.03" N 86°03'06.11" E	SW6	Pond
7.	Rahadpur	4.2 NW	20°45'30.09" N 86°02'15.81" E	SW7	Pond
8.	Sahanidiha	6.1 Km, N	20°50'28.33" N 86°03'38.78" E	SW8	Nala
9.	Brundadeipur	2.2 Km, NE	20°47'54.95" N 86°06'58.43" E	SW9	Brahamani river

Fig. 3.14: Surface Water Quality Monitoring Stations (Satellite Map)

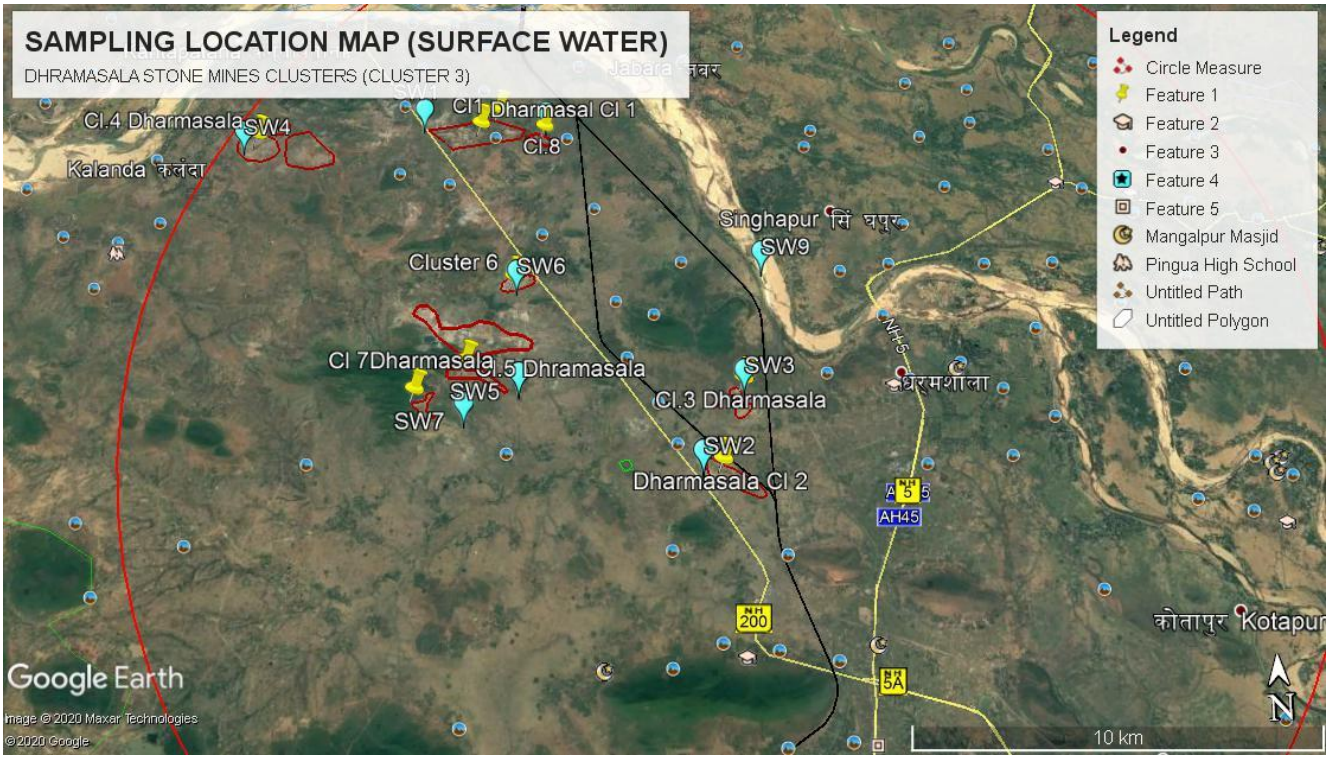


Table 3.20: Surface water quality analysis results

Parameter	Unit	Test Method	Standard as per IS 2296:1982 Class C	LAB CODE & LOCATION							
				S-2575	S-2577	S-2579	S-2583	S-2585	S-2587	S-2588	S-2589
				SW1	SW2	SW3	SW5	SW6	SW7	SW8	SW9
PH	--	IS 3025:PART11:1983 (Reaff 2002)	6.5 – 8.5	7.6	8	7.8	7.4	7.7	7.9	7.3	7.6
Electrical Conductivity	µs/cm	APHA-23rd Edition (2510 A):2017	--	285	468	323	275	295	480	300	144
Total Dissolved Solid	mg/l	IS 3025:PART15:1984 (Reaff 2002)	1500	200	320	240	190	210	350	270	90
Chemical Oxygen Demand	mg/l	APHA-23rd Edition (5220 B)	--	28	58	23	25	30	81	20	20
Taste	-	IS 3025 (Part - 8):1984 RA 2006	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Biochemical Oxygen Demand	mg/l	APHA-23rd Edition (5210 B)	3.0	5	9	4	5	6	10	4	4
Chloride	mg/l	IS 3025:PART32:1988	600	20.9	41.7	12.5	29.2	27.1	62.6	29.2	14.6
Fluoride	mg/l	IS 3025:PART60:2008	1.5	0.48	0.86	1.19	0.65	0.72	0.63	0.21	0.18
Sulphat	mg/l	IS 3025:PART24:1986	400	< 1	80	150	30	22	48	75	9

e											
Total Hardness as CaCO3	mg/l	IS 3025:PART21:2009	--	96	144	96	64	52	92	100	64
Dissolved Oxygen	mg/l	APHA-23r^{d} Edition (4500-O-C)	4.0 (min)	6.8	7.2	5.9	6.3	6.7	5.9	5.6	5.7
Zinc as Zn	mg/l	IS 3025:PART49:1994	1.5	< 0.01	0.013	< 0.01	< 0.01	< 0.01	0.03	< 0.01	< 0.01
Copper as Cu	mg/l	IS 3025:PART42:1992	1.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Cyanide as CN	mg/l	IS 3025 (Part 27):1986 RA 2009	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Iron as Fe	mg/l	IS 3025:PART53:2003	50	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.31	< 0.05	< 0.05
Cadmium as Cd	mg/l	IS 3025:PART41:1992	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lead as Pb	mg/l	IS 3025:PART47:1994	0.1	< 0.01	<0.01	<0.01	< 0.01	< 0.01	0.025	< 0.01	< 0.01
Arsenic as As	mg/l	IS 3025:PART37:1988	0.2	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Selenium as Se	mg/l	IS 3025 (Part 56):2003 RA 2009	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ammonia	mg/l	APHA 23RD EDITION-4500 –NH3-B	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Colour	True Colour Units	IS3025:PART04:1983	300	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Odour	--	IS3025:PART05:1983	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable

Nitrate as NO_3	mg/l	IS 25:PART34:1988	50	2.2	3.2	1.2	1.1	1.6	3.5	1.8	1.3
Total Alkalinity	mg/l	IS 3025 (Part 23):1986 RA 2009	-	117	180	66	54	89	191	99	66
Barium as Ba	mg/l	Annex F of IS 13428:2005 or IS 15302:2003 RA 2009	--	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Boron as B	mg/l	IS 3025:PART57:2005	--	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Mercury as Hg	mg/l	IS 3025:PART48:1994	--	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Calcium as Ca	mg/l	IS 3025:PART40:1991 (Reaff 2003)	--	27.2	41.6	30.4	16	12.8	16	30.4	22.4
Toal Suspended solid	mg/l	APHA-23r^{d} Edition (2540 D)	--	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	8	< 0.4	6
Sodium as Na	mg/l	IS 3025:PART45:1993 (RA 2014)	--	31	60	48	42	50	82	38	20
TOTAL cHROMIUM	mg/l	IS 3025:PART52:2003 RA 2009	--	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
ANIONIC DETERGENTS (AS MBAS)	mg/l	AANEX K OF IS 13428:2005	1.0	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Coliforms	MPN/ 100 ml	IS 1622:1981 RA 2009	5000	170	220	60	110	90	130	110	06

3.10.3 Interpretation Surface Water Quality Results

From the analysis result of surface water it has been found that the Biological oxygen Demand is comparatively higher with reference to Class C classification of surface water. From the water quality results it can be inferred that all the parameters analyzed are under the prescribed limit as per IS 2296:1982 as per class C and the water does not contain any pollutant which would be hazardous for human, animal or crop health.

3.10.4 Secondary data on Surface water quality

As per the EIA/EMP study carried out for Aruha Stone quarry located within the present cluster by M/s Overseas Min-Tech Consultant the surface water quality analysed at different location of the project site and the study area is as below:

pH value was found to be 7.44 to 7.82which indicates that surface water is alkaline in nature, TDS was found to be 245-194 mg/l which is within the permissible limit 500 mg/l, Dissolve oxygen were found about 10.54-11.0 mg/l. It is seen that the physicochemical analysis of other parameters like chloride, calcium, magnesium, nitrate and fluoride were found within the desirable limit. The overall surface water quality of the available sources within the study area was found to be good physico-chemically with respect to all the parameters. There is no organic loadobserved in the sources monitored indicating no pollution load in the source.

3.10.5 Ground water quality of the study area

The ground water samples were collected from 8 different sampling stations & and analyzed as per IS 10500:2012 to assess the portability of the ground water. The analysis result of the samples has been tabulated as below**,**

Table No. 3.21 Location of Ground Water Sampling Stations

Station No.	Locations	Distance/ Direction	Latitude & Longitude	Sampling Source
GW1	Anjira	3.4 Km, NW	20°50'24.62N 86°02'42.34" E	Tube Well
GW2	Aruha	1.2 Km, SW	20°44'57.55N 86°05'54.08" E	Tube Well
GW3	Bajabati	0.2 Km, E	20°45'48.16N 86°06'37.16" E	Tube Well
GW5	Dankari	3.7 Km, NWW	20°45'31.24N 86°03'01.50" E	Tube Well
GW6	Lunibara	4.3 Km, NW	20°48'10.12N 86°03'18.56" E	Bore well
GW7	Rahadpur	4.6 Km, W	20°46'16.86N 86°02'05.13" E	Tube Well
GW8	Sahanidiha	5.8 Km, NWW	20°50'12.65N 86°03'43.62" E	Tube Well

Fig. 3.15 Ground Water Quality Monitoring Stations (Satellite Map)

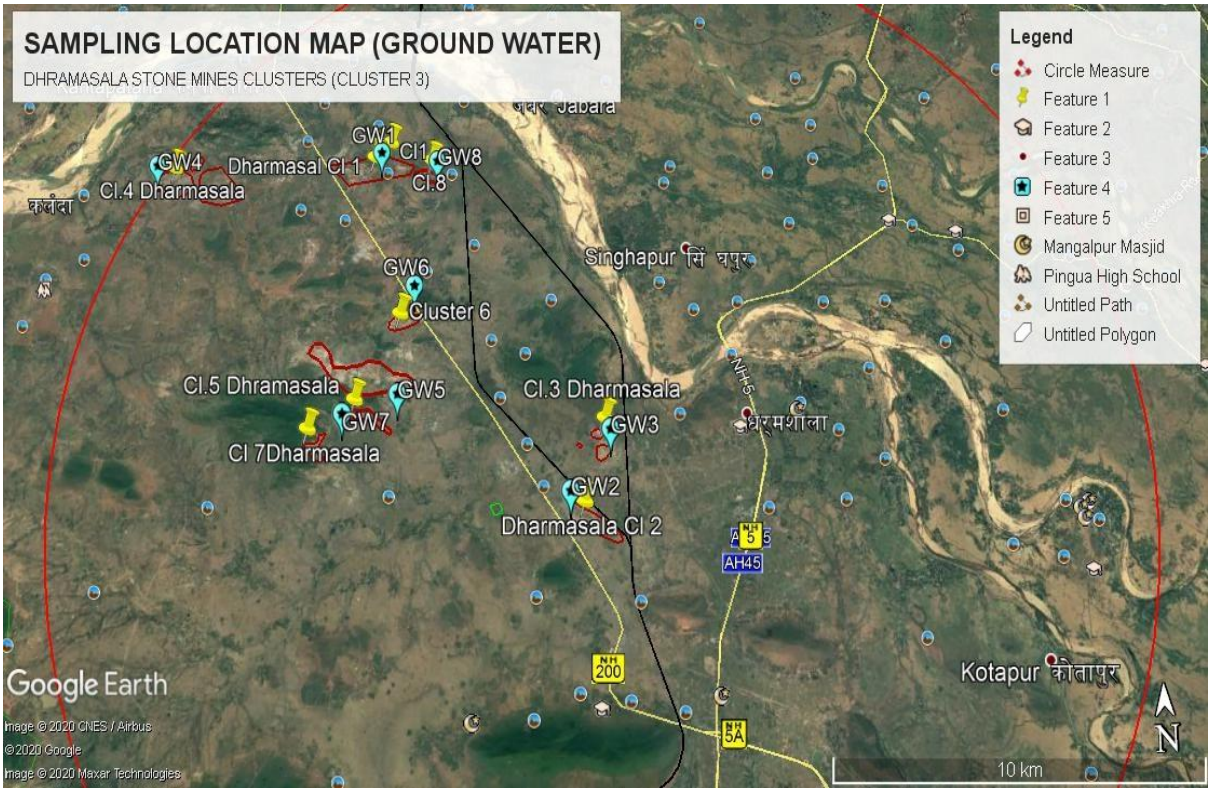


Table 3.22: Ground water quality analysis results

Parameter	Unit	Standard as per IS 10500:2012	Test Method				LAB CODE & LOCATIONS			
				S-2574	S-2576	S-2580	S-2590	S-2584	S-2586	S-2582
				GW1	GW2	GW3	GW5	GW6	GW7	GW8
PH	--	6.5 – 8.5	IS 3025 (Part 11):1983 RA 2012	7.1	6.7	7.2	7.0	7.7	7.3	6.9
Turbidity	NTU	1.0	IS 3025 (Part 10):1984 RA 2006	0.2	0.9	0.8	0.4	0.1	0.7	0.5
Phenolic Compounds as C6HOH	mg/l	0.001	IS 3025 (Part 43):1992 RA 2009	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Colour	Hazen	5	IS3025:PART04:1983	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Odour	--	Agreeable	IS3025:PART05:1983	agreeable	agreeable	agreeable	agreeable	agreeable	agreeable	agreeable
Taste	-	Agreeable	IS 3025 (Part - 8):1984 RA 2006	agreeable	agreeable	agreeable	agreeable	agreeable	agreeable	agreeable
Barium as Ba	mg/l	0.7	Annex F of IS 13428:2005 or IS 15302:2003 RA 2009	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Boron as B	mg/l	0.5	IS 3025:PART57:2005	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Silver as Ag	mg/l	0.1	Annex J of IS 13428 : 2005 RA 2009	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Manganese as Mn	mg/l	0.1	IS 3025 (Part 59):2006 RA 2012	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Selenium as Se	mg/l	0.01	IS 3025 (Part 56):2003 RA 2009	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Ammonia	mg/l	0.5	IS 3025 (Part 34): 1988 RA 2003	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Cadmium as Cd	mg/l	0.003	IS 3025 (Part 41):1992 RA 2009	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Mineral oil	mg/l	0.5	Clause 6 of IS 3025 (Part- 39):1991 RA 2003	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025
Zinc as Zn	mg/l	5	IS 3025:PART49:1994	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Copper as Cu	mg/l	0.05	IS 3025:PART42:1992	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Lead as Pb	mg/l	0.01	IS 3025 (Part 47):1994 RA 2009	< 0.005	< 0.005	0.008	< 0.005	< 0.005	< 0.005	< 0.005
Mercury as Hg	mg/l	0.001	IS 3025 (Part 48):1994 RA 2009	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Arsenic as As	mg/l	0.01	IS 3025 (Part 37): 1988 RA 2009	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cyanide as CN	mg/l	0.05	IS 3025 (Part 27):1986 RA 2009	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chloride as Cl	mg/l	250	IS 3025 (Part 32):1988 RA 2009	27.1	14.6	20.9	138.4	54.3	27.1	14.6
Fluoride as F	mg/l	1.0	IS 3025 (Part 60):2008	1.69	0.69	1.19	0.16	1.64	0.9	0.85

Total Alkalinity (as CaCO3)	mg/l	200	IS 3025 (Part 23):1986 RA 2009	172	90	207	469	339	189	180
Sulphate as SO_4	mg/l	200	IS 3025 (Part 24):1986 RA 2009	150	200	32	440	400	60	40
Nitrate as NO3	mg/l	45	IS 25:PART34:1988	1.2	1.3	1.5	3.5	2.2	1.7	1.4
Nickel as Ni	mg/l	0.02	IS 3025 (Part 54): 2003 RA 2009	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sulphide	mg/l	2.0	APHA 22nd Edition (4500-S2--F)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aluminium as Al	mg/l	0.03	IS 3025 (PART 55):2003 RA 2009	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total Hardness (as CaCO3)	mg/l	200	IS 3025 (Part 21):2009	148	144	164	712	300	180	152
Calcium as Ca	mg/l	75	IS 3025 (Part 40):1991 RA 2009	35.2	40	35.2	248	68.8	48	33.6
Magnesium as Mg	mg/l	30	IS 3025 (Part 46):1994 RA 2003	14.58	10.69	18.47	22.36	31.1	14.58	13.61
Iron as Fe	mg/l	1.0	IS 3025 (Part 53):2003 RA 2009	< 0.05	0.29	0.12	< 0.05	< 0.05	< 0.05	< 0.05
Total Chromium	mg/l	0.05	IS 3025 (Part 52):2003 RA 2009	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02

Total Dissolved Solid	mg/l	500	IS 3025 (Part 16):1984 RA 2006	360	330	270	1450	750	310	300
TOTAL COLIFORMS	MPN/100 ml	Shall not be detected in any 100 ml sample	IS 1622:1981 RA 2009	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
E Coli	MPN/100 ml	Shall not be detected in any 100 ml sample	IS 1622:1981 RA 2009	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

3.10.6 Discussion

As per the analysis of ground water of the area it has been observed that, water is colourless and odourless. Fluoride content is found to behigher in few groundwater samples of Anjira, Bajabati and Lunibara. Total Alkalinity and total hardness is found to be higher in ground water samples of Bajabati, Lunibara and Dankari. Other parameters are within the standard as prescribed in IS10500: 2012.

3.10.7 Secondary data on Ground water quality

(Ref: Ground water information booklet, CGWB, May 2013)

3.10.7.1 Ground water Quality:

As per the study carried out by CGWB in Jajpur district the chemical quality of groundwater both from shallow is alkaline in nature with pH value ranging from 7.34 to 8.30. The electrical conductance values show a wide range from 73 to 1660 μS / cm at 25˚C. Concentration of chloride is within the desirable limit i.e. 250 mg/l. Nitrate concentration is generally within the desirable limit in all cases except 3 places at Chinguripali (111 mg/l), Rampei (168 mg/l) and Haridaspur where concentrations are found more than the desirable limit. Although the fluoride concentration varies from 0.15 to 5.20 mg/l), it is by and large less than 1.0 mg/l (permissible limit 1.5 mg/l). Concentration of iron is below the permissible limit in all cases except at Saruabili (7.4 mg/l), Haridaspur (1.48) and Binjharpur (3.37)(permissible limit 1.0 mg/l).Total Hardness in nearly seventy percent cases is within 250 mg/l (desirable limit 300 mg/l) and in rest thirty percent cases it varies from 320 to 470 mg/l (permissible limit 600 mg/l). However in other areas concentration of other chemical constituents like Calcium, Sulphate and Phosphate are well within the desirable limit in more than ninety percent cases and rest is well within the permissible limit. It is observed that, in general chemical quality of ground water from shallow aquifers is good and fit for both domestic and irrigation purposes except in isolated patches mentioned above, where the parameters are beyond the permissible limits. However in other areas all the constituents are well within the permissible limit.

In deeper aquifers the pH value ranges from 6.95 to 8.45, with the majority of the value ranging between 7.5 and 8.0 which indicate ground water from deeper aquifers is generally alkaline in nature. The electrical conductance values ranges from 211 to 1700 μS / cm at 25˚C. The concentration of total dissolved solids ranges from 144 to 764 mg/l. The chloride content in the area varies from 13 to 255 mg / l. Nitrate concentration in deeper aquifers is non detectable to 1.6 mg/l and the maximum fluoride content is 0.58 mg/l, which indicate that concentration of both the pollutants in deeper aquifers are well within the permissible limit (100 mg/l for nitrate and 1.5 mg/l for fluoride). The concentration of iron varies from 0.25 to 1.13 mg/l against the permissible limit of 1.0 mg/l. Total hardness varies from 50 to 285 mg/l against the desirable limit of 300 mg/l. The concentration of other chemical constituents like Calcium, Sulphate and Phosphate are within the desirable limits.

3.11 NOISE ENVIRONMENT

The environmental impact assessment of noise from the industrial activity, construction activity and vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses, and annoyance and general community responses. The environmental impact of noise can have several effects varying from Noise Induced Hearing Loss (NIHL) to annoyance depending on loudness of noise.

3.11.1 Methodology

For measurement of ambient noise level, a Digital Sound Level Meter was used. The meter was calibrated with a standard acoustic calibrator before using in the field. The measurements were carried out continuously for the 24-hour period with one hour interval starting at 00.30 hrs to 00.30 hrs next day to obtain hourly equivalent sound pressure level, 1 hour Leq. From these values, day and night time as well as 24-hour Leq values were also calculated. The Leq is the equivalent continuous sound level, which is equivalent to the same sound energy as the fluctuating sound measured in the same period. The levels were monitored on working days only.

3.11.2 Sampling Locations

A total of 8 sampling locations were selected for noise monitoring analysis. The station for monitoring of noise level has been given in Table below.

Table No. 3.23 Location of Noise monitoring Stations

Station Code	Sampling Location	Distance / Direction	Coordinates	Area details	Wind Direction
N1	Lease Area	--	20°45'50.482"N 86° 06'35.1561" E	Industrial Area	--
N2	MakundPur	6.2 Km, N	20° 50'44.37" N 86° 3' 20.37" E	Village Area	1st Predominant Wind Direction
N3	Jena Pur	6.4 Km, NE	20° 51'23.64" N 86° 4'28.51"E	Village Area	1st Predominant Wind Direction
N4	Aruha	1.8 Km, SE	20°44'28.99"N 86° 5'51.26" E	Village Area	2nd Predominant Wind Direction
N5	Bajabati	0.5 Km, SE	20°45'58.36"N 86° 6'51.98" E		2nd Predominant Wind Direction
N7	Dankri	3.5 Km, NW	20° 46'24.69"N 86° 3'10.46"E	Village Area	Down Wind direction

N8	Luni Bara	4.0 Km, N	20° 48'12.79"N 86° 3' 19.37"E	Village Area	2nd Predominant Wind Direction
N10	Sahanidiha	5.5 Km, NE	20° 50'11.85"N 86° 3'39.09"E	Village Area	1st Predominant Wind Direction

The result of noise level monitoring has been given in the **table** below

Table No. 3.24 Noise Level Monitoring Results

Station No.	Location Village	L_{eq}Day	L_{eq}Night
N1	Lease Area	56.8	46.2
N2	MakundPur	56.4	39.6
N3	Jena Pur	51.6	31.2
N4	Aruha	42.3	35.2
N5	Bajabati	48.9	38.2
N7	Dankri	51.3	41.1
N8	Luni Bara	49.3	36.6
N10	Sahanidiha	51.6	40.2

Table No. 3.25 Noise Standards

Land Use Category	Limit in dB(A)	
	Day Time (6 A.M. to 10 P.M)	Night Time (10 P.M. to 6 A.M)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40
Source: Noise Rule – 2000		

3.12 BIOLOGICAL ENVIRONMENT

The study of biological environment includes baseline data covering both flora & fauna including the terrestrial ecology which were supplemented. The buffer zone has been surveyed for enumeration of flora and fauna. The study was carried out for 10Km radius buffer zone including core zone. The study area mainly comprises of scrub land, agricultural land, waste land and open/ scrubbed and degraded forest land. The project site and its buffer zone include 6 nos of protected forest and reserved forest. The details are as below:

3.12.1 Selection of Study Sites

While selecting the areas for detailed studies on terrestrial and aquatic ecology following considerations were made-

- Location of the mining and the predominant wind directions
- Different land use patterns viz.
- Natural vegetation
- Agri-ecosystems and surrounding areas
- Water bodies- lakes and canals, ponds etc
- Topography and the geology of the area

3.12.2Study Methodology

The survey procedure is divided into two parts i.e. qualitative survey and quantitative evaluation. The qualitative survey procedure includes:

- Listing of the species
- Analysis of vegetation stratification
- Life form studies
- Listing of genetically and economic important plants
- Listing of medicinal plants
- Listing of rare and endangered plant species
- Listing of fauna

The study was aimed at enumeration of the available plant resources and obtaining a broad representation of the existing floristic variations in the mine lease area and surrounding mine lease areas. Enumeration of the plant wealth was done by surveying the area through walking along the gradients of hillocks and valleys followed by collection and identification of plant specimens during the month of December. Besides the primary data collected from the field secondary data was also collected from the forest department and the local people. The secondary data was collected from Forest range office, local people and block offices.

3.12.3Flora Composition in the study area

3.12.3.1 Flora Composition in the Core Zone

There are few existing plantations within the lease area. The existing plantation in the roadside of the entry of lease cluster, and few plantations in the safety zone. The existing vegetationin the lease area include few scrubs like arakh, Baigaba, Tal, Khajur, Palas, Gahira etc.

3.12.3.2 Flora Composition in the Buffer Zone

The study was conducted at selected sampling locations in the buffer zone. The area is moderately vegetated with natural vegetation. The details of flora composition in the buffer zone are given in the table below:

Table no.3.26 Details of flora composition in the buffer zone

Sl. No	Name of the plant	Local name	Family	Habitat
1.	*Abromaaugusta*	Olatakamala	Sterculiaceae	Shrub
2.	*Abrusprecatorius*	Kaincha	Fabaceae	Climber
3.	*Abutilon indicum*	Pedipedica	Malvaceae	Shrub
4.	*Acalyphaindica*	*Nakachana*	Euphorbiaceae	Herb
5.	*Achyranthes aspera*	*Apamaranga*	Amaranthaceae	Herb
6.	*Acorus calamus*	Bacha	Araceae	Herb
7.	*Ageratum conyzoides*	Pokasungha	Compositeae	Herb
8.	*Aegle marmelos*	Bela	Rutaceae	Tree
9.	*Aervasanguinolenta*	Chauladhua	Amaranthaceae	Shrub
10.	*Agave americana*		*Agavaceae*	*Herb*
11.	*Alstoniascholaris*	Chatiana	Apocyanaceae	Tree
12.	*Alternanthera sessilis*	*Madaranga*	Amaranthaceae	Herb
13.	*Amorophophaluscampanul atus*	Olua	Araceae	Herb
14.	*Anacyclus pyrethrum*	*Akarakara*	Asteraceae	Herb
15.	*Ananas comosus*	Sapuri	Bromeliaceae	Herb
16.	*Andrographis paniculata*	Bhuinnimba	Acanthaceae	Herb
17.	*Annona squamosa*	Ata	Apocyanaceae	Tree
18.	*Anogeissuslatifolia*	Dhau	Combretaceae	Tree
19.	*Argyreia nervosa*	Brudhadaraka	Convolvulaceae	Climber
20.	*Aristolochiabracteata*	Panairii	Aristolochiaceae	Climber
21.	*Artocarpushetrophyllus*	Panas	Moraceae	Tree
22.	*Asparagus racemosus*	Satabari	Liliaceae	Climber
23.	*Atylosiascarabaeoides*	Banakolatha	Fabaceae	Climber
24.	*Averrhoa carambola*	Karamanga	Geraniaceae	Tree
25.	*Azadirachtaindica*	Nimba	Meliaceae	Tree
26.	*Bacopa monnieri*	Brhmi	Scrophulariaceae	Herb
27.	*Barleriacristata*	Daskerenda	Acantheceae	Herb
28.	*Bauhinia variegata*	Kanchana	Caesalpiniaceae	Tree
29.	*Beideliaretusa*	*Kasi*	Euphorbiaceae	Tree
30.	*Boerhaviadiffusa*	Puruni	Nyctaginaceae	Herb
31.	*Bombax ceiba*	Simuli	Bombacaceae	Tree
32.	*Bryophyllumpinnatum*	Amarapoi	Crassuliaceae	Herb
33.	*Buchananialanzan*	Chara	Anacardiaceae	Tree

34.	*Butea monosperma*	Palasa	Fabaceae	Tree
35.	*Caesalpiniabonduc*	Gila	Caesalpiniaceae	Shrub
36.	*Callistemon liniaris*	kundana	Myrtaceae	Shrub
37.	*Calotropis gigantea*	Arakha	Asclepiadaceae	Shrub
38.	*Caricapapeya*	Amrutabhand	Caricaceae	Tree
39.	*Cassia angustifolia*	Sunamukhi	Caesalpiniaceae	Herb
40.	*Cassia fistula*	Sunari	Caesalpiniaceae	Tree
41.	*Cassia siamia*	*Chakunda*	Caesalpiniaceae	Tree
42.	*Catharanthus roseus*	Sadabihari	Apocyanaceae	Herb
43.	*Centellaasiatica*	Thalkudi	Apiaceae	Herb
44.	*Cissampelospareira*	Akanabindhi	Menispermaceae	Climber
45.	*Cissusquadrangularis*	Hadabhanga	Vitaceae	Climber
46.	*Cleistanthuscollinus*	Karada	Euphorbiaceae	Tree
47.	*Cleome gynandra*	Anaorisa	Capparidaceae	Herb
48.	*Clitoria ternate*	Aparajita	Fabaceae	Climber
49.	*Commelinabenghalensis*	Kansiri	Commelinaceae	Herb
50.	*Couropitaguianensis*	*Nageswar*	Lecythidaceae	Tree
51.	*Curculigoorchioides*	Talamuli	Amaryllidaceae	Herb
52.	*Cuscutareflexa*	Nirmuili	Convolvulaceae	Climber
53.	*Cyanodondactylon*	Duba	Poaceae	Herb
54.	*Cycas circinalis*	Cycas	Cycadaceae	Shrub
55.	*Cyperusrotundus*	Mutha	Poaceae	Herb
56.	*Albizialebbek*	Sirsa	Mimoceae	Tree
57.	*Dalbergiasisso*	Sisoo	Fabaceae	Tree
58.	*Datura metel*	Dudura	Solanaceae	Shrub
59.	*Dioscoriabulbifera*	Pitalau	Dioscoriaceae	Climber
60.	*Diospyrusmontana*	Halda	Ebenaceae	Tree
61.	*Diospyrustomentosa*	Kedu	Ebenaceae	Tree
62.	*Elephantopusscaber*	Mayurachulia	Asteraceae	Herb
63.	*Emblica officinalis*	Amla	Euphorbiaceae	Tree
64.	*Erythrina variegata*	Paladhua	Fabaceae	Shrub
65.	*Eucalyptus citriodora*	*Eucalyptus*	Myrtaceae	Tree
66.	*Euphorbia hirta*	Chitakuti	Euphorbiaceae	Herb
67.	*Euphorbia tirucalli*	Khadisiju	Euphorbiaceae	Herb
68.	*Ficus benghalansis*	Bara	Moraceae	Tree
69.	*Ficus carica*	Dimiri	Moraceae	Tree
70.	*Flacourtiajangomas*	Baichikoli	Flacourtiaceae	Shrub
71.	*Gloriosa superba*	Agnisikha	Liliaceae	Climber
72.	*Gmeliaarborea*	Gambhari	Verbenaceae	Tree
73.	*Heliotropiumindicum*	Hatisundha	Boraginaceae	Herb
74.	*Hemidesmus indicus*	Anantamul	Asclepiadaceae	Climber
75.	*Hibiscus aculeatus*	Piripirika	Malvaceae	Herb
76.	*Hibiscus rosa-sinensis*	Mandar	Malvaceae	Shrub

77.	*Holarrhenapubescens*	Kurua	Apocyanaceae	Shrub
78.	*Ipomoea eriocarpa*	*Musakani*	Convolvulaceae	Shrub
79.	*Jatropha curcas*	DhalaBaigaba	Euphorbiaceae	Shrub
80.	*Jatropha gossypifolia*	NaliBaigaba	Euphorbiaceae	Shrub
81.	*Justicia adhatoda*	Vasak	Acanthaceae	Shrub
82.	*Kaemferiagalanga*	Gandhasunthi	Zingiberaceae	Herb
83.	*Lagerstroemia parviflora*	Sidha	Lythraceae	Tree
84.	*Lantena alba*	Nagaairi	Verbenaceae	Herb
85.	*Lantena camera*	Lantena	Verbenaceae	Herb
86.	*Lawsoniainnermis*	Manjuati	Lythraceae	Shrub
87.	*Leeaasiatica*	Hatikana	Vitacecae	Shrub
88.	*Leucas aspera*	Gayasaa	Lamiaceae	Herb
89.	*Madhucaindica*	Mahula	Sapotaceae	Tree
90.	*Mallotusphilippensis*	Kunkuma	Euphorbiaceae	Tree
91.	*Mangifraindica*	Amba	Anacardiaceae	Tree
92.	*Martyniaannua*	Baghanakhi	Pedaliaceae	Herb
93.	*Mimosa pudica*	Lajakuli	Mimoceae	Herb
94.	*Mimosopselengi*	Baula	Sapotaceae	Tree
95.	*Morindapubescens*	Achu	Rubiaceae	Tree
96.	*Moringa oleifera*	Sajana	Moringaceae	Tree
97.	*Mucuna nigricans*	Baidonka	Fabaceae	Climber
98.	*Murrayakoenigii*	Bhrusanga	Rutaceae	Shrub
99.	*Nerium indicum*	Karabira	Apocyanaceae	Shrub
100.	*Nyctanthus arbor-tristis*	Ganga siuli	Oleaceae	Shrub
101.	*Ocimum sanctum*	Tulasi	Lamiaceae	Herb
102.	*Operculinaturpenthum*	Tihudi	Convolvulaceae	Climber
103.	*Opuntia sricta*	Nagapheni	Cactaceae	Shrub
104.	*Oxalis corniculata*	Ambiliti	Oxalidaceae	Herb
105.	*Pachyrhizuserosus*	Sakarakanda	Fabaceae	Shrub
106.	*Paederiafoetida*	Prasaruni	Rubiaceae	Climber
107.	*Phyllanthus amarus*	Bhuinamla	Euphorbiaceae	Herb
108.	*Plumbago zeylanica*	Sweta Chitaparu	Plunbaginaceae	Herb
109.	*Pongamiapinnata*	Karanja	Fabaceae	Tree
110.	*Psidium guajava*	Pijuli	Myrtaceae	Tree
111.	*Punicagranatum*	Dalimba	Puniaceae	Shrub
112.	*Ricinus communis*	Gaba	Euphorbiaceae	Shrub
113.	*Rumexvesicarius*	Khatapalanga	Polygonaceae	Herb
114.	*Saracaasoca*	Ashok	Caesalpiniaceae	Tree
115.	*Schleicheraoleosa*	Kusuma	Sapindaceae	Tree
116.	*Scopariadulsis*	Badijustimadhu	Scrophulariaceae	Herb
117.	*Semicarpus anacardium*	Bhalia	Anacardiaceae	Tree
118.	*Sesbania cannabina*	Dhaincha	Fabaceae	Herb
119.	*Sesbania grandiflora*	Agasti	Fabaceae	Tree

120.	*Shorearobusta*	Sala	Dipterocarpaceae	Tree
121.	*Sidacordifolia*	Bajramuli	Malvaceae	Herb
122.	*Smilax zeylanica*	Muturi	Liliaceae	Climber
123.	*Solanum nugrum*	Nunnunia	Solanaceae	Herb
124.	*Solanum xanthocapum*	Ankaranti	Solanaceae	Herb
125.	*Solenaamplexicaulis*	Banakunduri	Cucurbitaceae	Climber
126.	*Sphaeranthus indicus*	BhuinKadamba	Asteraceae	Herb
127.	*Strebulus asper*	*Sahada*	Moraceae	Tree
128.	*Strychnosnux-vomica*	Kochila	Loganiaceae	Tree
129.	*Syzygiumcumini*	Jamu	Myrtaceae	Tree
130.	*Tamarindusindica*	Tentuli	Caesalpiniaceae	Tree
131.	*Tectonagrandis*	*Teak*	Verbenaceae	Tree
132.	*Terminalia arjuna*	Arjuna	Combrtaceae	Tree
133.	*Terminalia bellerica*	Bahada	Combrtaceae	Tree
134.	*Terminalia chebula*	Harida	Combrtaceae	Tree
135.	*Terminalia tomentosa*	Asana	Combretaceae	Tree
136.	*Tinosporacordifolia*	Guluchi	Menispermaceae	Cliber
137.	*Tridaxprocubens*	Bisalyakarani	Asteraceae	Herb
138.	*Tylophoraindica*	Anantamul	Asclepiadaceae	Climber
139.	*Urariahamosa*	Salaparni	Fabaceae	Herb
140.	*Vetiveriazizanioides*	Bena	Poaceae	Herb
141.	*Vitex nigundo*	Begunia	Verbenaceae	Shrub
142.	*Wedeliachinensis*	Bhrungaraj	Asteraceae	Herb
143.	*Wooddordiafruiticosa*	Dhatuki	Lythraceae	Shrub
144.	*Ziziphus oenoplia*	Kanakoli	Myrtaceae	Shrub
145.	*Zizyphusjujuba*	Barakoli	Rhamnaceae	Tree
Source: Primary Ecological study by KLPL during May 2020				

Table No.3.27 Ferns

Sl. No	Name of the Plant	Family	Local Name
1.	*Adiantum incisum*Forssk.	Adiantaceae	--
2.	*Adiantum philippense*L.	Adiantaceae	--
3.	*Dryopteris* sp.	Dryopteridaceae	--
4.	*Lygodiumflexuosum* (L.) Sw.	Lygodiaceae	Indrajal
5.	Marsileaminuta L.	Marsileaceae	Sunsunia
6.	Sellaginellasps	Sellaginellaceae	Sanjibani

3.12.2 Medicinal Flora:

The medicinal flora of the area as per the survey and information obtained from the local people has been tabulated as below:

Table no.3.28 Medicinal Flora within the Study Area

Sl. No	Name of the Plant	Family	Local Name	Parts used
1.	*Aegle marmelos*	Rutaceae	Bela	Fruits, Leaves
2.	*Alstoniascholaris*	Apocynaceae	Chatiana	Bark
3.	*Azadirachtaindica*	Meliaceae	Nima	Leaves, Bark, Seed
4.	*Bombax ceiba*	Bombacaceae	Simili	Thorn
5.	*Butea monosperma*	Fabaceae	Palasa	Seeds
6.	*Cassia fistula*	Caesalpiniaceae	Sunari	Bark
7.	*Cleistanthuscollinus*	Euphorbiaceae	Karada	Fruits, Leaves
8.	*Eucalyptus citridora*	Myrtaceae	Eucalyptus	Leaves
9.	*Holarrhenapubescens*	Apocynaceae	Kutaja	Bark
10.	*Lagerstroemia parviflora*	Lythraceae	Sidha	Bark
11.	*Mimusopselengii*	Sapotaceae	Baula	Bark
12.	*Nyctanthes arbor-tristis*	Nyctanthaceae	Gangasiuli	Leaves
13.	*Phyllanthus emblica*	Euphorbiaceae	Amla	Fruit
14.	*Pongamiapinnata*	Fabaceae	Karanja	Bark, Seed oil
15.	*Schleicheraoleosa*	Sapindaceae	Kusuma	Seed oil
16.	*Semecarpus anacardium*	Anacardiaceae	Bhalia	Seed
17.	*Syzygiumcumini*	Myrtaceae	Jamun	Fruit, Bark
18.	*Terminalia arjuna*	Combretaceae	Arjuna	Bark
19.	*Terminalia bellirica*	Combretaceae	Bahada	Fruit
20.	*Terminalia chebula*	Combretaceae	Harida	Fruit
21.	*Abrusprecatorius*	Faceae	Kaincha	Seed
22.	*Aristolochiaindica*	Aristolochiaceae	Panairi	Root
23.	*Asparagus racemosus*	Liliaceae	Satabari	Tuber
24.	*Atylosiascrabaeoides*	Fabaceae	Banakolatha	Root/ Whole plant
25.	*Caesalpiniabonduc*	Caesalpiniaceae	Gila	Seed
26.	*Cissampelospareira*	Menispermaceae	Akanabindhi	Leaves, Root
27.	*Cissusquadrangularis*	Vitiaceae	Hadajoda	Stem
28.	*Hemidesmusinducus*	Periplocaceae	Anantamool	Root
29.	*Mucunapuriens*	Fabaceae	Baidonka	Seeds
30.	*Smilax zeylanica*	Smilacaceae	Muturi	Root
31.	*Tinosporacordifolia*	Menispermaceae	Guluchi	Stem
32.	*Tylophoraindica*	Asclepiadaceae	Anantamool	Leaves
33.	*Calotropis gigantea*	Asclepiadaceae	Arakha	Root
34.	*Datura metel*	Solanaceae	Dudura	Seed
35.	Jatropha gossypifolia	Euphorbiaceae	Nalibaigaba	Stem
36.	*Justicia adhatoda*	Acanthaceae	Basanga	Leaves
37.	*Lawsoniainermis*	Lythraceae	Manjuati	Leaves/ Root
38.	*Ricinus communis*	Euphorbiaceae	Gaba	Seeds/ Root
39.	*Vitex nigundo*	Verbenaceae	Begunia	Leaves
40.	*Woodfordiafruticosa*	Lythraceae	Dhataki	Flower
41.	*Alternanthera sessilis*	Amaranthaceae	Madarnga saga	Whole plant
42.	*Achyranthes aspera*	Amaranthaceae	Apamaranga	Root
43.	*Andrographis paniculata*	Acanthaceae	Bhuin neem	Whole Plant
44.	*Barleriacristata*	Acanthaceae	Daskerenda	Leaves

45.	*Centellaasiatica*	Apiaceae	Thalakudi	Leaves
46.	*Costusspeciosus*	Zingiberaceae	Keu	Tuber
47.	*Curculigoorchioides*	Hypoxidaceae	Talamuli	Root
48.	*Cyperusrotundus*	Cyperaceae	Mutha	Tuber
49.	*Elephantopusscaber*	Asteraceae	Mayurchulia	Root
50.	*Mimosa pudica*	Mimoceae	Lajakuli	Root
51.	*Phyllanthus amarus*	Euphorbiaceae	Badi anala	Whole Plant
52.	*Scopariadulcis*	Scrophulariaceae	Badijustimadhu	Whole Plant
53.	*Sidaacuta*	Malvaceae	Bajramuli	Stem
54.	*Sida cordata*	Malvaceae	Brhmanajhatia	Stem
55.	*Solanum virginianum*	Solanaceae	Ankaranti	Fruit/ Root
56.	*Sphaerathus indicus*	Rubiaceae	BhuinKadamba	Whole Plant
57.	*Tridaxprocumbens*	Asteraceae	Bisayakarani	Whole Plant
58.	*Vetiveriazizanioides*	Poaceae	Bena	Root
Source: Primary Ecological Study during May 2020				

3.12.3 Agriculture and Irrigation in the study area

Basically, Jajpur has two agro ecological situations viz, north Eastern coastal plain and mid central table land consisting of red laterite, laterite and alluvial. Being surrounded by rivers, Jajpur has good potentials for agricultural development. Out of the total geographical area of 2, 89,900 ha, 46% was net sown, 25% was covered by forest and land under non agricultural use was 17%. The cropping intensity of Jajpur, that is 186%, is higher than the state average of 158%. Baitarani, Brahmani and Kharasrota are the major rivers flowing through the district. By virtue of these rivers Jajpur has a lot of irrigation potential. They create a favorable situation for agriculture in the district. A total of 71,530 ha area is irrigated in Jajpur district during kharif season. Similarly, a total of 63,840 ha area is irrigated in Jajpur district during Rabi season.

