

# ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENT MANAGEMENT PLAN

CLUSTER-6 MINE CONSTITUTED OF LUNIBAR HILLOCKS  
OVER AN AREA OF 22.26 HECTARES

AT VILLAGE: LUNIBAR  
TAHASIL: DHARMASALA  
DISTRICT: JAJPUR,  
ODISHA

**CATEGORY OF PROJECT: B**

**FILE NO: SIA/OR/MIN/52571/2020**

**BASELINE MONITORING PERIOD: MARCH 2020 TO MAY 2020**

**PROJECT PROPOSED BY**

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|  |                         |  |                             |
|--|-------------------------|--|-----------------------------|
| <b>Document No. :KLPL-EIA(MM)B<sub>1</sub>/2020-14</b> |                         | <b>Document Name: EIA/EMP Report For Lunibar hillocks (Cluster-6) over an area of 22.26 Hectares in Village Lunibar of Dharmasala Tahasil, District - Jajpur Odisha.</b> |                             |
| <b>Issue. No.: 01</b>                                  | <b>Date: 17.06.2020</b> | <b>Copy No.: -</b>   | <b>Copy Holders Name: -</b> |

**AMENDMENT PAGE**

**(F-0103)**

| <b>SL. No.</b> | <b>Page No.</b> | <b>Section / Clause / Para / Line (as Applicable)</b> | <b>Date of Amendment</b> | <b>Amendment Made</b> | <b>Reasons of amendment</b> | <b>Signature of Person Authorizing Amendment</b> |
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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 Lunibar Hillocks (Cluster 6) over an area of 55 Acres or 22.26 Hectares in village Lunibar, 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 Lunibar 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 4<sup>th</sup> 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 Lunibar Hillocks (Cluster 6) over an area of 55 acres/ 22.26 Ha in village Lunibar, Dist: Jajpur, Odisha.

## **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. 8327/SEIAA dated 03.06.2020 for preparation of EIA/EMP report for Environment Clearance of For Lunibar Hillocks (Cluster 6) over an area of 55 acres/ 22.26 Ha in village Lunibar, Dist: Jajpur, Odisha has 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. Debasis Biswal**

**EIA Co-ordinator (Mining of Minerals)**

## ANNEXURE – VII

### Declaration by Experts contributing to the EIA of Lunibar Hillocks (Cluster 6) over an area of 55 acres/ 22.26 Ha in village Lunibar, Dist: Jajpur, 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. Debasis Biswal

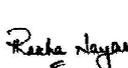


Signature and Date: .....

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:

| Sl. No. | Functional areas | Name of the expert/s | Involvement (period and task**)  | Signature and date  |
|---------|------------------|----------------------|--|---|
| 1       | AP*              | Dr. Debasis Biswal   | March 2020 to May 2020<br>Assessment of existing air quality, Impact of the project on ambient air, Suggested mitigation measures for air pollution                                |  |
| 2       | WP*              | Dr. Rekha Nayak      | March 2020 to May 2020<br>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. Debasis Biswal   | March 2020 to May 2020<br>Assessment of waste generated from the project, Suggested waste management practices. Dumping of waste and dump management practices                     |  |

|    |        |                      |   |   |
|----|--------|----------------------|---|---|
| 4  | SE*    | Mr. Jagabandhu Bisoi | March 2020 to May 2020<br>Baseline SE study, Data compilation and assessment. Impact of the project on SE status of the area. Formulation of CER plan,  | Jagabandhu Bisoi  |
| 5  | EB*    | Dr. Rekha Nayak      | March 2020 to May 2020<br>Impact prediction and assessment of the project on biological environment. Comparisons of primary and secondary ecological data                                     | Rekha Nayak   |
|    |        | Dr. Madhusmita Jena  | March 2020 to May 2020<br>Baseline field data collection of related to ecology of the area.   | Madhusmita Jena   |
| 6  | HG*    | Mr. S.C. Nayak       | March 2020 to May 2020<br>Hydro geological feature of the area. Ground water depth and impact of project on ground water of the area.   |    |
| 7  | AQ*    | Dr. Debasis Biswal   | March 2020 to May 2020<br>Air quality modeling utilizing the area source model. Prediction of ground level concentration of the dust. Suggesting suitable mitigation measure.                 | Debasis Biswal  |
| 8  | Noise* | Mr. S.C. Nayak       | March 2020 to May 2020<br>Ambient noise study of the area. Incremental noise generation due to plant operation and impact of the noise due to the project.                                    |  |
| 9  | LU*    | Mr. Sahil Sood       | March 2020 to May 2020<br>Preparation of land use map based on satellite imagery. Land use classification and analysis. Impact prediction of the project on the surrounding land environment. | Sahil Sood  |
| 10 | RH*    | Dr. Debasis Biswal   | March 2020 to May 2020<br>Identification of the Risk related to the mining activities. Preparation of emergency   | Debasis Biswal  |

|    |    |                     |   |                        |
|----|----|---------------------|---|------------------------|
|    |    |                     | disaster management plan.<br>Plan for supply of safety<br>equipment for the worker.   |                        |
| 11 | SC | Dr. Madhusmita Jena | March 2020 to May 2020<br>Soil monitoring, Secondary data<br>collection on soil type, Soil<br>management practices,<br>Utilization of topsoil | <i>Madhusmita Jena</i> |

**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 Lunibar Hillocks (Cluster 6) over an area of 55 acres/ 22.26 Ha in village Lunibar, 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. Debasis Biswal

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 28<sup>th</sup> April 2022.

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### **COMPLIANCE TO TERMS OF REFERENCE**

| <b>Sl. No.</b> | <b>ToR points</b>   | <b>Compliance</b>   |
|----------------|---|---|
| 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 to 1994. The production details need to submit since inception of mine duly authenticated by department of Mines & Geology, State Government   | 1 <sup>st</sup> 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 show 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 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 | Chapter 10, Section 10.6                                    |

|    |   |   |
|----|---|---|
|    | 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<br>Chapter 3, Section 3.6 Figure 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  | Chapter 3, Section 3.12.7 Table 3.33                                      |

|    |  |   |
|----|--|---|
|    | 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.  |   |
| 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<br>Table 3.26 – 3.34  |
| 20 | Proximity to area declared as 'Aravali Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed authorities, such as the SPCB or State Mining Department. Should be secured and furnished to the effect that the proposed mining activities could be considered.  | No such area exists within 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);  | Chapter 3, Section 3.7 – 3.13<br>Table 3.7 to 3.34  |

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|----|---|---|
|    | 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. |   |
| 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. |
| 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  | Chapter 2, Section 2.4.6  |

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|    | for working below ground and for pumping of ground water should also be obtained and copy furnished.   |   |
| 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 hydrology should be brought out.   | No seasonal or perennial nala passing through the project site. |
| 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 afforestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and 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  |

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| 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:-<br>a) All documents to be properly referenced with index and continuous page numbering.<br>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.<br>c) Project Proponent shall enclose all the analysis/ testing reports of water, air soil, noise etc using the MoEF & CC / NABL accredited laboratories. All the original analysis/ testing report should be available during appraisal of the project.<br>d) Where the documents provided are in a language other than English, an English translation should be provided.<br>e) The Questionnaire for environmental appraisal of mining projects as devised earlier by the ministry shall also be filled and submitted.<br>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.<br>g) The consultant involved in the preparation of EIA/EMP | Noted  |

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|  | <p>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.</p> <p>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 &amp; 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.</p> <p>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.</p> <p>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.</p> |  |
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## 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 B<sub>2</sub> (lease area <25 Ha), B<sub>1</sub> (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-6 mines consist of Lunibar hillocks located within a lateral distance of 500m from each other. This cluster comes under ownership of Tahasildar, Dharmasala. The cluster 6 mining lease for Building stone/ Road metal comprising 5 nos. of lease areas covering a total mineralized area of 50 Acres or 22.26 Hectares located in village/Mouza Lunibar of Tahasil Dharmasala & 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 14<sup>th</sup> September 2006 and subsequent amendments. This EIA 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-6 area belongs to the Sariat Sources under Dharmasala Tahasil of Jajpur District. Small quarry leases within the Cluster-6 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<br>At: Dharmasala, Jajpur, Odisha  |
| 2. Particulars of the area     | Name of the Quarry- Cluster-6 (Lunibar Hillocks)<br>Building Stone/Road Metal Quarry.<br>Area 50 acres or 22.26 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 6 lease consists of 5nos of quarry leases of Lunibar hillock of village/Mouza Lunibar of Tahasil Dharmasala & District Jajpur, Odisha. Further Cluster-6 has been further Toposheet No. 73 L/1 and bounded between the latitudes 20°47'55.16" N to 20°48'15.06" N and longitudes 86°02'59.48" E to 86°03'18.90" E.

#### 1.4.1 Accessibility:

The cluster is well accessible through NH 200 which is only 100m, E from the boundary of the cluster area. NH-5 is located at a distance of 5.9 Km, E from the cluster. New Gada Madhupur railway station is located at a distance of 1.7 Km, E 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**

| Sl. No | Attributes                    | Details   |          |          |        |
|--------|-------------------------------|---|----------|----------|--------|
|        |                               | SI No   | Khata No | Plot No. | Kisam  |
| 1.     | Plot / Survey / Khasra number | 1   | 224      | 707/1042 | Pahada |
|        |                               | 2   | 224      | 707/1042 | Pahada |
|        |                               | 3   | 224      | 707/1042 | Pahada |
|        |                               | 4   | 224      | 707/1047 | Pahada |
|        |                               | 5   | 224      | 707/1042 | Pahada |
| 2.     | Village; Tehsil; District;    | Vill: Lunibar, Tahasil: Dharmasala, Dist: Jajpur, |          |          |        |

|     |   |  |
|-----|---|--|
|     | State   | Odisha   |
| 3.  | Survey of India Topo Sheet number   | 73L/1 ( <b>Topomap attached</b> )  |
| 4.  | Latitude/ Longitude   | Cluster 6 latitudes 20°47'55.16" N to 20°48'15.06" N and longitudes 86°02'59.48" E to 86°03'18.90" E.<br>(Satelite Map attached) |
| 5.  | Maximum elevation above MSL   | 100 mRL  |
| 6.  | Distance of nearest Highest Flood Level (HFL) from the project boundary within the study area | 3.0 Km   |
| 7.  | Seismic Zone  | Zone III   |
| 8.  | Nearest railway station; Distance   | Haridashpur railway station 4.5Km, SSE   |
| 9.  | Nearest NH/SH   | NH 200-100m, E,<br>NH -5, 5.9 Km, E  |
| 10. | Nearest Airport; Distance from nearest Airport (in Km)  | Bhubaneswar, 61 Km   |
| 11. | Nearest Town/City/District head quarter (Distance in Km)                                      | Jajpur   |
| 12. | Village Panchayats, Zila Parishad, Municipal Corporation, Local Body                          | Dharmasala   |
| 13. | Nischint  | Mahabinayak RF - 6.0 Km, S<br>Kapilash RF - 17 Km, SW  |
| 14. | Nearest Eco-sensitive zone (Kapilash Sanctuary)   | 15Km, SW   |
| 15. | Nearest River   | Brahamani River 3.0 Km, E  |
| 16. | State or national boundary  | Nil  |
| 17. | Nearest Defense installation  | Charbatia:29Km,S   |
| 18. | Nearest Habitation  | Lunibar village: 0.5 Km, N   |
| 19. | Near Hospital (Jenapur Primary Health Centre):<br>Nearest School (Lunibar Primary School):    | 3Km<br>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 6 Mines is being prepared in accordance with the standard TOR issued by SEIAA, Odisha vide letter no. **letter no 8335/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 6 mine of Dharmasala consists of Lunibar hillocks consists of 5 nos of different mining leases located within a lateral distance of 500m from each other. This cluster 6 comes under ownership of Tahasildar, Dharmasala. Total mineralised area of 50 Acres or 22.26Hectares located in village/Mouza Lunibarof Tahasil Dharmasala & District Jajpur, Odisha. The individual lease area has been/ proposed to be leased out to different intenders through auction. The mining plan for Cluster-6 constituted Lunibar building stone quarry has been approved by The Deputy Directorate Mines, Jajpur Road Circle, Jajpur Road, vide memo no. 318 on dated 19.02.2020. (Copy attached **Annexure-2**)

**Table 2.1: List of quarry leases of Cluster-6 (Lunibar Hillocks)**

| SI No        | Name of Quarry lease             | Village/Mouza | Area in Ac  | Area in Ha   |
|--------------|----------------------------------|---------------|-------------|--------------|
| 1            | Lunibar Black Stone Quarry No. 1 | Lunibar       | 12.5        | 5.06         |
| 2            | Lunibar Black Stone Quarry No. 2 | Lunibar       | 10.0        | 4.05         |
| 3            | Lunibar Black Stone Quarry No. 5 | Lunibar       | 12.5        | 5.06         |
| 4            | Lunibar Black Stone Quarry No. 4 | Lunibar       | 10.0        | 4.05         |
| 5            | Lunibar Black Stone Quarry No. 3 | Lunibar       | 10.0        | 4.05         |
| <b>TOTAL</b> |                                  |               | <b>55.0</b> | <b>22.26</b> |

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-6 (Lunibar 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- 6 (Lunibar hillocks) over total mineralized area of 50 Acres or 22.26 Hectares is categorized as 'B1' ( $\geq 25\text{ha}$  &  $\leq 100\text{ha}$ ) 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 be useful for excavation of stone in an environmental friendly manner. For construction purpose the total 434000cum/annum building stone/road metal of the cluster-6 area will be dispatched to domestic end users.

## 2.3 LOCATION AND TOPOGRAPHY

Cluster-6 (Lunibar hillocks) is featured in the Survey of India Toposheet No. 73 L/1 and bounded between latitudes  $20^{\circ}47'55.16''$  N to  $20^{\circ}48'15.06''$  N and longitudes  $86^{\circ}02'59.48''$  E to  $86^{\circ}03'18.90''$  E.

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 are listed in the satellite map and Surface Plan (**Figure 2.1& 2.2**).

**Table No. 2.2 Co-ordination points of Cluster-6**

| <b>Id</b> | <b>Longitude</b>       | <b>Latitude</b>        |
|-----------|------------------------|------------------------|
| 1         | $86^{\circ}03'18.90''$ | $20^{\circ}48'03.57''$ |
| 2         | $86^{\circ}03'18.78''$ | $20^{\circ}48'00.56''$ |
| 3         | $86^{\circ}03'18.77''$ | $20^{\circ}48'00.43''$ |
| 4         | $86^{\circ}03'18.71''$ | $20^{\circ}48'00.13''$ |
| 5         | $86^{\circ}03'18.42''$ | $20^{\circ}47'59.93''$ |
| 6         | $86^{\circ}03'18.15''$ | $20^{\circ}47'59.90''$ |
| 7         | $86^{\circ}03'18.07''$ | $20^{\circ}47'59.50''$ |
| 8         | $86^{\circ}03'17.55''$ | $20^{\circ}47'59.41''$ |
| 9         | $86^{\circ}03'17.51''$ | $20^{\circ}47'59.01''$ |
| 10        | $86^{\circ}03'17.45''$ | $20^{\circ}47'58.75''$ |
| 11        | $86^{\circ}03'17.27''$ | $20^{\circ}47'58.25''$ |
| 12        | $86^{\circ}03'17.08''$ | $20^{\circ}47'58.23''$ |
| 13        | $86^{\circ}03'17.05''$ | $20^{\circ}47'58.13''$ |
| 14        | $86^{\circ}03'16.95''$ | $20^{\circ}47'58.13''$ |
| 15        | $86^{\circ}03'16.89''$ | $20^{\circ}47'58.05''$ |

|    |              |              |
|----|--------------|--------------|
| 16 | 86°03'16.53" | 20°47'58.09" |
| 17 | 86°03'16.35" | 20°47'57.49" |
| 18 | 86°03'14.41" | 20°47'57.87" |
| 19 | 86°03'13.74" | 20°47'57.96" |
| 20 | 86°03'13.48" | 20°47'57.36" |
| 21 | 86°03'12.76" | 20°47'57.54" |
| 22 | 86°03'12.11" | 20°47'57.68" |
| 23 | 86°03'11.85" | 20°47'57.45" |
| 24 | 86°03'11.78" | 20°47'57.28" |
| 25 | 86°03'11.41" | 20°47'57.23" |
| 26 | 86°03'10.79" | 20°47'57.06" |
| 27 | 86°03'09.67" | 20°47'56.78" |
| 28 | 86°03'07.40" | 20°47'56.41" |
| 29 | 86°03'06.19" | 20°47'56.34" |
| 30 | 86°03'05.29" | 20°47'56.39" |
| 31 | 86°03'04.53" | 20°47'56.46" |
| 32 | 86°03'03.90" | 20°47'56.58" |
| 33 | 86°03'03.42" | 20°47'56.70" |
| 34 | 86°03'03.05" | 20°47'56.65" |
| 35 | 86°03'02.73" | 20°47'56.41" |
| 36 | 86°03'02.65" | 20°47'56.20" |
| 37 | 86°03'02.64" | 20°47'55.72" |
| 38 | 86°03'02.53" | 20°47'55.55" |
| 39 | 86°03'02.09" | 20°47'55.16" |
| 40 | 86°02'59.48" | 20°47'55.52" |
| 41 | 86°02'59.51" | 20°47'59.78" |
| 42 | 86°03'00.72" | 20°48'00.87" |
| 43 | 86°03'01.01" | 20°48'02.14" |
| 44 | 86°03'00.37" | 20°48'02.37" |
| 45 | 86°02'59.55" | 20°48'02.48" |
| 46 | 86°02'59.55" | 20°48'03.89" |
| 47 | 86°03'00.49" | 20°48'03.96" |
| 48 | 86°03'01.04" | 20°48'04.02" |
| 49 | 86°03'01.65" | 20°48'04.12" |
| 50 | 86°03'01.91" | 20°48'04.22" |
| 51 | 86°03'02.09" | 20°48'04.25" |
| 52 | 86°03'02.66" | 20°48'04.64" |
| 53 | 86°03'03.16" | 20°48'04.87" |
| 54 | 86°03'03.11" | 20°48'05.13" |
| 55 | 86°03'02.87" | 20°48'05.80" |
| 56 | 86°03'02.80" | 20°48'05.82" |
| 57 | 86°03'02.45" | 20°48'06.26" |
| 58 | 86°03'02.29" | 20°48'06.51" |

|    |              |              |
|----|--------------|--------------|
| 59 | 86°03'01.87" | 20°48'06.96" |
| 60 | 86°03'01.44" | 20°48'07.02" |
| 61 | 86°03'01.01" | 20°48'07.10" |
| 62 | 86°03'00.54" | 20°48'07.17" |
| 63 | 86°03'00.31" | 20°48'07.25" |
| 64 | 86°03'00.21" | 20°48'07.39" |
| 65 | 86°03'00.18" | 20°48'07.94" |
| 66 | 86°03'00.48" | 20°48'08.59" |
| 67 | 86°03'00.86" | 20°48'09.35" |
| 68 | 86°03'00.05" | 20°48'09.96" |
| 69 | 86°02'59.64" | 20°48'10.36" |
| 70 | 86°02'59.68" | 20°48'14.36" |
| 71 | 86°03'00.37" | 20°48'14.48" |
| 72 | 86°03'01.00" | 20°48'14.86" |
| 73 | 86°03'01.37" | 20°48'14.98" |
| 74 | 86°03'01.77" | 20°48'15.06" |
| 75 | 86°03'02.63" | 20°48'14.59" |
| 76 | 86°03'03.12" | 20°48'14.32" |
| 77 | 86°03'03.46" | 20°48'14.07" |
| 78 | 86°03'03.87" | 20°48'13.84" |
| 79 | 86°03'04.29" | 20°48'13.12" |
| 80 | 86°03'04.44" | 20°48'12.97" |
| 81 | 86°03'05.46" | 20°48'12.62" |
| 82 | 86°03'06.02" | 20°48'12.52" |
| 83 | 86°03'06.60" | 20°48'12.52" |
| 84 | 86°03'07.15" | 20°48'12.13" |
| 85 | 86°03'07.43" | 20°48'12.04" |
| 86 | 86°03'08.59" | 20°48'11.30" |
| 87 | 86°03'08.18" | 20°48'10.83" |
| 88 | 86°03'08.47" | 20°48'09.89" |
| 89 | 86°03'09.59" | 20°48'10.13" |
| 90 | 86°03'09.72" | 20°48'09.90" |
| 91 | 86°03'09.78" | 20°48'09.76" |
| 92 | 86°03'09.34" | 20°48'09.65" |
| 93 | 86°03'09.56" | 20°48'08.95" |
| 94 | 86°03'09.62" | 20°48'08.42" |
| 95 | 86°03'09.88" | 20°48'07.59" |
| 96 | 86°03'10.53" | 20°48'07.83" |
| 97 | 86°03'17.70" | 20°48'07.45" |
| 98 | 86°03'17.74" | 20°48'03.62" |