The present irrigated area of Jajpur district during Kharif season is 48.1% of net sown area and during Rabi and summer season it is 42.9% of the net sown area in Rabi season. The overall irrigated and rainfed areas of the district are 45.5 and 54.5% of the total cropped area, respectively. Due to availability of assured irrigation, summer crop is usually practiced in the district. The important horticulture crops are coconut, cashew nut, mango, papaya, banana, guava & pineapple etc. Out of the total cropped area of the district, 5.46% has been devoted for the production of fruits.

Table 2.1: Area-wise and Crop-wise Irrigation Status of Jajpur District (2013-14)

Crop Type	Kharif ('000 ha)			Rabi ('000 ha)			Total ('000 ha)			Horticulture and Plantation Crops ('000 ha)		
	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total
Cereals	57.45	66.17	123.62	2.86	0.00	2.86	60.31	66.17	126.48	-	-	-
Coarse cereals	0.97	2.00	2.97	0.10	0.00	0.10	1.07	2.00	3.07	-	-	-
Pulses	0.44	5.17	5.61	10.53	56.35	66.88	10.97	61.52	72.49	-	-	-
Oil seeds	1.24	1.11	2.35	31.02	2.56	33.58	32.26	3.67	35.93	-	-	-
Fibres	1.47	0.30	1.77	-	-	-	1.47	0.30	1.77	-	-	-
Vegetables	9.08	2.10	11.18	12.74	0.00	12.74	21.82	2.10	23.92	-	-	-
Condiments and Spices	0.88	0.45	1.33	4.52	0.00	4.52	5.40	0.45	5.85	-	-	-
Sugarcane	-	-	-	2.07	0.00	2.07	2.07	0.00	2.07	-	-	-
Mango	-	-	-	-	-	-	-	-	-	1.76		1.76
Guava	-	-	-	-	-	-	-	-	-		0.13	0.13
Citrus	-	-	-	-	-	-	-	-	-		0.22	0.22
Sapota	-	-	-	-	-	-	-	-	-		0.12	0.12
Banana	-	-	-	-	-	-	-	-	-	0.41		0.41
Papaya	-	-	-	-	-	-	-	-	-	0.05		0.05
Pineapple	-	-	-	-	-	-	-	-	-		0.02	0.02
Coconut	-	-	-	-	-	-	-	-	-		2.51	2.51
Cashew nut	-	-	-	-	-	-	-	-	-		1.7	1.7
Others	-	-	-	-	-	-	-	-	-		0.97	0.97
Total Fruits Area	-	-	-	-	-	-	-	-	-	**2.22**	**5.67**	**7.89**
Total Cropped Area	**71.53**	**77.30**	**148.83**	**63.84**	**58.91**	**122.75**	**135.37**	**136.21**	**271.58**	**2.22**	**5.67**	**7.89**

Source: Odisha Agricultural Statistics 2013-14

The major field crops of the district during Kharif are paddy, maize, biri and arhor. Area under paddy is highest among other field crops i.e. 1,10,000 ha which is gradually increased up to 2013-14 from 2012-13 but decreased during 2014-15 i.e. 1,06,570 ha due to crop diversification. During 2015-16 paddy area again increased to 1,11,000 ha. Similarly, area under maize varied more or less around 3,000 ha over the years. Vegetables like sweet potato, spices and condiments like chilli, ginger etc. are major crops grown in Kharif season. Area under pulses varied widely over years. Though the area under arhor varied in and around 2,500 ha but there was wide variation in area under biri (greengram) and other pulses over years. During 2012-13, the area under biri was 33,465 ha and it reduced to only 753 ha during 2014-15, which was again suddenly increased to 33,500 ha during 2015-16. The major cereal crops of the district during Rabi season are paddy, wheat and maize. Among pulses, green gram, black gram and kulthi, and in oil seeds, groundnut and mustards are the main crops grown. Important vegetables during Rabi season are potato, onion, garlic, coriander, sweet potato. Among all the crops grown in the district, paddy is cultivated in highest area of 4,240 ha. In pulses, blackgram covered highest area of 24,610 ha and in oil seeds, groundnut was cultivated in 30,110 ha. during 2014-15. Among vegetables, potato, coriander and chilli were cultivated in the district and cash crop like sugarcane is also increased cultivation.

Table no.3.29: Area, Production and Productivity of Major crops in Jajpur District

Crop Type	Kharif			Rabi		
	Area ('000 ha)	Yield (kg/ha)	Production (MT)	Area ('000 ha)	Yield (kg/ha)	Production (MT)
HYV Paddy	95.64	1773	169.57	2.45	3851	9.43
Local Paddy	27.98	849	23.76	0.00	-	0.00
Wheat	0.00	-	0.00	0.41	1742	0.71
Maize	2.87	1857	5.33	0.09	1778	0.16
Ragi	0.02	605	0.01	0.01	906	0.01
Jowar	0.08	500	0.04	0.00	-	0.00
Total Pulses	5.61	615	3.45	66.88	465	31.10
Total Oilseeds	2.35	817	1.92	33.58	1752	58.83
Fibres	1.77	1784	3.16	-	-	-
Vegetables	11.18	11096	124.05	12.74	15560	198.23
Spices and Condiments	1.33	1955	2.60	4.52	1414	6.39
Sugarcane	-	-	-	2.07	69800	144.49
Total	**148.83**	**-**	**333.89**	**122.75**	**-**	**449.36**

Source: Odisha Agricultural Statistics, 2013-14

Table no.3.30: Area under different Fruit Crops in Jajpur

Crop	Area ('000 ha)	Distribution of area (%)	Productivity in MT/ha	Production ('000 MT)
Coconut	2.51	31.7	8.75	21.96
Mango	1.76	22.2	10	17.60
Cashew nut	1.7	21.5	0.5	0.85
Citrus	0.22	2.8	7	1.54
Guava	0.13	1.6	12.5	1.63
Banana	0.41	5.2	30	12.30
Papaya	0.05	0.6	30	1.50
Sapota	0.12	1.5	-	-
Pineapple	0.02	0.3	-	-
Others	0.97	12.2	-	-
Total	**7.92**	100.0	-	-

Source: Orissa Agriculture Statistics: 2013-14, Directorate of Agriculture and Food Production, Bhubaneshwar, Orissa

Name of crop	Area ('000ha)	Production ('000MT)	Productivity (MT/ha)
Sweet potato	0.12	1.02	8.5
Potato	0.45	5.26	11.7
Onion	0.87	7.91	9.1
Other vegetables	15.95	177.16	11.1
Chilly	2.57	2.18	0.8
Corriander	1.19	0.60	0.5
Garlic	0.66	1.99	3.0
Turmeric	0.18	0.40	2.2
Ginger	0.25	0.46	1.8

Irrigation is the lifeline for crop production. Massive efforts are geared towards increasing the irrigation potential of the district. This endeavour has resulted in creating a potential of annual net and gross irrigated area of 1,34,623 and 2,12,900 ha, respectively. Similarly, total unirrigated or fully rainfed area in Jajpur district is 84,760 ha.

Table no.3.31: Irrigation based classification of Jajpur district (utilizable)

Sl. No.	Block/ District	Irrigated Area (ha)		Rainfed Area (ha)	
		Gross irrigated area	Net irrigated area	Partially irrigated/ protective irrigation	Unirrigated or Totally rainfed
1.	Jajpur	212900	134623	-	84760

Source: Department of Water Resources, Govt. of Odisha

The district has about 49.8% land are irrigated. Many major, medium and minor irrigation projects havebeen constructed during the plan period in the district. To create additional irrigation facilities, the Agriculture Department provided subsidy to farmers for digging of bore wells, dug wells and purchase of pump sets etc. Following table shows that the total water available from different sources during kharif season is around 1.346 BCM, in which the share of surface and ground water are 1.048 and 0.298 BCM, respectively, while during rabi& summer it is 0.783 BCM.

Table 3.32: Status of Water Availability (Total Utilizable Irrigation Potential)

Sl. No.	Sources	Kharif (ha)	Rabi & Summer (ha)*	Total (ha)	Total in BCM
	Surface water				
1	**Surface Irrigaiton**				
(i)	Canal (Major & Medium Irrigation)	61530	32920	94450	0.945
(ii)	Minor Irrigation (Flow)	7875	1457	9332	0.093
(iii)	Minor Irrigation (Lift)	35434	20750	56184	0.562
(iv)	Various Water Bodies including Rain Water Harvesting	-	-	-	
(v)	Treated Effluents Received from STP	-	-	-	
(vi)	Untreated Effluent	-	-	-	
(vii)	Perennial sources of water	-	-	-	
	Sub Total	**104839**	**55127**	**159966**	**1.600**
2	**Ground Water**				
(i)	Open well (Dug well)				
(ii)	Deep Tube Well	4275	1200	5475	0.055
(iii)	Medium Tube Well (Bore well)				
(iv)	Shallow Tube Wells				
(v)	Other sources	23584	21866	45450	0.455
(v)	Other sources Jalanidhi I & II	1925	84	2009	0.020
	Sub Total	**29784**	**23150**	**52934**	**0.529**
	Total	**134623**	**78277**	**212900**	**2.129**

Source: Department of Water Resources, Govt. of Odisha

But the utilized irrigation potential during kharif is 71530 ha (0.715 BCM) and rabi is 63840 ha (0.638 BCM) taking together will be 135370 ha (1.354 BCM) per annum.

Table no.3.33: Status of Water Availability (Total Utilized Irrigation Potential)

Sl. No.	Sources	Kharif (ha)	Rabi & Summer (ha)	Total (ha)	Total in BCM
	Surface water				
1	**Surface Irrigation**				
(i)	Canal (Major & Medium Irrigation)	24837		24837	0.248
(ii)	Minor Irrigation (Flow)	18844		18844	0.188
(iii)	Minor Irrigation (Lift)	8043		8043	0.080
(iv)	Various Water Bodies including Rain Water Harvesting			0	0.000
(v)	Treated Effluents Received from STP	0		0	0.000
(vi)	Untreated Effluent	0		0	0.000
(vii)	Perennial sources of water	0		0	0.000
	Sub Total	**51724**		**51724**	**0.517**
2	**Ground Water**				
(i)	Open well (Dug well)	800		800	0.008
(ii)	Deep Tube Well	0		0	0.000
(iii)	Medium Tube Well (Bore well)	17100		17100	0.171
(iv)	Shallow Tube Wells				
(v)	Other sources	1906		1906	0.019
	Sub Total	**19806**		**19806**	**0.198**
	Sub-sub Total				**0.715**
	Total	**71530**	**63840**	**135370**	**1.354 (0.638 + 0.715)**

3.12.4 Avenue Plantation:

There are several road side plantation found in the area, which includes *Mangiferaindica,Azadiractaindica, Bombax ceiba, Delonix regia, Cassia siamea, Albizzia lebbeck, Terminalia chebula, Terminalia bellirica, Emblica officinalis, Mangiferaindica, Terminalia arjuna, Terminalia alata, Gmeliaarborea, Syzyziumcuminii, Cassia fistula, Anthocephaluskadamba, Acacia nilotica, Eucalyptus sps.* etc.

3.12.5 Aquatic Flora of the Study area

The swampy and aquatic vegetation is very less as observed during the study. The aquatic vegetation found near river bed of Brahmani river and some of the village ponds. Major component of the aquatic flora found in the study area are rooted submerged species, rooted submerged species, floating and marshy species.

Hbitat	Species
Rooted submerged species	*Hydrilla verticillata, Potamogetonsps, Valisnariaspirallis, Urticularia*
Floating species	*Nymphea, Nelunbo, Azolla, Lemna, Ichornea, Pistea, Salvinea, Sagiteria, Fragmitis, Juncus*
Marshy species	*Marsillea, Cyperus, Adiantum, Alternathera, Centella, Ecliptasps*
Decomposers	*Aspergillus, Cephalosporium, Cladosporium, Pythium, Rhizopus, Pennicillium, Phieladia, Alternaria, Trichoderma, Cercinella, Fusarium, Curvularia, Saprolegnia*

3.12.6 Threatened Plant Species

No plant species in the study area found to be included under any category of threat (Critically Endangered, Endangered and Threatened) as per the guideline of International Union for Conservation of Nature and Natural Resources (IUCN).

3.12.7 Ecologically Sensitive Zone in the Area:

The study area within 10 Km of the project site is devoid of any national parks, sanctuaries, Biosphere reserves, wild life corridors, tiger/elephant reserves etc. The area is also devoid of any kind of vulnerable, endangered and critically endangered flora and fauna.

Table No. 3.34 Checklist of Ecological Field Study

Sl. No	Ecological Study List	Present/ Absent
1.	Trees	Present
2.	Herbs	Present
3.	Shrubs	Present
4.	Grasses	Present
5.	Bushes	Present

6.	Climbers	Present
7.	Lichens	Present
8.	Mosses	Present
9.	Ferns	Present
10.	Epiphytes	Present
11.	Cultivable Plants	Present
12.	Natural forest	Present
13.	Mangroves	Absent
14.	Corals	Absent
15.	Endangered Flora	Absent
16.	Biosphere reserve	Absent
17.	National park and Wild life sanctuary	Absent
18.	Natural lake	Absent
19.	Swamps	Present
20.	Tiger reserve	Absent
21.	Elephant reserve	Absent
22.	Habitat of Migratory birds	Absent
23.	Aquatic flora	Present
24.	Aquatic fauna	Present
25.	Fishes	Present

3.12.8 FAUNAL COMPOSITION IN THE STUDY AREA:

3.12.9 Methodology for Faunal study:

The methodology adopted for faunal survey involve; Random survey, Opportunistic observations, Diurnal bird observation, active search for reptiles, faunal habitat assessment, active search for scats and foot prints and review of previous studies. Secondary data also collected by interaction with local people and data from forest department. The aim was to set baselines in order to monitor and identify trends after the commissioning of the project. Emphasis has been placed on presence of endemic species, threatened species if any present in the study area. Desktop literature review was conducted to indentify the representative spectrum of threatened species, population and ecological communities listed by IUCN, WCMC, ZSI, BSI and Indian wild Life Protection act, 1972. The status of individual species was assessed using the revised IUCN/SSC category system.

3.12.10Fauna Composition in the Core Zone

There is no fauna found in the project site except few birds like crow, myna, drongo, squirrel and lizard.

3.12.11Fauna Composition in the Buffer Zone

For the documentation of the faunal biodiversity of the study area with respect to birds, reptiles, amphibians and butterfly species, a baseline survey had been conducted & the details of flora composition is given in the table below,

Table no.3.35 Enumeration of Faunal Composition in the Buffer Zone

Sl. No	Common Name	Scientific Name	Schedule As per Wild life Protection Act, 1972
Mammal			
1.	Common Mongoose	*Herpestresedwardsii*	IV
2.	Jackal	*Canis aureus*	II, V
3.	Common house rat	*Rattus rattus*	V
4.	Indian hare	*Lepus nigricollis*	IV
5.	Indian Field Mouse	*Mus booduga*	V
6.	Rhesus Monkey	*Macacamulata*	II
7.	Squirrel	*Funambulus pennant*	IV
Reptiles			
8.	Monitor Lizard	*Varanus spp.*	II
9.	Common krait	*Bangaruscaerulidus*	II
10.	Common Indian House Geiko	*Homodactylusflevirudis*	IV
11.	Yellow Rat Snake	*Ptyasmucosus*	IV
12.	Garden Lizard	*Calotes versicolor*	
13.	Common of Brahminy Skink	*Mabuyacarinata*	
Birds			
14.	Pariah Kite	*Milvus migrans*	V
15.	Common Crow	*Corvussplendens*	V
16.	Jungle Crow	*C. marorhynchos*	IV
17.	House Sparrow	*Passer domesticus*	
18.	Common Mynah	*Acridotherestristis*	IV
19.	Pied Mynah	*Sturnus contra*	IV
20.	Cattle Egret	*Bubulcus ibis*	IV
21.	Pond Heron	*Ardeolagrayii*	IV
22.	Drongo	*Dicrurusadsimilis*	IV
23.	Doves	*Streptopeliaspp*	IV
24.	Common Kingfisher	*Alcedoatthis*	IV
25.	Common Babbler	*Turboidescaudatus*	IV
26.	Crow-Pheasant	*Psittaculakrameri*	IV
27.	Koel	*Eudynamysscolopacea*	IV

28.	Tailor Bird	*Orthotomussutorius*	IV
29.	House Sparrow	*Passer domesticus*	IV
Amphibians			
30.	Common Indian Toad	*Bufo melanosticus*	
31.	Paddy-field Frog	*Rana limnocharis*	IV

The common mammalian species observed during the study are Common Mongoose, Field mouse, Monkey, Common house rat, Squirrel etc. The reptiles reported are Monitor Lizard, krait, rat snake etc. The common birds reported from the study area are Common Crow, Drongo, Common Mynah, Common king fisher, Doves, Sparrow etc.

3.12.11.1 Livestocks& Animal Husbandry

Animal Husbandry has been adopted by the farming community of the district since long. Livestock on or more than one type including cattle, buffalo, sheep, goat, pigs and poultry are being reared by the farmer for their sustenance. The indigenous cattle of this district like Binjharpuri Cattle has been registered as one of the registered cattle breeds of our country. In small animal resources, the district is highly rich in small animals particularly goats. Among the tribal farming community mostly found in blocks like Sukinda, Danagadi&Korei goat rearing is very popular and they directly or indirectly depend upon these animals for social, cultural and economic need. In poultry sector, the district is self sufficient in production of broiler meat with a good number of broiler farms do exist all over the district.

3.12.11.2 Aquatic Fauna within the Study Area:

During the field survey the aquatic fauna was identified and enumerated as below:

a. Benthic Macro-invertebrates available from water bodies of study area.

The zoo planktons found during the study are *Peniliaavirostris, Evadnatergestina, Daphnia sp., Ceriodephnia, Alonella, belongs to Cladocera, Brachionus, Keratella, Mytilina etc.* belongs to Rotifera *Nauplius sp., Oithona nana, Acartiaspinata, Miraciaefferata, Harpacticoid sp., Diaptomus, Cyclopus etc.* belongs toCopepoda.

b. Aquatic Fish Fauna

Among all the aquatic life in the study area the fish fauna occupies an important place. The fish fauna of the study area are given in table below:

Table no. 3.36. Aquatic Fish Fauna

Sl. No	Local Name	Scietific Name
1.	Mohurali	Amblyupharngodon mola
2.	Bhakura	Catla catla
3.	Kerondi	Labio calbasi

4.	Crab	Cancer sps
5.	Mirikali	Cirrhina mrigala
6.	Pohala	Cirrhina reba
7.	Dhandikiri	Esomus dondrica
8.	Singi	Heterophnaustes fossilis
9.	Leech	Hirudinaria sps
10.	Rohi	Labeo rohita
11.	Todi	Mastacombelus armetus
12.	Changa	Notoperus chital
13.	Seula	Ophiocephalus striatus
14.	Prawn	Paleomon sps
15.	Apple snail	Pila globusa
Source: Baseline study		

3.13 SOCIO ECONOMIC ENVIRONMENT

The project site has long term irreversible impact on local, sociological, cultural and economic aspects. Socio economic survey in the study area has been carried out to assess the status of demographic pattern, cropping pattern and general amenities available in the study area. Besides the primary baseline survey in the buffer zone secondary data was also collected from Census 2011, District statistical handbook, official website of the district, Block office etc. This study evaluates both positive and negative impacts of proposed area on the local inhabitants. The socio-economic study in the present case includes demographic structure, population dynamics, infrastructure resources, status of human health and economic attributes like employment, per-capita income, agriculture, trade, industrial development etc. in the project area.

The data collection on the impact of mining on the socio-economic aspects in the study area has been done through analysis of various secondary data and supplemented by the primary data generated through the process of limited socio- economic survey.

3.13.1 Objectives of the study

(i) To identify villages located within an aerial coverage of 10 km from the boundary of the proposed project site.

(ii) To study demographic pattern in these villages including ethnic composition, workforce participation, literacy, etc based on census 2011 data.

(iii) To identify and record the infrastructure and service facilities like road communication, electricity, education, health, drinking water etc available in the villages located within a radius of 10 km from the boundary of the project site.

(iv)To conduct sample household survey in these periphery villages and find out occupational pattern, extent and sources of household income, land holding pattern, health status, skill etc of people residing in these villages.

(v) On the basis of empirical study suggest measures for socio-economic development of the study area.

3.13.2 Study Area

There are 49 villages present within the buffer zone of the project area located within 10 km radius of the project site.

3.13.3 Methodology Used

The study was conducted in following four phases :

Phase-I: Identification of different tools for the study, preparation of different schedules which includes Focus Group Discussions with Community Leaders, Villagers and some key informants, Interview of Local Government official, Revenue Department officials etc and Sample household survey through properly designed questionnaires.

Phase-II: Collection of secondary data from Census 2011 and census 2001, Block office and district statistical hand book.

Phase-III : Collection of primary data from the field through survey and discussions.

Phase-IV: Analysis of both primary and secondary data and preparation of project report.

A. Demography

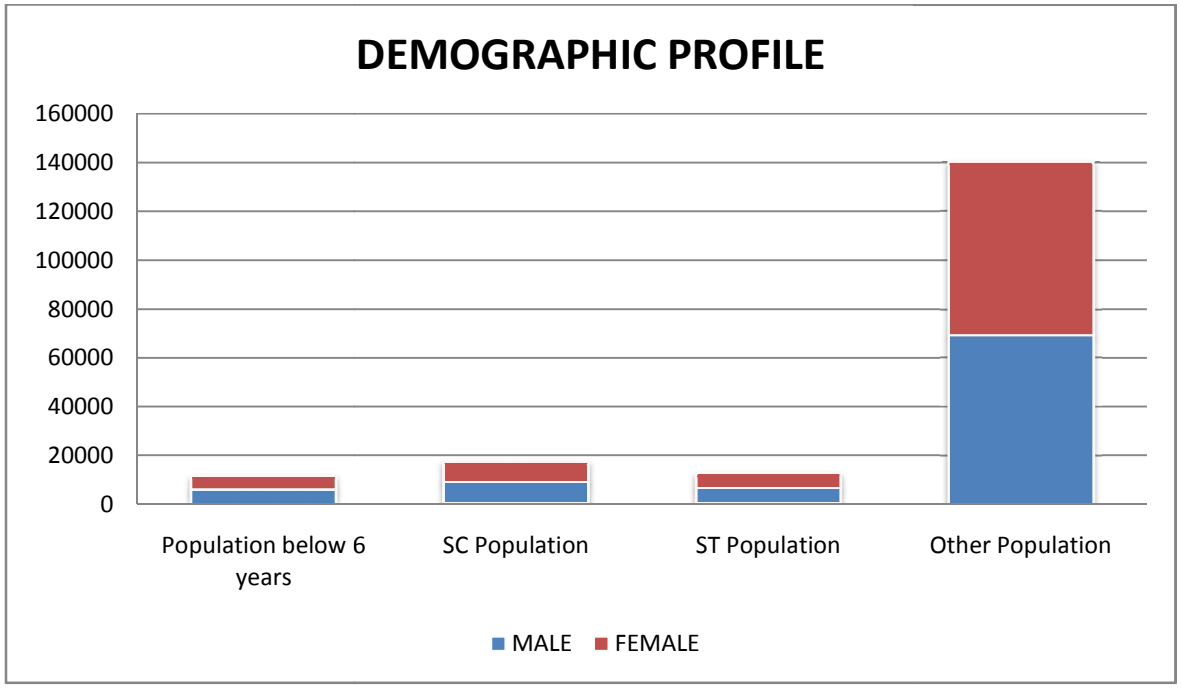
The demography of the project area is summarized from census data 2011 for Jajpur District. The position of demographic profile of the project area has been given in **Figure 3.16.** The village wise demographic profile of the project area has been given in **Annexure 4.**

Table 3.37: Demographic profile of the buffer zone

Sl. No.	Attributes	Radius of 10 km
1	No. of Villages	49
2	Total Household	20760

3	Total Population	91007
4	Male Population	46376
5	Female Population	44631
6	Total ST population	12737
7	Total SC Population	17561
8	Sex Ratio (F /M)	96 : 100
9	Population below 6 Years	11341

Figure 3.16 Demographic Profile of Study area



B. Literacy

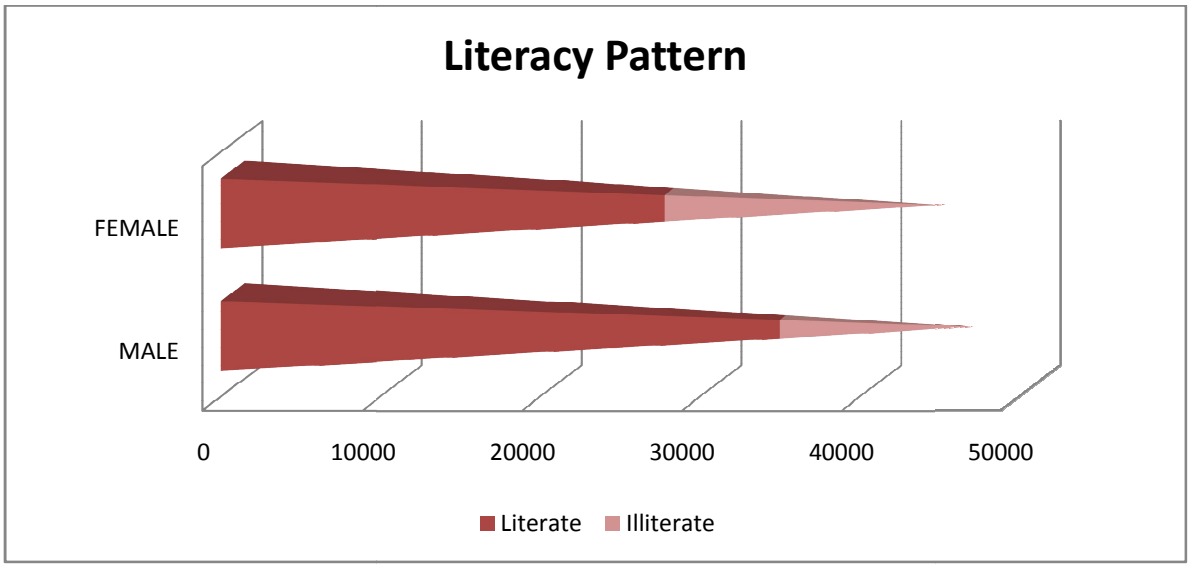
Out of the total population, 61805 persons are literate which contribute about 68% within the buffer zone. Out of the total literate, male literacy is contributed as 34455 i.e. 56% and female literacy is contributed as 27350 by 44%. It is observed that the literacy percentage is more among the male as compare to the female population. About 32% of the total population of the project villages is illiterate. The details of literacy pattern and the education facilities in the villages of the study area have been given in **Annexure 4.**

Table 3.37: Literacy palttern of the area

Sl. No.	Attributes	Radius of 10 kms
1	Total Literate	61805
2	Literate Male	34455
3	Literate Female	27350
4	Total Illiterates	29202
5	Illiterate Male	11921
6	Illiterate Female	17281

The graphical presentation showing the literacy pattern of the area has been given in **Figure 3.17.**

Figure 3.37: Literacy Pattern of study area



C. Occupation

The work force classification in the study area helps in formulating strategies in any development programme. It also helps in identifying the potential workforce, their aptitude, skill, etc in any targeted population. As per census data of 2011 the village wise work group participation has been given in **Annexure 4.**As per the census 2011 the work group participation of the study villages are as follows :

- Out of the total population, 30656 persons (about 34%) are workers and 60351 (about 66%) persons are non workers. This can be inferred that almost half of the population is depending on others for their livelihood.

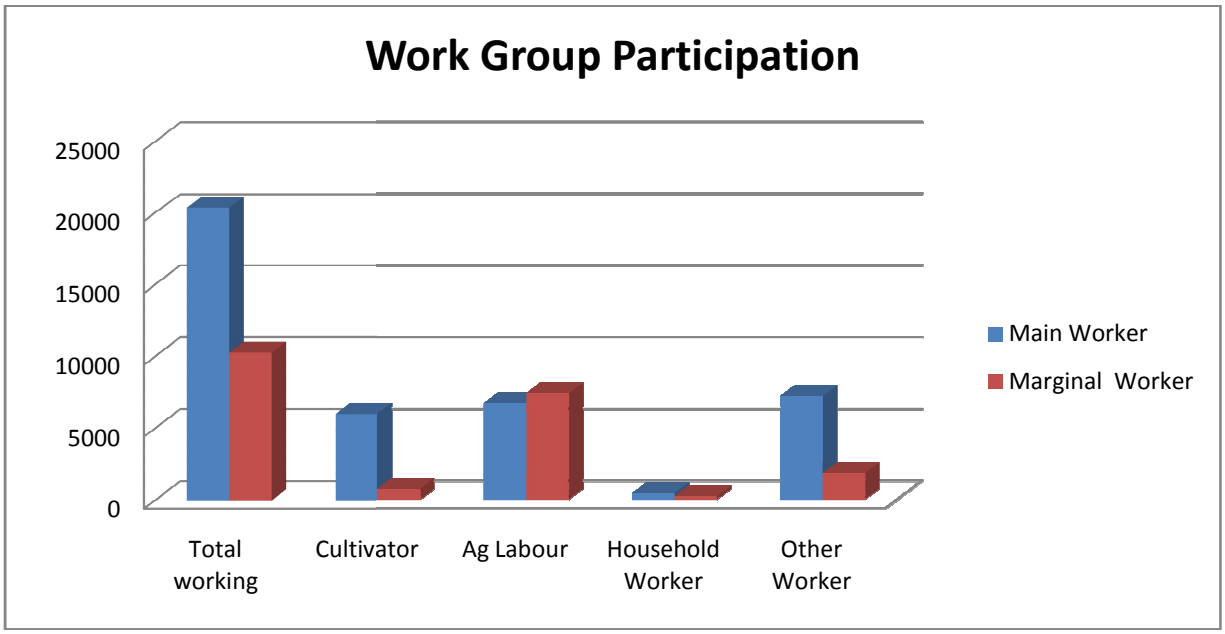
- Regarding workforce participation rate of both the sex, the data reveals that female workforce participation rate is comparatively low with respect to male. Out of the total working population 25293 (83%) are male and 5363 (17%) are female.
- Out of the total workers 20385 are main workers and 10271 are marginal workers. In both main and marginal workers population the male workers are dominated in comparison to female workers. As per the census 2011 the work group participation of the study villages have been given below :

Table 3.38: Work group participation in main and marginal section

Sl. No.	Attributes	Main	Marginal
1	Total Working	20385	10271
2	Cultivator	5994	750
3	Agricultural labour	6721	7421
4	Household workers	448	247
5	Other Workers	7222	1853

The graphical presentation of the work group has been shown in **Figure 3.18.**

Figure 3.18: Work Group Participation of Study area



3.14 TRAFFIC DENSITY OF THE PROJECT SITES

The traffic density study was conducted in on NH 200 located near the lease area.

Table No.3.39 Traffic study points

Sl No.	Location	Distance from the Project site
Traffic Point 1	On NH 200	1.5 Km

3.14.1 Objective

Objective of the study was to measure traffic volumes and to note other related traffic characteristics such as flow composition, flow fluctuations etc.

3.14.2 Methodology

Manual Classified Count (MCC) method was used to count the number of vehicles passing through a given point on the road and classify them according to vehicle type (e.g. Heavy Goods vehicles, cars, motorbikes etc). Manual Classified Turning Count (MCTC) – was used to count the number of vehicles passing through intersections and classify the vehicles according to type (e.g. cars, motorbikes etc).

Traffic density measurements were done continuously for 24 hours by visual observations and counting of vehicles under various categories. The time period chosen from 10.30 pm to 11.30 pm and from 4.00 pm to 5.00 pm. Two skilled persons were deployed simultaneously during each shift – one person on each of the two directions for counting the traffic. A summary of the traffic density monitored during survey period is given **Table** below:

Table No.3.40 Traffic Density of the study area

Types of vehicles	Number of Vehicles / hr
	TP1
HMV	230
LMV	380
4/3-Wheeler	550
2-Wheeler	720
Cycles	34
Total	**1914**
Source: Field observation	

CHAPTER 4

ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.1 IMPACT ASSESSMENT METHOD

In the present study, matrix method has been used. This method is best suited to single project assessments, and is not recommended for large regional actions. The mining and allied activities as proposed in the project area which influence the environmental attributes include:

1. Excavation
2. Construction of approach and haulage road
3. Drilling & blasting
4. Loading & transportation of stones and wastes
5. Processing & sizing of stones
6. Disposal of overburden/waste etc.
7. Stockpiling of low-grade stones.
8. Site preparation

The pollution potential of a mining project in general and in specific to the proposed stone mining project is outlined as per Table-4.1 for general reference. In this specific case blasting and drilling operation is involved in the process. Screening process is also involved for extraction of stone from the waste dump. The environmental impact due to the mining activities is expected to be quite marginal in nature because all possible measures will be taken to minimize the impact. This will be analyzed in details in subsequent table.

Table No. 4.1 Overview of Environmental Impacts due to different phases of mining

Mining Phase	Activity	Potential Environmental Impact
Mine Development, Sourcing and Stockpiling	Mining activity, Land cleaning, Excavation, Construction of internal road and site services.	Habitat loss and disturbance of habitation of flora and fauna. Reduction in biodiversity of the locality. Altered landforms due to construction. Altered drainage and runoff flows Increased erosion of site area Increased situation of surface water

Removal and storage of stones and waste materials	Stripping /sorting of soil overburden. Waste rock stock piling, extracted stone piling.	Land alienation from waste rock stock piles. Disturbance form vehicle and machinery noise and site illumination.
Blasting and Mining	Blasting of rock for extraction collection and sizing of stone	Ground surface disturbance. Disturbance due to noise and vibrations. Dust and fumes from explosion, mine vehicles and transport systems Contamination from explosive residues.
Transport of final product to markets	Packaging /loading of final product for transportation Transportation of final product	Disturbance due to noise, vibrations and site illumination. Dust & fumes from exposed product & stockpiles.
Mine closure and post operational waste	Decommissioning of roads Dismantling of buildings Plantation in disturbed areas Recounting waste dumps Water Quality treatment Fencing dangerous areas	Noise & dust during dismantling. Subsidence, slumping and flooding of previously mined areas. Continuous discharge of contaminants to ground and surface water via seepage.

The magnitude of the proposed mining activity being small is not likely to create any serious impacts on the existing environmental set up of the area. However, the likely impacts of the proposed mining and allied activities on the various environmental parameters are discussed in the table below:

Table No. 4.2 Proposed Mining and Allied Activities on the Various Environmental Parameters

Environment Attributes	***Impact Parameters***	***Mining Activities***						
		Drilling and Blasting	***Mining Operation***	***Material storage, Transportation and handling***	***Storage of waste Material (OB)***	***Movement of Vehicles***	***Water use***	***Mine drainage water***
Soil/ Land	*Soil quality*			*	*			
	Soil contamination			*	*			
Resources	*Fuel/ Electricity*	*		*			*	

	Mineral excavation	*	*					
Water	*Water quality*			*	*		*	
	Surface runoff and contamination			*	*			*
Air	*Air quality*	*	*	*	*	*		
	Noise quality	*	*	*	*	*		
	Traffic			*	*	*		
Biological	*Removal of vegetation*	*	*	*	*	*		
	Disturbance of biotic environment	*	*	*	*	*		
Socio Economic	*Development of Local Employment*	*	*	*	*	*		
	Increase in infrastructure facility		*					*
	Impact on health	*	*	*	*	*	*	*

4.2 IMPACT OF MINING ON LAND ENVIRONMENT

4.2.1 Impact on Topography

The impact on the topography is in the form of changed landscape due to the mining activities in the form of digging, leveling of lands & dumping of waste etc. There will be topographical change due to mining activity within the lease clusters. Cluster-3 (Bajabati Hillocks) is located within the revenue jurisdiction of Bajabati village under Dharmasala Tahasil of Jajpur district. The targeted area represents a hilly terrain comprising three Patches, viz., Cluster-3A, 3B & 3C with undulated topography. Cluster-3A displays highest altitude of 80 mRL and lowest altitude of 35mRL, Cluster-3B displays highest altitude of 25mRL and lowest altitude of 20mRL & Cluster-3C displays highest altitude of 40mRL and lowest altitude of 35mRL.. Impact on topography can be categorized as follows;

i. Impacts due to Development of Mine & Excavation of stone

Ultimate extent of the quarry will be confined to the area of 7.33 hectares in Cluster-3A (Bajabati), 3.37 hectares in Cluster-3B (Bajabati) & 0.98 hectares in Cluster-3C (Bajabati). As discussed, based upon the existing quarries as well as surface exposures total resource of the cluster has been estimated as the probable resource over the mineralized area of the respective hillock will be mined out during conceptual period. The ultimate quarry bottom will be at 10mRL in Cluster-3A (Bajabati), (-10mRL) in Cluster-3B (Bajabati) & 10mRL in Cluster-3C (Bajabati).

ii. Other Impacts

The land-use pattern undergoes a change due to the use of the land for mining, dumping, and other mining and associated activities. The drainage pattern on the surface undergoes a change due to the alterations in the surface topography due to mining and associated activities.

4.2.2 Mitigation Measures

The quarry within the lease cluster will be utilized as water reservoir. There will be construction of retaining wall along the quarry boundary and plantation will be carried out along the boundary of the quarry.

4.2.3 Impact on drainage:

It is observed from the dug wells of the adjacent plain area and in the nearby villages that, the ground water table varies between 3 m to 8 m from the surface level depending upon seasonal variations. During dry season the water table falls to 8 m from the surface, whereas during rainy season the water table remains at around 3 m from the surface.

During the proposed plan period no particular pit lay out will be followed for all the quarries in the respective hill/patch of the Cluster-3 area. Therefore, at the end of the plan (lease) period depth of the respective quarry over the Cluster-3 area is not possible to predict. However, after 10 years (plan period) of mining the tentative bottom RLs of Cluster 3A & 3B would be 10.5m and (-7.5m) respectively. Whereas, the ultimate quarry bottom over the Cluster-3 area will be at 10mRL in Cluster-3A (Bajabati), (-10mRL) in Cluster-3B (Bajabati) & 10mRL in Cluster-3C (Bajabati) at the end of the conceptual period. This is above the ground water table as the RL of ground water table is around 8 m except in sub-cluster-3B, where permission will be taken from the concerned authority to carry out the mining operation by dewatering the quarry floor, if ground water punctured. Therefore, it is proposed to keep one 5 HP diesel operated pump at each quarry site of sub-cluster 3B, particularly during monsoon to draw out the accumulated water from the quarry. Therefore such depth of working would not affect the ground water table. The water so discharged will be routed to the natural drainage through series of drains and settling pits.

4.2.4 Mitigation measures

- The dump slope will be provided with retaining wall and garland drain to arrest the wash off from the dumps.

- Garland drains will be connected to settling tank and settled water will be transferred to the water reservoir and used for green belt development and dust suppression.
- As there is no natural drain passing through the project area there will be no diversion of the drainage pattern of the area.

4.2.5 Impact on Land environment and Land use

Mining operations involve development of benches, approach roads, haul roads, drilling, blasting, excavation and transport and handling of product and waste materials. These activities have significant impact on the land use pattern of the lease area. The land use pattern of the buffer zone will be changed due to the mining activities. The mining lease area is under waste land category and this will changed to mine reclaimed land and water reservoir during the conceptual period. The surrounding lease area will be agricultural land the impact of mining on the surrounding agricultural land will not envisaged. There will be no defstonestation activity within and outside the lease area. There will be plantation in the lease boundary and reclaimed area which will increase the vegetation within the lease area.