**Figure 2.1 Satellite Map Showing Lease Areas**

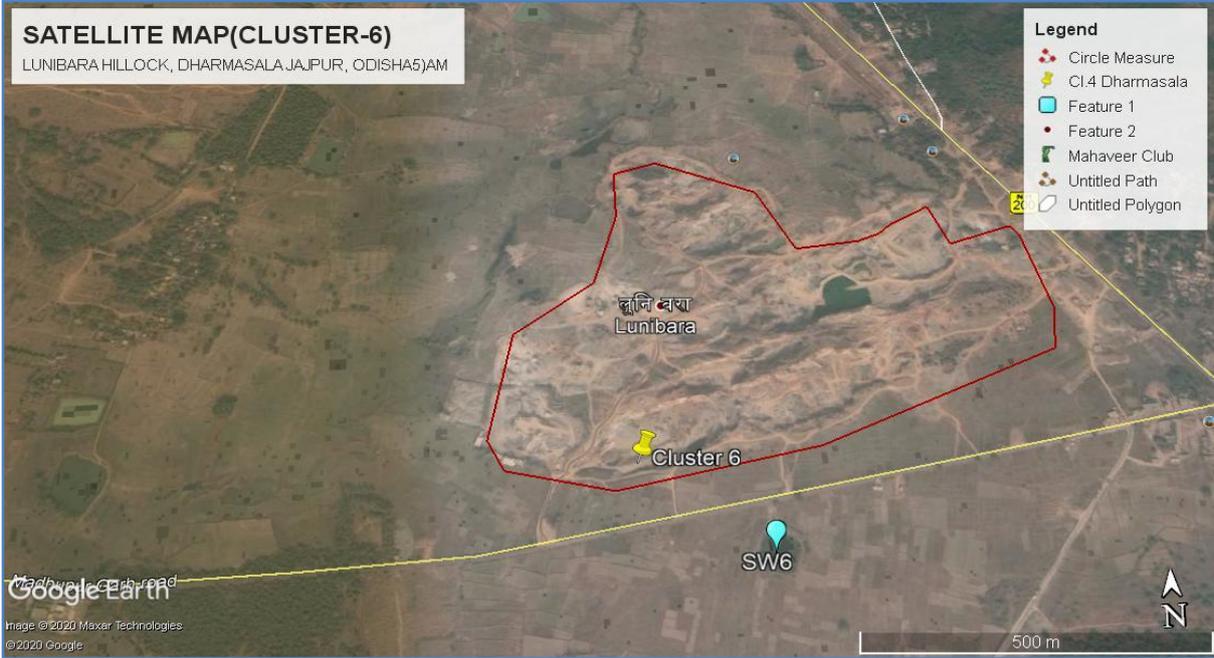
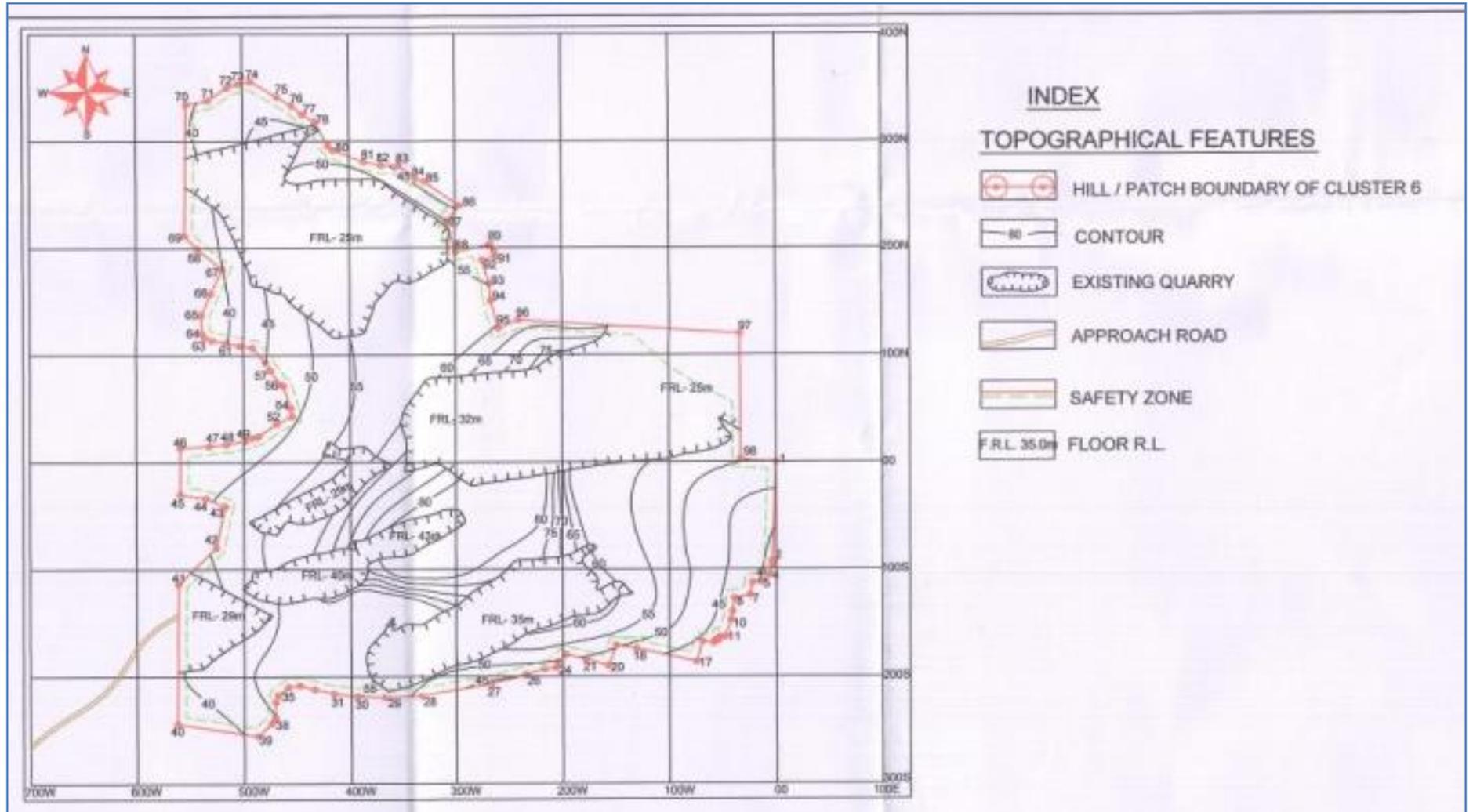


Figure 2.2 surface Plan



## 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 of Cluster - 6 and neighboring quarries.

However, the reserve of the cluster-6 has 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-6 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 of 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 and the continuation of the same rock type has been observed up to a lowest extent of 10 mRL in neighboring quarries.
- iv) Based on the above field observations, geological reserve is estimated considering 15 below the lowest extent of exposed rock mass in existing quarries as probable limit over the Cluster-6 area as there is every possibilities of stone beneath. Hence, geological reserve under probable category having higher confidence level has been estimated up to of 10 mRL. Possible category having less confidence level. has been estimated up to 7mRL in Cluster-6 below the probable reserve over the area.
- v) In the Cluster-6 area, one cross section G1-G1' has been drawn tentatively across the trend of the rock mass covering three existing quarries.
- vi) The length of influence for geological and mineable reserve calculation has been given in reserve calculation tables.
- vii) 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.

- viii) Based on the above parameters, the geological reserve (Probable & Possible) for building stone/road metal has been estimated as 5584824 cum.
- ix) The mineable reserve has been estimated in similar manner as geological reserve leaving 7.5m safety zone barrier all along the hillock area boundary and maintaining the safety distance of 200 meters from existing revenue habitations, if any and the mineral blocked under benches to maintain safe quarry slope. Thus, the mineable reserve (Probable) for building stone/road metal is worked out to be 4349654cum over the cluster-6.

**Safety zone** barrier of 7.5 m has been taken into account all along the mineralised area boundary of separate hillock patches of the cluster-6. 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.

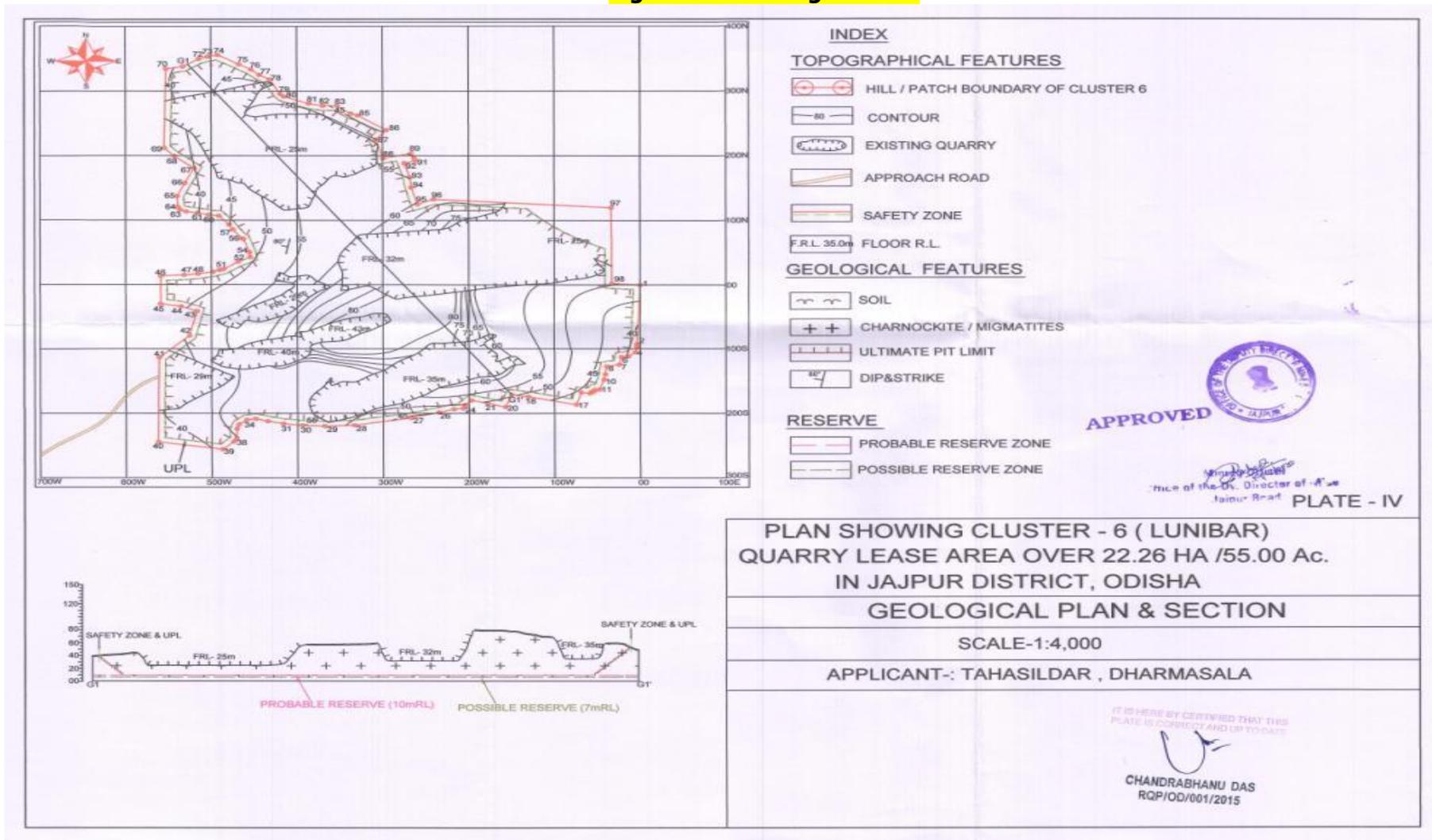
The hillock/patch wise geological and mineable reserve estimation over the cluster-6(Lunibar hillocks) is given as follows. The geological map showing the lease area has been given in

**Figure 2.3.**

**Table.No.2.3: Geological Reserve of Black Stone: Cluster-6**

| GEOLOGICAL RESERVE |                        |                                       |                                     |                       |                    |                                  |                                |          |
|--------------------|------------------------|---------------------------------------|-------------------------------------|-----------------------|--------------------|----------------------------------|--------------------------------|----------|
| SECTION CONSIDERED | LENGTH OF INFLUENCE(m) | X-AREA OF ROCK MASS (m <sup>2</sup> ) | VOL. OF ROCK MASS (m <sup>3</sup> ) | SALEABLE ROCK IN (m3) | WASTE ROCK IN (m3) | X-AREA OF SOIL (m <sup>2</sup> ) | VOL. OF SOIL (m <sup>3</sup> ) | CATEGORY |
| A                  | B                      | C                                     | D=BXC                               | E=D X .70             | F=D X .30          | E                                | F=E XB                         | G        |
| G1-G1'             | 336                    | 21835                                 | 7336560                             | 5135592               | 2200968            | 398                              | 133728                         | PROBABLE |
|                    | 336                    | 1910                                  | 641760                              | 449232                | 192528             | 0                                | 0                              | POSSIBLE |
| <b>TOTAL</b>       |                        | <b>23745</b>                          | <b>7978320</b>                      | <b>5584824</b>        | <b>2393496</b>     | <b>398</b>                       | <b>133728</b>                  |          |

**Figure 2.3. Geological Plan**



**Table No.2.4 Mineable Reserve of Black Stone: Cluster-6**

| MINEABLE RESERVE   |                         |                                       |                                     |                |                |                                  |                                |          |
|--------------------|-------------------------|---------------------------------------|-------------------------------------|----------------|----------------|----------------------------------|--------------------------------|----------|
| SECTION CONSIDERED | LENGTH OF INFLUENCE (m) | X-AREA OF ROCK MASS (m <sup>2</sup> ) | VOL. OF ROCK MASS (m <sup>3</sup> ) | SALEABLE       | WASTE          | X-AREA OF SOIL (m <sup>2</sup> ) | VOL. OF SOIL (m <sup>3</sup> ) | CATEGORY |
| A                  | B                       | C                                     | D=BXC                               | E=D X .70      | F=D X .30      | G                                | H=GXB                          | I        |
| G1-G1'             | 312                     | 19916                                 | 6213792                             | 4349654        | 1864138        | 373                              | 116376                         | Probable |
| <b>TOTAL</b>       | ---                     | ---                                   | <b>6213792</b>                      | <b>4349654</b> | <b>1864138</b> | ---                              | <b>116376</b>                  | ---      |

#### 2.4.2 Method of Mining

As discussed, cluster- 6 consists of one hillock known as Lunibar. Area boundary has been demarcated following the mineralized area boundary of the hillock. Moreover, the hillock/patch over the Cluster-6 area comprises of a number of small individual quarry lease areas. Each quarry lease would represent 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.

In the cluster-6 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-6 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:

**Table 2.5: Machineries used for Mining**

| Name                     | Capacity               | Number |
|--------------------------|------------------------|--------|
| Excavator/ Loader        | 0.9/2.1 m <sup>3</sup> | 10     |
| Wagon drill              | -                      | 6      |
| Jack hammer & compressor | -                      | 20     |
| Tippers /Trucks          | 10T/20T                | 40/25  |

#### **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 4,34,000m<sup>3</sup> (max) productions per annum of Cluster-6, the monthly production target will be around 36167m<sup>3</sup>. To produce 36167m<sup>3</sup> of rock mass, tentatively 72334kg/month of explosive will be required assuming powder factor 2m<sup>3</sup>/kg.

Deep hole blasting as well as jack hammer drilling and blasting will be practised in the Cluster-6 area. For the purpose, licensed contractors will be utilised by the respective auction holders/lessee. The nearest habitation is around 1.0 km 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-6 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 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.

#### **2.4.2.3 Proposed pit face lay out**

As discussed, no particular pit lay out is feasible to be proposed over the Cluster-6 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-6 area. However, the quarries in cluster 6 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-6 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-6 area. However, after 10 years (plan period) of mining the tentative bottom RLs of Cluster 6 will be 28mRL and 10 mRL after 5 years of mining. Similarly, at the end of conceptual (life of mine) the bottom RL of Cluster-6 will be 10 mRL. The quarries are proposed on the hill slope of the particular cluster. During monsoon the run-off water will flow from the quarry bottom along the natural slope. Hence, there will be no water accumulation inside the quarry at quarry bottom.

#### 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 434000cum of building stone/road metal will be extracted per annum from the Cluster-6 area. As no particular pit lay out will be followed over the cluster-6 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-6 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-6 (Lunibar Hillock) |
|--------------|-----------------------------|
| First        | 4,34,000                    |
| Second       | 4,34,000                    |
| Third        | 4,34,000                    |
| Fourth       | 4,34,000                    |
| Fifth        | 4,34,000                    |
| Sixth        | 4,34,000                    |
| Seventh      | 4,34,000                    |
| Eighth       | 4,34,000                    |
| Ninth        | 4,34,000                    |
| Tenth        | 4,34,000                    |
| <b>Total</b> | <b>4,34,0000</b>            |

#### 2.4.3 Waste Generation

As the Cluster-6 area is for building stone, suitability of the rock is not dependant on chemical parameters. The Cluster-6 area is partly covered with soil mixed with 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 quarries and adjacent to haul roads of the same in Cluster-6. 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-6 (Lunibar) area is of the order of 4349654cum. During the plan period of ten years, a total of about 4340000 cum is proposed to be excavated from the Cluster-6 area. Considering maximum production of 434000 cum/annum the reserve will be exhausted in  $4349654/434000 = 10.02$  including the present 10 years of planning period. Hence, the life of the mine is ten years.

However, rate of production may change in future depending upon the market demand, expansion programme and mechanization etc. and accordingly, the life of mine may vary. Conceptual mining plan has been prepared up to the end of the life of Cluster-6.

#### **Ultimate Extent and Size of the Quarry**

Ultimate extent of the quarry will be confined to the area of 19.345 hectares in Cluster-6. 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 hillock will be mined out during conceptual period. The ultimate quarry bottom will be at 10mRL as shown in the Conceptual Plan & Sections.

### 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 80° to 85° with ultimate pit slope of less than 45°. (Conceptual Plan **Figure 2.4**)

### 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-6.

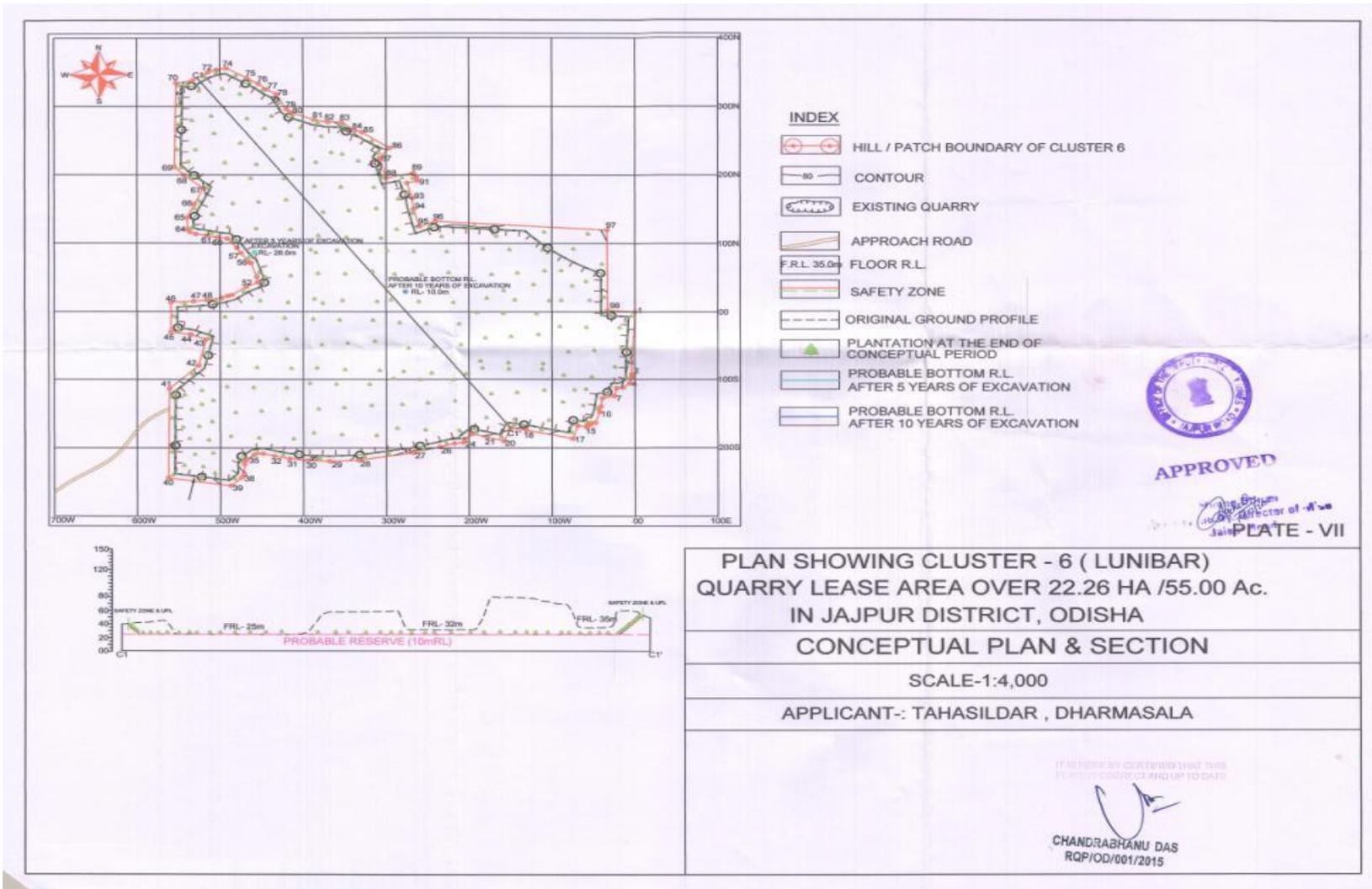
### Land Degradation

The aerial extent of the Cluster-6 (Lunibar hillock) area is 22.26 hectares. As discussed, hillock boundary is delineated following the mineralized area boundaries of the 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-6 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 hillock/patch of the Cluster-6 area, land use at the end of the proposed plan period will be an irregular one for overall Cluster-6 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 hillock will be mined out during conceptual period. The breakup of the tentative land use over the cluster-6 at present, after plan period of ten (10) years and at the end of conceptual (life of mine) period is given in table below -

**TABLE – 2.7: Land use at present, at the end of plan period and at the end of conceptual (life of mine) period**

| 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                    | 7.59              | 19.346                                   | 19.346  |
| 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               | 2.914                                    | 2.914   |
| <b>Total</b>              | <b>7.59</b>       | <b>22.26</b>                             | <b>22.26</b>  |

**Figure 2.4 Conceptual Plan**



**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 5 m to 8 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 hill/patch of the Cluster-6 area. Therefore, at the end of the plan (lease) period depth of the respective quarry over the Cluster-6 area is not possible to predict. However, after 10 years (lease period) of mining the tentative bottom RLs of Cluster 6 would be 10mRL. 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.

There is chance that during monsoon the run-off water may find access to some of the quarries in the cluster-6. 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-6 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-6 will be as per the respective approved mining plan of the small quarry lease. However, considering the proposed maximum annual production over the cluster-6 (Ref. Table- 5) the tentative maximum manpower will be as follows.

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

| SI No | Designation           | Qualification  | Numbers |
|-------|-----------------------|--|---------|
| 1     | Mines<br>Manager/Mine | Second class Manager's Certificate of Competency (DGMS)/ Permit Mine | 5       |

|                   |                |  |          |
|-------------------|----------------|--|----------|
|                   | Permit Manager | Manager's Certificate of Competency (DGMS) |          |
| <b>Sub -Total</b> |                |  | <b>5</b> |

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

Skilled: 27

Semi-skilled-70

Unskilled-180

**Sub Total:277**

**Total (a + b) : 277 + 12 = 289**

**c) OMS:**

Average ore production /annum : 434000 cum

Working days per year : 300 days (On an average)

Production per day : 434000/300=1447 cum

Overall output per man shift (OMS) : 1447/ 289= 5 cum.

**2.5 FINAL MINE CLOSURE PLAN:**

As discussed, a hillock boundary is delineated following the mineralized area boundaries of the hillock/patch of Cluster-6 area. Safety zone of 7.5m all along the peripheral hillock/patch boundary has been proposed/ considered for the hillock/patch of the Cluster-6 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 hillock/patch of the Cluster-6 area land use at the end of the proposed plan period cannot be predicted for overall Cluster-6 area. However, the hillock/patch wise breakup of the tentative land use over the cluster-6 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.

**(i) Mined out land:** During the plan period of ten (10) years the mined out land will be 19.346 ha in Cluster-6.

Since, the individual quarries of cluster-6 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-1 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 – 6 : Cluster-6 (Lunabar)  
Land use at present, at the end of plan period and at the end of conceptual (life of mine) period**

| 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                    | 7.59              | 19.346                                   | 19.346  |
| 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               | 2.914             | 2.914                                    | 2.914   |
| <b>Total</b>              | <b>7.59</b>       | <b>22.26</b>                             | <b>22.26</b>  |

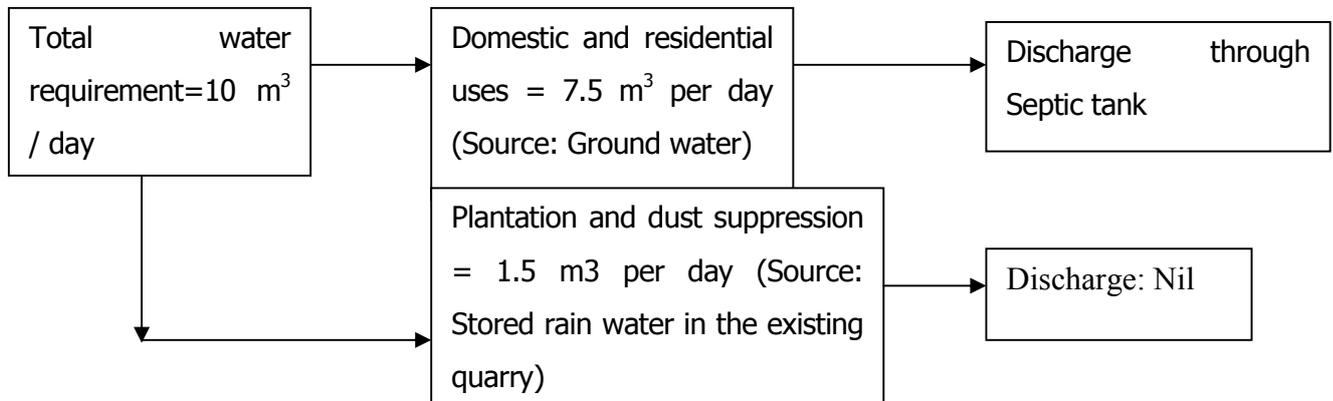
### 2.5.3 Topsoil stack and its utilization:

A total of 116376m<sup>3</sup> 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-6 and as such no soil stack will be there in the cluster-6 area at the end of plan period of ten (10) years.

## 2.6 WATER REQUIREMENT

10 KLD of potable water will be required from which 7.5 KLD of water will be required for drinking & domestic purpose 1.5 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 facility, crèche and rest shed will be constructed within the cluster area.

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

All possible mitigation measures to prevent any adverse incident during the process of mining, transportation and dumping will be taken care of. 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 6 Lunibar 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**.

#### 3.1 COMPONENTS 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 2020 has 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**.



**Table No. 3.1: Baseline data generation Matrix**

| <b>Attribute</b>        | <b>Parameters</b>  | <b>Locations/Source</b>                              |
|-------------------------|--|--|
| <b>Land Environment</b> | Topography & Drainage  | Primary and Secondary information                    |
|                         | Geology  | Primary and Secondary data                           |
|                         | Land use   | Primary and secondary data                           |
|                         | Soil Quaity  | 8 Locations/ Primary data/ Secondary data            |
|                         | Land use/ Landscape Based on Level III land use classification   | 10 Km Buffer Zone<br>Secondary data                  |
| Air Environment         | Sulphur Dioxide (SO <sub>2</sub> ) in µg/m <sup>3</sup> ,<br>Nitrogen Dioxide (NO <sub>2</sub> ) in µg/m <sup>3</sup> ,<br>PM10 in (µg/m <sup>3</sup> ), PM2.5 in (µg/m <sup>3</sup> )   | 8 Locations<br>Primary and Secondary data            |
| Noise                   | Noise Level (dB Leq)   | 8 Locations/ Primary and Secondary data              |
| Surface water           | As per IS 2296: 1982   | 9 Locations/ Primary data/ Secondary data            |
| Ground water            | As per IS 10500: 2012  | 8 Locations/ Primary data/ Secondary data            |
| Biological Environment  | <b>Aquatic:</b><br>Aquatic vegetation<br>Fishes & aquatic fauna<br><b>Terrestrial</b><br>Vegetation – species list. Economic importance, forest produce, medicinal value.<br>Terrestrial Fauna, Avi fauna<br>Rare and endnagered plant species | Core and Buffer Zone<br>Primary data/ Secondary data |
| Socio-economic          | Demographic structure<br>Infrastructure resource base.<br>Economic resource base. Cultural and aesthetic attributes, Health Education.   | Core and Buffer Zone<br>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      | Bichakhandi                        |     | **   | ** | ** |       |
| 7      | Dankari                            | **  | **   | ** | ** | **    |
| 8      | Lunibara                           | **  | **   | ** | ** | **    |
| 9      | Sahanidiha                         | **  | **   | ** | ** | **    |
| 10     | Rahadpur                           | **  | **   | ** | ** | **    |
| 11     | Brahmaniriver near<br>Brundadeipur |     |      | ** |    |       |
| 12     | Anjira                             |     | **   | ** | ** |       |

### 3.3 GEOLOGY AND HYDROLOGY

#### 3.3.1 Topography

Cluster-6 (Lunibar Hillock) is located within the revenue jurisdiction of Lunibar village under Dharmasala Tahasil of Jajpur district. The targeted area represents a hilly terrain with highest altitude of 80 mRL in the middle part where as the NE part shows the lowest altitude of 25 mRL. There is hardly any vegetation. There is no human settlement within the auction area.

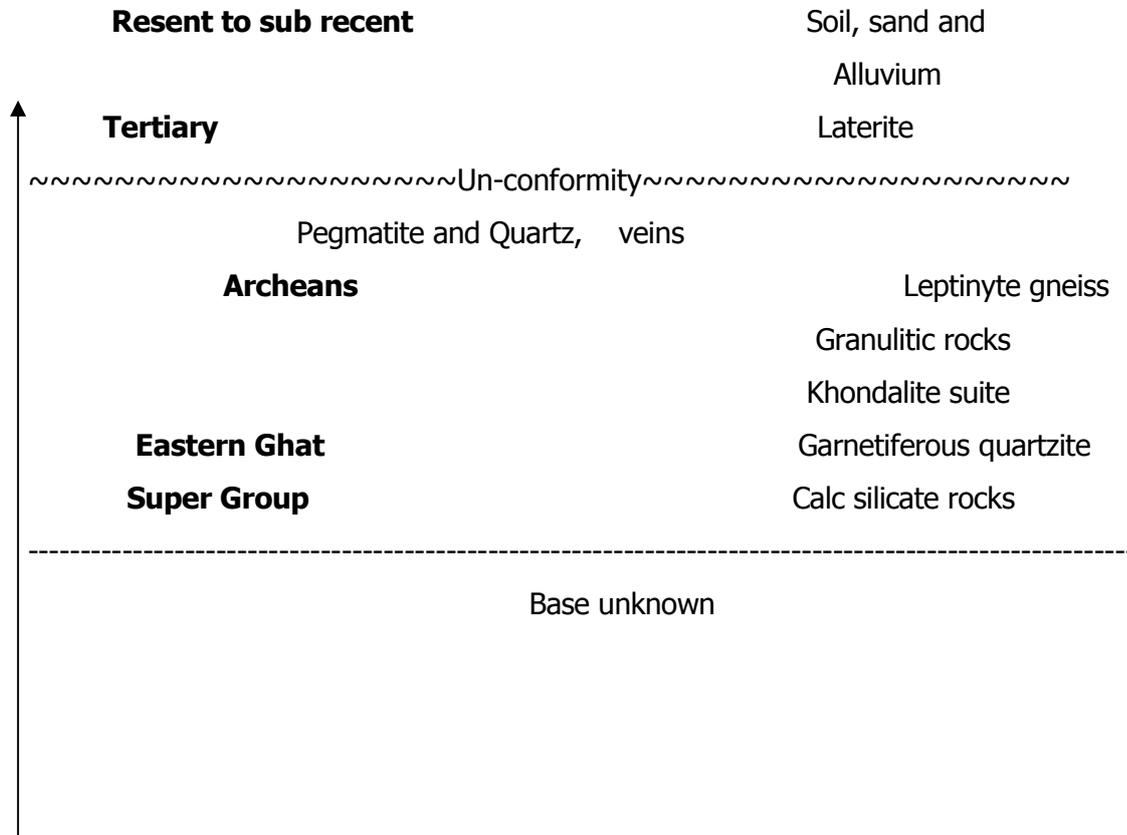
#### 3.3.2 Drainage

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 Brahmani River which flows at a distance of 3.0 Km. There is a High level canal flows at a distance of about 2.8 Km from the cluster area.

**3.3.3 Geology:**

**a. Regional Geology:**

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



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 activities 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 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/charnockite/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 ( $80^{\circ}$  -  $85^{\circ}$ ) 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 as follows.