However some of the identified sources which may that may affect the surrounding agricultural and Forest land is as below:

- Change in land use due to mining, dumping of waste.
- Drainage from the waste dump and contaminated water from the mines that may affect the characteristic of the top soil affecting the land use.
- Degradation of vegetation in the lease area due to quarrying, dumping and transportation.
- Buffer zone will not be affected as the mining operations are confined only to the cluster area.
- Ultimate extent of the quarry will be confined to the area of 7.33 hectares in Cluster-3A (Bajabati), 3.37 hectares in Cluster-3B (Bajabati) & 0.98 hectares in Cluster-3C (Bajabati).

4.2.6 Mitigation Measures

The mining quarry will be converted to water reservoir and retaining wall will be constructed along the boundary and plantation will be done along the boundary. Waste dumping for the lease cluster will be temporary in nature and will be utilized for construction of internal road within the cluster area. The water reservoir will be utilized for irrigation and pisciculture purpose.

Plantation (@ 1200 nos./ha.)of local species will be undertaken in the safety zone of the respective hillock/patch of the Cluster-3 area surrounding the individual hillocks. About 3024 nos. saplings will be planted over an area of 2.52 hectare in 7.5m wide safety zone along peripheral hillock boundary of Cluster-3A (Bajabati), about 2220 nos. saplings over an area of 1.85 hectare in 7.5m wide safety zone along peripheral hillock boundary of Cluster-3B (Bajabati) and about 804 nos. saplings of local species will be planted over an area of 0.67 hectare in 7.5m wide safety zone. Soil and cow dung will be utilized for growth & nourishment of trees. Utmost care will be taken to ensure the survival & growth of existing trees in the area and drought resistant & fast growing trees will be planted in the no-tree land to form a comprehensive green belt all around the quarried out area of the respective hillock/patch of Cluster-3 (Ref. Plate-VII). As the life of the mine is more than the plan period effort will be made by Tahasildar Dharmasala through district administration to undertake this plantation from the first year of operation of the quarry leases involving all lessees. Plantation within the safety zone is proposed to be completed within ensuing five (5) years of mining operation.

At the end of the conceptual period, considering the present status of exploration over the cluster-3 area, a large quantity of reserve will remain un-exploited. Hence, at present no reclamation is envisaged over the Cluster-3 area. However, as discussed the quarry floor of each hillock/patch will be a plane land after conceptual period which along with the exhausted benches are proposed to be rehabilitated by plantation @ 1200 nos./Ha provided existence of building stone/ road metal does not continue below the probable limit. In the process, 8796 nos., 4044 nos. and 1176 nos. of saplings will be used for plantation in the quarried out areas of 7.33 Ha, 3.37 Ha and 0.98 Ha in Cluster-3A (Bajabati), Cluster-3B (Bajabati) and Cluster-3C (Bajabati) respectively. However, depending on the conceptual depth of the mine, a decision would be taken to the effect that whether the exhausted quarry will be utilized as a water reservoir or plantation would be taken up throughout the exhausted portions i.e. if the depth of the ultimate quarry is around 10 m, plantation would be more feasible and for quarries having more than 10 m conceptual depth will be converted to water reservoir after making the slopes stable.

At the end of conceptual period, no waste dump will be there over the cluster area. The temporary waste dumps of all quarry leases will be disposed.

Water sprinkling by water tankers will be taken up by individual lessees of the cluster on haul roads and around potential dusting areas.

4.2.7 Impact of Solid waste generation

The Cluster-3 lease areas are partly covered with soil mixed rock boulders/pebbles followed by granite gneiss/charnockite/migmatite deposit. The soil to be generated will be stacked in the earmarked temporary soil stack and will be utilised for the plantation purpose to be undertaken around the respective hill/patch and adjacent to haul roads of the same in Cluster-3. Moreover, as envisaged, waste to the tune of about 30% of excavation will be generated during mining which will be utilised by the respective Lessee for making of mine road and allied infrastructures.

A total of 51,158m3 (43632m3 in Cluster3A + 7526m3 in Cluster3B) of top-soil mixed with boulders and pebbles are envisaged to be generated during the plan period in course of mining. It is proposed to store this top-soil in the earmarked site and will be utilized for nearby avenue plantation purpose after separated out from the mixed rock boulders and pebbles.

It is proposed to store this top-soil in the earmarked site and will be utilized for nearby avenue plantation purpose after separated out from the mixed rock boulders and pebbles.

These are the portions of total excavation which are not suitable for construction purpose due to weathering and softness. It will not be possible to separate the total waste from the suitable building stone/road metal at the quarry head. It is assumed that around 20% of the waste will be transported to the crusher site along with valuable building stone/road metal where these will be sorted out. The remaining 10% of the total waste will be separated at the quarry head and will be stacked in the temporary waste dump of respective quarry lease and will be utilised by the lessee for making of mine road and allied infrastructures. If required, the portion of soil unsuitable for plantation and the wastes will be sold out to intending users for construction purpose after obtaining permission from concerned authority and payment of advance Royalty.

4.2.8 Mitigation Measures

- It is proposed to stone this top-soil in the earmarked site & will be utilized for plantation purpose after separated out from the mixed rock boulders & pebbles.
- The portion of soil unsuitable for plantation will be sold out to intending users for construction purpose after obtaining permission from concerned authority & payment of advanced royalty.

- Waste to the tune of about 30% of excavation will be generated during mining which will be utilised by the respective Lessee for making of mine road and allied infrastructures.
- It is assumed that around 20% of the waste will be transported to the crusher site along with valuable building stone/road metal where these will be sorted out. The remaining 10% of the total waste will be separated at the quarry head and will be stacked in the temporary waste dump of respective quarry lease and will be utilised by the lessee for making of mine road and allied infrastructures.
- Dump slope will be provided with retaining wall and garland drain to prevent the wash off.
- Dump slope will be maintained at 22.5° with the horizontal to make the dump stable.
- During the conceptual period the waste generated will be utilized completely for road construction and rest will be transported to the crusher area.
- There will be no waste dump exists within the lease area during the conceptual period.

4.2.9 Impact of mining activity on the fertility status of the soil

The fertility status of the soil near by the lease area may affect due to extra dust deposition on the soil. This dust will be settled on the top soil resulting in decrease in the fertility of the soil as well as decrease in crop production.

4.2.10 Mitigation Measures

- Garland drain and retaining wall will be constructed in the slope of the dump and mineral stack. So the surface runoff from the dump will be passed through the garland drain and settled in a settling pit before discharging outside. This decreases the soil erosion or deposition of the contaminants on the agricultural land.
- The labours in the mines are from the nearby areas so there will be no residential colony development within the lease area. This result in very small generation of domestic solid waste. However the domestic solid waste will be treated through septic tank via soak pit.
- The top soil generated during the mining activity will be used for plantation

4.3 IMPACT ON AIR QUALITY

The impact on air environment due to the mining and allied activities arises during land development phase and during mining process. The excavation/removal of topsoil and dumping of overburden (top soil and host rock) generates fugitive dust in that area.

Mining operation are carried out by opencast semi mechanized methods generating dust particles due to various activities likes, excavation, loading, handling of mineral and

transportation. The air quality in the mining areas depends upon the nature and concentration of emissions and meteorological conditions. The major air pollutants due to mining activities include:-

- Particulate matter (dust) of various sizes.
- Gases, such as sulphur dioxide, oxides of nitrogen, carbon monoxide etc from machine & vehicular emission.

Dust is the single air pollutant observed in the open cast mines. Diesel operating drilling machines, blasting and movement of machineries/ vehicles produce NOx, SO2 and CO, usually at low levels. Dust can be of significant nuance surrounding land user and potential health risk in some circumstances.

The generation of fugitive dust during the mining activity will have some impact on the existing vegetation of the Core as well as nearby area. The dust may settle on the leaf surface decreasing the evapo-transpiration of the plant. This may also decrease the process of photosynthesis due to plugging of the chlorophyll on the leaf surface by the dust.

The most significant air pollutant from mining is particulate matter, which will be dispersing in the ambient air and thereby negatively affect the ambient air quality in the vicinity of the mine. Non-Point Sources are the major contributors to air pollution during mining operations (which cause fugitive emissions). This section describes the potential air quality impacts associated with the proposed mining activities. Transportation of final products, activities such as loading and unloading of products by the dumpers and transport of stone from mining site to the final point will involve movement of heavy vehicles. The dust will be generated during transportation, which may affect the localities adjacent to the transport route. The source of pollution is being given in **table below.**

Table 4.3 Sources of Air Pollution

Activities	**Air Pollutants**
Drilling	PM_{10}, PM 2.5
Loading & Unloading	PM_{10}, PM 2.5
Blasting	PM_{10}, PM 2.5, SO_2, Nox
Haul Road	PM_{10}, PM 2.5
Transportation	PM_{10}, PM 2.5, SO_2, NOx, CO
Waste / Top soil handling	$PM_{10,}$ PM 2.5

4.3.1 Impact prediction on ambient air quality by Mathematical modeling:

The AERMOD atmospheric dispersion modelling system (AERMOD Cloud remote version) is used for assessment of incremental Ground level concentration (GLC) for the proposed production. Area source model taken into consideration taking into consideration of the conceptual quarry area and dump area. Further line source model was taken into consideration for transportation of waste material through haul road.

A meteorological data pre-processor (AERMET) that accepts surface meteorological data, upper air soundings, and optionally, data from on-site instrument towers. It then calculates atmospheric parameters needed by the dispersion model, such as atmospheric turbulence characteristics, mixing heights, friction velocity, Monin-Obukov length and surface heat flux.

Dispersion modelling using AERMOD requires hourly meteorological data. Site specific data recorded during pre monsoon season (1stMarch to 31stMay2020) at project site is used for executing modelling studies. The site specific meteorological data is processed using AERMET processor.

Table 4.4 Model set up:

Parameters	Details
Model Name	AERMOD Cloud remote version
Model Type	Steady state Gaussian plume air dispersion model
Topography	Rural, Flat
Average Time	24 Hrs
Source type	Area source and line source
Boundary limit	10 Km radius
Receptor height	0
Anemometer height	10 m
Surface meteorological data	Site specific data processed by AERMET

4.3.2 Model Input data

The air pollution modelling carried out represents the normal operating scenarios. As the project is a mining project the major source of pollution is particulate matter. The SOx and NOx emission will be very less only due to vehicular emission. So the pollutant taken for prediction of incremental concentration is particulate matter. The predicted incremental Ground Level

Concentrations (GLCs) for particulate matter is likely to be contributed by the proposed project. The average predicted 24 hr average concentration has been tabulated as below.

4.3.3 Model Input data

The air pollution modelling carried out represents the normal operating scenarios. As the project is a mining project the major source of pollution is particulate matter. The SOx and NOx emission will be very less only due to vehicular emission. So the pollutant taken for prediction of incremental concentration is particulate matter. The predicted incremental Ground Level Concentrations (GLCs) for particulate matter is likely to be contributed by the proposed project. The average predicted 24 hr average concentration has been tabulated as below.

Table 4.5: First Highest, 24 Hr Average Predicted Concentration | Group: All

Report CT: 3

AERMOD RUN REPORT: 24 HR AVERAGE CONCENTRATION OF PM10

Title: Dharmasala Stone Mines Cluster - 4 (Bajabati Hillock)
Subtitle: Bajabati, Dharmasala, Jajpur, Odisha
Pollutant ID: PM10
Conc. Unit: MICROGRAMS/M**3
Source Group: ALL

Average Time	RANK	Conc. ug/m3	X-Coordinate meter	Y-Coordinate meter	Elevation meter	Flagpole^	Date/Time dd/mm/yy HH
24-HR	1	4.16372	406163.512	2293988.218	47.900	0.000	07-05-20 00:00
24-HR	2	4.115	406149.234	2293998.216	47.800	0.000	07-05-20 00:00
24-HR	3	3.9349	406175.838	2293975.893	48.100	0.000	07-05-20 00:00
24-HR	4	3.86448	406064.504	2294108.575	45.000	0.000	07-05-20 00:00
24-HR	5	3.52013	406272.439	2294011.614	47.200	0.000	07-05-20 00:00

Remarks:
1. ^ Summaries of FIRST highest values by receptor
2. ^ Flagpole: Receptor heights above ground-level

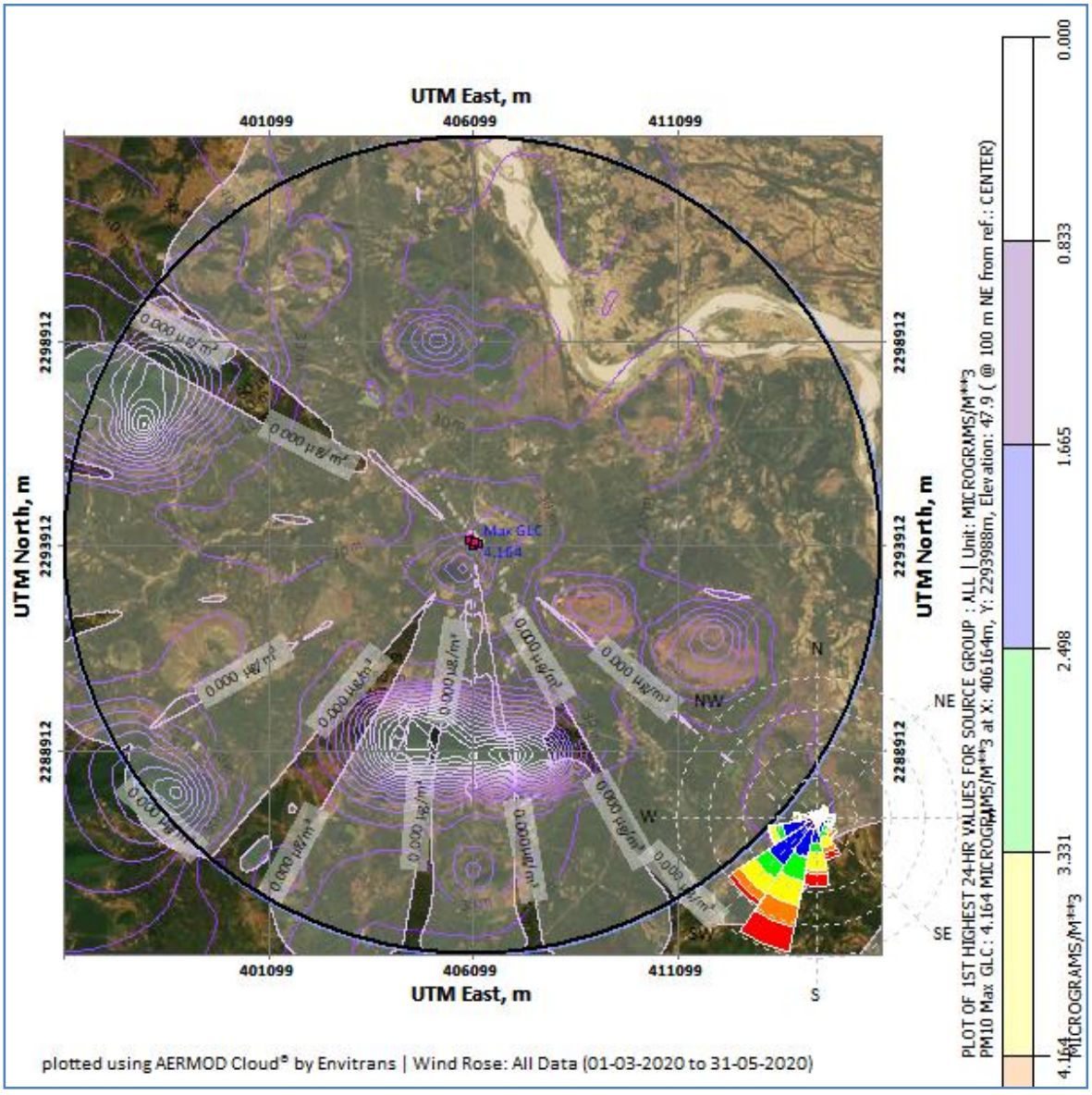
Project File: C:\Users\madhu\Documents\aermoddata\Dharmasala CLuster of Stone Mines Cluster 3 (Bajabati Hillock).ac5
Envitrans AERMOD Cloud v18.1.87
16-06-2020 11:39:34

4.3.4 Maximum Incremental Concentration

The maximum incremental GLCs due to the proposed project for particulate matter are superimposed on the maximum baseline Particulate matter concentrations recorded during the study period in the downwind direction to arrive at the likely resultant concentrations during the same period after implementation of the proposed project. The maximum GLC is predicted to be 6.01 µg/cu.m at a distance of 200m NE from the center of the lease cluster. The incremental

concentration decreases with respect to increase in distance. The isopleths for pollutants PM10 has been presented in **Figure 4.1** below:

Figure 4.1 Isopleths showing incremental concentration of PM10 (µg/cu.m)



4.3.5. Transportation

There will be transpoeration of building stone from the cluster area to the crusher sites which is located at

4.3.6. Transportation

There will be transportation of building stone from the cluster area to the crusher sites. There are few crushers exists near the cluster area which are presently non working. However, the district administration decided to allocate another area for installation of crushers which is ata distance of about 10 Km from the project site. Considering average annual production of 1,80,000cu.m per annum i.e. 600 cu.m per day of stone there will be movement of around 60 trucks/ tippers per day for transportation of the stone. This will create additional traffic load to the high way and also additional emission due to vehicular movement.

Table 4.6 Proposed Mitigation Measures for Air pollution

Potential Sources of air pollution	Magnitude of air pollution	Proposed Pollution Control Measure
Excavation	Emission of Particulate Matter	Water sprinkling Workers provided with PPEs
Drilling and Blasting	Emission of Particulate Matter and gaseous emission	Wet drilling and blasting will be carried out. Water sprinkling Safety shelter will be constructed within lease area. Workers provided with PPEs
Loading of material on dumper	Air emission	Water sprinkling on excavated material/ over burden prior to loading
Transportation	High Dust generation	Water sprinklers installed along haul road. Provision of water sprinkling on the dumper to arrest fine dust before its transportation to washing unit
Storage of waste	High Dust generation	High dust generation due to wind from the overburden storage area. This area will be installed with water sprinklers. Plantation will be provided in the dump slope.

Further mitigation measures proposed for the mining will be as blow:

1. Water sprinkling on mining quarry, dumping area and haul road during dry wind periods, using a water tanker.

2. Water sprinkler wide angle nozzle of angle 150° will be selected for water sprinkling in the dust prone area.
3. Sprinklers will be installed at a distance of 20ft from each other around the dump, quarry faces and along the connecting road as well by the side of haul road with proper control base to maintain interval of sprinkler. There is the proposal for installation of about 20 sprinklers along both side of road, 20 sprinklers along the quarry faces and working area and 10 sprinklers near the temporary waste dump.
4. Dust emissions due to vehicles can be minimized by avoiding spillage from the loaded trucks.
5. Vehicular emission of particulates, SO2, NOx, hydrocarbons can be minimized by proper maintenance of vehicles and other oil - operated equipment. Vehicle without PUC will not be allowed to enter into the lease cluster.
6. Vehicle without PUC certificate will not allowed entering into the lease area. Instruction to the gate keeper will be given in this regard.
7. Water sprinkling on the top soil and over burden dump to minimise wind erosion.
8. Trees can act as efficient biological filters. A systematic and planned greenbelt development not only reduces the fugitive dust but also checks runoff and enhances the aesthetic beauty of an area.
9. There is the proposal of proper green belt along the boundary for reduction of dust and noise emission from the lease area.
10. Dust catching species like *Alstoniascholaris, Bombax ceiba, Terminalia arjuna, Cassia fistula, Bombax ceiba, Azadirchtaindica, Nyctanthesarbor-tristis, Psidium guajava, Tectonagrandisetc*will be planted in green belt.

4.4 NOISE ENVIRONMENT

4.4.1 Impact on Noise Quality:

Different activities in mining such as Blasting, drilling, loading, hauling, stone handling, mining etc. lead to generation of noise. The various sources of noise mentioned above shall only be periodical and are limited to a fixed period of operation only. In addition to this, the transportation of stones might cause a little effect on the noise level. The noise generated by different machinery used in mining operation is given in **table 4.7**.

Table 4.7 Noise generated by machinery used in mining

Machinery	Noise generated in dB (A)
Shovel	90-100
Dozer	90-106
Dumper	80-100
Drill	105
Sprinkler	80
Blasting	120

Work zone noise levels in the mining area expected to increase marginally due to Drilling, blasting, excavation, transportation and stone handling. It is expected that the generated noise will be contained within the mine lease cluster and there will be no profound effect of noise on buffer zone. It is further expected that, the ambient noise levels within the mine lease cluster will confirm to National Ambient noise standard prescribed under Environmental Protection Act, 1986.

4.4.2 Blasting Effects

The loosening of rock mass will be done by drilling and blasting. Drilling will be done either by wagon drill or jack hammer taking in to consideration the bench height varying from 3 meter to 6m. Assuming 1,80,000m3 (max) productions per annum of Cluster-3, the monthly production target will be around 15,000m3. To produce 15,000m3 of rock mass, tentatively 7500kg/month of explosive will be required assuming powder factor 2m3 /kg.

Noise due to blasting is site specific and depends on type, quantity of explosives, dimension of drill holes, degree of compaction of explosive in the hole and rock. Blasting will be performed during the day time. Shot hole drilling & blasting will be in practice so that the effect of blasting in terms of fly rock and maximum ground vibration will be negligible. The noise produced by blasting would be for extremely short duration of around 0.5 seconds, though with a high intensity. The blasting will be conducted in the day time only and once in a week by the licensed contractor. Time of blasting will be 12 noon to 12.30 PM in day time with prior intimation to the villagers for taking shelter. The practice of regularly wetting the blasting ground and spraying water over the blasted material will be adopted to control air pollution. Proposal is to adopt wet drilling on the benches.

4.4.3 Ground Vibration

Ground vibrations are generated by travelling of shock wave into the rock mass and attenuate very quickly. There are four parameters used to define the ground vibration namely:

Particle displacement - the distance that a particle moves before returning to its original positions (mm)

Particle velocity – the rate of change of particle displacement (mm/s)

Particle acceleration – the rate at which particle velocity changes (mm/s) or acceleration due to the earth's gravity (g).

Frequency – the number of oscillation per second of a particle, Hertz (Hz)

However, in all standards the most measured parameter is peak particle velocity (V_{max})

Vibrations and air over pressure are monitstoned in trial blasts to generated sufficient statistical data that could not be used for ascertaining site constants. The site characterization or attenuation relation is obtained by regression analysis of scaled distance (distance of blast from monitoring site divided by the square root maximum charge per delay) and peak particle velocity. In this manner a predictor equation is obtained which can be used for fixing of maximum charge per delay, to some degree of reliability according to existing regulations.

$$\mathbf{V_{max} = K\,(D/Q^{-1/2})^{\alpha}}$$

Where,

Vmax = Peak particle velocity

K & α = Site constants

D = Distance of the structure from the blast

Q = maximum charge per delay

After the regression analysis of the blast hole records, values for field constants K & α were derived from the following empirical equation:

$$V_{max} = 219.6\,(D/Q^{-1/2})^{-1.281}$$

Using the above equation maximum peak particle velocity has been calculated for Cluster 7 mines of Dharmasala. Maximum charge per delay has been considered as 1.5 Kg. Predicted V_{max} values at different distance are given in the **table 4.8** below:

Table 4.8 Peak particle velocity at different distances

Sl. No	Distance/Village	PPV(mm/s)
01	100m	0.79

02	900m	0.049
03	1000m	0.043
04	1500m	0.025

4.4.4 Mitigation Measures:

- Development of green belt in the lease boundary which acts as a barrier for noise abatement
- The noise generating machineries will be properly maintained
- The workers will be provided with proper PPEs to minimize the occupational exposures of noise.

4.5 WATER ENVIRONMENT

4.5.1 Impact on Water Quality

It is observed from the dug wells of the adjacent plain area and in the nearby villages that, the ground water table varies between 5 m to 10 m from the surface level depending upon seasonal variations. During dry season the water table falls to 10 m from the surface, whereas during rainy season the water table remains at around 5 m from the surface.

During the proposed plan period no particular pit lay out will be followed for all the quarries in the respective hill/patch of the Cluster-3 area. Therefore, at the end of the plan (lease) period depth of the respective quarry over the Cluster-3 area is not possible to predict. However, after 10 years (plan period) of mining the tentative bottom RLs of Cluster 3A & 3B would be 10.5m and (-7.5m) respectively. Whereas, the ultimate quarry bottom over the Cluster-3 area will be at 10mRL in Cluster-3A (Bajabati), (-10mRL) in Cluster-3B (Bajabati) & 10mRL in Cluster-3C (Bajabati) at the end of the conceptual period. This is above the ground water table as the RL of ground water table is around 8 m except in sub-cluster-3B, where permission will be taken from the concerned authority to carry out the mining operation by dewatering the quarry floor, if ground water punctured. Therefore, it is proposed to keep one 5 HP diesel operated pump at each quarry site of sub-cluster 3B, particularly during monsoon to draw out the accumulated water from the quarry. Therefore such depth of working would not affect the ground water table.

There is chance that during monsoon the run-off water may find access to some of the quarries in the Cluster-3. Therefore, it is proposed to keep one 5 HP diesel operated pump at each quarry site, particularly during monsoon to draw out the accumulated water from the quarry. The water so discharged will be routed to the natural drainage through series of drains and

settling pits. Also, it is proposed to have a peripheral drain around each pit of the individual QLs belonging to the cluster to restrict the surface runoff in to the quarry.

4.5.2 Mitigation measures

- Garland drains (1X1m) , settling tank (3m x3 x3m) and check dam will be constructed along individual mining lease area. The garland drains of the individual lease will be connected to settling tank and after settling the water will be discharged out to the natural drainage.
- There will be no waste water generated due to the mining activity. The domestic effluents being generated will be discharged to soak pits through septic tank.
- The abandoned pit will be converted to rain water storage tank and the rain water stored in the pit will be utilized for plantation as well as dust suppression.

4.5.3 Impacts on Water Regime

The Brahamani river is located at a distance of about 10 Km from the boundary of lease cluster.However there are several ponds exists within the villages. Opencast mining and associated activities have designated impact on the water regime of the area.

- All the aquifers, including the water-table aquifer, above the mineral deposit may be extracted are damaged because of excavation of stone from the lease area.
- If there are high pressure aquifers below the stone deposit it becomes necessary to pump out water from these aquifers to reduce water pressure to facilitate mining.
- In the reclaimed open pits the filled out areas may accumulate water in rock's interspaces. This may in the long run serve the purpose of a water body.

4.5.4 Mitigation measures

- Mining activities will be restricted to the layer above the ground water table
- Runoff water during rains will be desilted and discharged.
- Reclaimed pits will be stabilized with plantation where ever possible and other areas will be converted to water reservoir.

4.6 BIOLOGICAL ENVIRONMENT

4.6.1 Impact on Biological Environment

The impact of the mining activity on the biological environment is as follows:

- The mining lease area does not include any forest land. There will be no cutting of trees during the mining activity so no deforestation activity will be under taken.

- The existing vegetation within the ML area includes few trees and scrub vegetation which are sparsely scattered. They will not be disturbed due to the mining activity. So, the impact on the vegetation is very less.
- The mining activity is confined to the cluster area only which includes the individual leases within 500m radius area.
- The transportation of stone and waste may create dust pollution which may create loss of biodiversity of the area.
- Dust in atmosphere, contributed by mining and associated activities, when deposited on the leaves of the plants in the surrounding areas may retard their growth.
- The growth of vegetation and agriculture in and around the complexes. Noise and vibrations due to blasting and operation of the machines drive away the wild animals and birds from the nearby fstonests.
- The clust area and its buffer zone are devoid of any ecosensitive area. So the impact on the biodiversity and wild life is minimal.

4.6.2 Mitigation Measures

- Green belt will be developed along the individual lease boundary which will act as a pollution barrier for the biological environment.
- There is the proposal for plantation along the haul road of individual lease and also along the connecting road.
- The blasting, drilling and transportation will be carried out during the day time only minimizing the impact on the wild fauna movement.
- All the necessary pollution control measures will be undertaken by the lessee to minimize the impact on the surrounding environment.

4.6.3 Green Belt Plan

Greenbelt is an important sink of air pollutants and noise. Green cover in mining area not only helps in reducing pollution level, but also improves the ecological conditions and prevents soil erosion to great extent. It further improves the aesthetics and beneficially influences the microclimate of the surrounding. However, green belts of the lease cluster will include the local species which are suitable for the area. Plant species, selected for greenbelt have rapid growth, ever green, large crown volume and small/pendulous leave with smooth surface. A combination of different plant species is sought while selecting trees for vegetation cover. Greenbelt should

be developed in following areas:

- Along mine cluster boundary
- Along the side of major roads
- On backfill areas

The species of plantation should be selected considering the soil quality, place of plantation, chances of survival, commercial value etc. Only indigenous species will be planted. Mixed plantation should be done keeping optimum spacing between the sapling.

Proposed Plantation Programme

Plantation will be undertaken by the respective lessee within the safety zone around the cluster-3 area. Also, it is proposed to bring the conceptual quarried out area under plantation at the end of conceptual (life of the mine) period. It is proposed to undertake and complete the plantation programme over the peripheral safety zone of each hillock/patch of Cluster-3 area during the ensuing five (5) years of plan period (10 years). However, hillock/patch wise proposed plantation Programme during the ensuing five (5) years of plan period (10 years) in the peripheral safety zone and the ultimate quarry bottom at the end of conceptual period in Cluster-3 area is as follows:

Table 4.9 Plantation Programme during Plan Period

Period	Location	Area in Ha	No of saplings	Remarks
1st year of Plan Period	Peripheral Safety Zone of Cluster-3A	0.2093	251	Plantation will be undertaken by individual lessees of the cluster in the supervision of District administration
	Peripheral Safety Zone of Cluster-3B	0.1527	183	
	Peripheral Safety Zone of Cluster-3C	0.0	0	
Sub Total		**0.3620**	**434**	
2nd year of Plan Period	Peripheral Safety Zone of Cluster-3A	0.2141	257	
	Peripheral Safety Zone of Cluster-3B	0.1821	219	
	Peripheral Safety Zone of Cluster-3C	0.0	0	
Sub -Total		**0.3962**	**476**	
3rd year of Plan Period	Peripheral Safety Zone of Cluster-3A	0.2270	272	
	Peripheral Safety Zone of Cluster-3B	0.1680	202	

	Peripheral Safety Zone of Cluster-3C	0.0	0	
Sub- Total		**0.3950**	**474**	
4th year of Plan Period	Peripheral Safety Zone of Cluster-3A	0.1434	172	
	Peripheral Safety Zone of Cluster-3B	0.1152	138	
	Peripheral Safety Zone of Cluster-3C	0.0	0	
Sub- Total		**0.2586**	**310**	
5th year of Plan Period	Peripheral Safety Zone of Cluster-3A	0.1435	172	
	Peripheral Safety Zone of Cluster-3B	0.0928	111	
	Peripheral Safety Zone of Cluster-3C	0.0	0	
Sub -Total		**0.2363**	**283**	
Total		**6.488**	**7795**	
At the end of Conceptual (Life of mine) period	Quarried out area of Cluster- 3A	7.33	8796	Subject to exhaustion of ore at the end of life of the mine and conceptual depth of mine is not more than 10m.
	Quarried out area of Cluster- 3B	3.37	4044	
	Quarried out area of Cluster- 3C	0.98	1176	
Total		**11.68**	**14016**	

Besides these plantation there will be plantation on both side of the the entry road to the mines cluster. There will be proposal for three tier plantation in the safety zone and along the boundary of the lease cluster. The species proposed for three tier platation is as below:

Tier 1	Mango, Teak, Sisoo, Kadam, Gambhari, Chakunda, Mahaneem, Neem, Jamun, Baul, Albizia, Delonix
Tier 2	Nyctanthes, Chatiana, Simarouba, Sunari, Bmboo, Psidium guava, Bael
Tier 3	Bougainvillea, Ceasalpineapulcherima, Hibiscus rosasinensis, Nerium Indicum, Lagerstomiaindica, Brazil flower

4.7 SOCIO-ECONOMIC ENVIRONMENT

4.7.1 Impact on Socioeconomic Conditions

The mine lease area comprises of mainly non-forest waste land and the project does not involve any loss of agriculture land. Commenceent of mining activity will have beneficial to the socio-economic environment. The details of impact on socio economic environment is as below:

i. Displacement of the people:

The project does not involve any displacement of the people from the cluster as the cluster of mines is devoid of any human habitation.

ii. Loss of livelihood:

As the area is a non forest waste land and devoid of any grazing or agricultural activities, these impact on the livelihood dependancy will be very minimal. Cropping pattern and crop productivity of the area will not be affected by the mining operation as the lease area does not include any agricultural land. The mine storage water may be utilized for agriculture by the nearby area if proper arrangement will be made by the lessee.

Rather the project will create livelihood for the local people in the mines cluster as skilled, semiskilled and unskilled labour. Further the mine also create indirect business opertunity for transportation worker, crusher workers and small business development near the cluste area.

iii. Changes in population dynamics :

Invariably all the managerial, skilled, and semi-skilled manpower required for mining and associated activities comes from out side as such trained manpower is usually not available in local population. Further the mining will create additional facility for crushing unit. In addition people come to the mining areas for trade, etc. Thus, the population dynamics of the area undergoes a major change over the years. These effects will be very smaller in magnitude as this is a small mining lease employing mainly local people.

iv. Health impacts :

The health status of the people working in the lease area and also in the buffer zone will be affected mainly due to dust emission from the mining operation, Loading and transportation, noise generation due to mining and blasting operation, vibration due to drilling and blasting etc. The mines workers will be provided with the dust masks, ear muffs and ear plugs. Further a ccentralised first aid center will be developed for the cluster with all the facility for the workers. Initial health check up and periodical health check up will be conducted for the mines workers. Further there will be proposal for organizing healthcheck up camp for the nearby villagers and they will be provided with medicines at free of cost. There will be water sprinkling along the transportation route that passing through the villages.

v. Infrastructure facilities :

There will be development of infrastructure facility due to the mining operation in the cluster. This include internal village road development and maintenance, provision of safe driking water for the local people and mines workers, infrastructure and other development of the nearby schools etc.

vi. Employment opportunities :

The mining and associated activities offer opportunities of employment to the eligible people from the local population. The project will create direct employment opportunity for about 733 persons and indirect employment for about 2000 people.

4.7.2 Mitigation measure

As per the need assessment survey carried out during the primary data collections following socio economic activities are proposed to be conducted by the lessee:

- The mining activity will create employment opportunity for 733 people include Skilled workers 100, Semi-skilled workers 200 and Unskilled workers 400 nos.
- The labour force for the mine will be hired from the nearby locality.
- First aid facility will be provided to the local people at the door step.
- Safe drinking water facility will be provided to the people during the summer season.
- All the necessary pollution control measures will be undertaken by the lessee to minimize the pollution during the mining operation.

4.8 OCCUPATIONAL HEALTH

4.8.1 Impact on Occupational Health

- The process of excavation / quarrying leads to some health hazards.
- The most significant occupational health impacts are Noise Induced Hearing Loss (NIHL) and Occupational Lung Disease (OLD) due to inhalation of dust.
- As the mining involve excavation of building stone, there may be possibility of silicosis, tuberculosis, pulmonary and lungs disease.

4.8.2 Mitigation Measure

- As per Mines Rules, 1955, medical examination of employees at the initial stage and periodically, shall be done by a team of qualified medical officers provided by the project proponent.

- Regular medical checkup camps shall also be arranged for detection of occupational diseases and minor disease in the nearby rural population.
- Free check up and medicine for treatment for their acute and chronic illness shall be provided.
- All the mines workers will be provided with personal protective equipments like nose mask, ear muff, helmet, goggles etc.
- Education and training arrangement for the mines workers about the safety and various occupational health risks related to mining operation.

4.9 EVALUATION OF ENVIRONMENTAL IMPACTS

Matrix method has been adopted in this report for the purposes of impact evaluation. The advantage of matrix method is that it is possible to identify the most severe cause-effect relationship. The matrix method employs a list of project activities in addition to a checklist of potentially affected environmental characteristics. These two lists are related in a matrix, which identify cause-effect relationship between specific activities and impacts.

Among matrix methodologies, "Modified Matrix" has been adopted, similar to matrix method, involves assignment of "Parameter Importance Value" (PIV) against each environmental impact parameter. These values are determined by subjective judgment considering the relative importance or significance of individual parameter. After deciding PIV, these values have to be distributed among all the cause-effect relationship, which are established between those particular affected environmental parameters and the concerned project activities by means of indices, which are called "Relative Parameters Importance Indices" (RPII). The RPII is chosen in such a way that the sum of all the indices is equal to unity. The value of RPII is decided based on the relative importance of cause-effect relationships. Higher important one is given higher RPII value and the next important one is given next higher RPII value.

Another index which is to be determined for each cause effect relationship is called "Environmental Impact Index" (EII). The scale for EII varies from zero to one. The value one is assigned to an impact of highest order and zero is assigned to an impact of negligible magnitude. For adverse impacts, EII carries a negative sign and for beneficial impacts, it carries positive sign. For determining the value of EII, the environmental impact parameters are divided into two categories.

Category "A" incorporates environmental impact parameters whose quality varies linearly with the magnitude of impact and includes

- surface and ground water resources
- socio-economic aspects
- land use pattern
- human settlement

Category "B" incorporates environmental impact parameters whose quality varies logarithmically with the magnitude of impact and includes

- Surface ground water quality
- Air quality
- Noise quality
- Health
- Biodiversity

In the latter cause, a slight change in impact magnitude will have insignificant change in environmental quality, but as the magnitude increases, the deterioration in quality increases logarithmically. The basis for determination of EII for category A and category B are given in Tables 4.9 and 4.10 respectively. After determining EII for each cause-effect relationship the same will be multiplied with RPII to get a "Weighted Environmental Impact Index" (WEII). These values are once again multiplied with PIV and addition of all these values gives the impact score of that particular environmental parameters. The impact score so obtained for all environmental impact parameters is added together to get total impact score. This total impact score is used for interpretation and decision-making.

Table-4.10: Determination of EII for Category "A" Parameters

Sl. No.	Impact Magnitude in Percentage	EII
1	No change	0
2	0-4.9% change	0.05
3	5-14.9 % change	0.1
4	15-24.9% change	0.2
5	25-34.9% change	0.3

6	35-44.9% change	0.4
7	45-54.9% change	0.5
8	55-64.9% change	0.6
9	65-74.9% change	0.7
10	65-84.9% change	0.8
11	85-94.9% change	0.9
12	>95 change	1.0

Table-4.11: Determination of EII for Category "B" Parameters

Sl. No.	**Impact Magnitude in Percentage**	**EII**
1	No change	0
2	0-4.9% change	0.02
3	5-14.9 % change	0.05
4	15-24.9% change	0.10
5	25-34.9% change	0.15
6	35-44.9% change	0.25
7	45-54.9% change	0.50
8	55-64.9% change	0.75
9	>65% change	1.00

The mining and allied activities, which are likely to cause potential impacts on environment, are identified and listed as below:

1. Mining operations
2. Sizing of ores
3. Disposal of solid wastes
4. Transportation
5. Provision of civic amenities
6. Plantation programme

Each of the above activities is discussed below:

1. Mining Operation

This includes the activities like drilling, blasting and excavation.

2. Sizing of Ores

This includes the breaking and sizing of the ore to the required sizes.

3. Disposal of solid wastes

The activity includes removal and disposal of solid wastes associated with ore bodies.

4. Transportation

This includes total transportation system i.e. movement of ore from stack yard to the destination and transportation of overburden waste from mines to dump yard.

5. Provision of civic amenities

Civic amenities like water supply, sewage collection and disposal, recreational facility, power supply, medical facility and educational facilities will be provided in the residential colony at the project site.

6. Plantation programme

Development of green belt along the periphery of the lease area, colony area and avenue plantation along the roadside shall be organized.

4.9.1 Parameter Importance Value for Environmental Components

The environmental components listed in the earlier section are assigned with PIV so as to convert the environmental impacts into commensurate units, which could be aggregated easily to get the total score of environmental impacts. The parameter importance values are assigned by marking and pair-wise comparison procedure. This procedure involves preparation of a table containing number of columns corresponding to the range of value, which can be assigned a "Score of importance" against each impact area. The score of importance is any integer ranging from one to six. The most affected parameters carries a score of six and the least affected parameter carries a score of one.

4.9.2 Assigning Importance Ranking

Although the mine mostly consume surface water, the impact on surface water resources is insignificant due to the comparatively less quantity of surface water available. But in rainy season due to run-off the impact may increase. Hence it is assigned a ranking of **1**.

It is observed that ground water resources are required every day for mining and allied activities. Due to partial recharge of ground water from various activities, the effect is less pronounced. Hence, it is assigned a ranking of **2**.

Air quality with respect to particulate matter levels is of more concern followed by NOx and SO_2 levels, which are of lesser importance. The particulate matter levels will high within the mining area and also in the residential areas. Hence it is given a ranking of **4**.

Water quality will be affected because of mining discharge especially in rain; hence the ranking **3** is given.

The importance on health aspects is mostly restricted to workers working in the mines. Though, the health impact is most important, no serious health impacts have been identified. Hence raking for impact on health is **2**.

The economic aspects of the region will improve, but people will have to pay for other negative impacts. Hence a ranking of **4** is given.

The noise level will increase because of blasting and vehicles; hence it is given the ranking of **3**.

The impact on land use is more pronounced because of degradation of land due to mining activities, disposal of solid waste and construction of structures in the region. Hence, the land use is given a ranking as **5**.

The public utilities in the region are linked to the core area only. Hence ranking of **4** is given.

The human settlements in the region will receive mixed impacts. The ranking attributed for this is **3.**

The impact on wild life will be moderate as the lease area don't come near any sanctuary area; hence the ranking given is **2**.

The impact on flora has been assigned a ranking of **4**, which is affected due to felling of trees due to mining and allied activities.