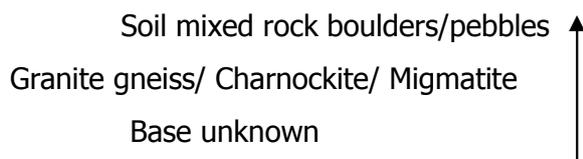
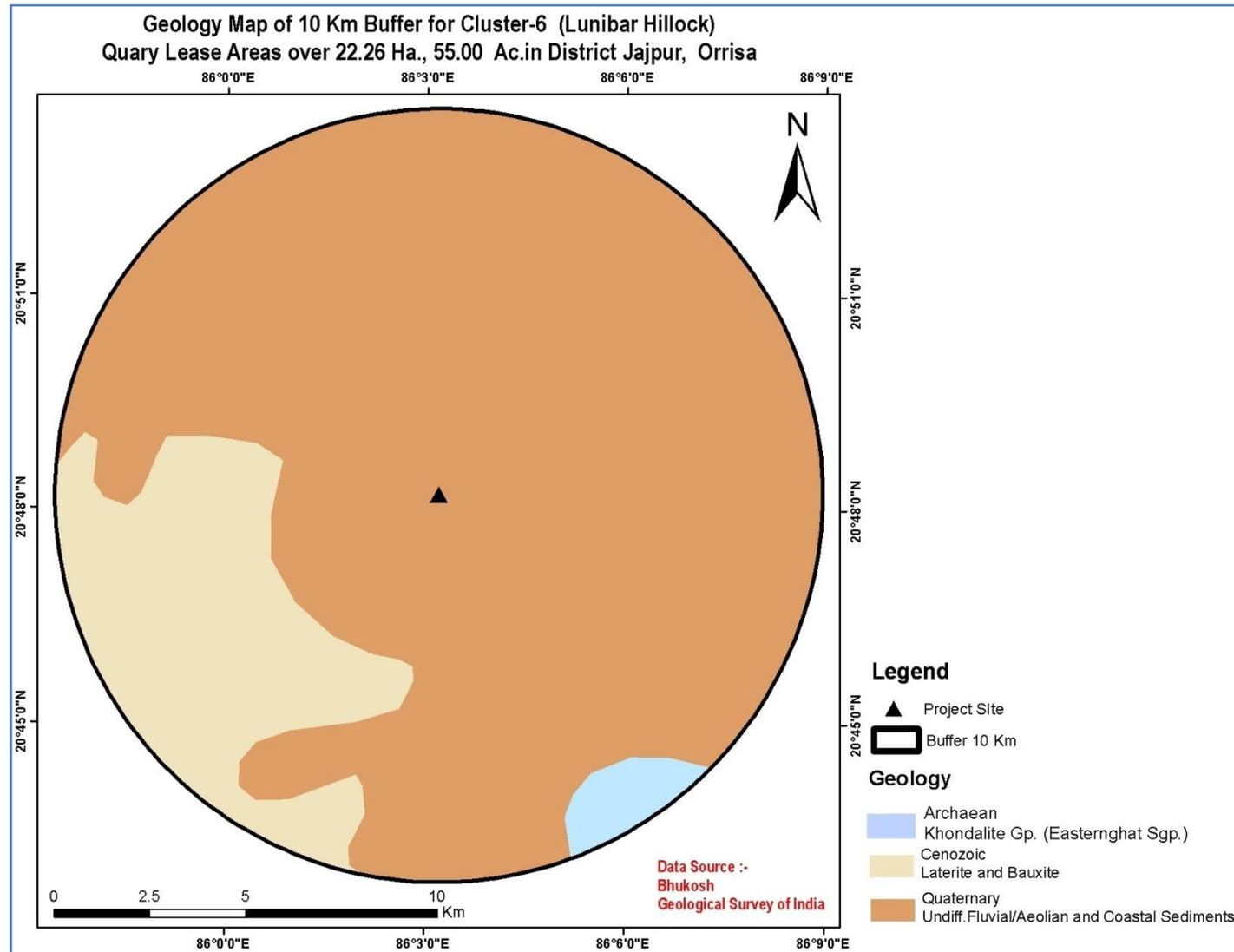


Figure 3.2: Geological map of the study area



### 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 Classes  | Soil | Area (Ha)       | 0-3%       | 3-8%   | 8-25%   | >25%  |
| 1      | Dharmasala | Matured Red & Laterite (alfisols)                      | Soil | 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 Coarse 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      |            | <b>Total</b>   |      | <b>31855.94</b> |            |        |         |       |

*Ref: District Irrigation Plan of Jajpur Odisha, March 2016 (District level implementation committee Jajpur, 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 m<sup>3</sup> /day to 25 m<sup>3</sup> /day while in schistose quartzites, it varies from 6 m<sup>3</sup> /day to 30 m<sup>3</sup> /day and in granite, it ranges from 6 to 15 m<sup>3</sup> /day. The specific capacity of dug well in these three hard formations vary from 0.0034 to 0.0054 m<sup>3</sup> /min/metre, 0.004 to 0.008 m<sup>3</sup> /min/metre and 0.0037 to 0.007 m<sup>3</sup> /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<sup>2</sup> /day to 3112 m<sup>2</sup> /day and 393 m<sup>2</sup> /day to 4650 m<sup>2</sup> /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<sup>2</sup>/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<sup>3</sup> /day. The specific capacity of the dug well varies from 0.82 m<sup>3</sup> /min/metre to 0.260 m<sup>3</sup> /min/metre draw down. The transmissivity of shallow aquifer constituted by laterites-limonites and chert varies from 40 m<sup>2</sup> /day to 234 m<sup>2</sup> /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<sup>2</sup> /day to 91 m<sup>2</sup> /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<sup>3</sup> /min/metre to 0.2214 m<sup>3</sup> /min/metre of draw down and the transmissivity varies from 3.2m<sup>2</sup> /day to 506m<sup>2</sup> /day. The specific capacity of the dug wells in laterites varies from 0.0016 m<sup>3</sup> /min/metre to 0.2214 m<sup>3</sup> /min/metre of draw down and the transmissivity varies from 3.2 m<sup>2</sup> /day to 506 m<sup>2</sup> /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:**

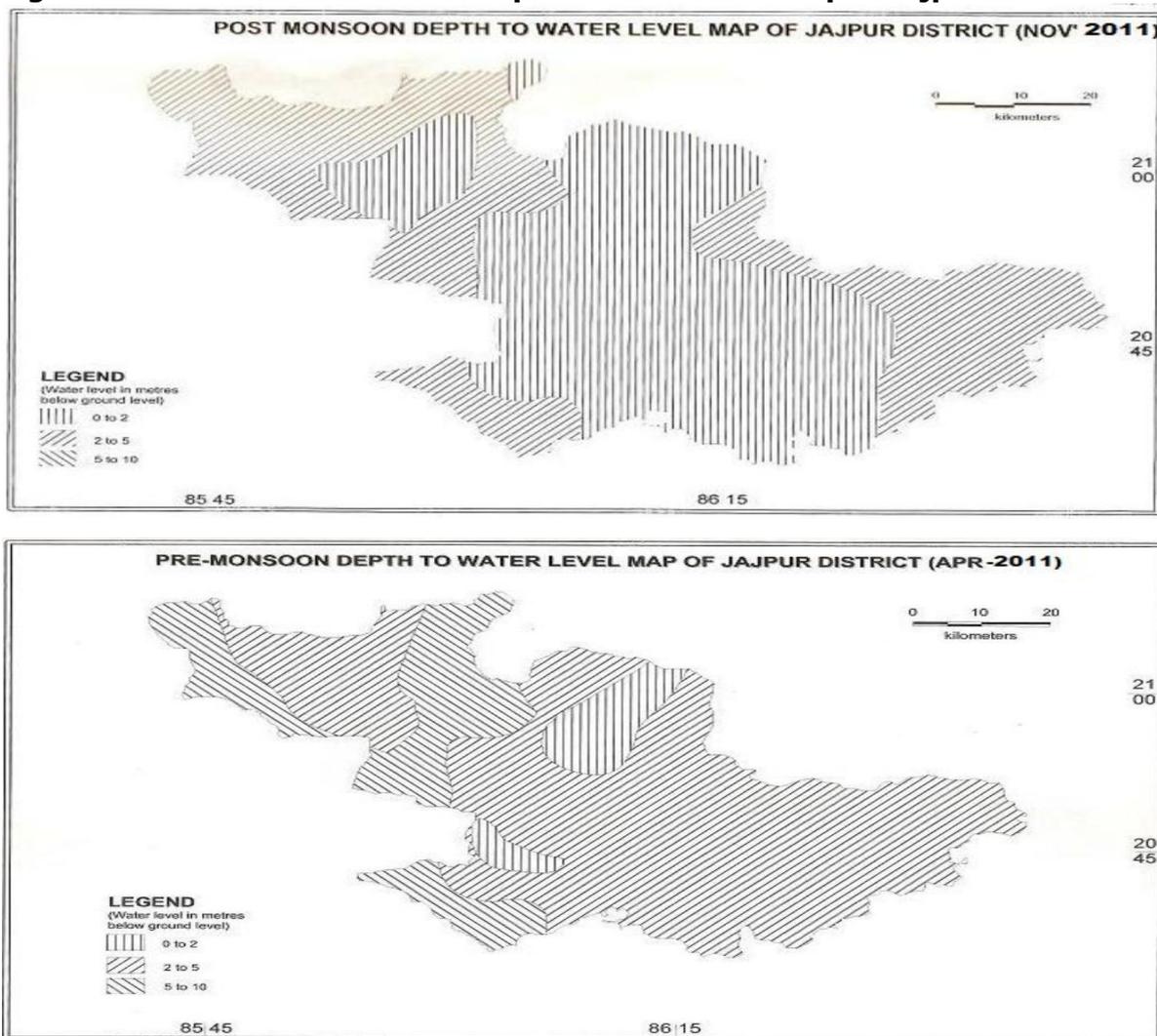
Long-term trend analysis (2001 - 2011) of phreatic water levels indicate that the water level in three-fourth of the dug wells show rising trend varying from 0.002 to 1.743 m/year, while the rest of the dug wells have declining trend ranging from 0.426 to 1.54 m/year.

### 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**

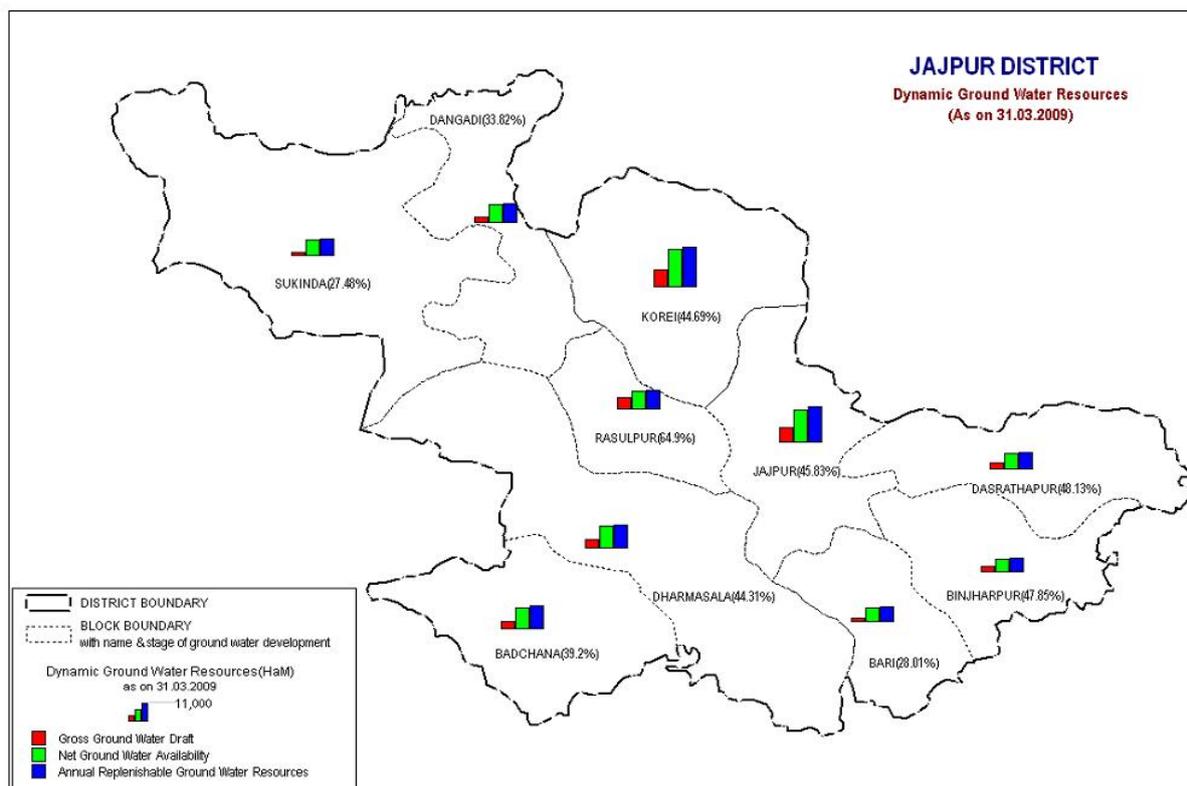


(Ref: Ground water information Booklet of Jajpur District, Odisha, May 2013)

**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 draft for industrial supply | Existing gross water and 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 |
|---|--|---|---|--|---|-----------------------------------|
| <i>All Figure in Ham</i>  |  |   |   |  |   |                                   |
| 6087  | 2640   | 56.82   | 2967  | 79   | 3368  | 44.31                             |
| <i>Ref: Ground water information Booklet of Jajpur District, Odisha, May 2013</i> |  |   |   |  |   |                                   |

**Figure 3.4 Dynamics of Ground water resource of Jajpur District**

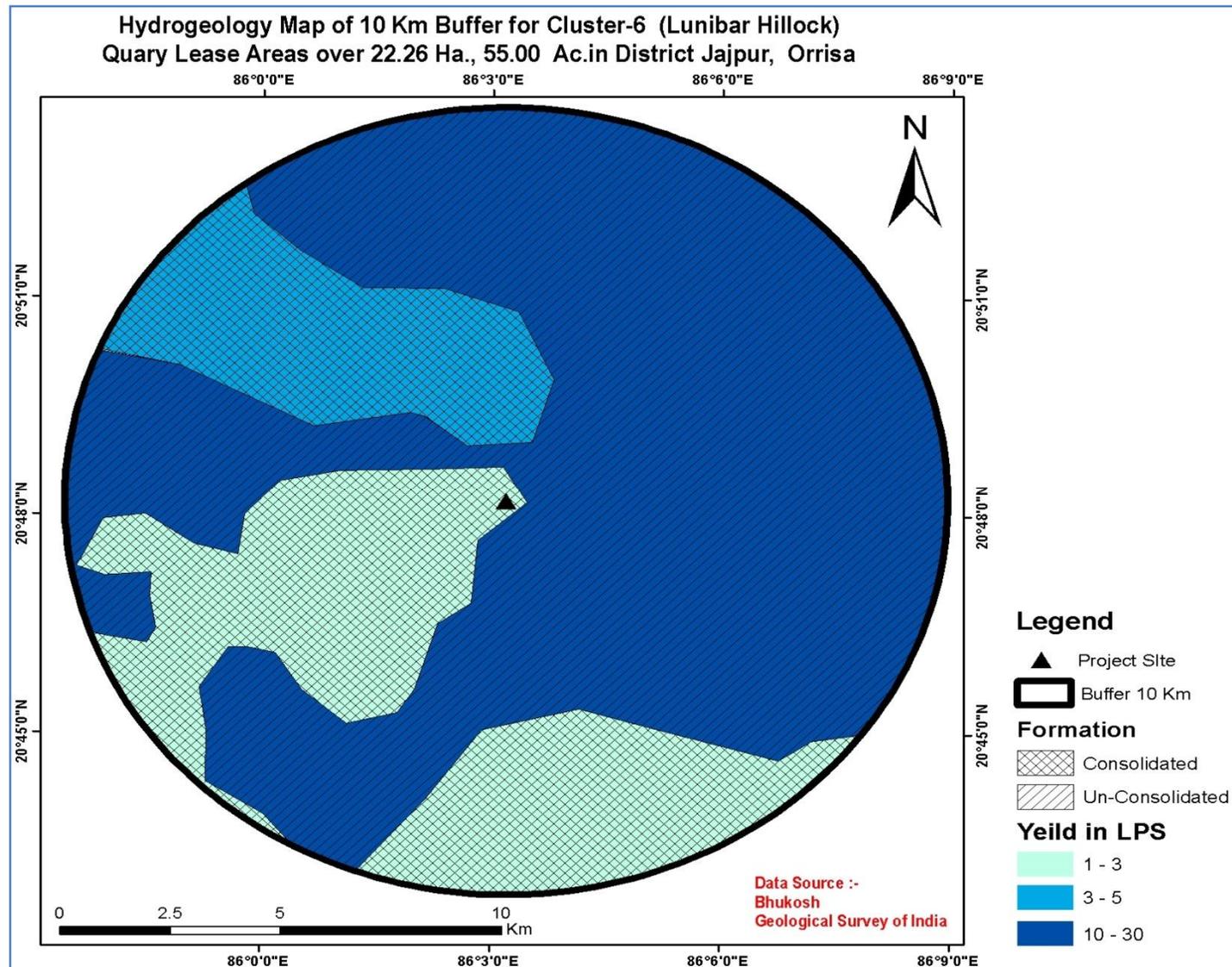


**3.5.2.1. Details of over exploited, critical and semi critical areas:**

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          | 2 <sup>nd</sup> 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 10.1 Software. 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**.