4.9.3 Summary of Importance Values

The impact areas considered along with their ranking are tabulated. The weightage for each impact area is calculated by dividing the ranking integer by sum of rankings. The total parameter importance value is assumed to be 1000 as per the standard practice. The value of total PIV is distributed among each impact area according to its weightage. The final values computed by this procedure are also tabulated in Table-4.11.

Table-4.11: Determination of Parameter Importance Value without Mitigation Measure

Sl. No.	Impact area	RANKING						Total	Weightage	PIV
		1	2	3	4	5	6			
1.	Surface water	-	✷	-	-	-	-	2	2/37	54.05
2.	Ground water	-	✷	-	-	-	-	2	2/37	54.05
3.	Air quality	-	-	-	✷	-	-	4	4/37	108.1
4.	Water quality	-	-	✷	-	-	-	3	3/37	81.08
5.	Noise level	-	-	✷	-	-	-	3	3/37	81.08

6.	Health	-	✷	-	-	-	-	2	2/37	54.05
7.	Public utilities	-	-	-	✷	-	-	4	4/37	108.1
8.	Economic aspects	-	-	-	✷	-	-	4	4/37	108.1
9.	Land use	-	-	-	-	✷	-	5	5/37	135.1
10.	Wild life	✷	-	-	-	-	-	1	1/37	27.02
11.	Flora	-	-	-	✷	-	-	4	4/37	108.1
12.	Human settlement	-	-	✷	-	-	-	3	3/37	81.08
Total									**37**	

4.9.4 Relative Parameter Importance Index (RPII)

The RPII indicates the importance of interaction between the action and environmental components. It is assigned any value between 0 and 1 so that the sum of all the values of EPII under each environmental component is equal to 1. The importance of an interaction is related to the significance or assessment of the consequences, of the anticipated interaction. Assignment of RPII to an interaction is based on the subjective judgment. While deciding RPII, first the RPII values are distributed among adverse and beneficial impacts depending upon their significance. The RPII values so distributed are once again distributed among the respective interactions depending upon their individual significance. The most importance interaction under a particular impact area is given the maximum RPII, whereas the least important one is given minimum RPII. As the significance of impact area increases the RPII also increases. The RPII values for all the interactions, along with the criteria for deciding the same is presented in Table-4.12.

4.9.5 Environmental Impact Index (EII)

The index represents the magnitude of an impact due to the interaction established between environmental component and a project activity. The environmental components are grouped into two categories viz. A and B as discussed in earlier paragraph.

4.9.6 Weighted Environmental Impacts Index (WEII)

The WEII is determined by multiplying RPII and EII of corresponding interaction. The values are tabulated in Table-4.13.

4.9.7 Environmental Impact Matrix without Mitigation Measures

The environment impact matrix incorporating all the environmental components and project activities (with in-built control measures) is presented in Table-4.11. The RPII and EII values are shown above while the WEII are shown below these against each interaction. The impact score is calculated by multiplying the sum of all WEII's against each environmental component

by its corresponding PIV. Total impact score is calculated by adding all individual impact scores. The total impact score is assessed by using following relative scale.

Table 4.12 : Impact Score Matrix without Mitigation Measures

Parameter Importance Value (PIV)	Project activity environmental components	Mining operation & allied activities	Disposal of solid waste	Transportation	Civil structure	Provision of civil amenities	Vegetative plantation	Impact score
54.04	Surface water resource	0.8 ×-0.05= -0.04	--	--	--	--	--	-2.162
54.05	Ground water resource	0.7 × -0.5 = –0.35	--	--	--	0.4 ×-0.2 = -0.08	--	-23.24
108.1	Air Quality	0.5 × -0.6 = -0.30	0.4 × -0.2 = -0.08	0.4 × -0.02 = -0.008	--	--	0.1 × 0.01 = 0.001	-42.05
81.08	Water Quality	--	0.2 × -0.1 = -0.02	--	--	--	--	-1.62
81.08	Noise Levels	0.6 × -0.6 = -0.36	--	0.3 × -0.3 = -0.09	--	--	0.1 × 0.0 = 0.0	-36.48
54.05	Health	0.3 × -0.5 = -0.15	--	0.3 × -0.2 = -0.06	--	0.2 × -0.3 = -0.06	0.2 × 0.0 = 0.0	-14.59
108.1	Public utilities	0.7 ×+0.5 = +0.35	--	0.2 × +0.2 = +0.04	--	0.1 × 0.2 = +0.02	--	+44.32
108.1	Economic aspect	0.6 × 0.4 = +0.24	--	0.3 × 0.3 = +0.09	--	0.1 × 0.1 = +0.01	--	+34.59
135.1	Land use & soil Characteristic	0.45 ×-0.4= -0.18	0.3 × -0.1 = -0.03	0.1 × -0.2 = -0.02	0.1 × -0.1 = -0.01	0.05 × -0.3 = -0.015	0.1 × 0.0 = 0.0	-52.68
27.02	Wild Life	0.5 × -0.4 = -0.2	--	0.3 × -0.2 = -0.06	--	--	0.2 × 0.0 = 0.0	-2.16
108.1	Flora	0.4 ×-0.2 = -0.08	--	0.4 × -0.2 = -0.08	0.1 × -0.1 = -	--	0.1 × 0 = 0	-14.05

					0.01			
81.08	Human settlement	0.4 × -0.5= -0.20	--	0.3 × +0.2 = +0.06	0.3 × -0.2 = -0.06	--	--	-25.94
TOTAL SCORE						**-136.06**		

Scale

Up to -200 : No appreciable impact on environment

-200 to –400 : Appreciable but reversible impact and measures impact

-400 to –600 : Significant impact mostly reversible after a short period and mitigation measures crucial

-600 to –900 : Major impact which is mostly irreversible

-900 to –1000 : Permanent irreversible impacts

Table: 4.13 Impact Matrix without Mitigation Measures

Sl. No	Environmental components	Project activities	Interaction No	Impacts	Adverse / Beneficial	RPII Value	Remarks for RPII	EII	Remarks for EII
01	Surface water resources	Mining operation	1	Depletion of surface water body due to water utilization in study area	Adverse	0.8	Mining activity has limited impact, hence it is assigned a lower RPII value of 0.8	-0.05	Mining operations largely utilize surface water rather than ground water. Hence moderate impact.
02	Ground water resources	Mining Operations	1	Mining activity causes depletion of mine water from underground due to dewatering from the mine and consumption for various mining operations. Mining will intersect ground water during conceptual period	Adverse	0.9	There are two interactions under this area. Amongst these, the interaction no.1 is significant. Hence it is assigned with highest RPII of 07.	-0.5	The criteria for deciding EII for interaction under this impact is quality of inflow.
03	Ground water resources	Provision of civic amenities	2	Total irrigation and domestic water required is obtained from ground water resources	Adverse	0.3	Interaction 2 is marginal. However, it occurs through out the year. Hence, given RPII of 0.3.	-0.1	
04.	Air Quality	Mining operations	1	Dust & gases Nox are produced after blasting. Large SPM is observed during	Adverse	0.5	There are four activities causing impact on air quality of work environment 0.5	-0.6	It is observed that the amount of SPM generated is high. Minor increase in

				these operations.			RPII values have been assigned to interactions 1 & 2 due to following reason: Dust & gases produced after blasting are instantaneous.		SPM is observed during loading operations.
05.	Air Quality	Transportation	2	Causes dust nuisance as well as Nox pollution due to vehicular emission	Adverse	0.4	Emission from traffic is significant and depends on wind direction.	-0.02	Marginal vegetation covers through out the year. No reduction is observed in SPM concentration. It is moderate impact.
06	Air Quality	Vegetative plantation	3	It serves as a natural screen in reducing the SPM concentration	Beneficial	0.1	Vegetation results in significant reduction of SPM concentrations.	0.01	In the premeditative stage, no vegetation is proposed.
07	Air Quality	Disposal of solid waste	4	Increase in SPM levels	Adverse	0.4	Solid waste is being generated due to mining.	-0.2	Minor increase in SPM is observed which is dependent on quantity of solid waste dumped, the wind speed and likely soil contamination.
08.	Water Quality	Disposal of solid waste	1	Increase in SPM levels	Adverse	0.2	Solid waste is being generated due to mining.	-0.1	Minor increase in SPM is observed which is dependent on quantity of solid waste dumped, the wind speed and likely soil

									contamination.
09	Noise levels	Mining operations	1	Increase in noise levels due to increase of various mining equipment	Adverse	0.6	There are three project activities influencing the noise levels in the area. The interaction 1& 2 are the most important and major contributor to both working and surrounding environment5, hence they are assigned with RPII of 0.6 & 0.3	-0.6	Assuming a background noise level of 45 dB(A) the increase in noise level is about 35 percent.
10	Noise levels	Transportation	2	Increase of noise levels due to vehicular traffic	Adverse	0.3	This is less significant compared to above. Hence RPII=0.3	-0.3	Increase in noise level due to transport by diesel trucks.
11	Noise levels	Vegetative plantation	3	It serves as barrier for noise propagation. Thus reducing noise levels.	Beneficial	0.1	The vegetation reduces noise levels in surrounding environment. Hence, it is given RPII of 0.1	0.0	Marginal vegetation covers throughout the year.
12	Health	Mining operation	1	Deteriorates	Adverse	0.3	The maximum importance is given to interaction 1 as the workers are exposed to high levels of noise and air pollutants	-0.5	a)The people in mine area are exposed to higher SPM levels. b) The people are exposed to increased noise levels.

									c) The injury rate is 0.2% of mandays worked.
13.	Health	Transportation	2	Deteriorates health due to air and noise pollutants	Adverse	0.3	Interactions 2 &3 are assigned with 0.3 & 0.2 RPII as their influence is limited	-0.2	a) Increase of traffic 25-30% in mining area. b) Air and noise pollution
14.	Health	Provision of civic amenities	3	Affects health through disposal of sewage of open land which cause mosquito nuisance	Adverse	0.2		-0.3	a) Mosquito nuisance b) Above moderate impact.
15	Health	Vegetative plantation	4	Improves the health of inhabitants by acting as a barrier to air and noise pollution, uptake of liquid waste disposed of land and imparts pleasant atmosphere in this area.	Beneficial	0.2	This is significant as far as noise reduction is concerned. Hence RPII=0.2	0.00	
16	Public utilities	Mining	1	Improved public utility services in surrounding villages improves power supply, road network, water supply, sanitation, medical care facilities and communication	Beneficial	0.7	Interaction 1 and 2 are more influential than the other interaction. It covers the surrounding villages hence it is given higher RPII value.	+0.5	a) Literacy is improved. b) Improvement in power supply is significant c) Improvement in transportation facility by 100 percent.
17	Public utilities	Transportati	2	Provides better	Beneficia	0.2	This has next	+0.2	This benefits

		on		transportation systems to mining area. Improves road network and vehicular movement	l		significant impact RPII=0.2		approx.25% EII =0.2
18	Public utilities	Provision of civic amenities	3	Provides water supply, sanitation, power supply, medical facilities and communication in the core area.	Beneficia l	0.1	While in case of civic amenities, it is provides to employees, it is provided to employees of the mines.	+0.2	The existing scenario is not very encouraging because there is no domestic effluent treatment.
19.	Economic aspects	Mining operation	1	Increased employment opportunities both direct and indirect thereby increasing economic status of people	Beneficia l	0.6	Interaction 1 has a large potential in providing employment to substantial people both direct and indirect. Hence assigned highest RPII.	+0.4	a)Large % of affected area people with direct employment. b) 50% improvement in economic status of people in affected area.
20.	Economic aspects	Transportati on	2	Increased employment opportunity (mostly indirect employment) and thereby increase in economic status.	Beneficia l	0.3	Indirect employment opportunities are therefore limited. Persons involved in pvt. transportation activities. Hence RPII of 0.3	+0.3	Job opportunities are observed considering that transportation of ore to other industries.
21	Economic aspects	Provision of civic amenities	3	Increased employment both by direct & indirect ways. Employment in	Beneficia l	0.1	Employment opportunities are therefore limited. Persons involved in	+0.1	Marginal job opportunities are observed hence marginal impact

				commercial services improved economic status of people.			other transportation activities. Hence a RPII of 0.1		
22	Land use & soil characteristics	Disposal of solid waste	1	Land degradation due to disposal of solid waste	Adverse	0.3	Solid waste in the form of waste rock is generated in initial stage of mining.	-0.1	Minor impact is observed
23.	Land use & soil characteristics	Civil structures	2	Lands degradation due to erection of civil structure	Adverse	0.1	Civil structures are minimum	-0.1	Civil structures in the area are observed in the study area are negligible
24	Land use & soil characteristics	Provision of civic amenities	3	Adverse effect on soil characteristics due to disposal of domestic waste on land	Adverse	0.05	Adverse effect on soil quality is observed if untreated sewage is directly disposed on land. hence RPII of 0.05	-0.3	Change is observed over baseline condition. Moderate impact.
25.	Land use & soil characteristics	Vegetative plantation	4	Beneficial effect on land as it improves aesthetics and provides shelter for wild animals	Beneficial	0.1	Vegetation plantation improves land RPII-=0.1	0.0	Marginal permanent vegetation cover exists in this area.
26	Land use & soil characteristics	Transportation	5	Impact due to settlement of wind borne dust on agricultural fields	Adverse	0.1	This has insignificant impact, hence, RPII =0.1	-0.2	Significant dust emissions are observed.
27	Land use & soil characteristics	Mining	6	Impact due to open cast/excavation	Adverse	0.45	This is the most significant activity. Hence RPII=0.45	-.0.4	This occupies large chunk of the study area
28.	Wild Life	Mining	1	Affects wildlife through air and noise pollution and	Adverse	0.5	All operations are open cast, hence strong impact is observed.	-0.4	Impact due to air, noise and land pollution which is

				habit destruction			RPII of 0.5		significant
29	Wild Life	Transportation	2	Adverse effect due to air and noise pollution by vehicular traffic and roadside accidents	Adverse	0.3	This is comparatively less important than other interaction. Hence RPII = 0.3	-0.2	Significant traffic movement is observed due to transportation of ore and waste materials.
30	Wild Life	Vegetative plantation	3	Habitat to be created which will be suitable for wildlife	Beneficial	0.2	Vegetation enhances wildlife in the region	0.0	Existing vegetation cover is low for wild life.
31	Flora	Mining	1	Impact due to air, noise pollution	Adverse	0.4	There are four interactions under this impact area. The interaction 1 has been assigned a RPII value of 0.4 as dust & noise is observed during mining and loading operations	-0.2	Significant impact due to dust pollution
32	Flora	Transportation	2	Adverse impact of dust emission due to vehicular traffic and habitat destruction due to road construction	Adverse	0.4	Dust & noise generation during vehicular movement and mining operation. Hence RPII = 0.4	-0.1	Minor impact is observed.
33	Flora	Civil structures	3	Habitat destruction	Adverse	0.1	Marginal civil structures are observed hence RPII of 0.1	-0.1	Minor impact is noticed.
34	Flora	Vegetative plantation	4	Creation of vegetative habitat	Beneficial	0.1	In pre-mitigation stage, RPII=0.1	-0.0	Marginal vegetation exists in this area
35	Human settlement	Mining operation	1	Increased population density thereby	Adverse	0.4	Interaction 1 is significant as more	-0.5	Increase in population density is

				environmental degradation since more natural resources like fuel wood, water, electricity etc are required			number of persons are in this area. Hence RPII of 0.4		in affected area including natural increase in population.
36.	Human settlement	Provision of civic amenities	2	Increased employment opportunities in service sector have increased population density in and around mines	Adverse	0.3	In case of interaction 2 opportunities exist due to residential colonies	-0.2	Significant increase is observed.
37	Human settlement	Transportation	3	This helps in transporting people from far off places, reducing stress on local settlements	Beneficial	0.3	Transportation is next significant. RPII=0.3	+0.2	Moderate increase is observed

4.9.8 Summary of Impacts without mitigation measures

The total impact score is found to be –136.06**.**From the above table in comparison with the present result indicates that, presently the impacts are not appreciable. But, it is certain that the negative impacts are getting accumulated. Even though, the assimilative capacity of the region is not damaged completely, it is amply endangered. The mitigation measures for the present mining and allied activities are important and they are very crucial in the context of the future development expansions of the existing leases in the region. The predominantly affected environmental attributes are air quality, water quality, land use, soil characteristics and health. On the other hand, economic aspects and public utilities in the region will be benefited with the advent of new industries.

4.10 MITIGATION MEASURES

In order to minimize the impact of the project activities on the ecosystem and to achieve the desired objectives of mineral excavation the different management strategies are to be undertaken, which includes both physical as well as socio-economic factors which are being summarized below:**1.**

1. Reclamation of Degraded Land:
2. Programme for plantation
3. Measures for Controlling Water Pollution
4. Measures for Controlling Air Pollution
5. Measures for controlling noise pollution
6. Socio-Economic Measures
7. Safety & Occupational Health

4.11 ASSESSMENT OF ENVIRONMENTAL IMPACTS AFTER IMPLEMENTATION OF MITIGATION MEASURES

Assessment of the environmental impacts due to the project after adhering to different mitigation measures has been computed in the matrix method and presented in the similar method as without mitigation measure.

4.11.1 Assigning Importance Ranking

Although the mines mostly consume surface water, the impact on surface water resources is insignificant due to the comparatively less quantity of surface water available. But in rainy season due to run-off the impact may increase. Hence, it is assigned a ranking of **1**.

It is observed that ground water resources are required every day for mining operations and domestic consumption. Due to partial recharge of ground water from various activities, the effect is less pronounced. Hence, it is assigned a ranking of **2**.Air quality with respect to SPM levels is of more concern followed by NO_x and SO_2 levels, which are of lesser importance. The SPM levels are high within the mining area and also in the residential areas. Hence it is given a ranking of **2**.

The impacts on health aspects are mostly restricted to workers working in the mines. Though, the health impact is most important, no serious health impacts have been identified. Hence the ranking for impact on health is **1**.

The economic aspects of the region will improve, but people will have to pay for other negative impacts. Hence a ranking of **3** is given.

The water quality in the region is affected, especially the surface water resources. Hence, it is given a ranking of **1**.

The impact on land use is more pronounced because of degradation of land due to mining activities, disposal of solid waste and construction of structures in the region. Hence, the land use is given a ranking as **3**.

The public utilities in the region are limited to the core area only. Hence ranking of **3** is given.

Although high noise levels are largely confined to the working environment, this impact increases due to the presence of vehicular traffic. Hence, the ranking is given as **3**.

The human settlements in the region will receive mixed impacts. The ranking attributed for this is **3**.

The impact on wild life will be moderate, because there is no dense forest nearby the mining area, because the present mining area is an existing mine. Hence, the ranking given is **1**. The impact on flora has been assigned a ranking of **1**, which is affected due to felling of trees due to mining and allied activities.

4.11.2 Summary of Importance Values

The summary of impact with mitigation measure is presented in Table-4.14. The weight age for each impact area is calculated by divding the ranking integer by sum of rankings as done in Table – 4.15. The total parameter importance value is assumed to be 1000 as per standard practice. The value of total PIV is distributed among each impact area according to its weightage. The final values computed by this procedure are also tabulated in Table-4.16

Table: 4.14 Impact Matrix with Mitigation Measures

Sl. No	Environmental components	Project activities	Interaction No	Impacts	Adverse/ Beneficial	RPII Value	Remarks for RPII	EII	Remarks for EII
01	Surface water resources	Mining operation	1	Depletion of surface water body due to water utilization in study area	Adverse	0.6	Mining activity has limited impact, hence it is assigned a lower RPII value of 0.8	-0.06	Mining operations largely utilize surface water rather than ground water. Hence moderate impact.
02	Ground water resources	Mining Operations	1	Mining activity causes depletion of mine water from underground due to dewatering from the mine and consumption for various mining operations.	Adverse	0.5	There are two interactions under this area. Amongst these, the interaction no.1 is significant. Hence it is assigned with RPII of 05.	-0.4	The criteria for deciding EII for interaction under this impact is quality of inflow.
03	Ground water resources	Provision of civic amenities	2	Total irrigation and domestic water required is obtained from ground water resources	Adverse	0.3	Interaction 2 is marginal. However, it occurs through out the year. Hence, given RPII of 0.3.	-0.1	
04.	Air Quality	Mining operations	1	Dust & gases Nox are produced after blasting. Large SPM is observed during these operations.	Adverse	0.3	There are four activities causing impact on air quality of work environment 0.5 RPII values have been assigned to	-0.4	It is observed that the amount of SPM generated is high. Minor increase in SPM is observed during loading operations.

							interactions 1 & 2 due to following reason : Dust & gases produced after blasting are instantaneous.		
05.	Air Quality	Transportation	2	Causes dust nuisance as well as Nox pollution due to vehicular emission	Adverse	0.3	Emission from traffic are significant and depends on wind direction.	-0.02	Marginal vegetation covers through out the year. No reduction is observed in SPM concentration. It is moderate impact.
06	Air Quality	Vegetative plantation	3	It serves as a natural screen in reducing the SPM concentration	Beneficial	0.1	Vegetation results in significant reduction of SPM concentrations.	0.05	In the premeditative stage, no vegetation is proposed.
07	Air Quality	Disposal of solid waste	4	Increase in SPM levels	Adverse	0.2	Solid waste is being generated due to mining.	-0.1	Minor increase in SPM is observed which is dependent on quantity of solid waste dumped, the wind speed and likely soil contamination.
08.	Water Quality	Disposal of solid waste	1	Increase in SPM levels	Adverse	0.2	Solid waste is being generated due to mining.	-0.1	Minor increase in SPM is observed which is dependent on quantity of solid waste dumped, the wind speed and likely soil contamination.
09	Noise levels	Mining operations	1	Increase in noise levels due to increase of various mining equipment	Adverse	0.3	There are three project activities influencing the noise levels in the area. The	-0.4	Assuming a background noise level of 45 dB(A) the increase in noise level is about 35 percent.

							interaction 1& 2 are the most important and major contributor to both working and surrounding environment5, hence they are assigned with RPII of 0.6 & 0.3		
10	Noise levels	Transportation	2	Increase of noise levels due to vehicular traffic	Adverse	0.3	This is less significant compared to above. Hence RPII=0.3	-0.3	Increase in noise level due to transport by diesel trucks.
11	Noise levels	Vegetative plantation	3	It serves as barrier for noise propagation. Thus reducing noise levels.	Beneficial	0.1	The vegetation reduces noise levels in surrounding environment. Hence, it is given RPII of 0.1	0.0	Marginal vegetation covers throughout the year.
12	Health	Mining operation	1	Deteriorates	Adverse	0.3	The maximum importance is given to interaction 1 as the workers are exposed to high levels of noise and air pollutants	-0.5	a)The people in mine area are exposed to higher SPM levels. b) The people are exposed to increased noise levels. c) The injury rate is 0.2% of mandays worked.
13.	Health	Transportation	2	Deteriorates health due to air and noise pollutants	Adverse	0.3	Interactions 2 &3 are assigned with 0.3 &0.2 RPII as their influence is limited	-0.2	c) Increase of traffic 25-30% in mining area. d) Air and noise pollution

14.	Health	Provision of civic amenities	3	Affects health through disposal of sewage of open land which cause mosquito nuisance	Adverse	0.2		-0.3	c) Mosquito nuisance d) Above moderate impact.
15	Health	Vegetative plantation	4	Improves the health of inhabitants by acting as a barrier to air and noise pollution, uptake of liquid waste disposed of land and imparts pleasant atmosphere in this area.	Beneficial	0.2	This is significant as far as noise reduction is concerned. Hence RPII=0.2	0.00	
16	Public utilities	Mining	1	Improved public utility services in surrounding villages improves power supply, road network, water supply, sanitation, medical care facilities and communication	Beneficial	0.7	Interaction 1 and 2 are more influential than the other interaction. It covers the surrounding villages hence it is given higher RPII value.	+0.5	d) Literacy is improved. e) Improvement in power supply is significant f) Improvement in transportation facility by 100 percent.
17	Public utilities	Transportation	2	Provides better transportation systems to mining area. Improves road network and	Beneficial	0.2	This has next significant impact RPII=0.2	+0.2	This benefits approx.25% EII =0.2

				vehicular movement					
18	Public utilities	Provision of civic amenities	3	Provides water supply, sanitation, power supply, medical facilities and communication in the core area.	Beneficial	0.1	While in case of civic amenities, it is provides to employees, it is provided to employees of the mines.	+0.2	The existing scenario is not very encouraging because there is no domestic effluent treatment.
19.	Economic aspects	Mining operation	1	Increased employment opportunities both direct and indirect thereby increasing economic status of people	Beneficial	0.6	Interaction 1 has a large potential in providing employment to substantial people both direct and indirect. Hence assigned highest RPII.	+0.4	a)Large % of affected area people with direct employment. b) 50% improvement in economic status of people in affected area.
20.	Economic aspects	Transportation	2	Increased employment opportunity (mostly indirect employment) and thereby increase in economic status.	Beneficial	0.3	Indirect employment opportunities are therefore limited. Persons involved in pvt. transportation activities. Hence RPII of 0.3	+0.3	Job opportunities are observed considering that transportation of ore to other industries.
21	Economic aspects	Provision of civic amenities	3	Increased employment both by direct & indirect ways. Employment in commercial services improved	Beneficial	0.1	Employment opportunities are therefore limited. Persons involved in other transportation	+0.1	Marginal job opportunities are observed hence marginal impact

				economic status of people.			activities. Hence a RPII of 0.3		
22	Land use & soil characteristics	Disposal of solid waste	1	Land degradation due to disposal of solid waste	Adverse	0.3	Solid waste in the form of waste rock is generated in initial stage of mining.	-0.3	Minor impact is observed
23.	Land use & soil characteristics	Civil structures	2	Lands degradation due to erection of civil structure	Adverse	0.1	Civil structures are minimum	-0.2	Civil structures in the area are observed in the study area are negligible
24	Land use & soil characteristics	Provision of civic amenities	3	Adverse effect on soil characteristics due to disposal of domestic waste on land	Adverse	0.05	Adverse effect on soil quality is observed if untreated sewage is directly disposed on land. hence RPII of 0.05	-0.3	Change is observed over baseline condition. Moderate impact.
25.	Land use & soil characteristics	Vegetative plantation	4	Beneficial effect on land as it improves aesthetics and provides shelter for wild animals	Beneficial	0.1	Vegetation plantation improves land RPII-=0.1	0.0	Marginal permanent vegetation cover exists in this area.
26	Land use & soil characteristics	Transportation	5	Impact due to settlement of wind borne dust on agricultural fields	Adverse	0.1	This has insignificant impact, hence, RPII =0.1	-0.2	Significant dust emissions are observed.
27	Land use & soil characteristics	Mining	6	Impact due to open cast/excavation	Adverse	0.45	This is the most significant activity. Hence RPII=0.45	-.0.4	This occupies large chunk of the study area
28.	Wild Life	Mining	1	Affects wildlife through air and	Adverse	0.5	All operations are open cast, hence	-0.4	Impact due to air, noise and land pollution which

				noise pollution and habit destruction			strong impact is observed. RPII of 0.5		is significant
29	Wild Life	Transportation	2	Adverse effect due to air and noise pollution by vehicular traffic and roadside accidents	Adverse	0.3	This is comparatively less important than other interaction. Hence RPII = 0.3	-0.2	Significant traffic movement is observed due to transportation of ore and waste materials.
30	Wild Life	Vegetative plantation	3	Habitat to be created which will be suitable for wildlife	Beneficial	0.2	Vegetation enhances wildlife in the region	0.0	Existing vegetation cover is low for wild life.
31	Flora	Mining	1	Impact due to air, noise pollution	Adverse	0.4	There are four interactions under this impact area. The interaction 1 has been assigned a RPII value of 0.4 as dust & noise is observed during mining and loading operations	-0.2	Significant impact due to dust pollution
32	Flora	Transportation	2	Adverse impact of dust emission due to vehicular traffic and habitat destruction due to road construction	Adverse	0.4	Dust & noise generation during vehicular movement and mining operation. Hence RPII = 0.4	-0.2	Minor impact is observed.
33	Flora	Civil structures	3	Habitat destruction	Adverse	0.1	Marginal civil structures are observed hence RPII of 0.1	-0.1	Minor impact is noticed.

34	Flora	Vegetative plantation	4	Creation of vegetative habitat	Beneficial	0.1	In pre-mitigation stage, RPII=0.1	-0.1	Marginal vegetation exists in this area
35	Human settlement	Mining operation	1	Increased population density thereby environmental degradation since more natural resources like fuel wood, water, electricity etc are required	Adverse	0.4	Interaction 1 is significant as more number of persons are in this area. Hence RPII of 0.4	-0.5	Increase in population density is in affected area including natural increase in population.
36.	Human settlement	Provision of civic amenities	2	Increased employment opportunities in service sector have increased population density in and around mines	Adverse	0.3	In case of interaction 2 opportunities exist due to residential colonies	-0.2	Significant increase is observed.
37	Human settlement	Transportation	3	This helps in transporting people from far off places, reducing stress on local settlements	Beneficial	0.3	Transportation is next significant. RPII=0.3	+0.2	Moderate increase is observed

Table-4.15: Determination of Parameter Importance Value with Mitigation Measure										
Sl. No	**Impact Area**	**Ranking**						**Total**	**Weightage**	**PIV**
		1	2	3	4	5	6			
1.	Surface water	✷	-	-	-	-	-	1	1/27	37.03
2.	Ground water	-	✷	-	-	-	-	2	2/27	74.07
3.	Air quality	-	✷	-	-	-	-	2	2/27	74.07
4.	Water quality	✷	-	-	-	-	-	1	1/27	37.03
5.	Noise level	-	-	✷	-	-	-	3	3/27	111.11
6.	Health	✷	-	-	-	-	-	1	1/27	37.03
7.	Public utilities	-	-	✷	-	-	-	3	3/27	111.11
8.	Economic aspects	-	-	✷	-	-	-	3	3/27	111.11
9.	Land use	-	-	✷	-	-	-	3	3/27	111.11
10.	Wild life	✷	-	-	-	-	-	1	1/27	37.03
11.	Flora	-	-	-	✷	-	-	4	4/27	148.15
12.	Human settlement	-	-	✷	-	-	-	3	3/27	111.11
Total								**27**	**1.0**	**1000**

TABLE 4.16 : Impact Score Matrix with Mitigation Measures								
Parameter Importance Value (PIV)	**Project activity environmental components**	**Mining operation & allied activities**	**Disposal of solid waste**	**Transportation**	**Civil structure**	**Provision of civil amenities**	**Vegetative plantation**	**Impact score**
27.8	Surface water resource	0.6 ×-0.06= -0.036	--	--	--	--	--	-1.008
55.6	Ground water resource	0.5 × -0.4 = –0.20	--	--	--	0.3 ×-0.1 = -0.03	--	-12.78
111.1	Air Quality	0.3 × -0.4 = -0.12	0.2 × -0.1 = -0.02	0.3 × -0.02 = -0.006	--	--	0.1 × 0.01 = 0.001	-16.33
83.3	Water Quality	--	--	--	--	0.2 × -0.1 = -0.02	--	-1.66
83.3	Noise Levels	0.3 × -0.4 = -0.42	--	0.3 × -0.3 = -0.09	--	--	0.1 × 0.0 = 0.0	-17.49
55.6	Health	0.3 × -0.5 = -0.15	--	0.3 × -0.2 = -0.06	--	0.2 × -0.3 = -0.06	0.2 × 0.0 = 0.0	-15.01
111.1	Public utilities	0.7 ×+0.5 = +0.35	--	0.2 × +0.2 = +0.04	--	0.1 × 0.2 = 0.02	--	+45.5
111.1	Economic aspect	0.6 × 0.4 = +0.24	--	0.3 × 0.3 = +0.09	--	0.1 × 0.1 = +0.01	--	+37.74
138.9	Land use & soil Characteristic	0.45 ×-0.4= -0.18	0.3 × -0.3 = -0.09	0.1 × -0.2 = -0.02	0.1 × -0.2 = -0.02	0.05 × -0.3 = -0.015	0.1 × 0.0 = 0.0	-45.14
27.8	Wild Life	0.5 × -0.4 = -0.2	--	0.3 × -0.2 = -0.06	--	--	0.2 × 0.0 = 0.0	-7.23
111.1	Flora	0.4 ×-0.2 =	--	0.4 × -0.2	0.1 × -	--	0.1 × -0.1	-19.98

		-0.08		= -0.08	0.1 = -0.01		= -0.01	
83.3	Human settlement	0.4 × -0.5= -0.20	--	0.3 × +0.2 = +0.06	--	0.3 × -0.2 = -0.06	--	-26.7
TOTAL SCORE							**80.08**	

Scale

Up to -200	:	No appreciable impact on environment
-200 to –400	:	Appreciable but reversible impact and measures impact
-400 to –600	:	Significant impact mostly reversible after a short period and mitigation measures crucial
-600 to –900	:	Major impact which is mostly irreversible
-900 to –1000	:	Permanent irreversible impacts

4.11.3 Summary of Impacts with mitigation measures

After incorporating all the mitigation measures as part of the action plan, an impact matrix has been prepared. The total impact score after mitigation measure is found to be –80.08. This indicates that presently the impacts are not significant when the benefits are accounted for. But, it is certain that the negative impacts are being accumulated. Even though, the assimilative capacity of the region is not damaged completely, it is amply endangered. The mitigation measures for the present mining and allied activities are important and they are very crucial in the context of the future development expansion of the existing lease in the region. The predominantly affected environmental attributes are air quality, water quality, land use, soil characteristic and health. On the other hand economic aspect and public utilizes in the region have improved.

CHAPTER 5

ANALYSIS OF ALTERNATIVES (TECHNOLOGY & SITE)

The project is a mining project and will be operated within the lease grant area. So no alternate sites have been assessed. The mining technology is semi mechanised open cast in single shift manual mining without any change in technology.

The mining project is being granted on mineral bearing zone, only by the appropriate authorities. This project is being granted to the project proponent by Director of Geology, Bhubaneswar in the approved mineralized zone. This project is far distance from habitation & on maximum non productive land hence this is best suitable for mining activity.

For recovery of mineral the procedure used here is the traditional method and as labour intensive, this is adopted for the site proved as the best practice.

CHAPTER 6

ENVIRONMENTAL MONITORING PROGRAMME

6.1 ENVIRONMENT MONITORING

The environmental monitoring is important in terms of evaluating the performance of pollution control equipments installed in the project. The sampling and analysis of the environmental attributes will be as per the guidelines of Central Pollution Control Board/ Odisha State Pollution Control Board (OSPCB). The frequency of sampling and location of sampling will be as per the directives of CPCB/OSPCB.

Environmental monitoring will be conducted on regular basis by Lessee to assess the pollution level in the surrounding area. Usually, as in the case of the study, an impact assessment study is carried over short period of time and the data cannot bring out all variations induced by the natural or human activities. Therefore, regular monitoring programme of the environmental parameters is essential to take into account the changes in the environment.

The attributes, which require regular monitoring, are given below:

1] Air Quality;

2] Surface water and ground water Quality;

3] Noise Levels;

4] Soil Quality;

5] Ecological Preservation and Afstonestation; and

6] Socio Economic Aspects and Community Development

6.2: MONITORING SCHEDULE

A monitoring schedule is very important in order to ensure that effluent and emissions conform to the standard for which control measures have been designed. As it is required that installation and operation of water pollution control facilities should limit concentration and quantum of pollutants released to the environment properly regular continuous monitoring of flow and pollutants should be done. A comprehensive monitoring program is suggested in Table below.

Table 6.1 Monitoring schedule for environment parameters

Sl. No.	Description	Schedule and duration of monitoring	Important monitoring parameter
1.	**Air quality**		
	Selected 2 location (one in individual lease of the cluster and 1 in the nearby village)for ambient air quality monitoring specified by OSPCB	24 hour continuous sampling Twice in a Year	PM_{10}, $PM_{2.5}$,SO_2, NOx
2.	**Water and waste water quality**		
a.	Ground water	Half yearly and grab sampling	Parameter specified in the IS:10500
b.	Surface water	Half yearly and grab sampling	Parameter specified under IS:2296
3.	**Noise level monitoring**		
a.	Selected 2 location (one in individual lease of the cluster and 1 in the nearby village)for ambient air quality monitoring specified by OSPCB	Half yearly	Noise level in dB(A)
Green belt monitoring			
5.	Monitoring of green belt development	Once in a year	

6.3 GREEN BELT AND AFFSTONESTED AREAS

Continuous vigilance and monitoring of green belt will be done for its performance and survival rate. Watch and ward personnel will properly guard the plantation. Provision will be made for fertilizers application and watering on schedule.

CHAPTER 7
ADDITIONAL STUDIES

7.1 RISK ASSESSMENT

Risk is the probability of the harm or likelihood of harmful occurrence being released and its severity. Environmental risk is a measure of the potential threats to the environment, life and property and which is more likely to happen in the mining activities. All the type of developmental activities like mining, industries, developmental projects may face certain type of hazards which can disrupt the normal activities abruptly and lead to disaster like fires, inundation, failure of machinery, explosion etc. On account of the possible risk, a risk assessment has been carried out and the Disaster Management Plan formulated with an aim of taking precautionary measures to control the hazard propagation, avert disaster and also to take such action after the disaster, which limits the damage to the minimum.

7.1.1 Objectives

The objectives of environmental risk assessment are governed by the following, which excludes natural calamities:

- To identify the potential hazardous areas so that necessary design safety measures can be adopted to minimise the probability of accidental events.
- To identify the potential areas of environmental disaster which can be prevented by proper designing of the installations and its controlled operation.
- To manage the emergency situation or a disastrous event, if any.

The major risk associated with the project activities are as follows:

7.1.2 Open Cast Bench Slope Failure

Conventional method of mining will be adopted in the mining leases within cluster 3area (Bajabati Hillock). In the present plan period it is proposed to shape the quarry with bench heights of 3 m to 6m (max). The width of the benches will be kept either equal or more than the height. The slope of the individual bench will be maintained at around 80° to 85° with ultimate pit slope of less than 45°. Mine road will be maintained between benches for easy movement of workers and vehicles. Suitable gradient of haul road will be maintained in between 1 in 16 to 1 in 20. Well-developed drainage systems over the lease hold area are to ensure & check the water flows out of the lease area.

7.1.3 Disaster due to Failure of Waste Dump

The over all waste dump slope, considering the angle of repose, has been fixed to be not more than 35º-37º. The waste dump will be stabilized by planting grasses and other arrangements as detailed below:-

- Individual dump slope angle will be 35º to the horizontal.
- A series of stone toe wall will be made all around the waste dump to prevent waste dump material being carried out to the general drainage system of the area.
- A garland drain will be constructed all around the waste dump area for smooth flow of water.
- The waste generated from the mines will utilized for internal road construction and there will be no waste dump within the mines during conceptual period.

7.1.4 Disaster due to Surface Fire

Sufficient fire extinguishers will be installed at selected location like Electrical Sub-stations, Garage, Diesel Depot, Stores etc. Besides, sufficient number of water hydrants with sufficient hosepipes will be made available. Adequate fire trenches shall be dug around the fuel depot so as to preclude chances of fires from adjacent forest areas.

7.1.5 Possible Dangers due to Storage of Explosives

The explosives to be used for blasting purpose will be procured by hired licensed blasting contractors by individual lessees from authorised dealers and blasting will be performed by the contractor also. Daily requisition of explosives will be as per the same day requirement. At the end of the blasting surplus explosives will be refunded to the dealer. A daily register will be maintained for total use and refund of explosives.

A zone around the mine periphery for safe blasting is proposed and the area shall be suitably fenced. Further, for the protection of the mine infrastructure facilities, controlled blasting has been suggested when mining operations approach to the vicinity of such structures.

In case of any fire, whosoever notices the fire will sound the alarm and inform the shift-in-charge. The shift-in-charge will inform security personnel & arrange to evacuate all personnel, except those who are required for fire fighting, from the area. The fire brigade shall be summoned to deal with the emergency. Concerned district official will be informed. Nearby hospitals will be informed to standby to handle casualties.

7.1.6 Accidents due to Machinery (Transport as well as non-transport machinery)

Machineries engaged in both transport and non-transport activities can be a cause of accident if awareness is not created among the employees. Following are some likely causes and preventive measure;

- Unauthorized driving of vehicles, mostly by helpers should be prohibited.
- Overloading a vehicle can be a cause of mishaps.
- Driving vehicles in an intoxicated stage should be prohibited.
- Use of sub standardequipments or machinery parts can result in accidents or break down. Standard machinery with authorized spare parts must be used.
- Managerial, supervisory and competent persons of the mine would be engaged for supervising machinery, maintenance & housekeeping of the mine areas, as per needs.

7.2 DISASTER MANAGEMENT PLAN

Mining operation shall be carried out under the control and direction of a vastly experienced and well qualified mine manager holding a First Class Manager's certificate of competency. The DGMS have been issuing a number of standing orders, model standing orders and circulars to be complied by the mine management in case of disaster, if any.

The following precautionary measures shall be taken to prevent any kind of disaster in the mining operations:

- Blasting and removal of stone shall be done from top to downwards. No overhand will be allowed.
- Special attention and requisite precautions shall be taken while working in areas of geological weakness like existence of slip, fault etc.
- Provision of safety belt or rope while persons are at work at the hill sides from where there are chances of falling down for more than 1.8m.
- Providing the safety appliances such as safety boot, helmets, goggles etc. to the employees and ensuring their use by them by conducting surprise checking
- Spoil banks not to be retained by artificial means at an angle of repose in excess of its natural angle.