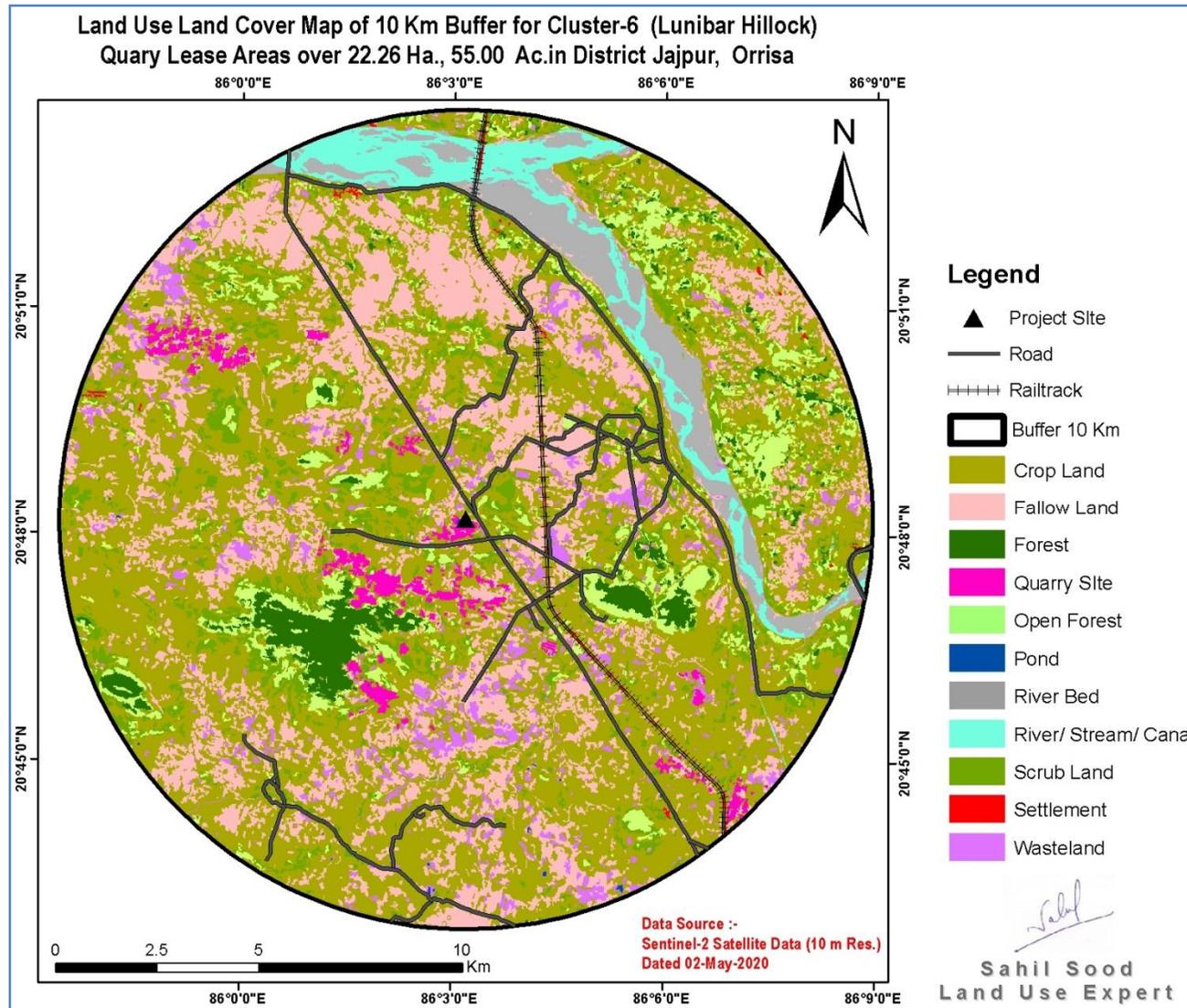
### 3.6.2 Land Use & Land Cover in Buffer zone

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          | 146.3669      | 14636.69        | 46.56               |
| 2            | Fallow Land          | 69.49958      | 6949.96         | 22.11               |
| 3            | Forest               | 8.702251      | 870.23          | 2.77                |
| 5            | Open Forest          | 19.67015      | 1967.02         | 6.26                |
| 6            | Pond                 | 0.10912       | 10.91           | 0.03                |
| 7            | River Bed            | 12.78656      | 1278.66         | 4.07                |
| 8            | River/ Stream/ Canal | 9.365637      | 936.56          | 2.98                |
| 9            | Scrub Land           | 29.28803      | 2928.80         | 9.32                |
| 10           | Settlement           | 0.886763      | 88.68           | 0.28                |
| 11           | Wasteland            | 12.69415      | 1269.41         | 4.04                |
| 12           | Mining Site          | 4.976312      | 497.63          | 1.58                |
| <b>Total</b> |                      | <b>314.34</b> | <b>31434.54</b> | <b>100</b>          |

**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 46.5% of the land is used for agricultural purpose, fallow land 22% 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 9.0% of the buffer zone and 9% 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

Eight 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 40 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 physico-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<br>4.6- 5.50 Strongly acidic<br>5.6-6.5 moderately acidic<br>6.6 – 6.9 slightly acidic<br>7.0 Neutral<br>7.1-8.5 Moderately alkaline<br>>8.5 strongly alkaline |
| 02     | Salinity Electrical Conductivity (µmhos/cm)<br>(1ppm = 640 µmho/cm) | Up to 1.00 Average<br>1.01-2.00 harmful to germination<br>2.01-3.00 harmful to crops (sensitive to salts)  |
| 03     | Organic carbon (%)  | < 0.5 – Low<br>0.5-0.75 – Medium<br>>0.75- High  |

|    |   |   |
|----|---|---|
| 04 | Nitrogen (kg/Ha)                                    | <280 low<br>280– 560 Medium<br>>560 High  |
| 05 | Phosphorus as P <sub>2</sub> O <sub>5</sub> (Kg/Ha) | <10 low<br>10 – 24.6 Medium<br>>24.6 High |
| 06 | Potassium as K <sub>2</sub> O (Kg/Ha)               | <108 low<br>108 – 280 Medium<br>>280 High |

**Ref: Department of Agriculture & Cooperation Ministry of Agriculture Government of India New Delhi, January, 2011**

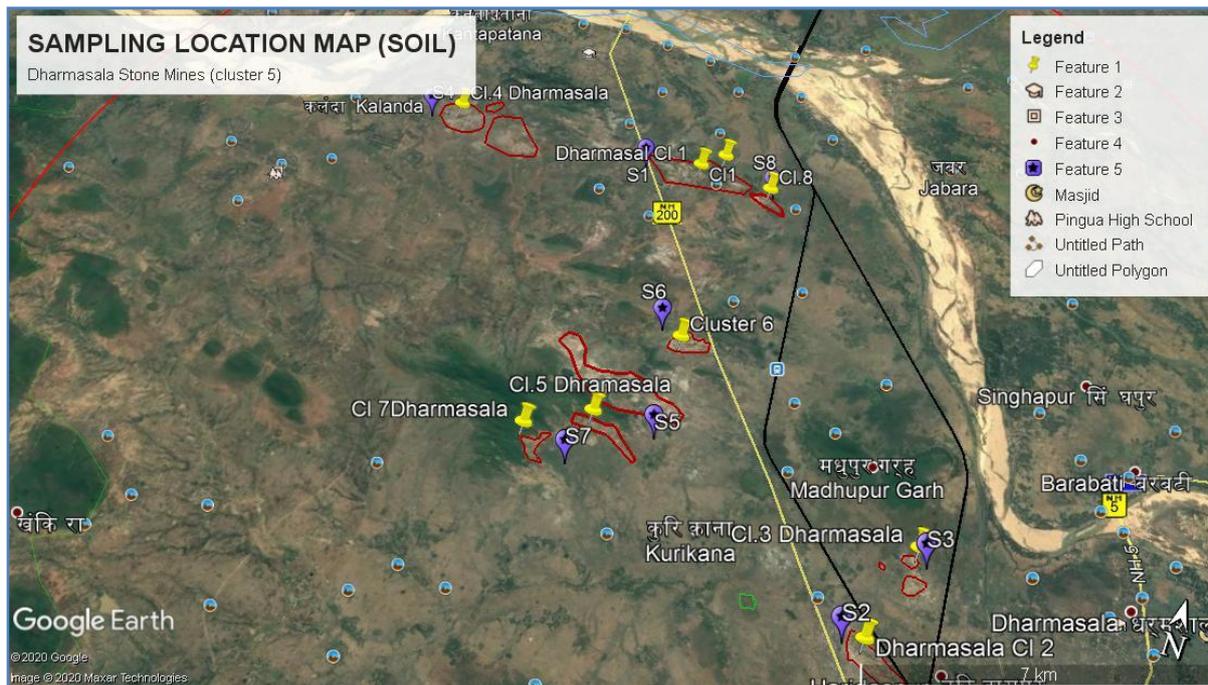
### 3.7.3 Sampling Locations

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        | 4.2 K, N             | 20°50'26.79" N<br>86°01'45.81" E  | Agricultural Land            |
| S2          | Aruha             | 4.0 Km, SE           | 20°45'1.41" N<br>86°05'50.25" E   | Agricultural land            |
| S3          | Bajabati          | 4.3 Km, SE           | 20°46'6.10" N<br>86°06'37.25" E   | Agricultural land            |
| S4          | Bichakhandi       | 5.8 Km, NW           | 20°50'26.79" N<br>86°01'45.81" E  | Agricultural land            |
| S5          | Dankari           | 0.5 Km, SE           | 20°46'41.864" N<br>86°03'03.828"E | Agricultural land            |
| S6          | Lunibar           | 6.3 Km, NW           | 20°48'7.22"N<br>86°02'43.98"E     | Agricultural land            |
| S7          | Rahadpur          | 1.0 Km, SW           | 20°46'5.04"N<br>86°02'6.15"E      | Agricultural land            |
| S8          | Sahanidiha        | 4.2 Kn, NE           | 20°50'27.846"N<br>86°03'37.78"E   | Non Agricultural Fallow land |

(Fig No.3.7: Soil Quality Monitoring Station)



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

**Table 3.9: Soil Quality Analysis Results**

| Location                        | S1        | S2            | S3         | S4            | S5        | S6         | S7              | S8              |
|---------------------------------|-----------|---------------|------------|---------------|-----------|------------|-----------------|-----------------|
| Colour                          | Grey      | Reddish Brown | Brown      | Reddish Brown | Grey      | Brown      | Brown           | Brown           |
| PH                              | 8.2       | 7.0           | 7.9        | 6.5           | 8.35      | 7.2        | 7.5             | 6.0             |
| Texture                         | Clay Loam | Sandy Loam    | Sandy Loam | Clay Loam     | Clay Loam | Sandy Loam | Silty Clay Loam | Silty Clay Loam |
| BULK DENSITY (G/Cc)             | 1.36      | 1.15          | 1.25       | 1.25          | 1.07      | 1.07       | 1.15            | 1.36            |
| Electrical Conductivity (µs/Cm) | 323       | 97            | 192        | 142           | 167       | 290        | 87              | 48              |
| Available Nitrogen (Kg/Ha)      | 1814      | 1389          | 1658       | 1501          | 1590      | 1747       | 1299            | 1210            |
| Available Phosphrous (Kg/Ha)    | 31.38     | 25.94         | 41.75      | 32.90         | 36.69     | 49.99      | 18.97           | 13.91           |
| Sodium (mg/kg)                  | 425       | 135           | 170        | 140           | 135       | 160        | 185             | 110             |
| Potassium (Kg/Ha)               | 482       | 134           | 168        | 269           | 314       | 336        | 179             | 235             |
| Total Organic Carbon            | 1.13      | 2.37          | 0.36       | 0.59          | 1.84      | 0.78       | 1.88            | 0.36            |
| Moisture (%)                    | 13.15     | 10.83         | 5.96       | 9.5           | 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  $\mu\text{s}/\text{Cm}$ . 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**

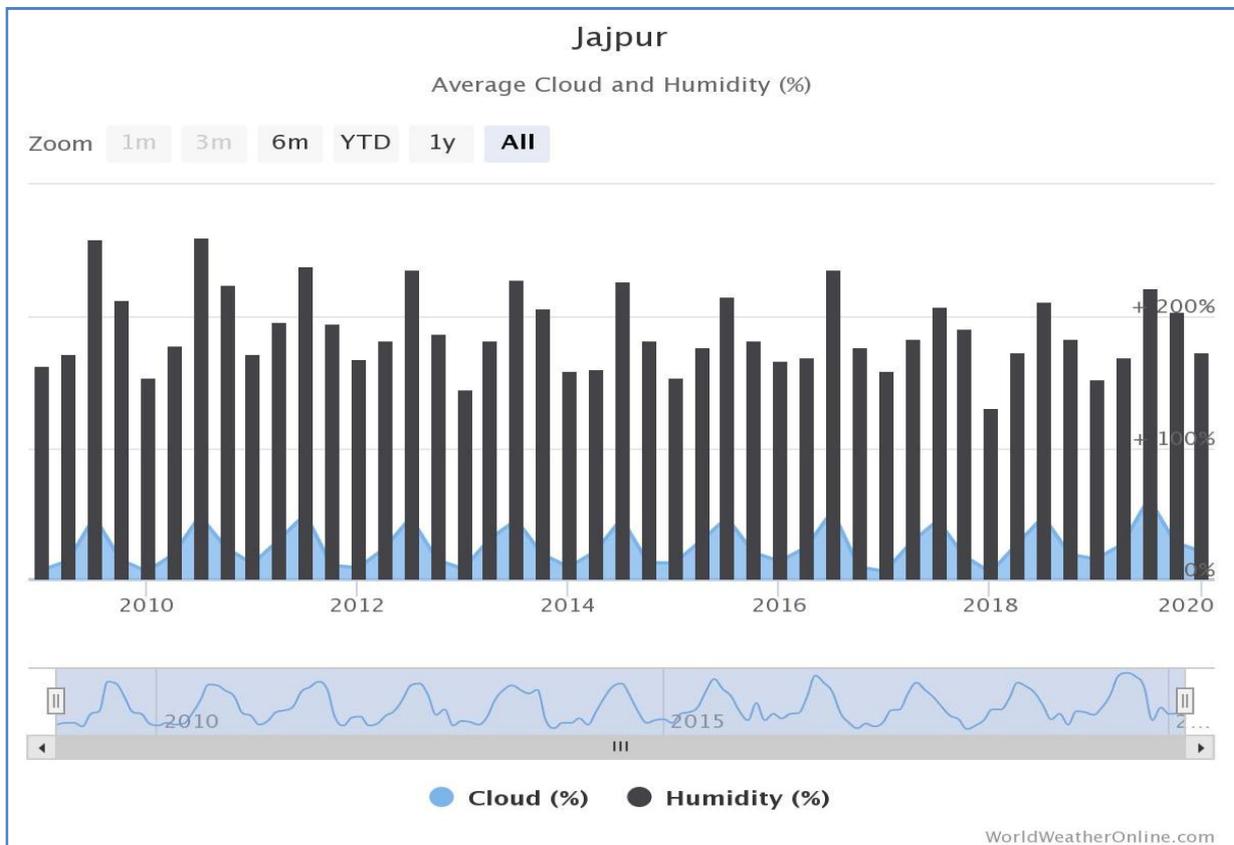
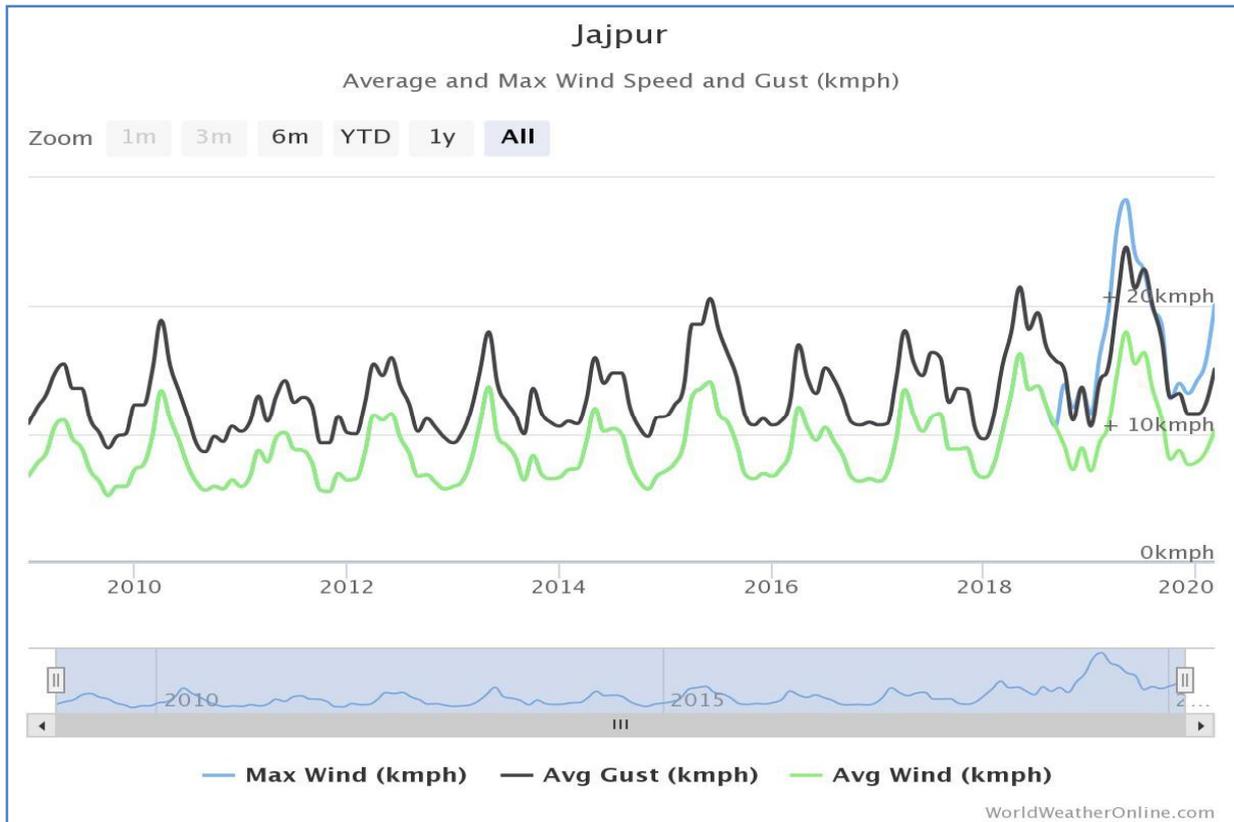
#### **3.8.1.1 Climate of the district**