- Drafting and implementation of preventive maintenance schedule for various kinds of machinery deployed in blasting, crushing and transportation.
- Suppression of dust on the haulage roads; provision of maintenance of properly laid haul roads with guards and road signs at strategic points.
- Precautions against danger while traversing dumpers, excavators etc. by installing audio-visual alarms and appointment of spotters.
- Transportation of ore within mine workings by vehicles under the direction, supervision and control of Mine Management only.
- Proper maintenance of vehicles i.e. weekly examination by an engineer and daily examination by a competent person.
- Training and retraining (at specified interval) of the machinery operators.
- Use of controlled blasting techniques; danger zone in 500m radius to be followed strictly.
- Provision of blasting shelters – properly constructed and maintained.
- Adequate maintenance of electrical equipments.
- Prohibiting entry of unauthorized persons in the mine lease area.
- Fire fighting& first-aid provisions in the mines office and mining & crushing area
- Working of mine, as per approved plans and regularly updating the mine plans;
- Regular maintenance and testing of all mining equipment as per manufacturer's guidelines;

7.3 SYSTEM OF COMMUNICATION

An internal fool proof communication system for the department head and to their line of command should be maintained. A list of the important and relevant telephone no. and addresses of responsible person, adjoining mines, rescue station, police station, Fire service station, local hospital electricity supply agency and standing consultative committee members shall be made conspicuous at all venerable places or locations.

7.3.1 First Aid & Medical Facilities

The mine management shall provide for adequate first aid/medical center for use in emergency situation. All casualties would be registered and injured will be given first aid.

The center will have facilities for first aid & minor treatment, resuscitation, ambulance and transport. It will have proper telephone/wireless set for quick communication with hospitals where the complicated cases are to be referred.

7.3.2 Stores and Equipment

A detailed list of equipment available, its type & capacity and items reserved for emergency shall be prepared and reserve maintained accordingly.

7.3.3 Transport Services

A well-defined transport control system will be provided to deal with the situation. Provision of one ambulance shall be earmarked for the purpose.

7.4: EMERGENCY PLAN

- On realizing anything serious happened anywhere in the mine, the foreman or his deputy will immediately inform the nearest mining official & the manager of mines.
- On being informed about the emergency the mines manager will verify for the correctness of information and telephone in particular to the mining officials of other part of the mine and managers of adjoining mine so that persons may be withdrawn.
- On receiving information of emergency intimation will be sent to the emergency coordinating committee. Shift in-charge will ensure that all the materials and transport system to deal with emergency situation is kept in fine fettle.
- First aid facilities shall be made readily available.

7.5: SOCIAL IMAPCT ASSESSMENT / R& R ACTION PLAN

There is no human settlement in the lease area. It is a private land without any fstonest area is involved. Thus, no R & R plan is required.

CHAPTER 8

PROJECT BENEFITS

There will be no adverse effect of mining on the socioeconomic status of the people rather the mining activities helps in improvement in the standard of living of the people. The mining activity creates the employment opportunity for the local people and this definitely hike the economic status of the local people. Apart from overall beneficial impact of the project on the local people, it is felt necessary to augment facilities in the fields of education, health and social awareness including concern for environment and eco-system.

8.1 IMPROVEMENT IN THE PHYSICAL INFRASTRUCTURE

The lease area is located in the agricultural based district of the state. In this locality a good number of people are engaged in agricultural work. The mining project in the locality helps in improvement of the physical infrastructure like roads, vehicles for public transportation, water and sanitation facility, house and rest shed for the mines worker, safety equipments for the mines workers etc.

8.2 IMPROVEMENT IN THE SOCIAL INFRASTRUCTURE

With the commitment of the upcoming mine there will be substantial improvement of economy of the local people. Amenities such as education and healthcare will be developing in and around the lease area, which will be available to the local people also. Development in business activity shall lead to infrastructure development in and around the project site.

8.3 EMPLOYMENT POTENTIAL

With the commencement of the mine, there will be substantial improvement of the income of the people through employment in the mining. The employment opportunity for the local people will increase. Through the project there will be creation of directly employment opportunity for 316 people in the proposed mining period. Apart from this the lease will create employment opportunity for about 1000 people of the nearby area, who will be involved in crushinhg, transportation, labour work etc. All the labour forces required for the proposed project will be from local areas. Economic growth of the people employed in the mine will be helpful for their improvement in cultural and educational facilities.

8.4 OTHER INTANGIBLE BENEFITS

Apart from overall beneficial impact of the project on the local people, the following measures will be taken up by the mine as periphery development project;

- Planting of economic important trees in the open spaces around the mining lease area which is accessible to the local people

- Encouraging to use boiled /cleaned drinking water and mosquito nets
- Development of socio economic status of the people of the project area
- Decrease in the rate of migration from the project villages as the employment opportunity will be created in the locality.

8.5 CORPORATE ENVIRONMENTAL RESPONSIBILITY

As per the MoEF& CC OM No. 22-65/ 2017-IA II(M) dated 01.05.2018, it has been recommended that 2% of the project cost will be accorded for Corporate Environmental responsibility. The details of CER plan has been given in the table below:

Table 8.1 Proposed CER Plan

Sl. No.	Activities	Location	Time Frame					Allocated Budget (Rs.)
Pollution Control measures			**1st Yr**	**2nd Yr**	**3rdYr**	**4th Yr**	**5th Yr**	
1.	Installation of water sprinklers (50 Nos)	Individual leases of the cluster	**	**				3,00,000.00
2.	Construction of Garland drain and retaining wall	Individual leases of the cluster	**	**	**			3,00,000.00
3.	Water sprinkling by tanker in the village road (10 KL water tanker)	Bajabati	**					3,00,000.00
4.	Plantation in the safety zone	Individual leases of the cluster	**	**	**			1,00,000.00
5.	Plantation in the village road connecting ML area	Avenue Plantation			**	**	**	2,00,000.00
6.	Rain water harvesting structure	Individual leases of the cluster		**	**			2,00,000.00
Peripheral Development								
1.	Development and maintenance of village road connecting individual lease of cluster	Nearby villages	**	**	**			3,00,000.00
2.	Employment opportunity for the local people including priority to youth of nearby Village.	Nearby villages	**	**	**	**	**	As per the Rule
3.	Installation of solar street light	Bajabati Village				**	**	2,00,000.00
4.	Distribution of education material to the primary school	Bajabati Village	**	**	**	**	**	1,00,000.00

CHAPTER 9
ENVIRONMENTAL COST BENEFIT ANALYSIS

The environmental cost benefit analysis is not recommended for this project during scoping stage.

CHAPTER 10

ENVIRONMENT MANAGEMENT PLAN

The Environmental management plan consists of mitigation measures to be adopted, environmental monitoring & institutional measurers (financial estimates and organizational set-up). The potential identified impacts of the proposed Bajabati mining Cluster -3of DharmasalaTahasilof Jajpurdistrict have been discussed in earlier Chapter 4. The environment management plan proposed in the lease area has been shown in **Figure 10.1.** EMP includes monitoring programs and management control strategies for minimizing the adverse impacts of the said mining activity.

10.1 OBJECTIVES

Keeping in view the mitigation of the adverse environmental impacts due to the process of mining the EMP has been worked out with the following objectives:

- Reclamation of the mined out area where ever and whenever possible.
- Restoration of landscape as near to its original form as far as possible, consistent with the economy of mining operations, keeping in view the drainage pattern, geological stability, vegetation etc.
- Minimization, mitigation and where possible elimination of degradation of land and quality of air as well as water.
- Making least disturbance to the water sources and its water quality.
- Least disruption to the existing basic ecological status in the mining area during mining, which will be conserved and protected.
- Improvement of the overall flora scenario of the area.
- Establishment of an environment, in which the activities presently being carried out may change for the better without disruption or disturbance to the socio economic condition.

10.2 AIR POLLUTION AND CONTROL

During the mining operation there are various sources of dust emission. The measures proposed for air pollution control includes:

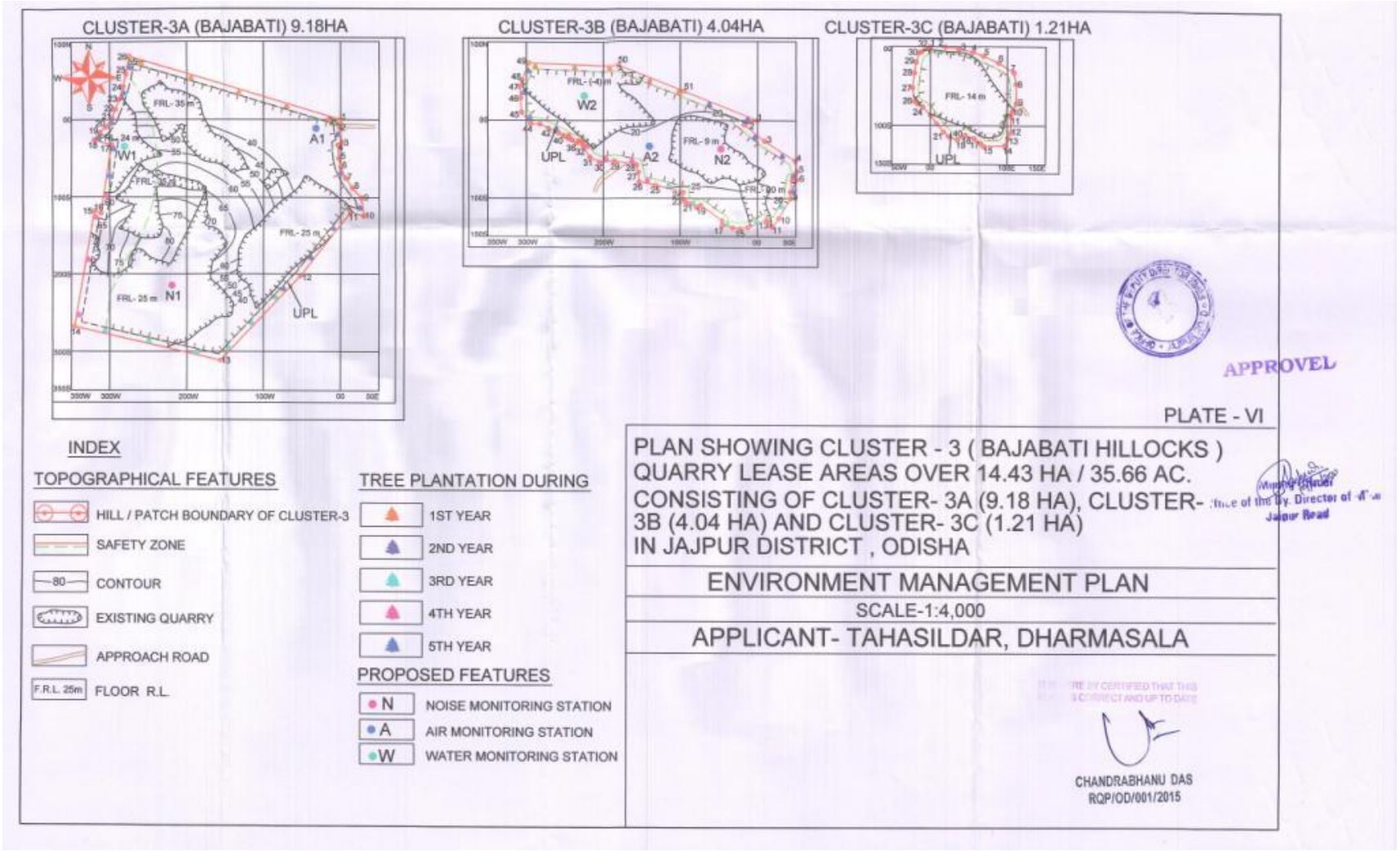
- Haul road within the cluster area well compacted that will reduce dust emission.
- Periodical water sprinkling on the haul road through water tanker of 10 KL capacity
- Over loading of transport equipmentsto be avoided to prevent spillage.

- Water sprinkling on the OB dump to reduce dust emission. About 100 water sprinklers will be installed around the dump in the individual quarry of the clusterarea to reduce the dust emission.
- Three tier plantation should be done in periphery.
- Wet drilling will be in practice to reduce dust emission
- Blasting will be carried out at a particular time of the day and blasting will be carried out in the day time only.
- Regular maintenance of mining equipment and vehicle will be conducted and pollution under control certificate be obtained for the vehicles used in the mining.
- Crushing operations inside the mine lease will be prohibited and may be carried out in another demarcated area abiding with statutory regulations.

10.3 WATER MANAGEMENT & WATER POLLUTION CONTROL:

- Mine water shall not be allowed to dissipate, but collected and discharged after allowing settlement of the suspended solids.
- Monitoring of the mine water as well as surface flows shall be done at close, regular intervals and records maintained.
- The surface run off from the mines will pass through the garland drain and enter to the settling tank. The silt and solids will be settled down in the tank and only water goes to the drainage.
- Precipitated rainwater should be harnessed by taking advantage of the given situation to create sufficient artificial storage capacities in natural or manmade depressions and inter-connecting them to meet affstonestation and other needs.
- Garland drains along with settling tank and retaining wall shall be constructed around the quarry and dumps. While constructing drains routing and tracing shall be done maintaining the overall slope in the direction of the premising flow direction so that the runoff distribution is not affected.
- Garland drain will be developed around waste dump beyond the retaining wall to receive run-off water coming out of the retaining wall of 1m height and settling tank will be made to receive the run-off water from garland drain to settle the sediments and release clean water.

Figure 10.1: Environment Management Plan



10.3.1 Surface Water Management

To avoid surface run – off during the monsoon season peripheral/ garland drains with the settling tanks have been proposed around the dumps. Further guided channel around the quarry have been proposed to stop the surface run – off in the quarry during monsoon. The dump and mine runoff water does not contain any chemical contaminant as the mining is only road metal/ stone, so there is no chance of contamination of the water. Further the water from the lease area after settling can be utilized for irrigation purpose.

During the rainy season the water from the lease area will be guided to the exhausted quarry within the lease area and will be utilized for water sprinkling and plantation purpose. During the conceptual period the entire quarry will converted to water reservoir and will be utilized for irrigation and pisciculture purpose.

10.3.2 Management Plan for Ground water

It is observed from the dug wells of the adjacent plain area and in the nearby villages that, the ground water table varies between 3 m to 8 m from the surface level depending upon seasonal variations. During dry season the water table falls to 8 m from the surface, whereas during rainy season the water table remains at around 3 m from the surface.

During the proposed plan period no particular pit lay out will be followed for all the quarries in the respective hill/patch of the Cluster-3 area. Therefore, at the end of the plan (lease) period depth of the respective quarry over the Cluster-3 area is not possible to predict. However, after 10 years (plan period) of mining the tentative bottom RLs of Cluster 3A & 3B would be 10.5m and (-7.5m) respectively. Whereas, the ultimate quarry bottom over the Cluster-3 area will be at 10mRL in Cluster-3A (Bajabati), (-10mRL) in Cluster-3B (Bajabati) & 10mRL in Cluster-3C (Bajabati) at the end of the conceptual period. This is above the ground water table as the RL of ground water table is around 8 m except in sub-cluster-3B, where permission will be taken from the concerned authority to carry out the mining operation by dewatering the quarry floor, if ground water punctured. Therefore, it is proposed to keep one 5 HP diesel operated pump at each quarry site of sub-cluster 3B, particularly during monsoon to draw out the accumulated water from the quarry. Therefore such depth of working would not affect the ground water table.

There is chance that during monsoon the run-off water may find access to some of the quarries in the Cluster-3. Therefore, it is proposed to keep one 5 HP diesel operated pump at each quarry site, particularly during monsoon to draw out the accumulated water from the quarry. The water so discharged will be routed to the natural drainage through series of drains and settling pits. Also, it is proposed to have a peripheral drain around each pit of the

individual QLs belonging to the cluster to restrict the surface runoff in to the quarry. Water requirement for domestic purpose will only sourced from ground water. Other required water will be sourced from rain water.

10.4 NOISE CONTROL:

Noise level shall be maintained below 90 dB (A) in the working zone (for 8 hr. exposure). Noise levels are expected to increase (w.r.t. present lower level) at surface work zone with commencement of mining and allied activities. The major source of noise is due to drilling, blasting and transportation of stone. The following measures will be taken up to reduce the noise level:

- Diesel powered machineries, which are major; source of noise in open cast environment will be properly maintained. Scheduled to prevent undesirable noise. Attention shall be paid towards rigorous maintenance of the silencer pipe of the diesel engines.
- All the workers working with drilling and blasting will be provided with ear muffs.
- Blasting will be carried out at a particular time of the day with proper information to the workers.
- Static diesel engines shall be housed as far as possible. If possible they will be placed on vibration isolators.
- Truck drivers will be issued ear plugs and ear muffs. Duty of the operators of the noisy machineries will be regulated to keep their noise exposures levels within the limits
- Green belt will be developed around the office building and mine to reduce noise exposure level.

10.5 EMP IMPLEMENTATION AND MONITORING

To meet with the objectives of Environmental Impact and monitoring an "Environmental Management and Monitoring Department (EMMD)" will be formed at Bajabati mining cluster (Cluster 3) mining project area, which will be responsible for implementation of EMP and post operation monitoring. The officers of the department will meet frequently to assess the progress and analyze the data collected during the preceding fortnight/month.

Table 10.1 Activities to be monitored / Inspected by EMMD

Activities	Inspection methods by EMMD
Land erosion	Regular observation for checking land erosion in hill slopes/dump slopes.
Drainage	The effectiveness of drainage system depends upon proper cleaning of all drains and sumps. Any blockage due to sitting or accumulation of loose

	material will be checked on a regular basis. Stone pitching, brick mounds etc., on drains shall also be monitstoned
Re-vegetation and Green Belt Development	Schedule planned for green belt development to be checked after every year and any alternation required will be implemented. Post plantation status will be regularly checked in every season. Phase wise development in the areas of plantation including rate of growth, survival rate etc., will be recorded systematically
Water quality Monitoring	Facilities for monitoring both surface run-off water and ground infiltration will be provided. Ground water, treated and untreated discharge water and also surface water bodies and wells will be monitstoned once in every month. Samples will be analyzed for the parameters specified by Orissa State Pollution Control Board.
Emissions and Air Quality	Dust prevention and control actions are to be taken at work zone. To monitor the effectiveness of dust control, and compare background levels of airborne dust with conditions downwind, and back this up with an adequate meteorological measurement. Two high volume samplers complete with particle size partitioning and independent power generators should provide sufficient data. The equipment to be selected should be capable of collecting sulfur dioxide & nitrogen oxides samples. The method of deployment would be in downwind condition at the mine site and in nearby villages where there is chance of dust nuisance. Air quality analysis will be carried out once every month all round the year. Monitoring shall be carried for particulate matter, Sulphur Dioxide, Nitrogen Oxides and Carbon Monoxide
Occupational Health	Facilities for checking, levels of dust in the workplace will be provided. Each group of mine workers will be monitstoned for health at regular intervals by a specialist
Socio-economic development	The environment department will be in regular touch with surrounding villages to monitor the implementation of various developmental schemes made by the mine authorities. They will also consider any immediate requirement, which can be taken care of.

Dump Management	Garland drain along with settling tank will be provided to protect wash off or leaching from dump in rainy season. Temporary plantation of grass species on the dump to minimize the impact of wind/ rain water on the dump. The waste will be completely utilized in the backfilling of exhausted quarry.
Backfilling of Exhausted Mine Lease Area	Backfilling of the exhausted quarry will be done during the conceptual period.

10.5.1 ENVIRONMENT POLICY

The Dharmasala Stone Cluster is presently under the jurisdiction of Tahasildar, Dharmasala and the concerned authority will stipulate a well defined Environmental policy for Bajabati Stone Cluster (Cluster 3) by which the lessee is committed to conduct business with strong environmental conscience towards community, customer & employees. The safety and environment policy is as below:

- The Environment, health and safety policy of Bajabati stone Cluste stone quarry.
- The Lessee is committed towards efficient use of natural resources based on reduce, recycle and reuse method.
- The Project is commited towards identification of possible impacts and will take necessary management plan to mitigate the impacts.
- Our environment and safety performance will regularly monitored and reported and helps for continual improvement of our environment and health performance.
- For health and safety of workers, our efforts is for identification of workplace hazards and creating awareness among the workers for reduce accident. Training to the workforce regariding prvention of accident, accident response and emegency preparedness.
- We strongly believe that accident and adverse environment impact can controlled through good quality of working environment, safety management and worker's involvement.

10.6 ORGANIZATION MANPOWER

10.6.1 Organizational Setup

Environmental monitoring and reporting will be designed to provide a close watch on the surrounding natural environment and provide early warnings of any adverse changes that may be related to some dimension of the mining and allied operations.

10.6.2 Man Power

EMMD will be manned by adequate staff. Services of retired fstonest officials may be taken for effective implementation of plantation schemes. For development and maintenance of jobs like drainage, settling tanks etc. assistance from the projects civil engineering department may be taken.Manpower recommended is included in **Table-10.3**

Table-10.3: Manpower requirement for environmental management & monitoring

Sl. No.	Description	Nos.
1.	Manager, (Pollution Control)	1
2.	Environmental Engineer	1
3.	Horticultural Supervisor	1
4.	Field assistant	1
5.	Labourers	1
Total		**5**

10.7 COST OF ENVIRONMENTAL POLLUTION CONTROL MEASURES:

In the process of environmental impact assessment a no. of site specific issues have been identified which require due consideration as part of the development planning and environmental project costing. The measures suggested are detailed under environmental management plan. The total cost of the project is Rs. 200 Lakhs and the updated capital cost and recurring cost (per annum) for the environmental facilities for the proposed mining project works out to be Rs. 20 lakhs and Rs. 10 lakh / year respectively.

Table 10.3: Cost of Environmental Pollution Control Measures

Environmental Management Activity	Capital Cost (Lakhs Rs.)	Recurring Cost (Lakhs Rs. / Yr.)
Pollution Control (Water sprinkling, Construction and maintenance of Garland Drain & retaining walletc)	10.00	5.00
Environmental Monitoring	5.00	2.00
Occupational Safety (Provision of PPEs)	3.00	2.00
Green belt Development	2.00	1.00
Total	**20.00**	**10.00**

CHAPTER 11

SUMMARY & CONCLUSION

11.1 INTRODUCTION

This Summary is a brief outline of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) carried out for Bajabati Hillocks (Cluster 3) over an area of 14.43Ha, at Village-Bajabati under Dharmasala tahasil District Jajpur, Odisha. Cluster-3 has been further sub divided to three sub-clusters, viz., Cluster-3A comprising mineralized area over 9.18 Ha, Cluster-3B comprising mineralized area over 4.04 Ha and Cluster-3C comprising mineralized area over 1.21Ha. Cluster-3 (Bajabati hillocks) is featured in the Survey of India Toposheet No. 73 L/2 and bounded between the latitudes from 20°45'46.74"N to 20°46'08.96"N and Longitudes 86°06'04.77"E to 86°06'37.98"E. Whereas, Cluster-3A is bounded between the latitudes 20°45'46.74"N to 20°45'59.49"N and longitudes 86°06'25.03"E to 86°06'37.98"E, Cluster-3B is bounded between latitudes 20°46'02.09"N to 20°46'08.96"N and longitudes 86°06'24.29"E to 86°06'36.77"E and Cluster-3C is bounded between latitudes 20°45'56.62"N to 20°46'00.72"N and longitudes 86°06'04.77"E to 86°06'09.42"E.

11.2 HIGHLIGHTS

A. The Project

Name of the Project : Bajabati Hillocks (Cluster 3)

Product : Building Stone

Type of mine : Semi mechanized open cast mining

Rated production capacity : 1,80,000m^3 during Plan Period (Ten Years).

Table 1.1: Brief profile of the project:

Sl. No.	Salient Features	Descriptions
1	Cluster area	14.43 Ha (6 nos of mining lease.)
2	Village	Bajabati
3	Tahasil	Jajpur
4	District and State	Jajpur, Odisha
5	Land category	Non forest Govt. Land
6	Toposheet No.	73L/2
7	Nearest town	Jenapur

8	Nearest road	NH:200- 2Km, SW
9	River distance	Brahmani River – 2.5Km, NNE
12	Railway station	Haridashpur Railway Station 4.5 Km, SSE
13	Jenapur	3 Km

B. Environmental Aspects

Pollution Potential: Land degradation, generation and propagation of fugitive dust, erosion of soil are the major pollutions anticipated from the proposed mining & allied activities

Environmental Impact: Marginal adverse impact on the localized air and land environment, which gets compensated by moderately beneficial impact on the human environment.

11.3 INTRODUCTION

Bajabati Hillocks (Cluster 3) over an area of 14.43 Ha is an opencast semi- mechanized mine situated in the village Bajabati, Tahasil Dhramasala, District Jajpur, Odisha. This cluster comes under ownership of Dharmasala, Tahasil, Jajpur, Odisha quarry leases for Building stone/ Road metal comprising 06nos. of lease areas covering a total mineralised area of 35.66Acres or 14.43 Hectares located in village/Mouza Bajabati of Dharmasala Tahasil & District Jajpur, Odisha have been proposed to be leased out to different intenders through auction. Cluster-3 constituted of Bajabati building stone quarry has been approved by approved by the Deputy Directorate Mines, Jajpur Road Circle, Jajpur Road, vide memo no. 314 on dated 19.02.2020.

To obtain environmental clearance, a suitable Environmental Impact Assessment and Environmental Management Plan for the mining lease area has been prepared.

In a view to obtain environmental clearance for Cluster 3 mines, Dharmasala Tahasildar, Jajpur has entrusted the assignment to M/s Kalyani Laboratories Private Limited Bhubaneswar for preparing EIA /EMP report.

Kalyani Laboratories private limited (MoEF& CC and NABL accredited Lab) has gathered required baseline data for pre monsoon season (March to May 2020) and accordingly prepared the EIA / EMP report.

11.4 PROJECT OUTLINE

Cluster-3 has been further sub divided to three sub-clusters, viz., Cluster- 3A comprising mineralized area over 9.18 Ha, Cluster-3B comprising mineralized area over 4.04 Ha and Cluster-3C comprising mineralized area over 1.21 Ha. The geological reserve (Probable & Possible) for building stone/road metal has been estimated as 22, 63,388Cum over the cluster-3A (Bajabati), 5, 65,740Cum over the cluster-3B (Bajabati) & 1, 26,932Cum over the

cluster-3C (Bajabati). Hence, the total geological reserve over Cluster-3 mineralized area has been estimated as 29, 56,060Cum.

It is evident that demonstrated the mineable reserve (Probable) for building stone/road metal worked out to be 15, 22,433Cum over the cluster-3A (Bajabati), 3,53,415Cum over the cluster-3B (Bajabati) & 36,519Cum over the cluster-3C (Bajabati). Hence, the total mineable reserve over Cluster-3 mineralized area has been estimated as 19, 12,367Cum.

Table 1.2 (A): Geological Reserve of Cluster

Section Considered	Length of Influence (m)	X-Area of Rock Mass (m2)	Volume of Excavation of Rock Mass(m3)	Vol. of Recoverable Building Stone (m3)	Vol. of Waste (m3)	X-Area of Soil Zone (m2)	Vol. of Soil Zone (m3)	Category
A	**B**	**C**	**D=BXC**	**E=D X .70**	**E=D X .30**	**F**	**G=FXB**	**H**
Cluster-3A (Bajabati)	273	10782	2943486	2060440	883046	218	59514	Probable
	273	1062	289926	202948	86978	---	---	Possible
Total			**3233412**	**2263388**	**970024**	---	**59514**	**---**
Cluster-3B (Bajabati)	120	5711	685320	479724	205596	82	9840	Probable
	120	1024	122880	86016	36864	---	---	Possible
Total			**808200**	**565740**	**242460**	**---**	**9840**	**---**
Cluster-3C (Bajabati)	108	1320	142560	99792	42768	56	6048	Probable
	108	359	38772	27140	11632	---	---	Possible
Total			**181332**	**126932**	**54400**	**---**	**6048**	**---**

Table 1.2 (B): Mineable Reserve of Cluster

Section Considered	Length of Influence (m)	X-Area of Rock Mass (m^2)	Volume of Excavation of Rock Mass(m^3)	Vol. of Recoverable Building Stone (m^3)	Vol. of Waste (m^3)	X-Area of Soil Zone (m^2)	Vol. of Soil Zone (m^3)	Category
A	**B**	**C**	**D=BXC**	**E=D X .70**	**E=D X .30**	**F**	**G=FXB**	**H**
Cluster-3A (Bajabati)	216	10069	2174904	1522433	652471	202	43632	Probable
Cluster-3B (Bajabati)	106	4763	504878	353415	151463	71	7526	Probable
Cluster-3C (Bajabati)	94	555	52170	36519	15651	33	3102	Probable

Method of mining will be opencast semi mechanized. Handling of rock mass will be done both manually and by excavators. Handpicks, spade, chisel, hammer will be used by manual labors

for sorting and sizing. Loosening of rock mass will be done by drilling and blasting Based on the demand of building stone/road metal as revealed by the respective lessees, a maximum of 1,80,000Cum of building stone/road metal will be extracted per annum from the Cluster-3 area. During next 10 years of the plan period the level of production expected is given in Table below.

Table 1.3: Proposed Tentative Maximum Production of Building Stone/Road Metal during Plan Period (Ten Years)

Year	Cluster-3A (Bajabati) in cum	Cluster-3B (Bajabati) in cum	Cluster-3C (Bajabati) in cum	Total (cum)
First	1,50,000	30,000	0	1,80,000
Second	1,50,000	30,000	0	1,80,000
Third	1,50,000	30,000	0	1,80,000
Fourth	1,50,000	30,000	0	1,80,000
Fifth	1,50,000	30,000	0	1,80,000
Sixth	1,50,000	30,000	0	1,80,000
Seventh	1,50,000	30,000	0	1,80,000
Eighth	1,50,000	30,000	0	1,80,000
Ninth	1,50,000	30,000	0	1,80,000
Tenth	1,50,000	30,000	0	1,80,000
Total	**15,00,000**	**3,00,000**	**0**	**18,00,000**

A total of 130 workers (Skilled-15nos., Semi-skilled-35nos. and Un-skilled-75nos & Mines Manager/Mine Permit Manager-05nos) will be employed during mining operation. The Cluster-3 area is partly covered with soil mixed rock boulders/pebbles followed by granite gneiss/charnockite/migmatite deposit. The soil to be generated will be stacked in the earmarked temporary soil stack and will be utilised for the plantation purpose to be undertaken around the respective hill/patch and adjacent to haul roads of the same in Cluster-3. Moreover, as envisaged, waste to the tune of about 30% of excavation will be generated during mining which will be utilised by the respective Lessee for making of mine road and allied infrastructures. These are the portions of total excavation which are not suitable for construction purpose due to weathering and softness. It will not be possible to separate the total waste from the suitable building stone/road metal at the quarry head.

It is assumed that around 2/3rd of the generated waste will be transported to the crusher site along with valuable building stone/road metal where these will be sorted out. The remaining 1/3rd of the total waste will be separated at the quarry head and will be stacked in the temporary waste dump of respective quarry lease and will be utilised by the lessee for making of mine road and allied infrastructures.

11.5 PRESENT ENVIRONMENTAL SETTING

To achieve these objectives of EIA/ EMP study, the EIA team members of M/s Kalyani Laboratories Private Limited, Bhubaneswar monitored different environmental parameters of the core zone (Lease area) and buffer zone (10 km. radial distance) of the project site in accordance with the Guidelines for EIA issued by the MoEF& CC, Govt. of India. The baseline study was carried during the period from March to May 2020. The baselinemonitoring and analysis of different environmental parameters was conducted by M/s Kalyani Laboratories Pvt. Ltd

11.5.1 Land use and Topography

The project site is located in survey of India Toposheet No. 73L/2 and bounded between the Latitude from 20°45'46.74"N to 20°46'08.96"N and Longitudes 86°06'04.77"E to 86°06'37.98"E. Lease area is accessible through NH 200 which is located at a distance of about 2Km, SW & NH 5 at a distance of 5Km, E from the cluster. The area is at a distance of 3 km from Jenapur town. The nearest railway siding is at Haridashpur railway station located at a distance of about 4.5 km, SSE from the cluster area.

It is observed from the dug wells of the adjacent plain area and in the nearby villages that, the ground water table varies between 3 m to 8 m from the surface level depending upon seasonal variations. During dry season the water table falls to 8 m from the surface, whereas during rainy season the water table remains at around 3 m from the surface.

There is chance that during monsoon the run-off water may find access to some of the quarries in the cluster-3. Therefore, it is proposed to keep one 5 HP diesel operated pump at each quarry site, particularly during monsoon to draw out the accumulated water from the quarry. The water so discharged will be routed to the natural drainage through series of drains and settling pits. Also, it is proposed to have a peripheral drain around the each pit of the individual QLs belonging to the cluster to restrict the surface runoff in to the quarry.

As per the satellite imagery data presented above it has been observed that about 3.9% of the land cover is covered under forest land, irrigated land (rabi crop land) include 48.70% and 19.20% fallow land, waste land 4.31%, scrub land 10.53% and river bed is covered under 2.99% of the total land use plan.

11.5. 2 Climate & Meteorology

The climate condition of the district is generally hot with high humidity during April and May and cold during December and January. The maximum temperature in the district rises up to 46˚C in the summer and falls to a minimum of 14˚C in winter. The December and January are the coldest and May is the hottest month. The relative humidity is high, on an

average, varies from 40 to 90% during the year. The average rainfall of the district is 1550mm. Maximum rainfall generally occurs in the month of August. Average nos. of rainy days in a year is 72. The western, south-western, eastern southern tract s receive a fairly high rainfall (>1500 mm.) which gradually decreases to 1300mm towards north-east.

11.5.3 Ambient Air quality

The major contributors of air emissions are industrial emission, vehicular movement combustion of bio-fuel and other man made sources. During the study period the concentration of PM10 varies from 35.02-80.0µg/m^3 and PM2.5 varies from 21.01-43.5µg /m^3. The concentration of SO2 varies from 4-10.4µg /m^3 and NOx concentrations vary from 9.1-20.4µg /m^3. From the ambient air quality monitoring carried out for three months (March-May 2020) of the study period shows that the critical pollutants like PM_{10}, Sox and NOx are well within the permissible limits.

11.5.4 Water Quality

- The pH range of the surface water samples is neutral ranging from 7.3 to 8.
- Electrical conductivity of water sample ranges from 144-480 µs/cm
- Dissolved oxygen in the surface water sample ranges from 5.6-7.2 mg/l.
- Biochemical oxygen demand of the surface water body is 4-10 mg/l. The BOD is comparatively higher in pond water as compare to river water.

From the water quality results it can be inferred that all the parameters analyzed are under the prescribed limit as per IS 2296:1982; class C and the water does not contain any pollutant which would be hazardous for human, animal or crop health.

As per the monitoring and analysis of ground water of selected sampling areas, it has been observed that

- Water is colorless and odorless and found to be suitable for human consumption.
- The pH level of the ground water sample ranges from 6.7-7.2. This indicates that the pH of the ground water in the study area is neutral and as per the drinking water standard.
- Total hardness ranges from 144-712 mg/l, and total dissolved solid ranges from 270 to 1450mg/l.
- Alkalinity ranges from 90-469 mg/l.

From the above water quality results it can be inferred that all the parameters analyzed are under the prescribed limit specified under IS10500, 2012 for drinking water. The water is free from microscopic organism and do not contain any pollutant which would be hazardous for human, animal or crop health, So it is fit for drinking purpose.

11.5.5 Noise Quality

At present the area is a barren land without any human interference. So the present noise level of the area is lower comparative with the village. The noise level as measured in the core zone is 56.8 dB (A) in day time and 46.2 dB (A) in the night time. In the buffer zone thenoise level ranges from 42.3 to 56.4 dBA during day time and 31.2 to 40.2 dBA during night time. The noise level is below the standard as per the Noise Rule, 2000 for rural area. The lease area and all the sampling points are comes under rural area.

11.5.6 Soil quality

The soil analysis result shows that, the pH of the soil samples collected are mostly alkaline except the soil of Bichakhandi and Sahanidih which are slightly acidic. Texture of the soil varies from silt loam to sandy clay loam. Electrical conductivity ranges from 48 to 323 µs/Cm. Nitrogen content of soil varies from 1210 to 1814 Kg/Ha; Phosphorous content varies from 13 to 49 Kg/Ha and Potassium content 134 to 482 Kg/Ha. Total organic carbon of the soil varies from 0.36 to 2.37 %. From the soil analysis result it can be concluded that the soil of the area is highly fertile and suitable for agricultural purpose.

11.5.7 Biological environment

The area is covered with mostly scrub and open forest along with scattered vegetation near villages. The most commonly growing and economically important plant species of the forest are Kaju, Baidanka, Neem, Khajur, Teak (*Tectona grandis*; Family: Verbenaceae), Bara, Osta, Simli, Sunari, kanteikoli, Augasti, Nirgundi, Anantamala, Tal, Bamboo, Kendu (*Diospyrous kaki*; Family: Ebenaceae), Sal (*Shoria robusta*; family: Dipterocarpaceae) and due to their inexpensive utility in commercial purposes. However, over the last hundred years or so, forests are being destroyed by several natural and anthropogenic activities.

11.5.8 Socio Economic Environment

There are 57 villages buffer zone of the project area. Detail demographic profile of study area is as below:

Table no.1.4 Demographic profile of the buffer zone

Sl. No.	Attributes	Radius of 10 km
1	No. of Villages	57
2	Total Household	10900
3	Total Population	49089
4	Male Population	25171
5	Female Population	239818
6	Total ST population	5238
7	Total SC Population	11632
8	Sex Ratio (F /M)	95 : 100

9	Population below 6 Years	5795

Out of the total population, 34419 persons are literate which contribute about 70% within the buffer zone. Out of the total literate, male literacy is contributed as 19109 i.e. 56% and female literacy is contributed as 15310 by 44%. It is observed that the literacy percentage is more among the male as compare to the female population. About 30% of the total population of the project villages is illiterate.

The work force classification in the study area helps in formulating strategies in any development programme. It also helps in identifying the potential workforce, their aptitude, skill, etc in any targeted population. As per the census 2011 the work group participation of the study villages are as follows,

- Out of the total population, 15815 persons (about 32%) are workers and 33274 (about 68%) persons are non workers. This can be inferred that more than half of the population is depending on others for their livelihood opportunity.
- Regarding workforce participation rate of both the sex, the data reveals that female workforce participation rate is comparatively low with respect to male. Out of the total working population 13900 (88%) are male and 1915 (12%) are female.
- Out of the total workers 11913 are main workers and 3902 are marginal workers. In both main and marginal workers population the male workers are overwhelmingly dominated in comparison to female workers. As per the census 2011 the work group participation of the study villages have been given below :

Table no.1.5 Work group participation in main and marginal section

Sl. No.	Attributes	Main	Marginal
1	Total Working	11913	3902
2	Cultivator	2657	350
3	Agricultural labour	2368	1871
4	Household workers	469	150
5	Other Workers	6419	1531

11.6 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

11.6.1 Impact of Mining on Land Environment

11.6.1.1 Impact on Topography

The impact on the topography is in the form of changed landscape due to the mining activities in the form of digging, leveling of lands & dumping of waste etc. There will be topographical change due to mining activity within the lease clusters. Cluster-3 (Bajabati Hillock) is located within the revenue jurisdiction of Bajabati village under Dharmasala

Tahasil of Jajpur district. The targeted area represents a hilly terrain comprising three Patches, viz., Cluster-3A, 3B & 3C with undulated topography. Cluster-3A displays highest altitude of 80mRL and lowest altitude of 35mRL, Cluster-3B displays highest altitude of 25mRL and lowest altitude of 20mRL & Cluster-3C displays highest altitude of 40mRL and lowest altitude of 35mRL

11.6.1.2 Impacts due to Development of Mine & Excavation of stone

Ultimate extent of the quarry will be confined to the area of 7.33 hectares in Cluster-3A (Bajabati), 3.37 hectares in Cluster-3B (Bajabati) & 0.98 hectares in Cluster-3C (Bajabati). As discussed, based upon the existing quarries as well as surface exposures total resource of the cluster has been estimated as the probable resource over the mineralized area of the respective hillock will be mined out during conceptual period. The ultimate quarry bottom will be at 10mRL in Cluster-3A (Bajabati), (-10mRL) in Cluster-3B (Bajabati) & 10mRL in Cluster-3C (Bajabati) as shown in the Conceptual Plan & Sections. This is above the ground water table as the RL of ground water table is around 8 m. Therefore such depth of working would not affect the ground water table.

11.6.1.3 Other Impacts

The land-use pattern undergoes a change due to the use of the land for mining, dumping, and other mining and associated activities. The drainage pattern on the surface undergoes a change due to the alterations in the surface topography due to mining and associated activities.

11.6.1.4 Mitigation Measures

The quarry within the lease cluster will be utilized as water reservoir. There will be construction of retaining wall along the quarry boundary and plantation will be carried out along the boundary of the quarry.

11.6.2Impact on Air Quality and Mitigation Measures:

Mining operation and its associated activities are potentially airs polluting and the major air pollutant is the particulate matter. The impacts on air quality due to the proposed mining cluster are as below:

- Dust from excavation and mining of stone.
- Loading, unloading and screening.
- Vehicular movement on the haul roads.

Further mitigation measures proposed for the mining will be as blow:

- Water sprinkling on mining quarry, dumping area and haul road during dry wind periods, using a water tanker.

- Dust emissions due to vehicles can be minimized by avoiding spillage from the loaded trucks.
- Top soil or overburden is susceptible to wind erosion speeds more than 5 m/sec.
- Water sprinkling on the top soil and over burden dump to reduce wind erosion.
- Dust catching species like cassia fistula, *Bombax ceiba, Azadirchtaindica, Nyctanthesarbor-tristis, Psidium guajava, tectonagrandis* etc will be planted in green belt.

11.6.3 Impact on Noise Quality and Mitigation Measures

11.6.3.1 Blasting Effects

The loosening of rock mass will be done by drilling and blasting. Drilling will be done either by wagon drill or jack hammer taking in to consideration the bench height varying from 3 meter to 6m. Assuming 1,80,000m^3 (max) productions per annum of Cluster-3, the monthly production target will be around 15,000m^3. To produce 15,000m^3 of rock mass, tentatively 7500kg/month of explosive will be required assuming powder factor 2m^3 /kg.