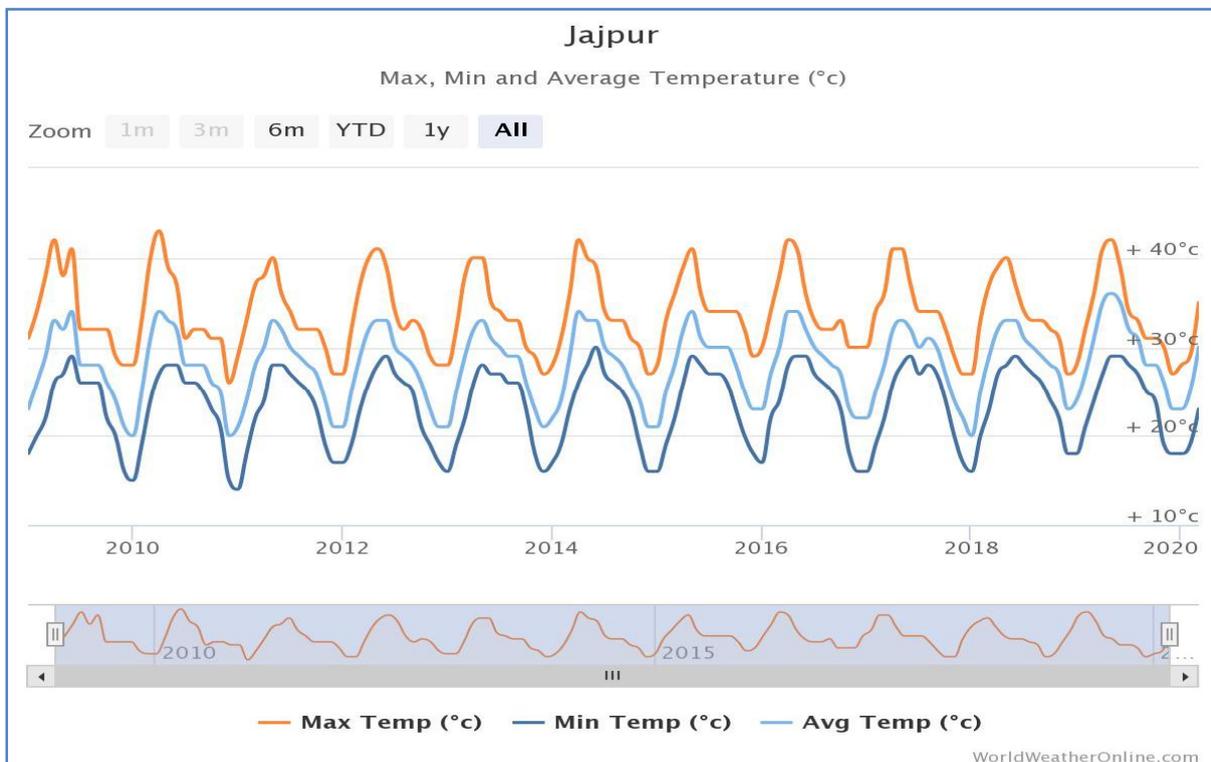
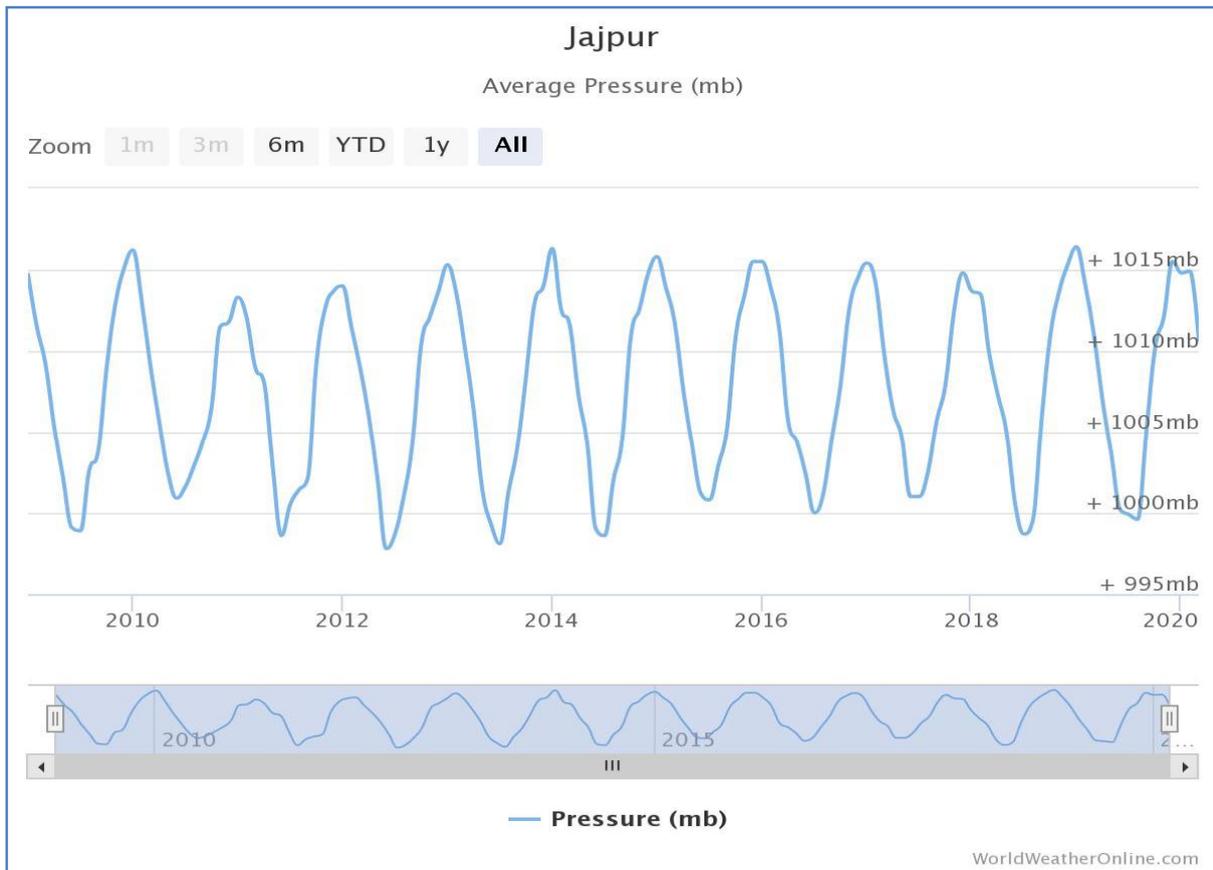
The district is characterized by humid sub - tropical monsoon climate having three distinct seasons in a year, i.e. winter, summer and rainy seasons. Winter commenced from late November and continues till end of February. Winter is followed by the summer season, which extends upto mid June. The rainy 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 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 tracts receive a fairly high rainfall (>1500 mm.) which gradually decreases to 1300mm towards north-east. The meteorological 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       | 38 °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%         | 35%         | 20%         | 37%        | 57%       |
| Humidity | 37%         | 52%         | 59%       | 55%         | 57%        | 34%        | 48%         | 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   |





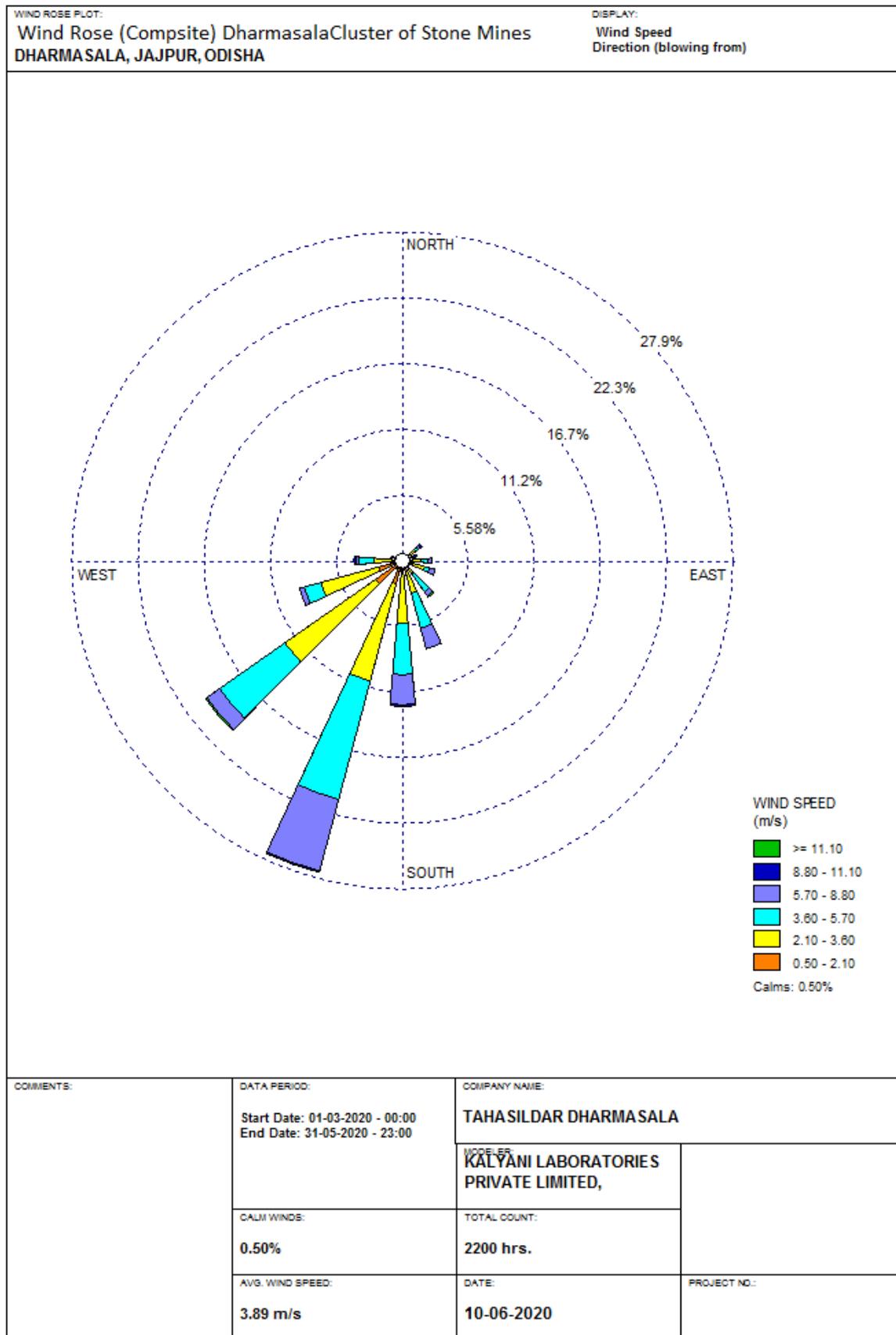
### 3.8.6 Rainfall

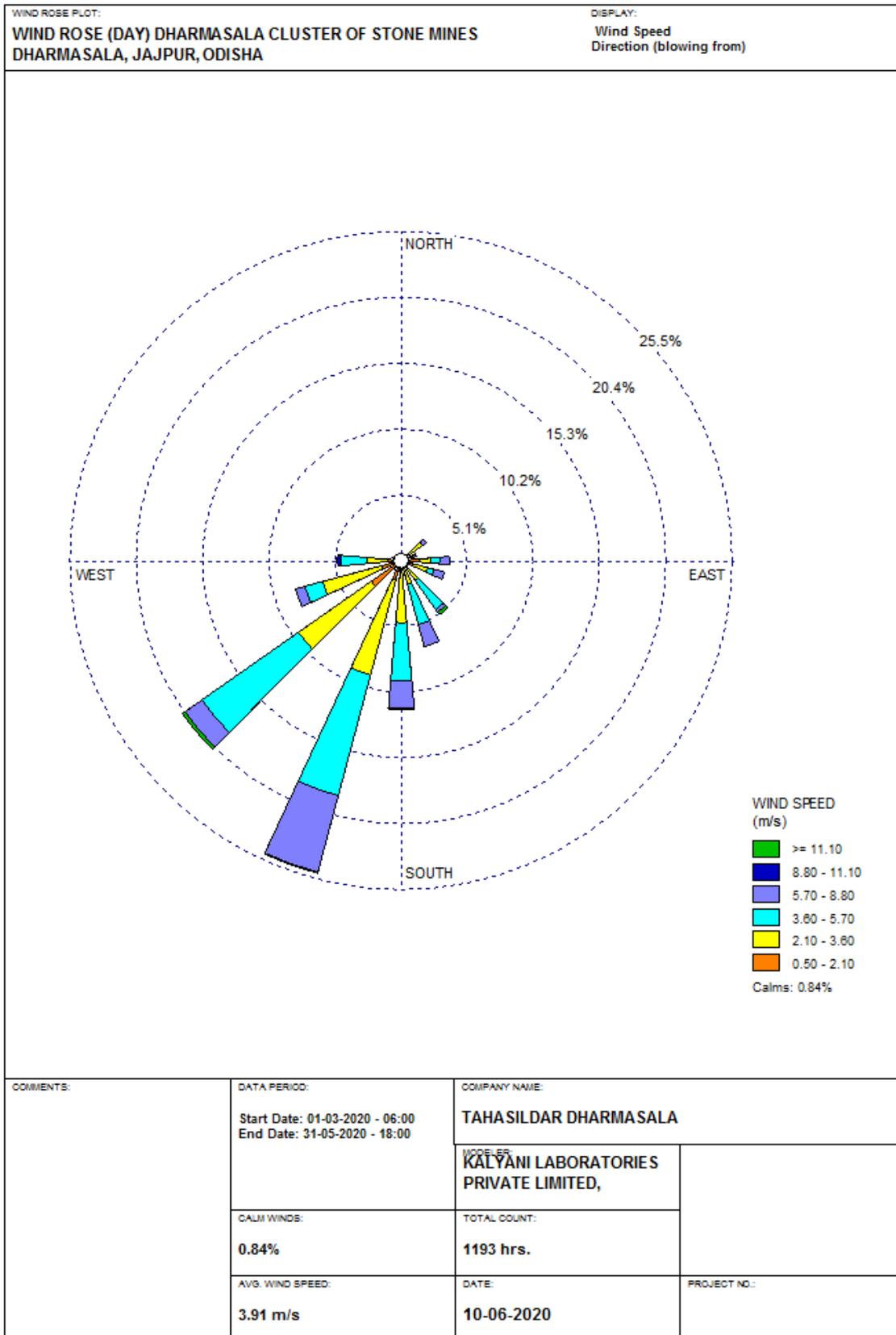
The average annual rainfall based on the 10 years (2009 – 2019) IMD data of Jajpur district, was observed to be 1557 mm distributed in 154 rainy days. The monsoon sets in the month of June and continues till September and sometime extends up to mid October. The maximum number of rainy days was observed 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          |               |            |
| <b>Total</b> | <b>2852.8</b> | <b>136</b> | <b>2621.3</b> | <b>174</b> | <b>1119.2</b> | <b>148</b> | <b>1370.7</b> | <b>143</b> | <b>1466.03</b> | <b>159</b> |               |            |
| 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          |
| <b>Total</b> | <b>1303</b>   | <b>159</b> | <b>753.5</b>  | <b>131</b> | <b>1251</b>   | <b>157</b> | <b>1790.4</b> | <b>166</b> | <b>2153.7</b>  | <b>133</b> | <b>1748.1</b> | <b>131</b> |

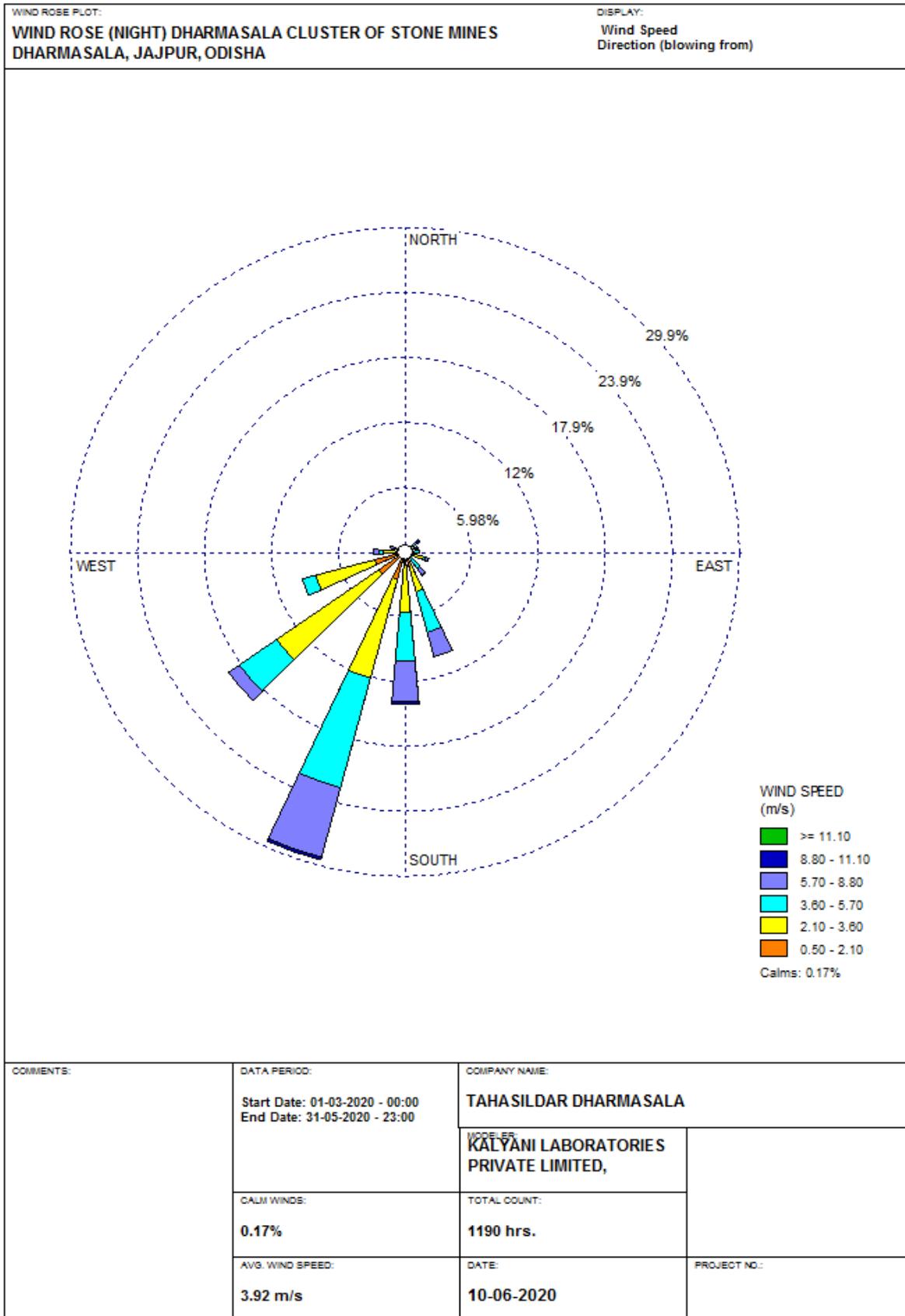
**Fig. 3.9: Wind Rose Diagram (Composite)**