Noise due to blasting is site specific and depends on type, quantity of explosives, dimension of drill holes, degree of compaction of explosive in the hole and rock. Blasting will be performed during the day time. Shot hole drilling & blasting will be in practice so that the effect of blasting in terms of fly rock and maximum ground vibration will be negligible. The noise produced by blasting would be for extremely short duration of around 0.5 seconds, though with a high intensity. The blasting will be conducted in the day time only and once in a week by the licensed contractor. Time of blasting will be 12 noon to 12.30 PM in day time with prior intimation to the villagers for taking shelter. The practice of regularly wetting the blasting ground and spraying water over the blasted material will be adopted to control air pollution. Proposal is to adopt wet drilling on the benches.

11.6.3.2 Ground Vibration

Ground vibrations are generated by travelling of shock wave into the rock mass and attenuate very quickly. Vibrations and air over pressure are moistened in trial blasts to generated sufficient statistical data that could not be used for ascertaining site constants.

11.6.3.3 Mitigation Measures:

- Development of green belt in the lease boundary which acts as a barrier for noise abatement
- The noise generating machineries will be properly maintained
- The workers will be provided with proper PPEs to minimize the occupational exposures of noise.

11.6.4 Impact on Water Quality and Mitigation measures

The there is no seasonal or perennial nalla found within the mines cluster, so there is no shifting of water course due to mining activities. The mining activities can cause adverse impacts due to mine drainage, siltation due to storm water & contaminated water from mining cluster area. 20 KLD of potable water will be required from which 15 KLD of water will be required for drinking & domestic purpose. 3 KLD of water is suggested to be utilized for dust suppression and 2 KLD for plantation purpose. Water will be sourced from ground water and rain water harvesting from the existing quarry.

During the proposed plan period no particular pit lay out will be followed for all the quarries in the respective hill/patch of the Cluster-3 area. Therefore, at the end of the plan (lease) period depth of the respective quarry over the Cluster-3 area is not possible to predict. However, after10 years (lease period) of mining the tentative bottom RL of Cluster 3A & 3B would be 10.5m and (-7.5m). Whereas, the ultimate quarry bottom over the Cluster-3 area will be at 10mRL in Cluster-3A (Bajabati), (-10mRL) in Cluster-3B (Bajabati) & 10mRL in Cluster-3C (Bajabati) at the end of the conceptual period. This is above the ground water table as the RL of ground water table is around 8 m except in sub-cluster-3B. Therefore such depth of working would not affect the ground water table.

There is chance that during monsoon the run-off water may find access to some of the quarries in the cluster-3. Therefore, it is proposed to keep one 5 HP diesel operated pump at each quarry site, particularly during monsoon to draw out the accumulated water from the quarry. The water so discharged will be routed to the natural drainage through series of drains and settling pits. Also, it is proposed to have a peripheral drain around the each pit of the individual QLs belonging to the cluster to restrict the surface runoff in to the quarry. The water so discharged will be routed to the natural drainage through series of drains and settling pits.

11.6.4.1 Mitigation measures

- Garland drains (1x1m), settling tank (3m x3m x3m) and check dam will be constructed along individual mining lease area. The garland drains of the individual lease will connected to settling tank and after settling the water will be discharged out to the natural drainage.
- There will be no waste water generated due to the mining activity. The domestic effluents being generated will be discharged to soak pits through septic tank.

- The abandoned pit will be converted to rain water storage tank and the rain water stored in the pit will be utilized for plantation as well as dust suppression.

11.6.5 Impact on Vegetation and Mitigation measures:

There are few existing plantation within the lease area. The existing plantation in the roadside of the entry of lease cluster, near the rest shed, near the existing crusher and few plantations in the safety zone. The existing plantations in the lease area include Mahaneem, Neem, Teak, Chatiana, Chakunda, Bara, Mango, Sisoo, Aswastha, Sunari, Osta etc.

During the conceptual period 11.68 Ha of dump area will be covered with plantation of 14016 saplings.

11.6.6 Impact on Socioeconomic Conditions:

The proposed project shall have major beneficial and more or less negligible adverse impacts on the following domains.

The project will create employment opportunities for the local inhabitants. The project will contribute direct employment scope for 130 persons for this mines project including skilled, semi-skilled and un-skilled mine workers, supervisory staffs, mining engineers, Mines manager, surveyors etc.

The project activities shall create awareness with the local people for preferring permanent services than periodical agricultural activities. Further there will be infrastructural development in the area due to the proposed project.

For occupational health and safety PPEs will be provided to the workers and regular health check up of the workers will be carried out.

11.7 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

11.7.1 Air Pollution & Control

During the mining operation there are various sources of dust emission. The measures proposed for air pollution control includes:

- Haul road within the cluster area well compacted that will reduce dust emission.
- Periodical water sprinkling on the haul road through water tanker of 10 KL capacity
- Over loading of transport equipments to be avoided to prevent spillage.
- Water sprinkling on the OB dump to reduce dust emission. About 100 water sprinklers will be installed around the dump in the individual quarry of the cluster area to reduce the dust emission.
- Three tier plantations should be done in periphery.
- Wet drilling will be in practice to reduce dust emission

- Blasting will be carried out at a particular time of the day and blasting will be carried out in the day time only.
- Regular maintenance of mining equipment and vehicle will be conducted and pollution under control certificate be obtained for the vehicles used in the mining.
- Crushing operations inside the mine lease will be prohibited and may be carried out in another demarcated area abiding with statutory regulations.

11.7.2 Water Management & Water Pollution Control:

- Mine water shall not be allowed to dissipate, but collected and discharged after allowing settlement of the suspended solids.
- Monitoring of the mine water as well as surface flows shall be done at close, regular intervals and records maintained.
- The surface run off from the mines will pass through the garland drain and enter to the settling tank. The silt and solids will be settled down in the tank and only water goes to the drainage.
- Precipitated rainwater should be harnessed by taking advantage of the given situation to create sufficient artificial storage capacities in natural or manmade depressions and inter-connecting them to meet afforestation and other needs.
- Garland drains along with settling tank and retaining wall shall be constructed around the quarry and dumps. While constructing drains routing and tracing shall be done maintaining the overall slope in the direction of the premising flow direction so that the runoff distribution is not affected.
- Garland drain will be developed around waste dump beyond the retaining wall to receive run-off water coming out of the retaining wall of 1m height and settling tank will be made to receive the run-off water from garland drain to settle the sediments and release clean water.

11.7.2.1 Surface Water Management

To avoid surface run-off during the monsoon season peripheral/ garland drains with the settling tanks have been proposed around the dumps. Further guided channel around the quarry have been proposed to stop the surface run-off in the quarry during monsoon. The dump and mine runoff water does not contain any chemical contaminant as the mining is only road metal/ stone, so there is no chance of contamination of the water. Further the water from the lease area after settling can be utilized for irrigation purpose.

During the rainy season the water from the lease area will be guided to the exhausted quarry within the lease area and will be utilized for water sprinkling and plantation purpose.

During the conceptual period the entire quarry will converted to water reservoir and will be utilized for irrigation and pisciculture purpose.

11.7.2.2 Management Plan for Ground water

During the proposed mining plan period there is no proposal for intersecting the ground water table. Water requirement for domestic purpose will only sourced from ground water. Other required water will be sourced from rain water.

11.7.3 Noise Control:

Noise level shall be maintained below 90 dB (A) in the working zone (for 8 hr. exposure). Noise levels are expected to increase (w.r.t. present lower level) at surface work zone with commencement of mining and allied activities. The major source of noise is due to drilling, blasting and transportation of stone. The following measures will be taken up to reduce the noise level:

- Diesel powered machineries, which are major; source of noise in open cast environment will be properly maintained. Scheduled to prevent undesirable noise. Attention shall be paid towards rigorous maintenance of the silencer pipe of the diesel engines.
- All the workers working with drilling and blasting will be provided with ear muffs.
- Blasting will be carried out at a particular time of the day with proper information to the workers.
- Static diesel engines shall be housed as far as possible. If possible they will be placed on vibration isolators.
- Truck drivers will be issued ear plugs and ear muffs. Duty of the operators of the noisy machineries will be regulated to keep their noise exposures levels within the limits
- Green belt will be developed around the office building and mine to reduce noise exposure level.

11.7.4 EMP Implementation and Monitoring

To meet with the objectives of Environmental Impact and monitoring an "Environmental Management and Monitoring Department (EMMD)" will be formed mining cluster (Cluster 3) mining project area, which will be responsible for implementation of EMP and post operation monitoring. The officers of the department will meet frequently to assess the progress and analyze the data collected during the preceding fortnight/month.

11.8 CORPORATE ENVIRONMENTAL RESPONSIBILITY

As per the MoEF & CC OM No. 22-65/ 2017-IA II(M) dated 01.05.2018, it has been recommended that 2% of the project cost will be accorded for Corporate Environmental responsibility. The details of CER plan has been given in the table below:

Table 1.5 Proposed CER Plan

Sl. No.	Activities	Location	Time Frame					Allocated Budget (Rs.)
Pollution Control measures			**1st Yr**	**2nd Yr**	**3rdYr**	**4th Yr**	**5th Yr**	
1.	Installation of water sprinklers (50 Nos)	Individual leases of the cluster	**	**				3,00,000.00
2.	Construction of Garland drain and retaining wall	Individual leases of the cluster	**	**	**			3,00,000.00
3.	Water sprinkling by tanker in the village road (10 KL water tanker)	Bajabati	**					3,00,000.00
4.	Plantation in the safety zone	Individual leases of the cluster	**	**	**			1,00,000.00
5.	Plantation in the village road connecting ML area	Avenue Plantation			**	**	**	2,00,000.00
6.	Rain water harvesting structure	Individual leases of the cluster		**	**			2,00,000.00
Peripheral Development								
1.	Development and maintenance of village road connecting individual lease of cluster	Nearby villages	**	**	**			3,00,000.00
2.	Employment opportunity for the local people including priority to youth of nearby Village.	Nearby villages	**	**	**	**	**	As per the Rule
3.	Installation of solar street light	Bajabati Village				**	**	2,00,000.00
4.	Distribution of education material to the primary school	Bajabati Village	**	**	**	**	**	1,00,000.00

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CHAPTER 12

DISCLOSURE OF CONSULTANTS ENGAGED

The EIA report is prepared on behalf of the proponents, collecting inputs from proponent's office staff, project management section etc by M/s **Kalyani Laboratories Pvt Ltd (KLPL)**, Bhubaneswar. KLPL is an Environmental Consultancy firm and Laboratory which have been accredited by QCI NABET. Also KLPL got approval from State Pollution Control Board, Odisha (Category A) for Environmental Consultancy services like Mining, Building Constructions, Industries and other related areas. The details accreditation of KLPL is as below:

12.1 ACCREDITATIONS

1. NABET: Certificate No. **NABET/EIA/1922/RA0154** dated 28th April 2022

2. NABL: Certificate No.TC -7043 dated 16.03.2018

3. MoEF: Gadget Notification No. S.O 2003 (E) dated 6th August 2014

4. Odisha State Pollution Control Board: Letter no. 266/ VISC (lem) i& PR-41/15-16 dated 12.02.2016

Kalyani Laboratories Private Limited also providedlaboratory services for monitoring and analysis of environmental parameters like Air, Water, Waste water, and Soil, Stack, Noise and Meteorological data to its clients.

The EIA expert team of KLPL is given in **Table No.12.1** below:

Table no.12.1 Lists of Experts with Kalyani Laboratories Private Limited

Sl. No	Name	Area of Expertise
EIA Coordinators		
01	Dr. D. Biswal	Mining of minerals(Open cast & underground) Coke oven plants Mineral Beneficiation Metallurgical Industries Thermal power Plant
02	Dr. R. Nayak	Mining of mineral(Open cast & underground), Coal washeries Building and large construction projects
03	Mr. Rajesh Kanungo	Metallurgical Industries Thermal power Plant
04	Dr. Madhusmita Jena	Building and large construction projects
Functional Area Experts		
01	Dr. D. Biswal	Air Pollution monitoring prevention and control, Water

		pollution monitoring prevention and control, Solid and Hazardous Waste management, Meteorology, Air quality modelling and Prediction
02	Dr. R. Nayak	Water pollution monitoring prevention and control, Soil Conservation, Ecology & Biodiversity
03	Ms. M. Jena	Ecology & Biodiversity & Soil Conservation
05	Mr. C.B. Das	Geology
06	Mr. N.K. Patel	Hydrogeology, ground water and water conservation
07	Mr. JagabandhuBisoi	Socio economics
09	Mr.Rajesh Kanungo	Risk & Hazard Management
10	Dr. Santilata Sahoo	Ecology & Biodiversity
11	Mr. S.C. Nayak	Hydrogeology, Geology, Noise & Vibration
12	Mr. Sahil Sood	Land Use
Team Member		
13	Er. SubhadarshaniRath	Air Pollution monitoring prevention and control, Solid and Hazardous Waste management

12.2 AREAS OF EXPERTISE OF KLPL

A. IMPACT ASSESSMENT STUDIES

- Conducting Environmental Impact Assessment Studies for industries, mines and construction projects.
- Baseline data generation- Monitoring of environmental attributes meteorology and fstonest surveys.
- Impact Modelling & formulation of Environmental Management plan.
- Hazardous waste audit for industrial establishments.
- Onsite Emergency plans for combating dangers related to fire or toxic release in industries.
- Pre Project health Assessments &socio economic surveys.
- Ecological and Biodiversity Survey and Preparation of Biodiversity Management Plan.

B. TECHNICAL SERVICES

- Operation and Maintenance of Effluent Treatment Plants and Sewerage Treatment Plants in industries.
- Designing of ETP and STPs.
- Integrated Solid waste management.
- Carrying out hazardous waste audit for different industrial projects

C. LABORATORY SERVICES

Laboratory of KLPL has been accredited by NABL and MoEF& CC. The laboratory facility available with KLPL is as below:

- Wet chemical and instrumental analysis of air, water, soil, noise, Biochemical, Radiological, solid, Food & hazardous waste analysis.
- Monitoring of ambient air, stack, noise etc.
- Meteorological monitoring
- Stone and Mineral Analysis.
- Bioassay of industrial effluents.
- Micro Biological analysis of food and water.
- Bio monitoring of surface water

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ଉପକ୍ରମ:

ଏହି ନିର୍ବାହ ସାରାଂଶଟି ଓଡ଼ିଶାର ଯାଜପୁର ଜିଲ୍ଲା ଅନ୍ତର୍ଗତ କ୍ଲଷ୍ଟର-୩ ପଥର ଖଣିରୁ ବଜବାଟି ଗ୍ରାମର ସର୍ବମୋଟ ୧୪.୪୩ ହେକ୍ଟର ପରିମିତ ଅଂଚଳରେ ପଥର ଉତ୍ପାଦନ ନିମନ୍ତେ ଲିଖିତ ପରିବେଶ ସଂଘାତ ଆକଳନ ଓ ପରିବେଶ ପରିଚାଳନା ଯୋଜନାର ସଂକ୍ଷିପ୍ତ ବିବରଣୀ ଅଟେ ।

କ) ପ୍ରସ୍ତାବିତ ପ୍ରକଳ୍ପର ବିଷଦ ବିବରଣୀ

କ୍ର.ନଂ.	ବିବରଣୀ	ସବିଶେଷ ସୂଚନା
୧.	ନାମ	କ୍ଲଷ୍ଟର-୩ (ବଜବାଟି) ପଥର ଖଣି
୨.	ସ୍ଥାନ	ଗ୍ରାମ- ବଜବାଟି, ତହସିଲ – ଧର୍ମଶାଳା, ଜିଲ୍ଲା- ଯାଜପୁର, ରାଜ୍ୟ – ଓଡ଼ିଶା
୩.	ଉତ୍ପାଦନର ନାମ	ଘର ନିର୍ମାଣ ପଥର
୪.	ଖନନ ପ୍ରକ୍ରିୟା	ଅର୍ଦ୍ଧଯନ୍ତ୍ରୀକୃତ ଖନନ କାର୍ଯ୍ୟ ପଦ୍ଧତି
୫.	ଉତ୍ପାଦନ ସଂଖ୍ୟା	୧୦ ବର୍ଷ ମଧ୍ୟରେ ୧୮ ଲକ୍ଷ ପଥର ଉତ୍ପାଦନ
୬.	ଅକ୍ଷାଂଶ/ଦ୍ରାଘିମା	୨୦° ୪୫” ୪୬.୭୪’ ଉତ୍ତର ଅକ୍ଷାଂଶରୁ ୨୦° ୪୬” ୦୮.୯୬’ ୮୬° ୦୬” ୦୪.୭୭’ ପୂର୍ବ ଦ୍ରାଘିମାରୁ ୮୬° ୦୬” ୩୭.୯୮’ ଟପୋସିଟ୍ ନଂ ୭୩ ଏଲ୍ /୨
	ପରିମିତ ଅଂଚଳ	୧୪.୪୩ ହେକ୍ଟର
	ଜାଗାର କିସମ	ଅଣଜଙ୍ଗଲ ସରକାରୀ ଜମି
	ସର୍ବନିମ୍ନ ଦୂରତାରେ ଥିବା କ) ରାଷ୍ଟ୍ରୀୟ ସଡ଼କ	N.H. ୨୦୦ (୨ କି.ମି. ଦୂରରେ ଅବସ୍ଥିତ)
	ଖ) ରେଳମାର୍ଗ	ହରିଦାସପୁର ରେଳଷ୍ଟେସନ ୪.୫ km
	ଗ) ନଦୀ	ବ୍ରାହ୍ମଣୀ ନଦୀ ୨.୫ km
	ଘ) ନିକଟତମ ସହର	ଜେନାପୁର ୩ km

ଖ) ପାରିବେଶିକ ଦୃଷ୍ଟିକୋଣ

ସମ୍ଭାବ୍ୟ ପ୍ରଦୂଷଣ - ପ୍ରସ୍ତାବିତ ଖଣି ଖନନ ଯୋଗୁଁ ଭୂମି ଅବକ୍ଷୟ, ଭାସମାନ ଧୂଳିକଣା, ମୃତ୍ତିକା କ୍ଷୟ ପ୍ରଭୃତି ମୁଖ୍ୟଭାବରେ ପ୍ରଦୂଷଣର କାରଣ ବୋଲି ଆଶା କରାଯାଏ ।

ପରିବେଶୀୟ ପ୍ରଭାବ – ଖଣି ଚୁରିପଟେ ବାୟୁ ଓ ଭୂମି ପରିବେଶ ଉପରେ ସାମାନ୍ୟ କୁପ୍ରଭାବ ପଡ଼ିବ ଯାହାକି ପରେ ମାନବୀୟ, ସାମାଜିକ ତଥା ଅର୍ଥନୈତିକ ଲାଭଜନକ ଯୋଜନା ଦ୍ୱାରା କ୍ଷତି ଭରଣା ହୋଇପାରିବ ।

ବିସ୍ତୃତ ବିବରଣୀ :

କ୍ଲଷ୍ଟର-୩ ପଥର ଖଣି ବଜବାଟି ଗ୍ରାମ ୧୪.୪୩ ହେକ୍ଟର ପରିମିତ ଅଂଚଳରେ ଧର୍ମଶାଳା ତହସିଲ, ଜିଲ୍ଲା-ଯାଜପୁର, ରାଜ୍ୟ – ଓଡ଼ିଶା ଅଧିନରେ ଆସୁଅଛି । ଏହି କ୍ଷେତ୍ରଟି ଏକ ପାହାଡ଼ିଆ ଅଂଚଳର ପ୍ରତିନିଧିତ୍ୱ କରୁଛି ଯେଉଁଥିରେ ୬ଟି ପଟ୍ଟା ଅଂଚଳ ରହିଛି । ଓଡ଼ିଶା ସରକାରଙ୍କ ଭୂବିଜ୍ଞାନ ନିର୍ଦ୍ଦେଶକଙ୍କ ଦ୍ୱାରା ପତ୍ର ସଂଖ୍ୟା ୩୧୪ ତା ୧୯.୦୨.୨୦୨୦ ମାଧ୍ୟମରେ ଖଣି ଖନନ ଯୋଜନା ପାଇଁ ମଞ୍ଜୁରି ଦିଆଯାଇଥିଲା ।

କ୍ଲଷ୍ଟର-୨ ବଜବାଟି ପଥର ଖଣି ପାଇଁ ପଟ୍ଟା ଆକାରରେ ଦିଆଯାଇଥିବା ଖନନ କାର୍ଯ୍ୟ ନିମନ୍ତେ ଭାରତ ସରକାରଙ୍କ ପରିବେଶ ସଂଘାତ ଆକଳନ ଓ ପରିବେଶ ପରିଚାଳନା ନିର୍ଦ୍ଦେଶନାମା, ୨୦୦୬ ଅନୁଯାୟୀ ଜଙ୍ଗଲ ଓ ପରିବେଶ ମନ୍ତ୍ରଣାଳୟର ଅନୁମତି ଆବଶ୍ୟକ । ଏହି ପରିବେଶୀୟ ଅନୁମୋଦନ ପ୍ରାପ୍ତ କରିବା ନିମନ୍ତେ ତହସିଲଦାର, ଧର୍ମଶାଳା ତହସିଲ କଲ୍ୟାଣୀ ଲାବୋରେଟୋରିଜ୍ ପ୍ରାଇଭେଟ୍ ଲିମିଟେଡ୍ ପାହାଳ, ଭୁବନେଶ୍ୱରଙ୍କୁ ଦ୍ରୁତ ପରିବେଶ ସଂଘାତ ଆକଳନ ଓ ପରିବେଶ ପରିଚାଳନା ଯୋଜନା ପ୍ରସ୍ତୁତ କରିବାର ଦାୟିତ୍ୱ ଅର୍ପଣ କରିଛନ୍ତି । କଲ୍ୟାଣୀ ଲାବୋରେଟୋରିଜ୍ ପ୍ରାଇଭେଟ୍ ଲିମିଟେଡ୍ ମାର୍ଚ୍ଚ ୨୦୨୦ ରୁ ମେ ୨୦୨୦ ମାସ ମଧ୍ୟରେ ସମସ୍ତ ମୂଳତଥ୍ୟ ଏକାଠି କରି ଏହି ରିପୋର୍ଟ ପ୍ରସ୍ତୁତ କରିଛନ୍ତି ।

କ୍ଲଷ୍ଟର-୩ ବଜବାଟି ପଥର ଖଣିର ପଥର (ଘର ନିର୍ମାଣ ପାଇଁ) ଭୂବିଜ୍ଞାନ ଭଣ୍ଡାର (ସମ୍ଭାବିତ ଓ ସମ୍ଭବ) ଏବଂ ଖନନ ଯୋଗ୍ୟ ଭଣ୍ଡାର (ସମ୍ଭାବିତ / ପ୍ରମାଣିତ) ପରିସଂଖ୍ୟାନ ନିମ୍ନରେ ଦିଆଯାଇଛି :

ଭୂବିଜ୍ଞାନ ଭଣ୍ଡାର (ସମ୍ଭାବିତ ଓ ସମ୍ଭବ)	
କ୍ଲଷ୍ଟର-୩ (କ) ୯.୧୮ ହେକ୍ଟର	୨୨,୬୩,୩୮୮ ଘନମିଟର
କ୍ଲଷ୍ଟର-୩ (ଖ) ୪.୦୪ ହେକ୍ଟର	୫,୬୫,୭୪୦ ଘନମିଟର
କ୍ଲଷ୍ଟର-୩ (ଗ) ୧.୨୧ ହେକ୍ଟର	୧,୨୬,୯୩୨ ଘନମିଟର
ମୋଟ	୨୯,୫୬,୦୬୦ ଘନମିଟର
ଖନନ ଯୋଗ୍ୟ ଭଣ୍ଡାର (ସମ୍ଭାବିତ / ପ୍ରମାଣିତ)	
କ୍ଲଷ୍ଟର-୩ (କ) ୯.୧୮ ହେକ୍ଟର	୧୫,୨୨,୪୩୩ ଘନମିଟର
କ୍ଲଷ୍ଟର-୩ (ଖ) ୪.୦୪ ହେକ୍ଟର	୩,୫୩,୪୧୫ ଘନମିଟର
କ୍ଲଷ୍ଟର-୩ (ଗ) ୧.୨୧ ହେକ୍ଟର	୩୬,୫୧୯ ଘନମିଟର
ମୋଟ	୧୯,୧୨,୩୬୭ ଘନମିଟର

ଭୂବିଜ୍ଞାନ ଭଣ୍ଡାର ପରିସଂଖ୍ୟାନ :

କ୍ଲଷ୍ଟର ନାମ		ଲମ୍ବ (ଘନମିଟର)	ପଥରର ଘନତ୍ୱ (ଘନମିଟର)	ଖନନଯୋଗ୍ୟ ପଥର ଉତ୍ପାଦନ (ଘନମିଟର)	ଅସୁଲଯୋଗ୍ୟ ପଥର (ଘନମିଟର)	ବର୍ଜ୍ୟବସ୍ତୁ ମାତ୍ରା (ଘନମିଟର)	ମୃତ୍ତିକା କ୍ଷେତ୍ର ଅଂଚଳ (ଘନମିଟର)	ମୃତ୍ତିକାର ମାତ୍ରା (ଘନମିଟର)	ବର୍ଗ
କ		ଖ	ଗ	ଘ=ଖXଗ	ଙ=ଘX୦.୭୦	ଙ=ଘX୦.୩୦	ଚ	ଛ=ଚXଖ	ଜ
କ୍ଲଷ୍ଟର- ୩ (କ) ବଜବାଟି		୨୭୩	୧୦୭୮୨	୨୯୪୩୪୮୬	୨୦୬୦୪୪୦	୮୮୩୦୪୬	୨୧୮	୫୯୫୧୪	ସମ୍ଭାବିତ
		୨୭୩	୧୦୬୨	୨୮୯୯୨୬	୨୦୨୯୪୮	୮୬୯୭୮	--	--	ସମ୍ଭବ
	ମୋଟ			୩୨୩୩୪୧୨	୨୨୬୩୩୮୮	୯୭୦୦୨୪	--	୫୯୫୧୪	--
କ୍ଲଷ୍ଟର- ୩ (ଖ) ବଜବାଟି		୧୨୦	୫୭୧୧	୬୮୫୩୨୦	୪୭୯୭୨୪	୨୦୫୫୯୬	୮୨	୯୮୪୦	ସମ୍ଭାବିତ
		୧୨୦	୧୦୨୪	୧୨୨୮୮୦	୮୬୦୧୬	୩୬୮୬୪	--	--	ସମ୍ଭବ
	ମୋଟ			୮୦୮୨୦୦	୫୬୫୭୪୦	୨୪୨୪୬୦	--	୯୮୪୦	-
କ୍ଲଷ୍ଟର- ୩ (ଗ) ବଜବାଟି		୧୦୮	୧୩୨୦	୧୪୨୫୬୦	୯୯୭୯୨	୪୨୭୬୮	୫୬	୬୦୪୮	ସମ୍ଭାବିତ
		୧୦୮	୩୫୯	୩୮୭୭୨	୨୭୧୪୦	୧୧୬୩୨	--	--	ସମ୍ଭବ
	ମୋଟ			୧୮୧୩୩୨	୧୨୬୯୩୨	୫୪୪୦୦	--	୬୦୪୮	-

ଖନନ ଯୋଗ୍ୟ ଭଣ୍ଡାର ପରିସଂଖ୍ୟାନ :

କ୍ଲଷ୍ଟର ନାମ	ଲମ୍ବ (ଘନମିଟର)	ପଥରର ଘନତ୍ୱ (ଘନମିଟର)	ଖନନଯୋଗ୍ୟ ପଥର ଉତ୍ପାଦନ (ଘନମିଟର)	ଅସୁଲଯୋଗ୍ୟ ପଥର (ଘନମିଟର)	ବର୍ଜ୍ୟବସ୍ତୁ ମାତ୍ରା (ଘନମିଟର)	ମୃତ୍ତିକା କ୍ଷେତ୍ର ଅଂଚଳ (ଘନମିଟର)	ମୃତ୍ତିକାର ମାତ୍ରା (ଘନମିଟର)	ବର୍ଗ
କ	ଖ	ଗ	ଘ=ଖXଗ	ଙ=ଘX୦.୭୦	ଙ=ଘX୦.୩୦	ଚ	ଛ=ଚXଖ	ଜ
କ୍ଲଷ୍ଟର- ୩ (କ) ବଜବାଟି	216	୧୦୦୬୯	୨୧୭୪୯୦୪	୧୫୨୨୪୩୩୩	୬୫୨୪୭୧	୨୦୨	୪୩୬୩୨	ସମ୍ଭାବିତ
କ୍ଲଷ୍ଟର- ୩ (ଖ) ବଜବାଟି	106	୪୭୬୩	୫୦୪୮୭୮	୩୫୩୪୧୫	୧୫୧୪୬୩	୭୧	୭୫୨୬	ସମ୍ଭାବିତ
କ୍ଲଷ୍ଟର- ୩ (ଗ) ବଜବାଟି	94	୫୫୫	୫୨୧୭୦	୩୬୫୧୯	୧୫୬୫୧	୩୩	୩୧୦୨	ସମ୍ଭାବିତ

ଅର୍ଦ୍ଧଯନ୍ତ୍ରୀକୃତ ଖନନ କାର୍ଯ୍ୟ ପଦ୍ଧତିରେ ଖଣି ଖନନ କାର୍ଯ୍ୟ କରାଯିବ । ପଥରଗୁଡ଼ିକୁ ଧରିବା ପାଇଁ ମନୁଷ୍ୟକୃତ ତଥା ଯାନ୍ତ୍ରିକ ପଦ୍ଧତି ଅବଲମ୍ବନ କରାଯିବ । ପଥର ଖୋଳାଯାଇ ଓ ବିସ୍ଫୋରଣ କରାଯାଇ ପଥରଗୁଡ଼ିକୁ ଢ଼ିଲା କରାଯିବ । ଘର ନିର୍ମାଣ ପାଇଁ ଆବଶ୍ୟକ ପଡୁଥିବା ଅଧିକରୁ ଅଧିକ ୧୮ଲକ୍ଷ ଘନମିଟର ପଥର ଖୋଳି ବାହାର କରାଯିବ । ଯୋଜନା ଅବଧି ସମୟ ୧୦ବର୍ଷ ମଧ୍ୟରେ ଉତ୍ପାଦନ ସ୍ତର ନିର୍ଦ୍ଧାରଣ କରାଯିବ । ଉତ୍ପାଦନର ଲକ୍ଷ୍ୟ ନିମ୍ନୋକ୍ତ ସାରଣୀ ମାଧ୍ୟମରେ ଦର୍ଶାଯାଇଛି :

ବର୍ଷ	କ୍ଲଷ୍ଟର-୩(କ) ବଜବାଟି (ଘନମିଟର)	କ୍ଲଷ୍ଟର-୩(ଖ) ବଜବାଟି (ଘନମିଟର)	କ୍ଲଷ୍ଟର-୩(ଗ) ବଜବାଟି (ଘନମିଟର)	ସର୍ବମୋଟ (ଘନମିଟର)
୧ମ	୧,୫୦.୦୦୦	୩୦,୦୦୦	--	୧,୮୦.୦୦୦
୨ୟ	୧,୫୦.୦୦୦	୩୦,୦୦୦	--	୧,୮୦.୦୦୦
୩ୟ	୧,୫୦.୦୦୦	୩୦,୦୦୦	--	୧,୮୦.୦୦୦
୪ର୍ଥ	୧,୫୦.୦୦୦	୩୦,୦୦୦	--	୧,୮୦.୦୦୦
୫ମ	୧,୫୦.୦୦୦	୩୦,୦୦୦	--	୧,୮୦.୦୦୦
୬ଷ୍ଠ	୧,୫୦.୦୦୦	୩୦,୦୦୦	--	୧,୮୦.୦୦୦
୭ମ	୧,୫୦.୦୦୦	୩୦,୦୦୦	--	୧,୮୦.୦୦୦
୮ମ	୧,୫୦.୦୦୦	୩୦,୦୦୦	--	୧,୮୦.୦୦୦
୯ମ	୧,୫୦.୦୦୦	୩୦,୦୦୦	--	୧,୮୦.୦୦୦
୧୦ମ	୧,୫୦.୦୦୦	୩୦,୦୦୦	--	୧,୮୦.୦୦୦
ମୋଟ	୧୫.୦୦,୦୦୦	୩.୦୦,୦୦୦	--	୧୮.୦୦,୦୦୦

ପ୍ରସ୍ତାବିତ ପଥର ଖଣିରେ ୧୩୦ ଜଣ ଲୋକଙ୍କ ପାଇଁ ନିଯୁକ୍ତିର ସୁଯୋଗ ରହିବ । ସେଥିମଧ୍ୟରୁ ୧୫ ଜଣ କୁଶଳୀ ଶ୍ରମିକ, ୩୫ ଜଣ ଅର୍ଦ୍ଧକୁଶଳୀ ଶ୍ରମିକ, ୭୫ ଜଣ ଅଣକୁଶଳୀ ଶ୍ରମିକ ତଥା ୫ ଜଣ ପରିଚାଳକ ଓ ତତ୍ତ୍ୱାବଧାରକ ଭାବରେ କାର୍ଯ୍ୟ କରିବେ । ଏହି ଖଣିର ପଥର ମାଟି ମିଶ୍ରିତ ତଥା ଗ୍ରାନାଇଟ ଯୋଗ୍ୟ ଅଟେ । ଏହି ମୃତ୍ତିକାକୁ ଚିହ୍ନିତ କରାଯାଇଥିବା ଘାଇରେ ରଖାଯିବ ଓ ବୃକ୍ଷରୋପଣ ନିମନ୍ତେ ଉପଯୋଗ କରାଯିବ । ଖନନ ସମୟରେ ୩୦ ପ୍ରତିଶତରୁ ଅଧିକ କଚରା ସଡ଼କ ନିର୍ମାଣ ପାଇଁ ଉପଯୋଗ କରାଯିବ । ସାଧାରଣତଃ ଦୁଇ ତୃତୀୟାଂଶ କଚରା କ୍ରସର ଥିବା ସ୍ଥାନକୁ ପଠାଯିବ ।

ପରିବେଶର ବର୍ତ୍ତମାନ ସ୍ଥିତି :

ଖଣି ଖନନ କାର୍ଯ୍ୟ ପାଇଁ ପରିବେଶ ସଂଘାତ ଆକଳନ କରିବା ଲକ୍ଷ୍ୟରେ ପ୍ରସ୍ତାବିତ ପ୍ରକଳ୍ପର କେନ୍ଦ୍ରାଂଚଳ ଓ ୧୦ କି.ମି. ବ୍ୟାସାର୍ଦ୍ଧରେ ଥିବା ପାର୍ଶ୍ୱବର୍ତ୍ତୀ ଅଂଚଳ ମଧ୍ୟରେ ପରିବେଶ ସମ୍ବନ୍ଧୀୟ ପ୍ରାଥମିକ ତଥ୍ୟ ହାସଲ କରିବା ପାଇଁ ଏକ ସଦ୍ଧ ସାମୟିକ ସ୍ଥାନୀୟ କ୍ଷେତ୍ର ଅଧ୍ୟୟନ ମାର୍ଚ୍ଚ ୨୦୨୦ ରୁ ମେ ୨୦୨୦ ମାସ ମଧ୍ୟରେ କଲ୍ୟାଣୀ ଲାବୋରେଟୋରିଜ୍ ପ୍ରାଇଭେଟ୍ ଲିମିଟେଡ୍, ଭୁବନେଶ୍ୱର (NABL ଏବଂ MoEF ସ୍ୱୀକୃତିପ୍ରାପ୍ତ ପରୀକ୍ଷାଗାର) ଦ୍ୱାରା କରାଯାଇଥିଲା ।

ଏହି ଖଣି ଅଂଚଳ ଯାଜପୁର ଜିଲ୍ଲାର ବଜବାଟି ଗ୍ରାମରେ ଅବସ୍ଥିତ । ଏହା ଟପୋସିଟ ନଂ 73 L/2 ରେ ଦର୍ଶାଯାଇଛି । ଏହି ଅଂଚଳ ୨୦° ୪୫" ୪୬.୭୪' ଉତ୍ତର ଅକ୍ଷାଂଶରୁ ୨୦° ୪୬" ୦୮.୯୬' ୮୬° ୦୬" ୦୪.୭୭' ପୂର୍ବ ଦ୍ରାଘିମାରୁ ୮୬° ୦୬" ୩୭.୯୮' ପୂର୍ବ ଦ୍ରାଘିମାରେ ଅବସ୍ଥିତ । ଏହି ଅଂଚଳ ଜେନାପୁର ଠାରୁ ୩ କି.ମି. ଦୂରରେ ଅବସ୍ଥିତ ।

ବର୍ଷାଦିନେ ଭୂତଳ ଜଳସ୍ତର ଭୂପୃଷ୍ଠଠାରୁ ୩ ମିଟର ଗ୍ରୀଷ୍ମଦିନରେ ୮ ମିଟର ନିମ୍ନରେ ରହିବ । ବର୍ଷାଦିନେ ବର୍ଷାଜଳ ଖଣି ଅଂଚଳ ମଧ୍ୟକୁ ପ୍ରବେଶ କରିବାର ସମ୍ଭାବନା ଅଛି । ଏହି ଜଳକୁ ନିଷ୍କାସନ କରିବା ପାଇଁ ୫ଏଚ୍.ପି. ଡିଜେଲ ପମ୍ପର ବ୍ୟବସ୍ଥା କରିବା ପାଇଁ ପ୍ରସ୍ତାବ ଦିଆଯାଉଛି । ଏହି ଅଂଚଳର ମୁଖ୍ୟ ବ୍ରାହ୍ମଣୀ ନଦୀ ଦ୍ୱାରା ପରିପ୍ଲାବିତ ।

ଏହି ଖଣି ଅଂଚଳଟି ୧୪.୪୩ ହେକ୍ଟର ପରିବ୍ୟାପ୍ତ ଓ ମୁଖ୍ୟତଃ ପାହାଡ଼ିଆ ଜମିକୁ ନେଇ ସୃଷ୍ଟ । ଏହା କୌଣସି ଐତିହାସିକ ଓ ସାଂସ୍କୃତିକ ଦୃଷ୍ଟିକୋଣରୁ ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ନୁହେଁ । ଅଧ୍ୟୟନ ଅଂଚଳର ଜମି ପ୍ରକାର ଭେଦରୁ ଜଣାଯାଏ ଯେ ଏଠାକାର ଜମିର ମୁଖ୍ୟ ବ୍ୟବହାର ରୁଷପଯୋଗୀ ଜମି ୪୮.୭୦ ପ୍ରତିଶତ, ଜଙ୍ଗଲ ଜମି ୩.୯ ପ୍ରତିଶତ, ନଦୀ ତଥା ଜଳାଶୟ ୧୭.୮୩ ପ୍ରତିଶତ ଓ ଅନାବାଦି ଜମି ୧୯.୨୦ ପ୍ରତିଶତ ଅଟେ ।

ଏଠାକାର ଜଳବାୟୁ ଗରମ ଅଟେ । ଏଠାରେ ଗ୍ରୀଷ୍ମଋତୁ ଅତି ପ୍ରଖର ଅଟେ । ଏଠାରେ ମୁଖ୍ୟତଃ ତିନୋଟି ଋତୁ ଅନୁଭୂତ ହୁଏ । ଗ୍ରୀଷ୍ମଋତୁ ମାର୍ଚ୍ଚ ମାସରୁ ଆରମ୍ଭ ହୋଇ ମେ ମାସ ପର୍ଯ୍ୟନ୍ତ ଲାଗି ରହେ । ଏହି ସମୟରେ ସର୍ବାଧିକ ତାପମାତ୍ରା ୪୬°C ହୋଇଥାଏ । ବର୍ଷାଋତୁ ଜୁନ ମାସ ମଧ୍ୟଭାଗରୁ ସେପ୍ଟେମ୍ବର ମାସ ମଧ୍ୟଭାଗ ପର୍ଯ୍ୟନ୍ତ ଲାଗି ରହେ । ଦକ୍ଷିଣ ପଶ୍ଚିମ ମୌସୁମୀ ବାୟୁ ଏହି ସମୟରେ ସକ୍ରିୟ ହୋଇ ସର୍ବାଧିକ ବୃଷ୍ଟିପାତ କରାଇଥାଏ । ବର୍ଷାଋତୁ ଅବଧି ଶେଷ ହେବା ପରେ ଦିନର ତାପମାତ୍ରା କିଛି ମାତ୍ରାରେ ବୃଦ୍ଧି ପାଏ ଏବଂ ରାତିରେ ତାପମାତ୍ରାର ପରିବର୍ତ୍ତନ ଆସିଥାଏ । ଡିସେମ୍ବରରୁ ଫେବୃୟାରୀ ପର୍ଯ୍ୟନ୍ତ ଶୀତଋତୁର ପ୍ରକୋପ ଅନୁଭୂତ ହୁଏ । ଏହି ଜିଲ୍ଲାର ବାର୍ଷିକ ହାରାହାରି ବୃଷ୍ଟିପାତ ୧୫୫୦ ମି.ମି. ଅଟେ ।

ପରିବେଷ୍ଟନୀ ବାୟୁର ଗୁଣବତା ପରୀକ୍ଷଣ ପାଇଁ ୮ଟି ଗ୍ରାମକୁ ମାର୍ଚ୍ଚରୁ ମେ ମାସ ପର୍ଯ୍ୟନ୍ତ ବାୟୁର ନମୁନା ସଂଗ୍ରହ କରାଯାଇଥିଲା । ଏହି ବାୟୁରେ ଭାସମାନ ପଦାର୍ଥର ମାତ୍ରା (ପି.ଏମ୍. ୧୦) ୩୫.୦୨ – ୮୦.୦ ମାଇକ୍ରୋଗ୍ରାମ/ଘନ ମି., ଭାସମାନ ପଦାର୍ଥ (ପି.ଏମ୍. ୨.୫) ମାତ୍ରା ୨୧.୦୧-୪୩.୫ ମାଇକ୍ରୋଗ୍ରାମ/ଘନ ମି.,ସଲଫର ଡାଇଅକ୍ସାଇଡ଼ ୪ ରୁ ୧୦.୪ ମାଇକ୍ରୋଗ୍ରାମ/ଘନ ମି. ଏବଂ ନାଇଟ୍ରୋଜେନ ଡାଇଅକ୍ସାଇଡ଼ର ମାତ୍ରା ୯.୧ ରୁ ୨୦.୪ ମାଇକ୍ରୋଗ୍ରାମ/ଘନ ମି. ରହିଛି । ଏହି ମାତ୍ରା କେନ୍ଦ୍ରୀୟ ପ୍ରଦୂଷଣ ନିୟନ୍ତ୍ରଣ ପରିଷଦ ଦ୍ୱାରା ସ୍ଥିରୀକୃତ ଜାତୀୟ ଭୂପୃଷ୍ଠ ବାୟୁର ନିର୍ଦ୍ଧାରିତ ମାନାଙ୍କଠାରୁ ଯଥେଷ୍ଟ କମ୍ ରହିଛି । ଭାସମାନ ପଦାର୍ଥ, ଶ୍ୱାସନୀୟ ଭାସମାନ ପଦାର୍ଥ ଓ ସଲଫର ଡାଇଅକ୍ସାଇଡ଼ର ମାନାଙ୍କ ଗ୍ରାମାଂଚଳ ପାଇଁ ଯଥାକ୍ରମେ ୧୦୦ ମାଇକ୍ରୋଗ୍ରାମ/ଘନ.ମି. ୬୦ ମାଇକ୍ରୋଗ୍ରାମ/ଘନ.ମି. ଅଟେ ।

ଭୂପୃଷ୍ଠ ଜଳର ନମୁନା ୮ଟି ସ୍ଥାନରୁ ସଂଗ୍ରହ କରାଯାଇଥିଲା ଏବଂ ଏଥି ମଧ୍ୟରେ ନଦୀ, ନାଳ ଓ ପୋଖରୀର ଜଳ ଅନ୍ତର୍ଭୁକ୍ତ । ଏହି ଜଳର ପି.ଏଚ୍. ୭.୩ ରୁ ୮ ଓ ଏହା ନିଷ୍ତ୍ରିୟ ଅଟେ । ଏହି ଜଳର ବୈଦ୍ୟୁତିକ ପରିବାହିତା ୧୪୪-୪୮୦ µs/cm ଅଟେ । ଏଥିରୁ ଜଣାଯାଏ ଯେ ଏହି ଜଳ ବିଶେଷ ଭାବରେ ଜୈବିକ ଭାବରେ ପ୍ରଦୂଷିତ ହୋଇନାହିଁ । ଏହି ଜଳର ଦ୍ରବୀଭୂତ ଅମ୍ଳଜାନ ମାତ୍ରା ୫.୬ ରୁ ୭.୨ ମି.ଗ୍ରା./ଲି । ବି.ଓ.ଡ଼ି. ର ମାତ୍ରା ୪ ରୁ ୧୦ ମି.ଗ୍ରା./ଲି ରହୁଛି । ଏଥିରେ କପର, ଲେଡ୍, ନିକେଲ, ଭାନାଡ଼ିୟମ୍, କ୍ରୋମିୟମ୍, ସିୟାନାଇଡ୍, ଫ୍ଲୋରାଇଡ୍, ତୈଳ ଓ ଗ୍ରୀସ୍ ଇତ୍ୟାଦି ନାହିଁ । ଭୂପୃଷ୍ଠ ଜଳର ପରୀକ୍ଷଣରୁ ଜଣାଯାଏ ଯେ, ଏହି ଜଳର ସମସ୍ତ ଉପାଦାନ ନିର୍ଣ୍ଣାୟକ ମାନାଙ୍କ ମଧ୍ୟରେ ରହିଛି ଓ ଏହା ମନୁଷ୍ୟ, ପଶୁପକ୍ଷୀ ଓ କୃଷି କାର୍ଯ୍ୟରେ ବ୍ୟବହାର ପାଇଁ ଉପଯୋଗୀ ଅଟେ ।

ଭୂତଳ ଜଳର ନମୁନା ୮ଟି ସ୍ଥାନରୁ ସଂଗ୍ରହ କରାଯାଇଥିଲା । ଭୂତଳ ଜଳର ପରୀକ୍ଷଣର ଫଳାଫଳରୁ ଜଣାଯାଏ ଯେ, ଏହି ଜଳର ପି.ଏଚ. ୬.୭ ରୁ ୭.୨ ଓ ଏହା ନିଷ୍ତ୍ରିୟ ଅଟେ । ଏହାର କଠିନତା ୧୪୪-୭୧୨ ମି.ଗ୍ରା./ଲି ,ଦ୍ରବୀଭୂତ କଠିନ ପଦାର୍ଥର ମାତ୍ରା ୨୭୦ ରୁ ୧୪୫୦ ମି.ଗ୍ରା./ଲି. ଅଟେ ।

ଆଲକାଲିନିଟିର ମାତ୍ରା ୯୦ ରୁ ୪୬୯ ମି.ଗ୍ରା./ଲି । ଭୂତଳ ଓ ଭୂପୃଷ୍ଠ ଜଳର ପରୀକ୍ଷଣର ସବିଶେଷ ବିବରଣୀ ପରିବେଶ ସଂଘାତ ଆକଳନ ଓ ପରିଚ୍ଛଳନା ଯୋଜନାର ତୃତୀୟ ଅଧ୍ୟାୟରେ ଦିଆଯାଇଛି । ଭୂତଳ ଜଳର ପରୀକ୍ଷଣର ଫଳାଫଳରୁ ଜଣାଯାଏ ଯେ, ଏହି ଜଳ ପାନୀୟ ଉପଯୋଗୀ ଅଟେ ।

ଏହି ଅଂଚଳର ପରିବେଷ୍ଟନୀ ଧ୍ୱନୀର ମାତ୍ରା ନିର୍ଦ୍ଧାରିତ ମାନାଙ୍କ ମଧ୍ୟରେ ରହିଛି । ୮ଟି ନମୁନା ସଂଗ୍ରହ କେନ୍ଦ୍ରରେ ଧ୍ୱନୀର ମାତ୍ରା ଆକଳନ କରାଯାଇଥିଲା । ପ୍ରକଳ୍ପ ଅଂଚଳରେ ଧ୍ୱନୀର ମାତ୍ରା ଦିନ ସମୟରେ ୫୬.୮ ଡେସିବଲ ଓ ରାତ୍ର ସମୟରେ ୪୬.୨ ଡେସିବଲ ରେକର୍ଡ଼ କରାଯାଇଛି ଯାହା କି ଅନୁମୋଦିତ ମାତ୍ରା ମଧ୍ୟରେ ରହିଛି । ବଫର ଅଂଚଳରେ ଦିନ ସମୟରେ ଶବ୍ଦର ମାତ୍ରା ୪୪.୩ ରୁ ୫୬.୪ ଡେସିବଲ ଓ ରାତ୍ର ସମୟରେ ୩୧.୨ ରୁ ୪୦.୨ ଡେସିବଲ ରେକର୍ଡ଼ କରାଯାଇଛି ।

ଅଧ୍ୟୟନର ୧୦ କି.ମି. ବ୍ୟାସାର୍ଦ୍ଧ ମଧ୍ୟରେ ମୃତ୍ତିକାର ନମୁନା ଗ୍ରାମରୁ ସଂଗ୍ରହ କରାଯାଇଥିଲା । ଏହାର ଉପଲବ୍ଧ ନାଇଟ୍ରୋଜେନର ମାତ୍ରା ୧୨୧୦ ରୁ ୧୮୧୪ କେ.ଜି./ ହେକ୍ଟର, ପଟାସିଅମର ପରିମାଣ ୧୩୪ ରୁ ୪୮୨ କେ.ଜି./ହେକ୍ଟର, ଫସଫରସର ପରିମାଣ ୧୩ ରୁ ୪୯ କେ.ଜି./ହେକ୍ଟର । ଅର୍ଗାନିକ କାର୍ବନର ମାତ୍ରା ୦.୩୬ ରୁ ୨.୩୭ ପ୍ରତିଶତ ମଧ୍ୟରେ ରହୁଛି । ମୃତ୍ତିକା ପରୀକ୍ଷଣର ଫଳାଫଳରୁ ଜଣାଯାଏ ଯେ, ଏଠାକାର ମୃତ୍ତିକା ମଧ୍ୟମ ଧରଣର ଉର୍ବର ।

ଏହି ଜଙ୍ଗଲରେ ଜଳବାୟୁ, ମୃତ୍ତିକା, ଉଚ୍ଚତା ଇତ୍ୟାଦିରେ ବୈଷମ୍ୟତା ରହିଥିବାରୁ ଏଠାକାର ଜୈବ ବିବିଧତା ଅଧିକ । ଏଠାକାର ମୁଖ୍ୟ ବୃକ୍ଷଲତାଗୁଡ଼ିକ ହେଲା – କାଜୁ, ନିମ୍ବ, ଖଜୁରୀ, ଶାଳ, ଓସ୍ତଗଛ, ତାଳଗଛ, ବାଉଁଶ, କେନ୍ଦୁ, ଶାଗୁଆନ, ଶିମିଳି, ସୁନାରୀ, ଅଗସ୍ତି, ନିର୍ଗୁଣ୍ଡି ଇତ୍ୟାଦି । ତେବେ ବିଗତ ଶହେ ବର୍ଷ ମଧ୍ୟରେ ପ୍ରାକୃତିକ ବିପର୍ଯ୍ୟୟ ତଥା ଅନ୍ୟାନ୍ୟ କାରଣ ଯୋଗୁ ଜଙ୍ଗଲ ସମ୍ପଦ ନଷ୍ଟ ହୋଇଆସୁଛି ।

ଅଧ୍ୟୟନ ଅଂଚଳରେ ୫୭ଟି ଗ୍ରାମ ରହିଛି ଓ ଏଠାକାର ସମୁଦାୟ ଜନସଂଖ୍ୟା ୪୯୦୮୯ (୨୦୧୧ ଜନଗଣନା, ଓଡ଼ିଶା) ଓ ଘର ସଂଖ୍ୟା ୧୦୯୦୦ ଅଛି । ସମୁଦାୟ ଜନସଂଖ୍ୟାରୁ ୨୫୧୭୧ ଜଣ ପୁରୁଷ ଓ ୨୩୯୧୮ ଜଣ ମହିଳା ଅଟନ୍ତି । ଏହି ଅଂଚଳର ଜନସଂଖ୍ୟା ମଧ୍ୟରୁ ୧୧୬୩୨ ତଫସିଲ ଭୁକ୍ତ ଜାତି ଓ ୫୨୩୮ ତଫସିଲ ଭୁକ୍ତ ଜନ ଜାତିର ଅନ୍ତର୍ଗତ । ସମୁଦାୟ ଜନସଂଖ୍ୟାରୁ ୩୪୪୧୯ ଜଣ ଶିକ୍ଷିତ ଅଟନ୍ତି ଓ ଏହା ସମୁଦାୟ ଜନସଂଖ୍ୟାର ୭୦ ଶତକଡ଼ା ଅଟେ । ସମୁଦାୟ ଶିକ୍ଷିତ ମଧ୍ୟରୁ ୧୯୧୦୯ ଜଣ ପୁରୁଷ ଓ ୧୫୩୧୦ ଜଣ ମହିଳା ଅଟନ୍ତି ।

ଅଧ୍ୟୟନ ଅଂଚଳରେ ୧୫୮୧୫ ଜଣ ରୋଜଗାରକ୍ଷମ ଅଟନ୍ତି । ପୁରୁଷ ଶ୍ରମଜୀବିଙ୍କ ସଂଖ୍ୟା ୧୩୯୦୦ ଥିବା ବେଳେ ମହିଳା ଶ୍ରମଜୀବିଙ୍କ ସଂଖ୍ୟା ୧୯୧୫ ଅଟେ । ସେଥିମଧ୍ୟରୁ ୧୧୯୧୩ ଜଣ ମୁଖ୍ୟ ଶ୍ରମଜୀବି ଓ ୩୯୦୨ ଜଣ ସାଧାରଣ ଶ୍ରମଜୀବି ଅଟନ୍ତି ।

ପରିବେଶ ସଂଘାତ ଆକଳନ :

ବର୍ତ୍ତମାନର ପରିବେଶ ସଂଘାତ ଆକଳନ ଏକ ଦ୍ରୁତ ପ୍ରକ୍ରିୟା ଯାହା କି ଯାଜପୁର ଜିଲ୍ଲାର ବଜବାଟି ଗ୍ରାମରେ ପ୍ରସ୍ତାବିତ ଖଣି ଖନନ କାର୍ଯ୍ୟ ଦ୍ୱାରା ସୃଷ୍ଟି ହେବାକୁ ଥିବା ପରିବେଶ ପ୍ରଦୂଷଣର କାରଣ ଓ ପ୍ରଭାବର ଗଭୀରତାକୁ ଆକଳନ କରୁଅଛି । ଏହି ପାହାଡ଼ ଖଣି ୩ଟି ଉପାଂଚଳକୁ ନେଇ ଗଠିତ, ଯଥା : କ୍ଲଷ୍ଟର- ୩ (କ), କ୍ଲଷ୍ଟର- ୩ (ଖ) ଓ କ୍ଲଷ୍ଟର- ୩ (ଗ) ।

ଭୂମି ଓ ଭୂମିରୂପ ଉପରେ ପ୍ରଭାବ :

- ଏହି ପଟ୍ଟା ଅଂଚଳରେ ଖଣି ଖନନ, ବର୍ଜ୍ୟବସ୍ତୁ ଗଦାଇବା ଓ ଆନୁସଙ୍ଗିକ ଭିତ୍ତିଭୂମି ନିର୍ମାଣ ଯୋଗୁଁ ଭୂମିରୂପର ପରିବର୍ତ୍ତନ ହେବାର ଆଶା କରାଯାଏ । ଖନନ ସମୟରେ ଉପର ମୃତ୍ତିକାକୁ ଅଲଗା ରଖାଯାଇ ବୃକ୍ଷରୋପଣ କାର୍ଯ୍ୟରେ ଲଗାଯିବ । ଖଣିର ଅବଧି ଶେଷ ହେବା ପରେ କ୍ଲଷ୍ଟର- ୩ (କ) ର ପରିମିତ ଅଂଚଳ ୯.୧୮ ହେକ୍ଟରରୁ ୭.୩୩ ହେକ୍ଟର, କ୍ଲଷ୍ଟର- ୩ (ଖ) ର ପରିମିତ ଅଂଚଳ ୪.୦୪ ହେକ୍ଟରରୁ ୩.୩୭ ହେକ୍ଟର ଓ କ୍ଲଷ୍ଟର- ୩ (ଗ) ର ପରିମିତ ଅଂଚଳ ୧.୨୧ ହେକ୍ଟରରୁ ୦.୯୮ ହେକ୍ଟରରେ ରୂପାନ୍ତରିତ ହେବ ।
- ବର୍ଷା ଖଣିରୁ ନିର୍ଗତ ଜଳରେ କେବଳ ଭାସମାନ ତଥା ଦ୍ରବୀଭୂତ କଠିନ ପଦାର୍ଥର ମାତ୍ରା ବେଶୀ ହୋଇପାରେ ।
- ଖଣିରୁ ପ୍ରବାହିତ ଜଳ ପାଖରେ ଥିବା ଚାଷ ଜମି ପାଇଁ ଜଳସେଚନ କାର୍ଯ୍ୟରେ ଲାଗିପାରିବ ।

ପରିଚାଳନା ଯୋଜନା :

- ଖନନ ସମୟରେ ଉପର ମୃତ୍ତିକାକୁ ଅଲଗା ରଖାଯାଇ ବୃକ୍ଷରୋପଣ କାର୍ଯ୍ୟରେ ଲଗାଯିବ ।
- ଖଣି ମଧ୍ୟରେ ବର୍ଷାଜଳ ସଂରକ୍ଷଣ ପଦ୍ଧତି ଅବଲମ୍ବନ କରାଯିବ ।
- ଖଣି ଅଂଚଳରେ ବର୍ଜ୍ୟବସ୍ତୁ ଗଦା ଅସ୍ଥାୟୀ ରୂପେ କାର୍ଯ୍ୟ କରିବ ।

ପରିବେଷ୍ଟନୀ ବାୟୁ ଉପରେ ପ୍ରଭାବ ଓ ପରିଚାଳନା ଯୋଜନା :

ଖଣି ଖନନ ଓ ତତ୍ ସଂଲଗ୍ନ ଦ୍ୱାରା ବାୟୁ ଉପରେ ପ୍ରଭାବ ପଡ଼ିବାର ସମ୍ଭାବନା ଅଛି । ଏହି ଖଣି ଦ୍ୱାରା ବାୟୁ ଉପରେ ପ୍ରଭାବ ପଡ଼ିବାର କାରଣ ଗୁଡ଼ିକ ହେଲା ଖନନ ପ୍ରକ୍ରିୟା, ବର୍ଜ୍ୟବସ୍ତୁ ପରିବହନ ଇତ୍ୟାଦି ।

- ଧୂଳିକଣାଜନିତ ପ୍ରଦୂଷଣର ମାତ୍ରା ଖଣି ଉତ୍ସ ନିକଟରେ ସର୍ବାଧିକ ଓ ଏହାର ମାତ୍ରା ଉତ୍ସଠାରୁ ଦୂରତା ଅନୁସାରେ କମ୍ ହୋଇଥାଏ ।

- ଧୂଳିକଣାଜନିତ ପ୍ରଦୂଷରର ମାତ୍ରା ଖଣି ଉତ୍ସ ନିକଟରେ ସର୍ବାଧିକ ହୋଇଥିବାରୁ ଏହାଦ୍ୱାରା ପାର୍ଶ୍ୱବର୍ତ୍ତୀ ଜନବସତି ଉପରେ ବିଶେଷ ପ୍ରଭାବ ପଡ଼ିବ ନାହିଁ ବୋଲି ଆଶା କରାଯାଏ ।
- ମୁଖ୍ୟ ବାୟୁ ପ୍ରଦୂଷଣର ସ୍ଥାନଗୁଡ଼ିକ ହେଲା ଖଣି ଖନନ ଗର୍ତ୍ତ, ଖଣି ରାସ୍ତା ଇତ୍ୟାଦି । ଭର୍ତ୍ତି କରିବା ଓ ଖଲାସ କରିବା କାର୍ଯ୍ୟ ସମୟରେ ଓ ଖଣିର ମାଟି ରାସ୍ତାରେ ଜଳ ସିଂଚନ ଦ୍ୱାରା ଭାସମାନ ଧୂଳିକଣାର ପରିମାଣ ହ୍ରାସ କରାଯାଇପାରିବ ।
- ବର୍ଜ୍ୟବସ୍ତୁ ଗଦାରେ ମଧ୍ୟ ଜଳ ସିଂଚନ କରାଯିବ ଓ ତା ଉପରେ ଘାସ ଲଗାଯିବା ଦ୍ୱାରା ବାୟୁରେ ଭାସମାନ ଧୂଳିକଣାର ପରିମାଣ ହ୍ରାସ କରାଯାଇପାରିବ ।
- ସବୁଜ ବଳୟରେ ଧୂଳିକଣାକୁ ଧରି ରଖିବା ପରି ବୃକ୍ଷରୋପଣ କରାଯିବ ଯଥା ସୁନାରୀ, ଶିମିଳି, ନିମ, ଗଙ୍ଗଶିଉଳି, ପିଜୁଳି, ଶାଗୁଆନ ଇତ୍ୟାଦି ।

ପରିବେଷ୍ଟନୀ ଧ୍ୱନୀ ଉପରେ ପ୍ରଭାବ ଓ ପରିଚାଳନା ଯୋଜନା :

ପଥର ଖୋଳିବା କାର୍ଯ୍ୟ ମାନବୀକୃତ ଭୂଉପରିସ୍ଥ ଖଣି ଖନନ ପଦ୍ଧତି ଦ୍ୱାରା ହେବ । ଏହି ପ୍ରକ୍ରିୟାରେ ବିସ୍ଫୋରକ ସାମଗ୍ରୀର ବ୍ୟବହାର ଦ୍ୱାରା ଶବ୍ଦ ପ୍ରଦୂଷଣ ଜାତ ହେବ । ମୋଟାମୋଟି ଭାବରେ ପ୍ରତିବର୍ଷ ୧,୮୦,୦୦୦ ଘନମିଟର ପଥର ଉତ୍ପାଦନ ପାଇଁ ହାରାହାରି ୭୫୦୦ କେ.ଜି. ପ୍ରତିମାସ ହିସାବରେ ବିସ୍ଫୋରକ ବ୍ୟବହୃତ ହେବ ଯେଉଁଥିରେ ପାଉଡ଼ର ମାତ୍ରା ୨ଘନମିଟର/କେ.ଜି. ରହିବ । ଗ୍ରାମବାସୀମାନଙ୍କୁ ଆଗରୁ ଖବର ଦିଆଯାଇ ଦିନ ୧୨ଟାରୁ ୧୨.୩୦ ମଧ୍ୟରେ ବିସ୍ଫୋରଣ କରାଯିବ ।

ଏହି ପ୍ରକ୍ରିୟା ଦ୍ୱାରା ଶବ୍ଦ ପ୍ରଦୂଷଣର ମୁଖ୍ୟତଃ ଡିଜେଲ ଚାଳିତ ଯନ୍ତ୍ରପାତିର ପରିଚାଳନା ଓ ଗାଡ଼ି ମଟର ଚାଲିବା ଦ୍ୱାରା ହୋଇଥାଏ । ଶବ୍ଦ ପ୍ରଦୂଷଣର ଏହି କାରଣଗୁଡ଼ିକ ସାମୟିକ ଭାବରେ ହୋଇଥାଏ । ଏହାଛଡ଼ା ଖଣିଜ ପଦାର୍ଥର ପରିବହନ ଦ୍ୱାରା କିଛି ମାତ୍ରାରେ ଶବ୍ଦ ପ୍ରଦୂଷଣର ସମ୍ଭାବନା ରହିଛି ।

ଶବ୍ଦ ପ୍ରଦୂଷଣ କମ ପରିବା ପାଇଁ ଡିଜେଲଚ୍ଚାଳିତ ସମସ୍ତ ଯନ୍ତ୍ରପାତିର ଉପଯୁକ୍ତ ରକ୍ଷଣାବେକ୍ଷଣ ଓ ସ୍ଥାୟୀ ଯନ୍ତ୍ରପାତିଗୁଡ଼ିକୁ ଯେତେଦୂର ସମ୍ଭବ ଆବଦ୍ଧ ସ୍ଥାନରେ ରଖାଯିବାର ବ୍ୟବସ୍ଥା କରାଯିବ । ଶ୍ରମିକମାନଙ୍କୁ ବ୍ୟକ୍ତିଗତ ରକ୍ଷାକାରୀ ଉପକରଣ ଯୋଗାଇ ଦିଆଯିବ । ଖଣି ଅଂଚଳର ଚତୁଃପାର୍ଶ୍ୱରେ ବୃକ୍ଷରୋପଣ କରାଯିବ ଯାହାଦ୍ୱାରା କି ଶବ୍ଦ ପ୍ରଦୂଷଣକୁ ରୋକାଯାଇପାରିବ ।

ଜଳ ଉପରେ ପ୍ରଭାବ :

ଏହି ଅଂଚଳର ମୁଖ୍ୟ ନଦୀ ଲିଜ ଅଂଚଳଠାରୁ ୨.୫ କି.ମି. ଦୂରରେ ଅବସ୍ଥିତ । ଲିଜ ଅଂଚଳ ମଧ୍ୟରେ କୌଣସି ନାଳ ପ୍ରବାହିତ ହେଉନାହିଁ । ଏହି ଅଂଚଳରେ ଭୂତଳ ଜଳ ବର୍ଷାଋତୁରେ ଭୂପୃଷ୍ଠରୁ ୩ମି. ଗଭୀରତାରେ ଓ ଗ୍ରୀଷ୍ମଋତୁରେ ୮ମି. ଗଭୀରତାରେ ରହିଥାଏ । ସ୍ଥାନୀୟ ଅଂଚଳର ଭୂତଳ ଜଳସ୍ତର ଉପରେ ଖଣି ଖନନର ପ୍ରଭାବ ଜାଣିବା ପାଇଁ ଏକ ଅନୁଧ୍ୟାନ କରାଯାଇଛି ଓ ତଦନୁଯାୟୀ ପରିଚାଳନା ଯୋଜନା ପ୍ରସ୍ତୁତ କରାଯାଇଛି ।

ପ୍ରତିଦିନ ୨୦ କିଲୋଲିଟର ଜଳର ଆବଶ୍ୟକତା ଥିବାବେଳେ ପାନୀୟ ତଥା ଗୃହପଯୋଗୀ ଜଳ ୧୫ କିଲୋଲିଟର, ଧୂଳିକଣା ହ୍ରାସ ପାଇଁ ୩ କିଲୋଲିଟର ଏବଂ ବୃକ୍ଷରୋପଣ ଉଦ୍ଦେଶ୍ୟରେ ୨ କିଲୋଲିଟର ଜଳ ଆବଶ୍ୟକ ହେବ । ଉପରୋକ୍ତ ଜଳର ମୁଖ୍ୟ ଉତ୍ସ ଭୂତଳ ଜଳ ଏବଂ ସଂରକ୍ଷିତ ବର୍ଷାଜଳ ଅଟେ ।

ବର୍ଜ୍ୟବସ୍ତୁ ଗଦାଗୁଡ଼ିକ ବର୍ଷାଦିନେ ଧୋଇହୋଇଯାଇ ଭୂପୃଷ୍ଠଜଳ ପ୍ରଦୂଷଣ କରିବାର ସମ୍ଭାବନା ରହିଥାଏ । ଖଣି ଖନନ ସ୍ଥାନରେ ମଧ୍ୟ ଗଦା ହୋଇଥିବା ଖଣିଜ ପଦାର୍ଥ ଓ ବର୍ଜ୍ୟବସ୍ତୁ ଧୋଇ ହୋଇଯିବାର ସମ୍ଭାବନା ରହିଥାଏ । ନିମ୍ନଲିଖିତ କାରଣଗୁଡ଼ିକ ଦ୍ୱାରା ଭୂପୃଷ୍ଠ ଜଳ ପ୍ରଦୂଷଣ ହୋଇପାରେ :-

- ବର୍ଜ୍ୟବସ୍ତୁ ଗଦାଗୁଡ଼ିକରୁ ବର୍ଜ୍ୟବସ୍ତୁ ଧୋଇହୋଇଯିବା ଦ୍ୱାରା
- ଅନ୍ୟାନ୍ୟ ବାହାର ପଦାର୍ଥ ବର୍ଷାଜଳ ସହ ମିଶିବା ଦ୍ୱାରା

ଖଣି ଖନନ ସମୟରେ ଲିଜ ମଧ୍ୟରେ ପ୍ରବାହିତ ନଳାର ଯଥାର୍ଥ ପରିଚାଳନା ଯୋଜନା ପ୍ରସ୍ତୁତ କରାଯିବ ଯାହାଦ୍ୱାରା କି ନାଳ ଉପରେ କୌଣସି କୁପ୍ରଭାବ ପଡ଼ିବ ନାହିଁ ।

ପ୍ରସ୍ତାବିତ ପ୍ରକଳ୍ପରେ ଭୂଉପରିସ୍ଥ ଖଣି ପ୍ରକ୍ରିୟାରେ ଖନନ କରାଯିବ । ବର୍ଜ୍ୟବସ୍ତୁ ବା ଖଣିଜ ଦ୍ରବ୍ୟ ବର୍ଷା ଜଳ ଦ୍ୱାରା ଧୋଇ ହୋଇ ନିକଟବର୍ତ୍ତୀ ଜଳର ଗୁଣକୁ ପ୍ରଭାବିତ କରିବାର ସମ୍ଭାବନା ରହିଛି । ତେଣୁ ନିମ୍ନଲିଖିତ ପ୍ରସ୍ତାବ ଗ୍ରହଣ କରାଯିବ ।

- ବର୍ଜ୍ୟବସ୍ତୁ ଗଦାଇବାର ସ୍ଥାନ ଠିକ୍ ଭାବରେ ନିରୂପଣ କରାଯିବ
- ବର୍ଜ୍ୟବସ୍ତୁ ଗଦା ଚାରିପଟରେ ଥିବା ଗାରଲ୍ୟାଣ୍ଡ ନାଳରେ ଛୋଟ ବନ୍ଧର ବ୍ୟବସ୍ଥା କରାଯିବ ଯାହା ଦ୍ୱାରା କି ଭାସିଯାଉଥିବା ବର୍ଜ୍ୟବସ୍ତୁ କୁ ରୋକା ଯାଇପାରିବ ।
- ବର୍ଷାଦିନେ ଗଦାରୁ ଗୋଡ଼ି, ମାଟି, ବର୍ଷାଜଳ ସହ ଧୋଇ ହୋଇ ଚାଲିଯିବାର ସମ୍ଭାବନା ଥିବାରୁ ଗଦା ଚାରିପଟେ ଥିବା ନାଳରେ କୁଣ୍ଡର ବ୍ୟବସ୍ଥା ରହିବ ଯାହାଦ୍ୱାରା କି ଗୋଡ଼ି, ମାଟି ତଳେ ବସିଯିବ ।
- ନାଳରେ ଜଳପ୍ରବା ସୁବିଧାଜନକ କରିବା ପାଇଁ ଆବଶ୍ୟକ ସ୍ତରରେ ପଥର ବ୍ୟବହାର କରାଯିବ ।
- ନାଳ ଓ କୁଣ୍ଡକୁ ନିୟମିତ ସଫା କରାଯିବ ।

- ଖଣିରୁ ବାହାରୁଥିବା ପାଣି ଓ ଭୂପୃଷ୍ଠ ଜଳର ନିୟମିତ ପରୀକ୍ଷା ସହ ତଥ୍ୟ ଲିପିବଦ୍ଧ କରି ରଖାଯିବ ।

ବୃକ୍ଷଲତା ଉପରେ ପ୍ରଭାବ ଓ ପରିଚାଳନା ଯୋଜନା :

- ଏହି ଲିଜ ଅଂଚଳରେ କୌଣସି ଜଙ୍ଗଲ ଜମି ନାହିଁ ଓ ଏହା ମୁଖ୍ୟତଃ ଚାଷ ଜମି । ଏହି ଲିଜ ଅଂଚଳ ମଧ୍ୟରେ କିଛି ମାତ୍ରାରେ ତୃଣ, ବୁଦା ଗଛ ରହିଅଛି । ଲିଜ ଅଂଚଳରେ କାଜୁ, ନିମ୍ବ, ଖଜୁରୀ, ଶାଳ, ଓସ୍ତଗଛ, ତାଳଗଛ, ବାଉଁଶ, କେନ୍ଦୁ, ଶାଗୁଆନ, ଶିମିଳି, ସୁନାରୀ, ଅଗସ୍ତି, ନିର୍ଗୁଣ୍ଡି ଇତ୍ୟାଦି ବୃକ୍ଷରୋପଣ କରାଯାଇଛି । ଖଣି କାର୍ଯ୍ୟକାଳ ସମାପ୍ତି ପରେ ଖଣି ଅଂଚଳର ୧୧.୬୮ ହେକ୍ଟରରେ ସବୁଜ ବଳୟ ସୃଷ୍ଟି କରିବା ପାଇଁ ହେକ୍ଟର ପ୍ରତି ୧୪୦୧୬ ଚାରା ରୋପଣ କରାଯିବ ।

ସାମାଜିକ ପ୍ରଭାବ ଓ ପରିଚାଳନା ଯୋଜନା :

ପ୍ରକଳ୍ପ କାର୍ଯ୍ୟଦ୍ୱାରା ପ୍ରତ୍ୟେକ୍ଷ ଓ ପରୋକ୍ଷ ନିଯୁକ୍ତି ସୁଯୋଗ, ଯାତାୟାତର ସୁବିଧା ଦ୍ୱାରା ସ୍ଥାନୀୟ ଅଂଚଳର ଅର୍ଥନୈତିକ ବିକାଶ ଦ୍ୱାରା ମାନବୀୟ ପରିବେଶ ଉପରେ ଲାଭଜନକ ପ୍ରଭାବ ପଡ଼ିବ । ପ୍ରସ୍ତାବିତ ପଥର ଖଣିରେ ୧୩୦ଜଣ ଲୋକଙ୍କ ପାଇଁ ନିଯୁକ୍ତିର ସୁଯୋଗ ରହିବ । ସେଥିମଧ୍ୟରୁ ୧୫ ଜଣ କୁଶଳୀ ଶ୍ରମିକ, ୩୫ ଜଣ ଅର୍ଦ୍ଧକୁଶଳୀ ଶ୍ରମିକ, ୭୫ ଜଣ ଅଣକୁଶଳୀ ଶ୍ରମିକ ତଥା ୫ ଜଣ ପରିଚ୍ଛଳକ ଓ ତତ୍ତ୍ୱାବଧାରକ ଭାବରେ କାର୍ଯ୍ୟ କରିବେ ।

ନିୟମିତ ଭାବରେ କାର୍ଯ୍ୟରତ ଶ୍ରମିକ ମାନଙ୍କର ସ୍ୱାସ୍ଥ୍ୟ ପରୀକ୍ଷା କରାଯିବ । ସେମାନଙ୍କ ସୁରକ୍ଷାର ସମସ୍ତ ଦାୟିତ୍ୱ ନିଆଯିବ ତଥା ସମସ୍ତଙ୍କୁ ବ୍ୟକ୍ତିଗତ ସୁରକ୍ଷା ଉପକରଣ ଯୋଗାଇ ଦିଆଯିବ । ପ୍ରସ୍ତାବିତ ପ୍ରକଳ୍ପ କାର୍ଯ୍ୟକାରୀ ହେବାଦ୍ୱାରା ସ୍ଥାନୀୟ ତଥା ଅର୍ଥନୈତିକ ଭିତ୍ତିଭୂମି ର ବିକାଶ ହେବ ।

ପର୍ଯ୍ୟାବରଣ ପ୍ରବନ୍ଧ ଯୋଜନା :

ବାୟୁ ପ୍ରଦୂଷଣ ଓ ନିରାକରଣ

ଖଣି ଖନନ କାର୍ଯ୍ୟ ଦ୍ୱାରା ଅନୁଭୂତ ହେବାକୁ ଥିବା ବାୟୁ ପ୍ରଦୂଷଣ କମ୍ କରିବା ପାଇଁ ନିମ୍ନଲିଖିତ ପଦ୍ଧତି/ପ୍ରଣାଳୀ ଅବଲମ୍ବନ କରାଯିବ :

- ଖଣିର ମାଟି ରାସ୍ତାରେ ଜଳ ସିଂଚନ ଦ୍ୱାରା ଭାସମାନ ଧୂଳିକଣାର ପରିମାଣ ହ୍ରାସ କରାଯାଇପାରିବ । ପ୍ରାୟ ୨୦ଟି ଜଳସିଂଚନକାରୀ ଯନ୍ତ୍ରର ସ୍ଥାପନ କରାଯିବାର ପ୍ରସ୍ତାବ ରହିଛି ।
- ଯାନବାହନରେ ଅତ୍ୟଧିକ ଉତ୍ପାଦିତ ସାମଗ୍ରୀ ପରିବହନ କରିବାକୁ ବାରଣ କରାଯିବ ।

- ଓଦା କରାଯାଇ ପଥର ଖୋଳିବା କାର୍ଯ୍ୟ କରାଯିବ ।
- ଦିନର ନିର୍ଦ୍ଦିଷ୍ଟ ସମୟ ଯଥା ୧୨ଟାରୁ ୧୨.୩୦ ମଧ୍ୟରେ ବିସ୍ଫୋରଣ କରାଯିବ ।
- ଡିଜେଲଚାଳିତ ସମସ୍ତ ଯନ୍ତ୍ରପାତିର ଉପଯୁକ୍ତ ରକ୍ଷଣାବେକ୍ଷଣ କରାଯିବ ।

ପଥର ଖୋଳିବା କାର୍ଯ୍ୟ ମାନବୀକୃତ ଭୂଉପରିସ୍ଥ ଖଣି ଖନନ ପଦ୍ଧତି ଦ୍ୱାରା ହେବ । ଏହି ପ୍ରକ୍ରିୟାରେ ବିସ୍ଫୋରକ ସାମଗ୍ରୀର ବ୍ୟବହାର ଦ୍ୱାରା ଶବ୍ଦ ପ୍ରଦୂଷଣ ଜାତ ହେବ । ମୋଟାମୋଟି ଭାବରେ ପ୍ରତିବର୍ଷ ୧,୮୦,୦୦୦ ଲକ୍ଷ ଘନମିଟର ପଥର ଉତ୍ପାଦନ ପାଇଁ ହାରାହାରି ୭୫୦୦ କେ.ଜି. ପ୍ରତିମାସ ହିସାବରେ ବିସ୍ଫୋରକ ବ୍ୟବହୃତ ହେବ ଯେଉଁଥିରେ ପାଉଡ଼ର ମାତ୍ରା ୨ ଘନମିଟର/କେ.ଜି. ରହିବ । ଗ୍ରାମବାସୀମାନଙ୍କୁ ଆଗରୁ ଖବର ଦିଆଯାଇ ଦିନ ୧୨ଟାରୁ ୧୨.୩୦ ମଧ୍ୟରେ ବିସ୍ଫୋରଣ କରାଯିବ ।

ଏହି ପ୍ରକ୍ରିୟା ଦ୍ୱାରା ଶବ୍ଦ ପ୍ରଦୂଷଣର ମୁଖ୍ୟତଃ ଡିଜେଲ ଚାଳିତ ଯନ୍ତ୍ରପାତିର ପରିଚାଳନା ଓ ଗାଡ଼ି ମଟର ଚାଲିବା ଦ୍ୱାରା ହୋଇଥାଏ । ଶବ୍ଦ ପ୍ରଦୂଷଣର ଏହି କାରଣଗୁଡ଼ିକ ସାମୟିକ ଭାବରେ ହୋଇଥାଏ । ଏହାଛଡ଼ା ଖଣିଜ ପଦାର୍ଥର ପରିବହନ ଦ୍ୱାରା କିଛି ମାତ୍ରାରେ ଶବ୍ଦ ପ୍ରଦୂଷଣର ସମ୍ଭାବନା ରହିଛି ।

ଶବ୍ଦ ପ୍ରଦୂଷଣ କମ କରିବା ପାଇଁ ଡିଜେଲଚାଳିତ ସମସ୍ତ ଯନ୍ତ୍ରପାତିର ଉପଯୁକ୍ତ ରକ୍ଷଣାବେକ୍ଷଣ ଓ ସ୍ଥାୟୀ ଯନ୍ତ୍ରପାତିଗୁଡ଼ିକୁ ଯେତେଦୂର ସମ୍ଭବ ଆବଦ୍ଧ ସ୍ଥାନରେ ରଖାଯିବାର ବ୍ୟବସ୍ଥା କରାଯିବ । ଶ୍ରମିକମାନଙ୍କୁ ବ୍ୟକ୍ତିଗତ ରକ୍ଷାକାରୀ ଉପକରଣ ଯୋଗାଇ ଦିଆଯିବ । ଖଣି ଅଂଚଳର ଚତୁଃପାର୍ଶ୍ୱରେ ବୃକ୍ଷରୋପଣ କରାଯିବ ଯାହାଦ୍ୱାରା କି ଶବ୍ଦ ପ୍ରଦୂଷଣକୁ ରୋକାଯାଇପାରିବ ।

ଜଳ ପ୍ରଦୂଷଣ ଓ ନିରାକରଣ

ଏହି ଅଂଚଳର ମୁଖ୍ୟ ନଦୀ ଲିଜ ଅଂଚଳଠାରୁ ୪.୨ କି.ମି. ଦୂରରେ ଅବସ୍ଥିତ । ଲିଜ ଅଂଚଳ ମଧ୍ୟରେ କୌଣସି ନାଳ ପ୍ରବାହିତ ହେଉନାହିଁ ॥ ସ୍ଥାନୀୟ ଅଂଚଳର ଭୂତଳ ଜଳସ୍ତର ଉପରେ ଖଣି ଖନନର ପ୍ରଭାବ ଜାଣିବା ପାଇଁ ଏକ ଅନୁଧ୍ୟାନ କରାଯାଇଛି ଓ ତଦନୁଯାୟୀ ପରିଚାଳନା ଯୋଜନା ପ୍ରସ୍ତୁତ କରାଯାଇଛି ।

ବର୍ଜ୍ୟବସ୍ତୁ ଗଦାଗୁଡ଼ିକ ବର୍ଷାଦିନେ ଧୋଇହୋଇଯାଇ ଭୂପୃଷ୍ଠଜଳ ପ୍ରଦୂଷଣ କରିବାର ସମ୍ଭାବନା ରହିଥାଏ । ଖଣି ଖନନ ସ୍ଥାନରେ ମଧ୍ୟ ଗଦା ହୋଇଥିବା ଖଣିଜ ପଦାର୍ଥ ଓ ବର୍ଜ୍ୟବସ୍ତୁ ଧୋଇ ହୋଇଯିବାର ସମ୍ଭାବନା ରହିଥାଏ । ନିମ୍ନଲିଖିତ କାରଣଗୁଡ଼ିକ ଦ୍ୱାରା ଭୂପୃଷ୍ଠ ଜଳ ପ୍ରଦୂଷଣ ହୋଇପାରେ :-