**Fig. 3.10: Wind Rose Diagram (Day)**

**Fig.3.11 Wind Rose Diagram (Night)**



WRPLOT View - Lakes Environmental Software

**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 /<br>Wind Classes<br>(m/s) | 0.50 -<br>2.10 | 2.10 -<br>3.60 | 3.60 -<br>5.70 | 5.70 -<br>8.80 | 8.80 -<br>11.10 | >=<br>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<sub>10</sub> & PM<sub>2.5</sub>), Sulphur Dioxide (SO<sub>2</sub>) Oxides of Nitrogen (NO<sub>x</sub>), Ozone (O<sub>3</sub>) and CO has 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:

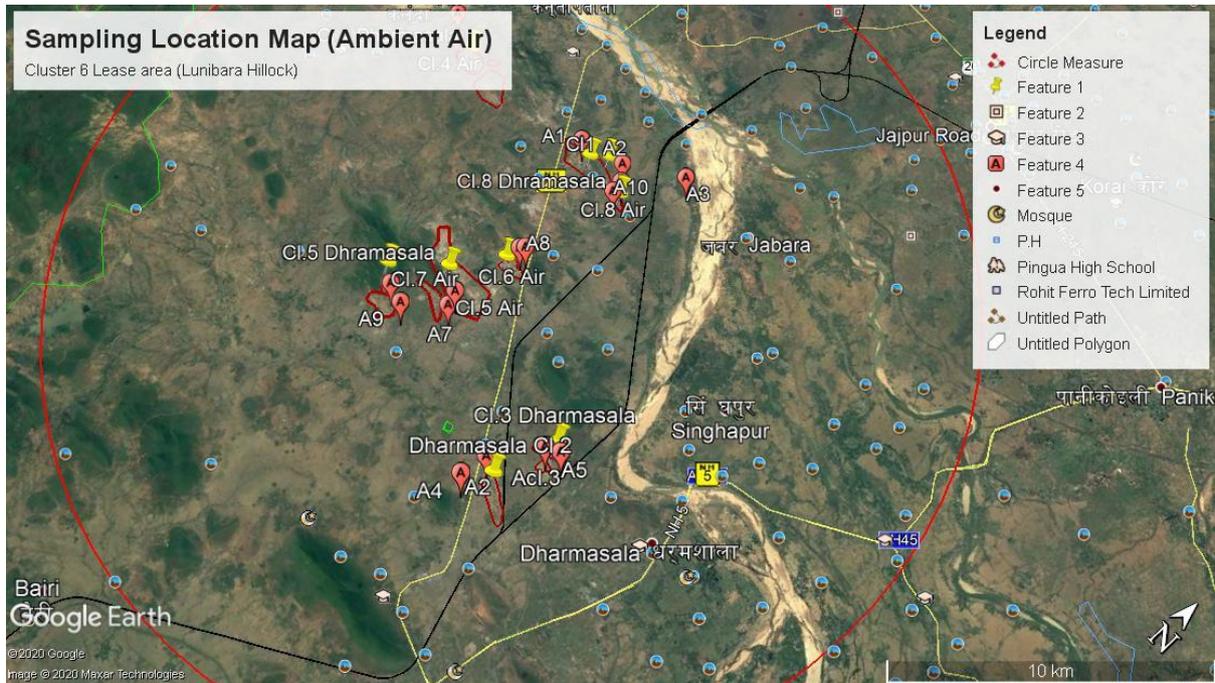
The details of these Ambient Air quality-sampling stations are given in **Table No. 3.13**.

**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°48'12.79"N<br>86° 03'19.37" E   | Industrial Area | --   |
| A2           | MakundPur         | 3.2 Km, N            | 20° 50'44.37" N<br>86° 3' 20.37" E | Village Area    | 1 <sup>st</sup><br>Predominant<br>Wind Direction |
| A3           | Jena Pur          | 4.2 Km, NE           | 20° 51'23.64" N<br>86° 4'28.51"E   | Village Area    | 1 <sup>st</sup><br>Predominant<br>Wind Direction |
| A4           | Aruha             | 4.8 Km, S            | 20°44'28.99"N<br>86° 5'51.26" E    | Village Area    | 2 <sup>nd</sup><br>Predominant<br>Wind Direction |
| A7           | Dankri            | 1.2 Km, SSW          | 20° 46'24.69"N<br>86° 3'10.46"E    | Village Area    | 2 <sup>nd</sup><br>Predominant<br>Wind Direction |
| A8           | Luni Bara         | 0.5 Km, N            | 20° 48'12.79"N<br>86° 3' 19.37"E   | Village Area    | 1 <sup>st</sup><br>Predominant<br>Wind Direction |
| A9           | Rahadpur          | 2.56 Km, SW          | 20° 45'49.53"N                     | Village Area    | Downwind   |

|     |            |            |                                 |              |  |
|-----|------------|------------|---------------------------------|--------------|--|
|     |            |            | 86° 2' 28.61"E                  |              | Direction  |
| A10 | Sahanidiha | 2.6 Km, NE | 20° 50'11.85"N<br>86° 3'39.09"E | Village Area | 1 <sup>st</sup><br>Predominant<br>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 <sub>2</sub> ), µg/m <sup>3</sup>      | Annual                | 50 µg/m <sup>3</sup>                         | 20 µg/m <sup>3</sup>                                    | Improved West &Gaeke   |
|  |  | 24 Hours              | 80 µg/m <sup>3</sup>                         | 80 µg/m <sup>3</sup>                                    |  |
| 2  | Nitrogen Dioxide (NO <sub>2</sub> ), µg/m <sup>3</sup>     | Annual                | 40 µg/m <sup>3</sup>                         | 30 µg/m <sup>3</sup>                                    | Modified Jacob &Hochheiser (Na – Arsenite)                         |
|  |  | 24 Hours              | 80 µg/m <sup>3</sup>                         | 80 µg/m <sup>3</sup>                                    |  |
| 3  | Particulate Matter(PM <sub>10</sub> ), µg/m <sup>3</sup>   | Annual                | 60 µg/m <sup>3</sup>                         | 60 µg/m <sup>3</sup>                                    | Gravimetric  |
|  |  | 24 Hours              | 100 µg/m <sup>3</sup>                        | 100 µg/m <sup>3</sup>                                   |  |
| 4  | Particulate Matter( PM <sub>2.5</sub> ), µg/m <sup>3</sup> | Annual                | 40 µg/m <sup>3</sup>                         | 40 µg/m <sup>3</sup>                                    | Gravimetric  |
|  |  | 24 Hours              | 60 µg/m <sup>3</sup>                         | 60 µg/m <sup>3</sup>                                    |  |
| 5.   | Carbon Monoxide (CO), mg/m <sup>3</sup>                    | 8 hours               | 02   | 02  | CPCB guideline for Measurementof Ambient Air Pollutant (Vol 1 & 2) |
|  |  | 1 Hour                | 04   | 04  |  |
| 6.   | Ozone (O <sub>3</sub> )                                    | 8 hours               | 100  | 100   |  |
|  |  | 1 Hour                | 180  | 180   |  |
| <b>Ref: National Ambient air quality standards, 2009</b> |  |                       |  |   |  |

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

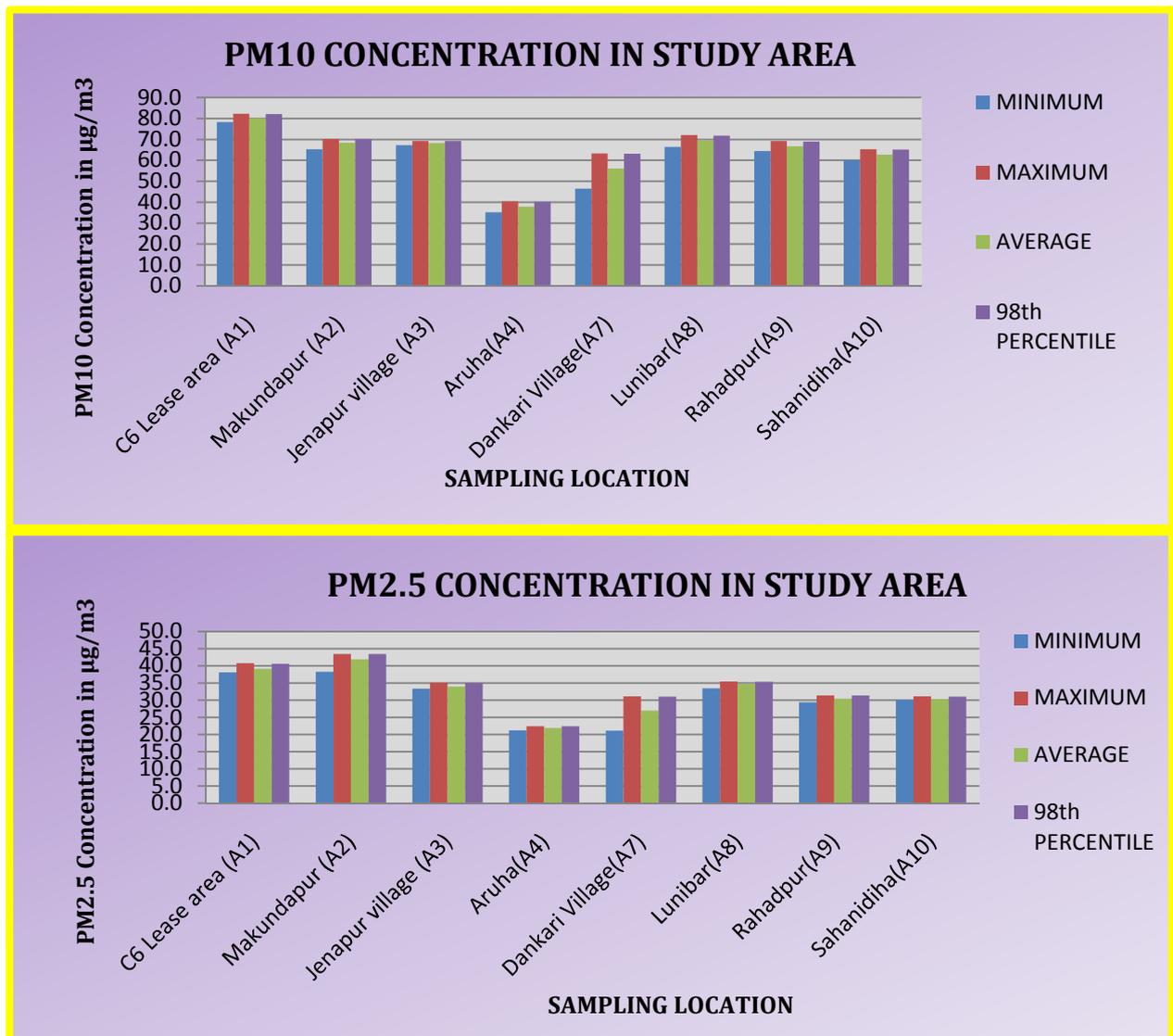
**Table 3.16: Summarized AAQ monitoring result**

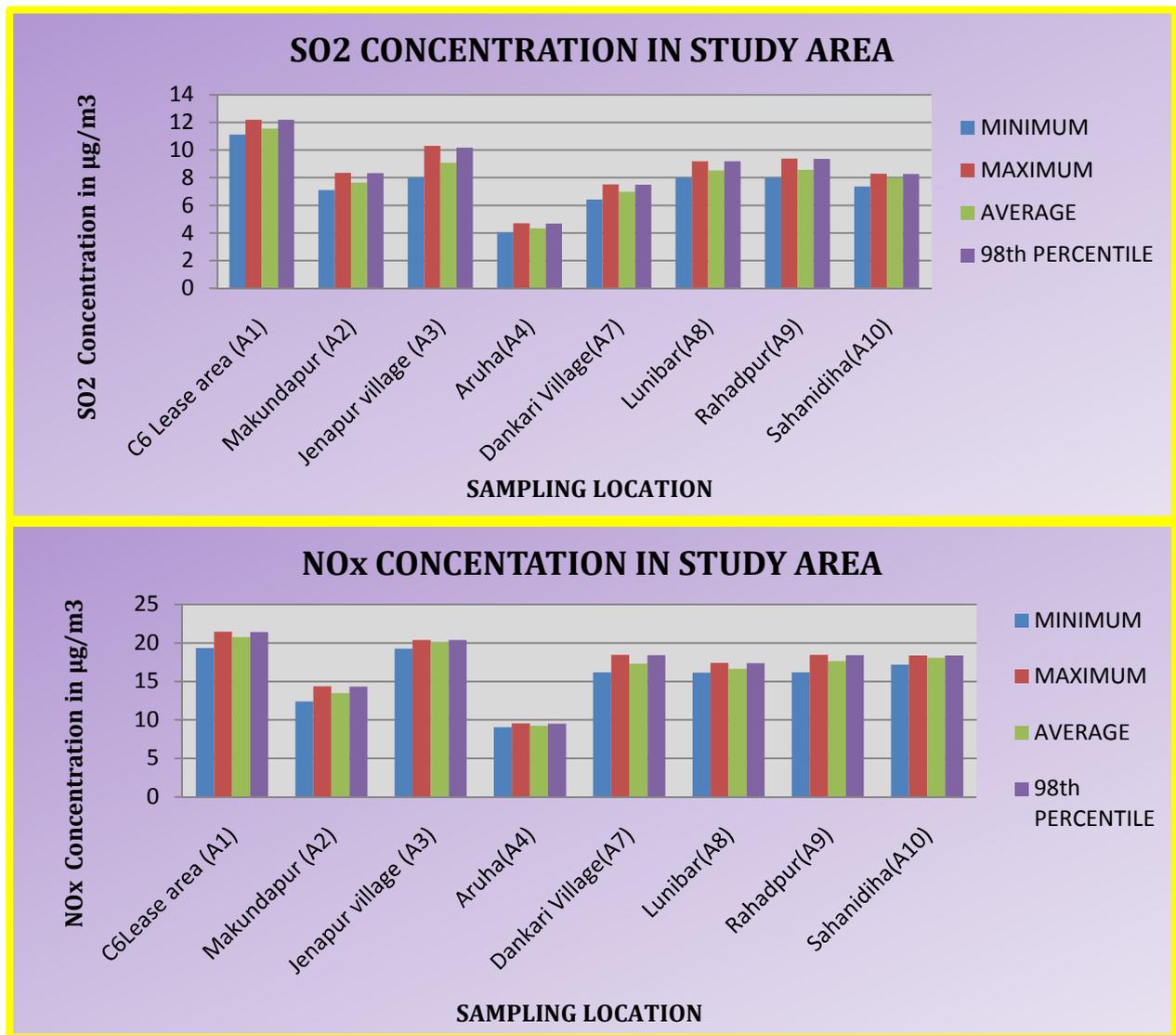
| Sl. No | Locati on | PM <sub>10</sub> (µg/m <sup>3</sup> ) |      |      |                       | PM <sub>2.5</sub> (µg/m <sup>3</sup> ) |      |      |                       | SO <sub>2</sub> (µg/m <sup>3</sup> ) |      |      |                       | NO <sub>x</sub> (µg/m <sup>3</sup> ) |      |      |                       |
|--------|-----------|---------------------------------------|------|------|-----------------------|--|------|------|-----------------------|--------------------------------------|------|------|-----------------------|--------------------------------------|------|------|-----------------------|
|        |           | Min                                   | Max  | Avg  | 98 <sup>th</sup> perc | Min                                    | Max  | Avg  | 98 <sup>th</sup> perc | Min                                  | Max  | Avg  | 98 <sup>th</sup> perc | Min                                  | Max  | Avg  | 98 <sup>th</sup> perc |
| 1      | A1        | 78.3                                  | 82.3 | 80.1 | 82.2                  | 38.1                                   | 40.7 | 39.1 | 40.6                  | 11.1                                 | 12.2 | 11.5 | 12.2                  | 19.3                                 | 21.5 | 20.8 | 21.4                  |
| 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 | 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 |
| 6 | 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 |
| 7 | A9  | 64.4 | 69.3 | 66.6 | 69.0 | 29.4 | 31.4 | 30.4 | 31.4 | 8.0 | 9.4 | 8.6 | 9.4 | 16.2 | 18.5 | 17.6 | 18.4 |
| 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 SO<sub>x</sub> concentration is below detection limit and NO<sub>x</sub> 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 nine 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 <sub>2</sub> ) , mg/l, min | 6  | 5       | 4       | 4       | -       |
| BOD, 3 days at 27 <sup>0</sup> 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       |
| <b>Below-E</b>                                    | <b>Not Meeting A, B, C, D &amp; E Criteria</b> |         |         |         |         |

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<sub>3</sub>. 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 <sub>2</sub> SO <sub>4</sub> 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 <sub>3</sub> 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 <sub>2</sub> SO <sub>4</sub> to pH>2, Refrigeration ,28 days  |
| 16      | Hexavalent Chromium (Cr <sup>+6</sup> )                    | Plastic / glass rinse with 1 + 1 HNO <sub>3</sub> | 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 <sub>3</sub> | 500            | Filter, add HNO <sub>3</sub> to pH<2, 6 months                      |
| 18      | Dissolved oxygen   | BOD Bottle/glass                                  | 300            | Analysed immediately, Titration may be delayed after                |