ଖଣି ଖନନ ସମୟରେ ଲିଜ ମଧ୍ୟରେ ପ୍ରବାହିତ ନଳାର ଯଥାର୍ଥ ପରିଚାଳନା ଯୋଜନା ପ୍ରସ୍ତୁତ କରାଯିବ ଯାହାଦ୍ୱାରା କି ନାଳ ଉପରେ କୌଣସି କୁପ୍ରଭାବ ପଡ଼ିବ ନାହିଁ ।

ପ୍ରସ୍ତାବିତ ପ୍ରକଳ୍ପରେ ଭୂଉପରିସ୍ଥ ଖଣି ପ୍ରକ୍ରିୟାରେ ଖନନ କରାଯିବ । ବର୍ଜ୍ୟବସ୍ତୁ ବା ଖଣିଜ ଦ୍ରବ୍ୟ ବର୍ଷା ଜଳ ଦ୍ୱାରା ଧୋଇ ହୋଇ ନିକଟବର୍ତ୍ତୀ ଜଳର ଗୁଣକୁ ପ୍ରଭାବିତ କରିବାର ସମ୍ଭାବନା ରହିଛି । ତେଣୁ ନିମ୍ନଲିଖିତ ପ୍ରସ୍ତାବ ଗ୍ରହଣ କରାଯିବ ।

- ବର୍ଜ୍ୟବସ୍ତୁ ଗଦାଇବାର ସ୍ଥାନ ଠିକ୍ ଭାବରେ ନିରୂପଣ କରାଯିବ
- ବର୍ଜ୍ୟବସ୍ତୁ ଗଦା ଚାରିପଟରେ ଥିବା ଗାରଲ୍ୟାଣ୍ଡ ନାଳରେ ଛୋଟ ବନ୍ଧର ବ୍ୟବସ୍ଥା କରାଯିବ ଯାହା ଦ୍ୱାରା କି ଭାସିଯାଉଥିବା ବର୍ଜ୍ୟବସ୍ତୁ କୁ ରୋକା ଯାଇପାରିବ ।
- ବର୍ଷାଦିନେ ଗଦାରୁ ଗୋଡ଼ି, ମାଟି, ବର୍ଷାଜଳ ସହ ଧୋଇ ହୋଇ ଚାଲିଯିବାର ସମ୍ଭାବନା ଥିବାରୁ ଗଦା ଚାରିପଟେ ଥିବା ନାଳରେ କୁଣ୍ଡର ବ୍ୟବସ୍ଥା ରହିବ ଯାହାଦ୍ୱାରା କି ଗୋଡ଼ି, ମାଟି ତଳେ ବସିଯିବ ।
- ନାଳରେ ଜଳପ୍ରବା ସୁବିଧାଜନକ କରିବା ପାଇଁ ଆବଶ୍ୟକ ସ୍ତରରେ ପଥର ବ୍ୟବହାର କରାଯିବ ।
- ନାଳ ଓ କୁଣ୍ଡକୁ ନିୟମିତ ସଫା କରାଯିବ ।
- ଖଣିରୁ ବାହାରୁଥିବା ପାଣି ଓ ଭୂପୃଷ୍ଠ ଜଳର ନିୟମିତ ପରୀକ୍ଷା ସହ ତଥ୍ୟ ଲିପିବଦ୍ଧ କରି ରଖାଯିବ ।

ଶବ୍ଦ ପ୍ରଦୂଷଣ ଓ ନିରାକରଣ

ଖଣି ଖନନ ଦୈନିକ ୮ଘଂଟା କାର୍ଯ୍ୟ ସମୟରେ ଧ୍ୱନିର ମାତ୍ରା ୯୦ ଡେସିବଲରୁ କମ କରାଯିବ । ପଥର ଖୋଳିବା କାର୍ଯ୍ୟ, ବିସ୍ଫୋରକର ବ୍ୟବହାର ତଥା ଉତ୍ପାଦିତ ସାମଗ୍ରୀର ପରିବହନ ଦ୍ୱାରା ଶବ୍ଦ ପ୍ରଦୂଷଣ ବୃଦ୍ଧି ପାଇବ ।

ଶବ୍ଦ ପ୍ରଦୂଷଣ କମ ପରିବା ପାଇଁ ଡିଜେଲଚ୍ଳିତ ସମସ୍ତ ଯନ୍ତ୍ରପାତିର ଉପଯୁକ୍ତ ରକ୍ଷଣାବେକ୍ଷଣ ଓ ସ୍ଥାୟୀ ଯନ୍ତ୍ରପାତିଗୁଡ଼ିକୁ ଯେତେଦୂର ସମ୍ଭବ ଆବଦ୍ଧ ସ୍ଥାନରେ ରଖାଯିବାର ବ୍ୟବସ୍ଥା କରାଯିବ । ଶ୍ରମିକମାନଙ୍କୁ ବ୍ୟକ୍ତିଗତ ରକ୍ଷାକାରୀ ଉପକରଣ ଯୋଗାଇ ଦିଆଯିବ । ଖଣି ଅଂଚଳର ଚତୁଃପାର୍ଶ୍ୱରେ ବୃକ୍ଷରୋପଣ କରାଯିବ ଯାହାଦ୍ୱାରା କି ଶବ୍ଦ ପ୍ରଦୂଷଣକୁ ରୋକାଯାଇପାରିବ । ଗାଡ଼ି ଚ୍ଳଳକମାନଙ୍କୁ ତଥା କାର୍ଯ୍ୟରତ ଶ୍ରମିକମାନଙ୍କୁ କାନ ସୁରକ୍ଷାକାରୀ ପ୍ଲଗ୍ ଯୋଗାଇ ଦିଆଯିବ ।

ପର୍ଯ୍ୟାବରଣ ପ୍ରବନ୍ଧ ଯୋଜନାର ରୂପାୟନ ତଥା କାର୍ଯ୍ୟକାରୀତାର ସଫଳ ପର୍ଯ୍ୟାଲୋଚନା ପାଇଁ ଖଣି ଅଂଚଳର ପ୍ରତିନିଧିମାନଙ୍କ ଦ୍ୱାରା ଏକ ପରିବେଶୀୟ ଯୋଜନା ଅନୁଧାନକାରୀ ବିଭାଗ ଗଠିତ ହେବ । ନିୟମିତ ଭାବରେ ଏହି ବିଭାଗ ଅଂଚଳର ସାମଗ୍ରିକ ବିକାଶ ପାଇଁ କାର୍ଯ୍ୟ କରିବ ।

ସମାଷ୍ଟିପାତି ପର୍ଯ୍ୟାବରଣ ଦାୟିତ୍ୱ :

ପର୍ଯ୍ୟାବରଣ, ବନ ଏବଂ ଜଳବାୟୁ ପରିବର୍ତ୍ତନ ମନ୍ତ୍ରାଳୟ ଅନୁସାରେ ଓ.ଏମ୍. ନଂ ୨୨-୬୫/୨୦୧୭-I(A) II(M) ତା ୦୧.୦୫.୨୦୧୮ରିଖ ଦିନ ଏହା ନିର୍ଦ୍ଦେଶିତ ହୋଇଛି ଯେ ମୋଟ ପ୍ରକଳ୍ପ ମୂଲ୍ୟର ଶତକଡ଼ା ୨ ପ୍ରତିଶତ ସମାଷ୍ଟିପାତି ପର୍ଯ୍ୟାବରଣ ଦାୟିତ୍ୱ ଖର୍ଚ୍ଚରେ ବିନିଯୋଗ କରାଯିବ ।

ପ୍ରସ୍ତାବିତ ସମାଷ୍ଟିପାତି ପର୍ଯ୍ୟାବରଣ ଦାୟିତ୍ୱର ସବିଶେଷ ବିବରଣୀ ନିମ୍ନରେ ଦିଆଯାଇଛି :

କ୍ରମିକ ସଂଖ୍ୟା	ଗତିବିଧି	ସ୍ଥାନ	ଓମୟସୀମା					ଖର୍ଚ୍ଚ (ଟଙ୍କାରେ)
			୧ମ	୨ୟ	୩ୟ	୪ର୍ଥ	୫ମ	
(କ)	ପ୍ରଦୂଷଣ ନିୟନ୍ତ୍ରଣ ଉପାୟ							
୧.	ପାଣି ଛିଂଚିବା ଯନ୍ତ୍ରର ସ୍ଥାପନା (୨୦)	ପଟ୍ଟା ଅଂଚଳ	**	**				୧୦ ଲକ୍ଷ
୨.	ଗାରଲ୍ୟାଣ୍ଡ ଡ୍ରେନ ଏବଂ ଇଟେନିଙ୍ଗ ୱାଲ	ପଟ୍ଟା ଅଂଚଳ	**	**	**			୧୦ ଲକ୍ଷ
୩.	ଗ୍ରାମ୍ୟ ସଡ଼କରେ ଟ୍ୟାଙ୍କର ଦ୍ୱାରା ଜଳ ସିଂଚନ କରିବା (୧୦ କିଲୋଲିଟର ଟ୍ୟାଙ୍କର)	ବଜବାଟି ଗ୍ରାମ	**					୧୦ ଲକ୍ଷ
୪.	ସୁରକ୍ଷିତ ଅଂଚଳରେ ବୃକ୍ଷରୋପଣ	ପଟ୍ଟା ଅଂଚଳ	**	**	**			୧୦ ଲକ୍ଷ
୫.	ପଟ୍ଟା ଅଂଚଳକୁ ସଂଯୋଗ କରୁଥିବା ସଡ଼କରେ ବୃକ୍ଷରୋପଣ	ରାଜସ୍ୱ ବୃକ୍ଷରୋପଣ			**	**	**	୫ ଲକ୍ଷ
୬.	ବର୍ଷାଜଳ ସଂରକ୍ଷଣ ସଂରଚନା	ପଟ୍ଟା ଅଂଚଳ		**	**			୩ ଲକ୍ଷ
(ଖ)	ପାରିପାର୍ଶ୍ୱିକ ଅଂଚଳର ବିକାଶ							
୧.	ବ୍ୟକ୍ତିଗତ ପଟ୍ଟା ଅଂଚଳକୁ ସଂଯୋଗ କରୁଥିବା ସଡ଼କର ବିକାଶ	ନିକଟସ୍ଥ ଗ୍ରାମ	**	**	**			୬ ଲକ୍ଷ
୨.	ନିକଟସ୍ଥ ଗ୍ରାମର ଯୁବକମାନଙ୍କୁ ପ୍ରାଥମିକତା ଭିତ୍ତିରେ ନିଯୁକ୍ତିର ସୁଯୋଗ	ନିକଟସ୍ଥ ଗ୍ରାମ	**	**	**	**	**	ନିୟମ ଅନୁସାରେ
୩.	ସୌରଚାଳିତ ବିଦ୍ୟୁତର ସ୍ଥାପନ	ବଜବାଟି ଗ୍ରାମ				**	**	୧୦ ଲକ୍ଷ
୪.	ପ୍ରାଥମିକ ଶିକ୍ଷାକେନ୍ଦ୍ର ମାନଙ୍କରେ ଶିକ୍ଷା ସମ୍ବନ୍ଧୀୟ ସାମଗ୍ରୀ ବିତରଣ	ବଜବାଟି ଗ୍ରାମ	**	**	**	**	**	୧ ଲକ୍ଷ

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EXECUTIVE SUMMARY

CLUSTER–3 MINE CONSTITUTED OF BAJABATI HILLOCKS

OVER AN AREA OF 14.43 HECTARES

AT VILL: BAJABATI

TAHASIL: DHARMASALA

DISTRICT: JAJPUR,

ODISHA

CATEGORY OF PROJECT: B

BASELINE MONITORING PERIOD: MARCH 2020 TO MAY 2020

PROJECT PROPOSED BY

DHARMASALA TAHASIL, JAJPUR, ODISHA

ENVIRONMENT CONSULTANT

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1.1 INTRODUCTION

This Summary is a brief outline of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) carried out for Bajabati Hillocks (Cluster 3) over an area of 14.43Ha, at Village-Bajabati under Dharmasala tahasil District Jajpur, Odisha. Cluster-3 has been further sub divided to three sub-clusters, viz., Cluster-3A comprising mineralized area over 9.18 Ha, Cluster-3B comprising mineralized area over 4.04 Ha and Cluster-3C comprising mineralized area over 1.21Ha. Cluster-3 (Bajabati hillocks) is featured in the Survey of India Toposheet No. 73 L/2 and bounded between the latitudes from 20°45'46.74"N to 20°46'08.96"N and Longitudes 86°06'04.77"E to 86°06'37.98"E. Whereas, Cluster-3A is bounded between the latitudes 20°45'46.74"N to 20°45'59.49"N and longitudes 86°06'25.03"E to 86°06'37.98"E, Cluster-3B is bounded between latitudes 20°46'02.09"N to 20°46'08.96"N and longitudes 86°06'24.29"E to 86°06'36.77"E and Cluster-3C is bounded between latitudes 20°45'56.62"N to 20°46'00.72"N and longitudes 86°06'04.77"E to 86°06'09.42"E.

1.2 HIGHLIGHTS

A. The Project

Name of the Project : Bajabati Hillocks (Cluster 3)

Product : Building Stone

Type of mine : Semi mechanized open cast mining

Rated production capacity : 1,80,000m^3 / Annum during Plan Period (Ten Years).

Table 1.1: Brief profile of the project:

Sl. No.	Salient Features	Descriptions
1	Cluster area	14.43 Ha (6 nos of mining lease.)
2	Village	Bajabati
3	Tahasil	Jajpur
4	District and State	Jajpur, Odisha
5	Land category	Non forest Govt. Land
6	Toposheet No.	73L/2
7	Nearest town	Jenapur
8	Nearest road	NH:200- 2Km, SW
9	River distance	Brahmani River – 2.5Km, NNE
12	Railway station	Haridashpur Railway Station 4.5 Km, SSE
13	Jenapur	3 Km

B. Environmental Aspects

Pollution Potential: Land degradation, generation and propagation of fugitive dust, erosion of soil are the major pollutions anticipated from the proposed mining & allied activities

Environmental Impact: Marginal adverse impact on the localized air and land environment, which gets compensated by moderately beneficial impact on the human environment.

1.3 INTRODUCTION

Bajabati Hillocks (Cluster 3) over an area of 14.43 Ha is an opencast semi- mechanized mine situated in the village Bajabati, Tahasil Dhramasala, District Jajpur, Odisha. This cluster comes under ownership of Dharmasala, Tahasil, Jajpur, Odisha quarry leases for Building stone/ Road metal comprising 06nos. of lease areas covering a total mineralised area of 35.66Acres or 14.43 Hectares located in village/Mouza Bajabati of Dharmasala Tahasil & District Jajpur, Odisha have been proposed to be leased out to different intenders through auction. Cluster-3 constituted of Bajabati building stone quarry has been approved by approved by the Deputy Directorate Mines, Jajpur Road Circle, Jajpur Road, vide memo no. 314 on dated 19.02.2020.

To obtain environmental clearance, a suitable Environmental Impact Assessment and Environmental Management Plan for the mining lease area has been prepared.

In a view to obtain environmental clearance for Cluster 3 mines, Dharmasala Tahasildar, Jajpur has entrusted the assignment to M/s Kalyani Laboratories Private Limited Bhubaneswar for preparing EIA /EMP report.

Kalyani Laboratories private limited (MoEF& CC and NABL accredited Lab) has gathered required baseline data for pre monsoon season (March to May 2020) and accordingly prepared the EIA / EMP report.

1.4 PROJECT OUTLINE

Cluster-3 has been further sub divided to three sub-clusters, viz., Cluster- 3A comprising mineralized area over 9.18 Ha, Cluster-3B comprising mineralized area over 4.04 Ha and Cluster-3C comprising mineralized area over 1.21 Ha. The geological reserve (Probable & Possible) for building stone/road metal has been estimated as 22, 63,388Cum over the cluster-3A (Bajabati), 5, 65,740Cum over the cluster-3B (Bajabati) & 1, 26,932Cum over the cluster-3C (Bajabati). Hence, the total geological reserve over Cluster-3 mineralized area has been estimated as 29, 56,060Cum.

It is evident that demonstrated the mineable reserve (Probable) for building stone/road metal worked out to be 15, 22,433Cum over the cluster-3A (Bajabati), 3,53,415Cum over the

cluster-3B (Bajabati) & 36,519Cum over the cluster-3C (Bajabati). Hence, the total mineable reserve over Cluster-3 mineralized area has been estimated as 19, 12,367Cum.

Table 1.2 (A): Geological Reserve of Cluster

Section Considered	Length of Influence (m)	X-Area of Rock Mass (m2)	Volume of Excavation of Rock Mass(m3)	Vol. of Recoverable Building Stone (m3)	Vol. of Waste (m3)	X-Area of Soil Zone (m2)	Vol. of Soil Zone (m3)	Category
A	**B**	**C**	**D=BXC**	**E=D X .70**	**E=D X .30**	**F**	**G=FXB**	**H**
Cluster-3A (Bajabati)	273	10782	2943486	2060440	883046	218	59514	Probable
	273	1062	289926	202948	86978	---	---	Possible
Total			**3233412**	**2263388**	**970024**	---	**59514**	**---**
Cluster-3B (Bajabati)	120	5711	685320	479724	205596	82	9840	Probable
	120	1024	122880	86016	36864	---	---	Possible
Total			**808200**	**565740**	**242460**	**---**	**9840**	**---**
Cluster-3C (Bajabati)	108	1320	142560	99792	42768	56	6048	Probable
	108	359	38772	27140	11632	---	---	Possible
Total			**181332**	**126932**	**54400**	**---**	**6048**	**---**

Table 1.2 (B): Mineable Reserve of Cluster

Section Considered	Length of Influence (m)	X-Area of Rock Mass (m^2)	Volume of Excavation of Rock Mass(m^3)	Vol. of Recoverable Building Stone (m^3)	Vol. of Waste (m^3)	X-Area of Soil Zone (m^2)	Vol. of Soil Zone (m^3)	Category
A	**B**	**C**	**D=BXC**	**E=D X .70**	**E=D X .30**	**F**	**G=FXB**	**H**
Cluster-3A (Bajabati)	216	10069	2174904	1522433	652471	202	43632	Probable
Cluster-3B (Bajabati)	106	4763	504878	353415	151463	71	7526	Probable
Cluster-3C (Bajabati)	94	555	52170	36519	15651	33	3102	Probable

Method of mining will be opencast semi mechanized. Handling of rock mass will be done both manually and by excavators. Handpicks, spade, chisel, hammer will be used by manual labors for sorting and sizing. Loosening of rock mass will be done by drilling and blasting Based on the demand of building stone/road metal as revealed by the respective lessees, a maximum of 1,80,000Cum of building stone/road metal will be extracted per annum from the Cluster-3 area. During next 10 years of the plan period the level of production expected is given in Table below.

Table 1.3: Proposed Tentative Maximum Production of Building Stone/Road Metal during Plan Period (Ten Years)

Year	Cluster-3A (Bajabati) in cum	Cluster-3B (Bajabati) in cum	Cluster-3C (Bajabati) in cum	Total (cum)
First	1,50,000	30,000	0	1,80,000
Second	1,50,000	30,000	0	1,80,000
Third	1,50,000	30,000	0	1,80,000
Fourth	1,50,000	30,000	0	1,80,000
Fifth	1,50,000	30,000	0	1,80,000
Sixth	1,50,000	30,000	0	1,80,000
Seventh	1,50,000	30,000	0	1,80,000
Eighth	1,50,000	30,000	0	1,80,000
Ninth	1,50,000	30,000	0	1,80,000
Tenth	1,50,000	30,000	0	1,80,000
Total	**15,00,000**	**3,00,000**	**0**	**18,00,000**

A total of 130 workers (Skilled-15nos., Semi-skilled-35nos. and Un-skilled-75nos & Mines Manager/Mine Permit Manager-05nos) will be employed during mining operation. The Cluster-3 area is partly covered with soil mixed rock boulders/pebbles followed by granite gneiss/charnockite/migmatite deposit. The soil to be generated will be stacked in the earmarked temporary soil stack and will be utilised for the plantation purpose to be undertaken around the respective hill/patch and adjacent to haul roads of the same in Cluster-3. Moreover, as envisaged, waste to the tune of about 30% of excavation will be generated during mining which will be utilised by the respective Lessee for making of mine road and allied infrastructures. These are the portions of total excavation which are not suitable for construction purpose due to weathering and softness. It will not be possible to separate the total waste from the suitable building stone/road metal at the quarry head.

It is assumed that around 2/3rd of the generated waste will be transported to the crusher site along with valuable building stone/road metal where these will be sorted out. The remaining 1/3rd of the total waste will be separated at the quarry head and will be stacked in the temporary waste dump of respective quarry lease and will be utilised by the lessee for making of mine road and allied infrastructures.

1.5 PRESENT ENVIRONMENTAL SETTING

To achieve these objectives of EIA/ EMP study, the EIA team members of M/s Kalyani Laboratories Private Limited, Bhubaneswar monitored different environmental parameters of the core zone (Lease area) and buffer zone (10 km. radial distance) of the project site in accordance with the Guidelines for EIA issued by the MoEF& CC, Govt. of India. The baseline study was carried during the period from March to May 2020. The baseline

monitoring and analysis of different environmental parameters was conducted by M/s Kalyani Laboratories Pvt. Ltd

1.5.1 Land use and Topography

The project site is located in survey of India Toposheet No. 73L/2 and bounded between the Latitude from 20°45'46.74"N to 20°46'08.96"N and Longitudes 86°06'04.77"E to 86°06'37.98"E. Lease area is accessible through NH 200 which is located at a distance of about 2Km, SW & NH 5 at a distance of 5Km, E from the cluster. The area is at a distance of 3 km from Jenapur town. The nearest railway siding is at Haridashpur railway station located at a distance of about 4.5 km, SSE from the cluster area.

It is observed from the dug wells of the adjacent plain area and in the nearby villages that, the ground water table varies between 3 m to 8 m from the surface level depending upon seasonal variations. During dry season the water table falls to 8 m from the surface, whereas during rainy season the water table remains at around 3 m from the surface.

There is chance that during monsoon the run-off water may find access to some of the quarries in the cluster-3. Therefore, it is proposed to keep one 5 HP diesel operated pump at each quarry site, particularly during monsoon to draw out the accumulated water from the quarry. The water so discharged will be routed to the natural drainage through series of drains and settling pits. Also, it is proposed to have a peripheral drain around the each pit of the individual QLs belonging to the cluster to restrict the surface runoff in to the quarry.

As per the satellite imagery data presented above it has been observed that about 3.9% of the land cover is covered under forest land, irrigated land (rabi crop land) include 48.70% and 19.20% fallow land, waste land 4.31%, scrub land 10.53% and river bed is covered under 2.99% of the total land use plan.

1.5. 2 Climate & Meteorology

The climate condition of the district is generally hot with high humidity during April and May and cold during December and January. The maximum temperature in the district rises up to 46˚C in the summer and falls to a minimum of 14˚C in winter. The December and January are the coldest and May is the hottest month. The relative humidity is high, on an average, varies from 40 to 90% during the year. The average rainfall of the district is 1550mm. Maximum rainfall generally occurs in the month of August. Average nos. of rainy days in a year is 72. The western, south-western, eastern southern tract s receive a fairly high rainfall (>1500 mm.) which gradually decreases to 1300mm towards north-east.

1.5.3 Ambient Air quality

The major contributors of air emissions are industrial emission, vehicular movement combustion of bio-fuel and other man made sources. During the study period the concentration of PM10 varies from 35.02-80.0µg/m^3 and PM2.5 varies from 21.01-43.5µg /m^3. The concentration of SO2 varies from 4-10.4µg /m^3 and NOx concentrations vary from 9.1-20.4µg /m^3. From the ambient air quality monitoring carried out for three months (March-May 2020) of the study period shows that the critical pollutants like PM_{10}, Sox and NOx are well within the permissible limits.

1.5.4 Water Quality

- The pH range of the surface water samples is neutral ranging from 7.3 to 8.
- Electrical conductivity of water sample ranges from 144-480 µs/cm
- Dissolved oxygen in the surface water sample ranges from 5.6-7.2 mg/l.
- Biochemical oxygen demand of the surface water body is 4-10 mg/l. The BOD is comparatively higher in pond water as compare to river water.

From the water quality results it can be inferred that all the parameters analyzed are under the prescribed limit as per IS 2296:1982; class C and the water does not contain any pollutant which would be hazardous for human, animal or crop health.

As per the monitoring and analysis of ground water of selected sampling areas, it has been observed that

- Water is colorless and odorless and found to be suitable for human consumption.
- The pH level of the ground water sample ranges from 6.7-7.2. This indicates that the pH of the ground water in the study area is neutral and as per the drinking water standard.
- Total hardness ranges from 144-712 mg/l, and total dissolved solid ranges from 270 to 1450mg/l.
- Alkalinity ranges from 90-469 mg/l.

From the above water quality results it can be inferred that all the parameters analyzed are under the prescribed limit specified under IS10500, 2012 for drinking water. The water is free from microscopic organism and do not contain any pollutant which would be hazardous for human, animal or crop health, So it is fit for drinking purpose.

1.5.5 Noise Quality

At present the area is a barren land without any human interference. So the present noise level of the area is lower comparative with the village. The noise level as measured in the core zone is 56.8 dB (A) in day time and 46.2 dB (A) in the night time. In the buffer zone the

noise level ranges from 42.3 to 56.4 dBA during day time and 31.2 to 40.2 dBA during night time. The noise level is below the standard as per the Noise Rule, 2000 for rural area. The lease area and all the sampling points are comes under rural area.

1.5.6 Soil quality

The soil analysis result shows that, the pH of the soil samples collected are mostly alkaline except the soil of Bichakhandi and Sahanidih which are slightly acidic. Texture of the soil varies from silt loam to sandy clay loam. Electrical conductivity ranges from 48 to 323 µs/Cm. Nitrogen content of soil varies from 1210 to 1814 Kg/Ha; Phosphorous content varies from 13 to 49 Kg/Ha and Potassium content 134 to 482 Kg/Ha. Total organic carbon of the soil varies from 0.36 to 2.37 %. From the soil analysis result it can be concluded that the soil of the area is highly fertile and suitable for agricultural purpose.

1.5.7 Biological environment

The area is covered with mostly scrub and open forest along with scattered vegetation near villages. The most commonly growing and economically important plant species of the forest are Kaju, Baidanka, Neem, Khajur, Teak (*Tectona grandis*; Family: Verbenaceae), Bara, Osta, Simli, Sunari, kanteikoli, Augasti, Nirgundi, Anantamala, Tal, Bamboo, Kendu (*Diospyrous kaki*; Family: Ebenaceae), Sal (*Shoria robusta*; family: Dipterocarpaceae) and due to their inexpensive utility in commercial purposes. However, over the last hundred years or so, forests are being destroyed by several natural and anthropogenic activities.

1.5.8 Socio Economic Environment

There are 57 villages buffer zone of the project area. Detail demographic profile of study area is as below:

Table no.1.4 Demographic profile of the buffer zone

Sl. No.	Attributes	Radius of 10 km
1	No. of Villages	57
2	Total Household	10900
3	Total Population	49089
4	Male Population	25171
5	Female Population	239818
6	Total ST population	5238
7	Total SC Population	11632
8	Sex Ratio (F /M)	95 : 100
9	Population below 6 Years	5795

Out of the total population, 34419 persons are literate which contribute about 70% within the buffer zone. Out of the total literate, male literacy is contributed as 19109 i.e. 56% and female literacy is contributed as 15310 by 44%. It is observed that the literacy percentage is more among the male as compare to the female population. About 30% of the total population of the project villages is illiterate.

The work force classification in the study area helps in formulating strategies in any development programme. It also helps in identifying the potential workforce, their aptitude, skill, etc in any targeted population. As per the census 2011 the work group participation of the study villages are as follows,

- Out of the total population, 15815 persons (about 32%) are workers and 33274 (about 68%) persons are non workers. This can be inferred that more than half of the population is depending on others for their livelihood opportunity.
- Regarding workforce participation rate of both the sex, the data reveals that female workforce participation rate is comparatively low with respect to male. Out of the total working population 13900 (88%) are male and 1915 (12%) are female.
- Out of the total workers 11913 are main workers and 3902 are marginal workers. In both main and marginal workers population the male workers are overwhelmingly dominated in comparison to female workers. As per the census 2011 the work group participation of the study villages have been given below :

Table no.1.5 Work group participation in main and marginal section

Sl. No.	Attributes	Main	Marginal
1	Total Working	11913	3902
2	Cultivator	2657	350
3	Agricultural labour	2368	1871
4	Household workers	469	150
5	Other Workers	6419	1531

1.6 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

1.6.1 Impact of Mining on Land Environment

1.6.1.1 Impact on Topography

The impact on the topography is in the form of changed landscape due to the mining activities in the form of digging, leveling of lands & dumping of waste etc. There will be topographical change due to mining activity within the lease clusters. Cluster-3 (Bajabati Hillock) is located within the revenue jurisdiction of Bajabati village under Dharmasala Tahasil of Jajpur district. The targeted area represents a hilly terrain comprising three Patches, viz., Cluster-3A, 3B & 3C with undulated topography. Cluster-3A displays highest altitude of 80mRL and lowest altitude of 35mRL, Cluster-3B

displays highest altitude of 25mRL and lowest altitude of 20mRL & Cluster-3C displays highest altitude of 40mRL and lowest altitude of 35mRL

1.6.1.2 Impacts due to Development of Mine & Excavation of stone

Ultimate extent of the quarry will be confined to the area of 7.33 hectares in Cluster-3A (Bajabati), 3.37 hectares in Cluster-3B (Bajabati) & 0.98 hectares in Cluster-3C (Bajabati). As discussed, based upon the existing quarries as well as surface exposures total resource of the cluster has been estimated as the probable resource over the mineralized area of the respective hillock will be mined out during conceptual period. The ultimate quarry bottom will be at 10mRL in Cluster-3A (Bajabati), (-10mRL) in Cluster-3B (Bajabati) & 10mRL in Cluster-3C (Bajabati) as shown in the Conceptual Plan & Sections. This is above the ground water table as the RL of ground water table is around 8 m. Therefore such depth of working would not affect the ground water table.

1.6.1.2 Other Impacts

The land-use pattern undergoes a change due to the use of the land for mining, dumping, and other mining and associated activities. The drainage pattern on the surface undergoes a change due to the alterations in the surface topography due to mining and associated activities.

1.6.1.4 Mitigation Measures

The quarry within the lease cluster will be utilized as water reservoir. There will be construction of retaining wall along the quarry boundary and plantation will be carried out along the boundary of the quarry.

1.6.2 Impact on Air Quality and Mitigation Measures:

Mining operation and its associated activities are potentially airs polluting and the major air pollutant is the particulate matter. The impacts on air quality due to the proposed mining cluster are as below:

- Dust from excavation and mining of stone.
- Loading, unloading and screening.
- Vehicular movement on the haul roads.

Further mitigation measures proposed for the mining will be as blow:

- Water sprinkling on mining quarry, dumping area and haul road during dry wind periods, using a water tanker.
- Dust emissions due to vehicles can be minimized by avoiding spillage from the loaded trucks.
- Top soil or overburden is susceptible to wind erosion speeds more than 5 m/sec.
- Water sprinkling on the top soil and over burden dump to reduce wind erosion.
- Dust catching species like cassia fistula, *Bombax ceiba, Azadirchtaindica, Nyctanthesarbor-tristis, Psidium guajava, tectonagrandis* etc will be planted in green belt.

1.6.3 Impact on Noise Quality and Mitigation Measures

1.6.3.1 Blasting Effects

The loosening of rock mass will be done by drilling and blasting. Drilling will be done either by wagon drill or jack hammer taking in to consideration the bench height varying from 3 meter to 6m. Assuming 1,80,000m^3 (max) productions per annum of Cluster-3, the monthly production target will be around 15,000m^3. To produce 15,000m^3 of rock mass, tentatively 7500kg/month of explosive will be required assuming powder factor 2m^3 /kg.

Noise due to blasting is site specific and depends on type, quantity of explosives, dimension of drill holes, degree of compaction of explosive in the hole and rock. Blasting will be performed during the day time. Shot hole drilling & blasting will be in practice so that the effect of blasting in terms of fly rock and maximum ground vibration will be negligible. The noise produced by blasting would be for extremely short duration of around 0.5 seconds, though with a high intensity. The blasting will be conducted in the day time only and once in a week by the licensed contractor. Time of blasting will be 12 noon to 12.30 PM in day time with prior intimation to the villagers for taking shelter. The practice of regularly wetting the blasting ground and spraying water over the blasted material will be adopted to control air pollution. Proposal is to adopt wet drilling on the benches.

1.6.3.2 Ground Vibration

Ground vibrations are generated by travelling of shock wave into the rock mass and attenuate very quickly. Vibrations and air over pressure are moistened in trial blasts to generated sufficient statistical data that could not be used for ascertaining site constants.

1.6.3.3 Mitigation Measures:

- Development of green belt in the lease boundary which acts as a barrier for noise abatement
- The noise generating machineries will be properly maintained
- The workers will be provided with proper PPEs to minimize the occupational exposures of noise.

1.6.4 Impact on Water Quality and Mitigation measures

The there is no seasonal or perennial nalla found within the mines cluster, so there is no shifting of water course due to mining activities. The mining activities can cause adverse impacts due to mine drainage, siltation due to storm water & contaminated water from mining cluster area. 20 KLD of potable water will be required from which 15 KLD of water will be required for drinking & domestic purpose. 3 KLD of water is suggested to be utilized for dust suppression and 2 KLD for plantation purpose. Water will be sourced from ground water and rain water harvesting from the existing quarry.

During the proposed plan period no particular pit lay out will be followed for all the quarries in the respective hill/patch of the Cluster-3 area. Therefore, at the end of the plan (lease) period depth of the respective quarry over the Cluster-3 area is not possible to predict. However, after

10 years (lease period) of mining the tentative bottom RL of Cluster 3A & 3B would be 10.5m and (-7.5m). Whereas, the ultimate quarry bottom over the Cluster-3 area will be at 10mRL in Cluster-3A (Bajabati), (-10mRL) in Cluster-3B (Bajabati) & 10mRL in Cluster-3C (Bajabati) at the end of the conceptual period. This is above the ground water table as the RL of ground water table is around 8 m except in sub-cluster-3B. Therefore such depth of working would not affect the ground water table.

There is chance that during monsoon the run-off water may find access to some of the quarries in the cluster-3. Therefore, it is proposed to keep one 5 HP diesel operated pump at each quarry site, particularly during monsoon to draw out the accumulated water from the quarry. The water so discharged will be routed to the natural drainage through series of drains and settling pits. Also, it is proposed to have a peripheral drain around the each pit of the individual QLs belonging to the cluster to restrict the surface runoff in to the quarry. The water so discharged will be routed to the natural drainage through series of drains and settling pits.

1.6.4.1 Mitigation measures

- Garland drains (1x1m), settling tank (3m x3m x3m) and check dam will be constructed along individual mining lease area. The garland drains of the individual lease will connected to settling tank and after settling the water will be discharged out to the natural drainage.
- There will be no waste water generated due to the mining activity. The domestic effluents being generated will be discharged to soak pits through septic tank.
- The abandoned pit will be converted to rain water storage tank and the rain water stored in the pit will be utilized for plantation as well as dust suppression.

1.6.5 Impact on Vegetation and Mitigation measures:

There are few existing plantation within the lease area. The existing plantation in the roadside of the entry of lease cluster, near the rest shed, near the existing crusher and few plantations in the safety zone. The existing plantations in the lease area include Mahaneem, Neem, Teak, Chatiana, Chakunda, Bara, Mango, Sisoo, Aswastha, Sunari, Osta etc.

During the conceptual period 11.68 Ha of dump area will be covered with plantation of 14016 saplings.

1.6.6 Impact on Socioeconomic Conditions:

The proposed project shall have major beneficial and more or less negligible adverse impacts on the following domains.

The project will create employment opportunities for the local inhabitants. The project will contribute direct employment scope for 130 persons for this mines project including skilled,

semi-skilled and un-skilled mine workers, supervisory staffs, mining engineers, Mines manager, surveyors etc.

The project activities shall create awareness with the local people for preferring permanent services than periodical agricultural activities. Further there will be infrastructural development in the area due to the proposed project.

For occupational health and safety PPEs will be provided to the workers and regular health check up of the workers will be carried out.

1.7 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

1.7.1 Air Pollution & Control

During the mining operation there are various sources of dust emission. The measures proposed for air pollution control includes:

- Haul road within the cluster area well compacted that will reduce dust emission.
- Periodical water sprinkling on the haul road through water tanker of 10 KL capacity
- Over loading of transport equipments to be avoided to prevent spillage.
- Water sprinkling on the OB dump to reduce dust emission. About 100 water sprinklers will be installed around the dump in the individual quarry of the cluster area to reduce the dust emission.
- Three tier plantations should be done in periphery.
- Wet drilling will be in practice to reduce dust emission
- Blasting will be carried out at a particular time of the day and blasting will be carried out in the day time only.
- Regular maintenance of mining equipment and vehicle will be conducted and pollution under control certificate be obtained for the vehicles used in the mining.
- Crushing operations inside the mine lease will be prohibited and may be carried out in another demarcated area abiding with statutory regulations.

1.7.2 Water Management & Water Pollution Control:

- Mine water shall not be allowed to dissipate, but collected and discharged after allowing settlement of the suspended solids.
- Monitoring of the mine water as well as surface flows shall be done at close, regular intervals and records maintained.
- The surface run off from the mines will pass through the garland drain and enter to the settling tank. The silt and solids will be settled down in the tank and only water goes to the drainage.
- Precipitated rainwater should be harnessed by taking advantage of the given situation to create sufficient artificial storage capacities in natural or manmade depressions and inter-connecting them to meet afforestation and other needs.

- Garland drains along with settling tank and retaining wall shall be constructed around the quarry and dumps. While constructing drains routing and tracing shall be done maintaining the overall slope in the direction of the premising flow direction so that the runoff distribution is not affected.
- Garland drain will be developed around waste dump beyond the retaining wall to receive run-off water coming out of the retaining wall of 1m height and settling tank will be made to receive the run-off water from garland drain to settle the sediments and release clean water.

1.7.2.1 Surface Water Management

To avoid surface run-off during the monsoon season peripheral/ garland drains with the settling tanks have been proposed around the dumps. Further guided channel around the quarry have been proposed to stop the surface run-off in the quarry during monsoon. The dump and mine runoff water does not contain any chemical contaminant as the mining is only road metal/ stone, so there is no chance of contamination of the water. Further the water from the lease area after settling can be utilized for irrigation purpose.

During the rainy season the water from the lease area will be guided to the exhausted quarry within the lease area and will be utilized for water sprinkling and plantation purpose. During the conceptual period the entire quarry will converted to water reservoir and will be utilized for irrigation and pisciculture purpose.

1.7.2.2 Management Plan for Ground water

During the proposed mining plan period there is no proposal for intersecting the ground water table. Water requirement for domestic purpose will only sourced from ground water. Other required water will be sourced from rain water.

1.7.3 Noise Control:

Noise level shall be maintained below 90 dB (A) in the working zone (for 8 hr. exposure). Noise levels are expected to increase (w.r.t. present lower level) at surface work zone with commencement of mining and allied activities. The major source of noise is due to drilling, blasting and transportation of stone. The following measures will be taken up to reduce the noise level:

- Diesel powered machineries, which are major; source of noise in open cast environment will be properly maintained. Scheduled to prevent undesirable noise. Attention shall be paid towards rigorous maintenance of the silencer pipe of the diesel engines.
- All the workers working with drilling and blasting will be provided with ear muffs.
- Blasting will be carried out at a particular time of the day with proper information to the workers.
- Static diesel engines shall be housed as far as possible. If possible they will be placed on vibration isolators.
- Truck drivers will be issued ear plugs and ear muffs. Duty of the operators of the noisy machineries will be regulated to keep their noise exposures levels within the limits
- Green belt will be developed around the office building and mine to reduce noise exposure level.

1.7.4 EMP Implementation and Monitoring

To meet with the objectives of Environmental Impact and monitoring an "Environmental Management and Monitoring Department (EMMD)" will be formed mining cluster (Cluster 3) mining project area, which will be responsible for implementation of EMP and post operation monitoring. The officers of the department will meet frequently to assess the progress and analyze the data collected during the preceding fortnight/month.

1.8 CORPORATE ENVIRONMENTAL RESPONSIBILITY

As per the MoEF & CC OM No. 22-65/ 2017-IA II(M) dated 01.05.2018, it has been recommended that 2% of the project cost will be accorded for Corporate Environmental responsibility. The details of CER plan has been given in the table below:

Table 1.5 Proposed CER Plan **Table 1.5 Proposed CER Plan**

Sl. No.	Activities	Location	Time Frame					Allocated Budget (Rs.)
Pollution Control measures			1st Yr	2nd Yr	3rdYr	4th Yr	5th Yr	
1.	Installation of water sprinklers (50 Nos)	Individual leases of the cluster	**	**				3,00,000.00
2.	Construction of Garland drain and retaining wall	Individual leases of the cluster	**	**	**			3,00,000.00
3.	Water sprinkling by tanker in the village road (10 KL water tanker)	Bajabati	**					3,00,000.00
4.	Plantation in the safety zone	Individual leases of the cluster	**	**	**			1,00,000.00
5.	Plantation in the village road connecting ML area	Avenue Plantation			**	**	**	2,00,000.00
6.	Rain water harvesting structure	Individual leases of the cluster		**	**			2,00,000.00
Peripheral Development								
1.	Development and maintenance of village road connecting individual lease of cluster	Nearby villages	**	**	**			3,00,000.00
2.	Employment opportunity for the local people including priority to youth of nearby Village.	Nearby villages	**	**	**	**	**	As per the Rule
3.	Installation of solar street light	Bajabati Village				**	**	2,00,000.00
4.	Distribution of education material to the primary school	Bajabati Village	**	**	**	**	**	1,00,000.00