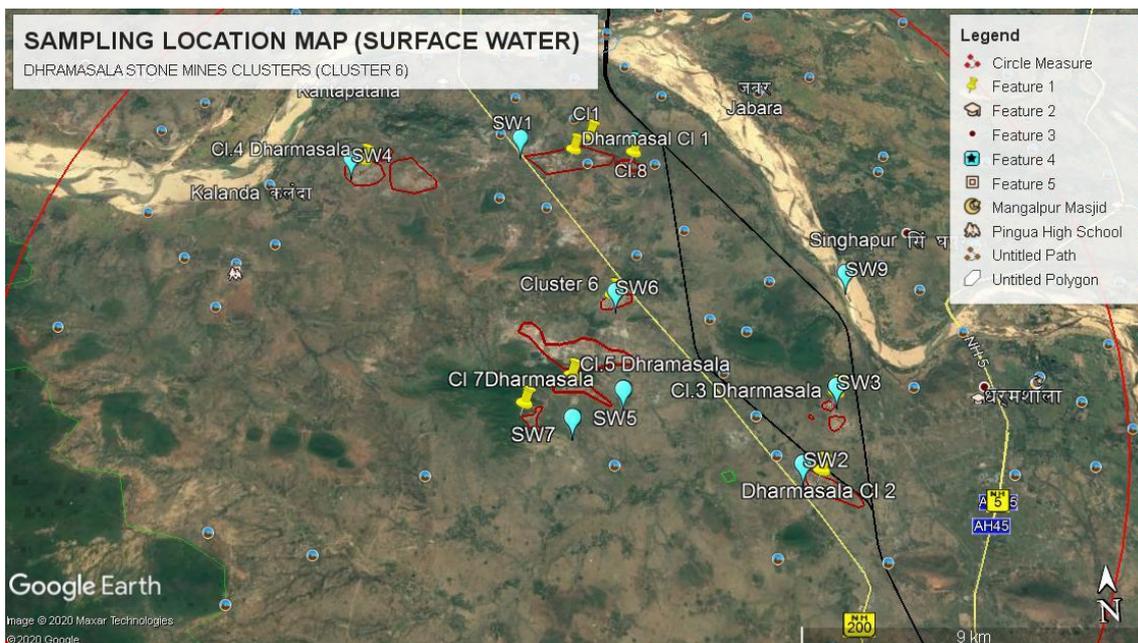
|    |           |                              |      |  |
|----|-----------|------------------------------|------|--|
|    |           |                              |      | acidification,8hours                                       |
| 19 | Turbidity | plastic/glass Floropolymer   | 100  | analyse same day store in dark upto 24 hours, cool, <= 6°C |
| 20 | Cyanide   | Grab sampling plastic bottle | 1000 | analyse within 15 min add NaOH to > 12,store in cool <=6°C |

[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.I. No | Locations    | Distance/ Direction in km | Latitude & Longitude             | Statio n No. | Details         |
|---------|--------------|---------------------------|----------------------------------|--------------|-----------------|
| 1.      | Anjira       | 3.0 Km, N                 | 20°50'38.25" N<br>86°01'38.79" E | SW1          | Pond            |
| 2.      | Aruha        | 4.3 Km, S                 | 20°44'56.20" N<br>86°05'49.70" E | SW2          | Pond            |
| 3.      | Bajabati     | 4.0 Km, SE                | 20°46'05.24" N<br>86°06'32.57" E | SW3          | Pond            |
| 4.      | Bichakhandi  | 5.7 Km, NNW               | 20°50'25.27" N<br>85°58'40.84" E | SW4          | Pond            |
| 5.      | Dankari      | 2.0 Km, S                 | 20°46'14.42" N<br>86°03'05.79" E | SW5          | Pond            |
| 6.      | Lunibara     | 0.3 Km, S                 | 20°47'50.03" N<br>86°03'06.11" E | SW6          | Pond            |
| 7.      | Rahadpur     | 2.7 Km, SW                | 20°45'30.09" N<br>86°02'15.81" E | SW7          | Pond            |
| 8.      | Sahanidiha   | 3.0 Km, NNE               | 20°50'28.33" N<br>86°03'38.78" E | SW8          | Nala            |
| 9.      | Brundadeipur | 4.0 Km, NE                | 20°47'54.95" N<br>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-2581    | S-2583    | S-2585    | S-2587    | S-2588    | S-2589    |
|                                     |       |   |                                      | SW1                 | SW2       | SW3       | SW4       | SW5       | SW6       | SW7       | SW8       | SW9       |
| PH                                  | --    | IS 3025:PART11:1983 (Reaff 2002)            | 6.5 – 8.5                            | 7.6                 | 8         | 7.8       | 7.6       | 7.4       | 7.7       | 7.9       | 7.3       | 7.6       |
| Electrical Conductivity             | µs/cm | APHA-23 <sup>rd</sup> Edition (2510 A):2017 | --                                   | 285                 | 468       | 323       | 260       | 275       | 295       | 480       | 300       | 144       |
| Total Dissolved Solid               | mg/l  | IS 3025:PART15:1984 (Reaff 2002)            | 1500                                 | 200                 | 320       | 240       | 180       | 190       | 210       | 350       | 270       | 90        |
| Chemical Oxygen Demand              | mg/l  | APHA-23 <sup>rd</sup> Edition (5220 B)      | --                                   | 28                  | 58        | 23        | 20        | 25        | 30        | 81        | 20        | 20        |
| Taste                               | -     | IS 3025 (Part - 8):1984 RA 2006             | -                                    | Agreeable           | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| Biochemical Oxygen Demand           | mg/l  | APHA-23 <sup>rd</sup> Edition (5210 B)      | 3.0                                  | 5                   | 9         | 4         | 3         | 5         | 6         | 10        | 4         | 4         |
| Chloride                            | mg/l  | IS 3025:PART32:1988                         | 600                                  | 20.9                | 41.7      | 12.5      | 14.6      | 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      | 0.55      | 0.65      | 0.72      | 0.63      | 0.21      | 0.18      |
| Sulphate                            | mg/l  | IS 3025:PART24:1986                         | 400                                  | < 1                 | 80        | 150       | 90        | 30        | 22        | 48        | 75        | 9         |
| Total Hardness as CaCO <sub>3</sub> | mg/l  | IS 3025:PART21:2009                         | --                                   | 96                  | 144       | 96        | 88        | 64        | 52        | 92        | 100       | 64        |
| Dissolved Oxygen                    | mg/l  | APHA-23 <sup>rd</sup> Edition (4500-O-C)    | 4.0 (min)                            | 6.8                 | 7.2       | 5.9       | 6.6       | 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    | < 0.01    | 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    | < 0.01    |

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|                            |                   |   |      |           |           |           |           |           |           |           |           |           |
|----------------------------|-------------------|---|------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 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    | < 0.01    |
| Iron as Fe                 | mg/l              | IS 3025:PART53:2003                               | 50   | < 0.05    | < 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    | < 0.01    |
| Lead as Pb                 | mg/l              | IS 3025:PART47:1994                               | 0.1  | < 0.01    | < 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    | < 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    | < 0.01    |
| Ammonia                    | mg/l              | APHA 23 <sup>RD</sup> EDITION-4500 -NH3-B         | -    | < 0.3     | < 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     | < 1.0     |
| Odour                      | --                | IS3025:PART05:1983                                | --   | Agreeable |
| Nitrate as NO <sub>3</sub> | mg/l              | IS 25:PART34:1988                                 | 50   | 2.2       | 3.2       | 1.2       | 1.5       | 1.1       | 1.6       | 3.5       | 1.8       | 1.3       |
| Total Alkalinity           | mg/l              | IS 3025 (Part 23):1986 RA 2009                    | -    | 117       | 180       | 66        | 88        | 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     | < 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     | < 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   | < 0.001   |
| Calcium as Ca              | mg/l              | IS 3025:PART40:1991 (Reaff 2003)                  | --   | 27.2      | 41.6      | 30.4      | 24        | 16        | 12.8      | 16        | 30.4      | 22.4      |
| Total Suspended solid      | mg/l              | APHA-23 <sup>rd</sup> Edition (2540 D)            | --   | < 0.4     | < 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        | 36        | 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    | < 0.01    |

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|                              |            |                          |      |       |       |       |       |       |       |       |       |       |
|------------------------------|------------|--------------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| M                            |            |                          |      |       |       |       |       |       |       |       |       |       |
| 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 | < 0.1 |
| Total Coliforms              | MPN/100 ml | IS 1622:1981 RA 2009     | 5000 | 170   | 220   | 60    | 110   | 110   | 90    | 130   | 110   | 06    |

**Ref: Sampling and Analysis by KLPL**

### 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 7.82 which 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 load observed in the sources monitored indicating no pollution load in the source.

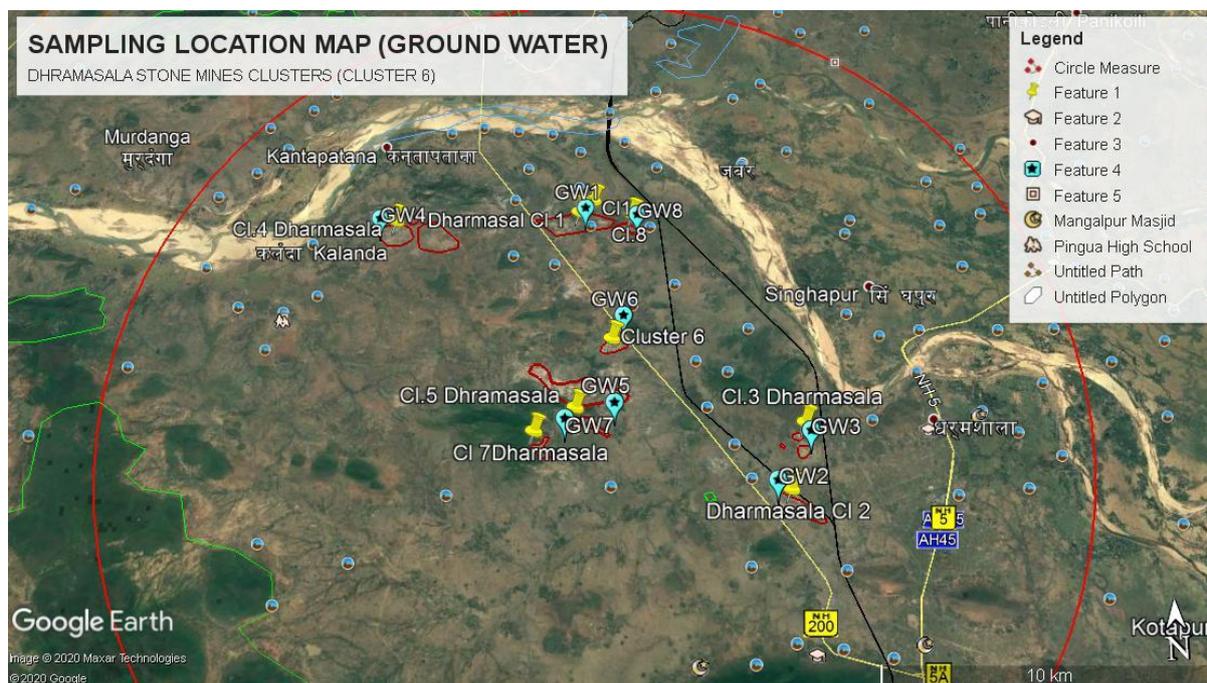
### 3.10.5 Ground water quality of the study area

The ground water samples were collected from 8 different sampling stations & 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      | 3.0 Km, N           | 20°50'24.62N<br>86°02'42.34" E | Tube Well       |
| GW2         | Aruha       | 4.4 Km, SE          | 20°44'57.55N<br>86°05'54.08" E | Tube Well       |
| GW3         | Bajabati    | 1.6 Km,SE           | 20°45'48.16N<br>86°06'37.16" E | Tube Well       |
| GW4         | Bichakhandi | 5.6Km, NW           | 20°50'25.27N<br>85°58'36.01" E | Tube Well       |
| GW5         | Dankari     | 1.2 Km, S           | 20°45'31.24N<br>86°03'01.50" E | Tube Well       |
| GW6         | Lunibara    | 0.2 Km, E           | 20°48'10.12N<br>86°03'18.56" E | Bore well       |
| GW7         | Rahadpur    | 2.0 Km, SW          | 20°46'16.86N<br>86°02'05.13" E | Tube Well       |
| GW8         | Sahanidiha  | 2.8 Km, NE          | 20°50'12.65N<br>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-2578    | S-2590    | S-2584    | S-2586    | S-2582    |
|                             |       |                               |   | GW1                  | GW2       | GW3       | GW4       | GW5       | GW6       | GW7       | GW8       |
| PH                          | --    | 6.5 – 8.5                     | IS 3025 (Part 11):1983 RA 2012                    | 7.1                  | 6.7       | 7.2       | 7.4       | 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       | 0.1       | 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   | < 0.001   |
| Colour                      | Hazen | 5                             | IS3025:PART04:1983                                | < 1                  | < 1       | < 1       | < 1       | < 1       | < 1       | < 1       | < 1       |
| Odour                       | --    | Agreeable                     | IS3025:PART05:1983                                | agreeable            | agreeable | agreeable | agreeable | agreeable | agreeable | agreeable | agreeable |
| Taste                       | -     | Agreeable                     | IS 3025 (Part - 8):1984 RA 2006                   | agreeable            | 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     | < 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     | < 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   | < 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    | < 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   | < 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     | < 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   | < 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   | < 0.025   |
| Zinc as Zn                  | mg/l  | 5                             | IS  | < 0.05               | < 0.05    | < 0.05    | < 0.05    | < 0.05    | < 0.05    | < 0.05    | < 0.05    |

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|  |      |       |  |          |          |          |          |          |          |          |          |
|--|------|-------|--|----------|----------|----------|----------|----------|----------|----------|----------|
|  |      |       | 3025:PART49:1994                           |          |          |          |          |          |          |          |          |
| 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   | < 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  | < 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 | < 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  | < 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   | < 0.01   |
| Chloride as Cl                           | mg/l | 250   | IS 3025 (Part 32):1988 RA 2009             | 27.1     | 14.6     | 20.9     | 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     | 0.86     | 0.16     | 1.64     | 0.9      | 0.85     |
| Total Alkalinity (as CaCO <sub>3</sub> ) | mg/l | 200   | IS 3025 (Part 23):1986 RA 2009             | 172      | 90       | 207      | 312      | 469      | 339      | 189      | 180      |
| Sulphate as SO <sub>4</sub>              | mg/l | 200   | IS 3025 (Part 24):1986 RA 2009             | 150      | 200      | 32       | 350      | 440      | 400      | 60       | 40       |
| Nitrate as NO <sub>3</sub>               | mg/l | 45    | IS 25:PART34:1988                          | 1.2      | 1.3      | 1.5      | 2.5      | 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   | < 0.01   |
| Sulphide                                 | mg/l | 2.0   | APHA 22nd Edition (4500-S <sub>2</sub> -F) | < 0.01   | < 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   | < 0.02   |
| Total Hardness (as CaCO <sub>3</sub> )   | mg/l | 200   | IS 3025 (Part 21):2009                     | 148      | 144      | 164      | 344      | 712      | 300      | 180      | 152      |
| Calcium as Ca                            | mg/l | 75    | IS 3025 (Part 40):1991 RA 2009             | 35.2     | 40       | 35.2     | 27.2     | 248      | 68.8     | 48       | 33.6     |

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Dharmasala stone Mine, Cluster 6

|   |            |  |                                |        |        |        |        |        |        |        |        |
|---|------------|--|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| Magnesium as Mg                           | mg/l       | 30   | IS 3025 (Part 46):1994 RA 2003 | 14.58  | 10.69  | 18.47  | 67.07  | 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 | < 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 | < 0.02 |
| Total Dissolved Solid                     | mg/l       | 500  | IS 3025 (Part 16):1984 RA 2006 | 360    | 330    | 270    | 680    | 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   | <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   | <2.0   |
| <b>Ref: Sampling and Analysis by KLPL</b> |            |  |                                |        |        |        |        |        |        |        |        |

### 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 be higher 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  $\mu\text{S} / \text{cm}$  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  $\mu\text{S} / \text{cm}$  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**

|    |            |             |                                    |                 |  |
|----|------------|-------------|------------------------------------|-----------------|--|
| A1 | Lease Area | --          | 20°48'10.55"N<br>86° 03'18.186" E  | Industrial Area | --   |
| A2 | MakundPur  | 4.68 Km, NE | 20° 50'44.37" N<br>86° 3' 20.37" E | Village Area    | 1 <sup>st</sup><br>Predominant<br>Wind Direction |
| A3 | Jena Pur   | 5.6 Km, NE  | 20° 51'23.64" N<br>86° 4'28.51"E   | Village Area    | 1 <sup>st</sup><br>Predominant<br>Wind Direction |
| A4 | Aruha      | 4.2 Km, S   | 20°44'28.99"N<br>86° 5'51.26" E    | Village Area    | 2 <sup>nd</sup><br>Predominant<br>Wind Direction |
| A7 | Dankri     | 0.5 Km, S   | 20° 46'24.69"N<br>86° 3'10.46"E    | Village Area    | 2 <sup>nd</sup><br>Predominant<br>Wind Direction |
| A8 | Luni Bara  | 1.5 Km, NE  | 20° 48'12.79"N<br>86° 3' 19.37"E   | Village Area    | 1 <sup>st</sup><br>Predominant<br>Wind Direction |

|     |            |            |                                  |              |  |
|-----|------------|------------|----------------------------------|--------------|--|
| A9  | Rahadpur   | 1.0 Km, SW | 20° 45'49.53"N<br>86° 2' 28.61"E | Village Area | Downwind<br>Direction                            |
| A10 | Sahanidiha | 4.0 Km, NE | 20° 50'11.85"N<br>86° 3'39.09"E  | Village Area | 1 <sup>st</sup><br>Predominant<br>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 <sub>eq</sub> Day | L <sub>eq</sub> Night |
|-------------|------------------|---------------------|-----------------------|
| A1          | Lease Area       | 55.8                | 44.3                  |
| A2          | MakundPur        | 56.4                | 39.6                  |
| A3          | Jena Pur         | 51.6                | 31.2                  |
| A4          | Aruha            | 52.3                | 39.2                  |
| A7          | Dankri           | 51.2                | 41.6                  |
| A8          | Luni Bara        | 51.3                | 41.1                  |
| A9          | Rahadpur         | 49.3                | 36.6                  |
| A10         | Sahanidiha       | 52.3                | 41.9                  |

**Table No. 3.25 Noise Standards**

| Land Use Category | Limit in dB(A)                 |                                  |
|-------------------|--------------------------------|----------------------------------|
|                   | Day Time<br>(6 A.M. to 10 P.M) | Night Time<br>(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.

### 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

### 3.12.2 Study 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.

### 3.12.3 Flora 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 vegetation in 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.     | <i>Abroma augusta</i>              | Olatakamala       | Sterculiaceae    | Shrub       |
| 2.     | <i>Abrus precatorius</i>           | Kaincha           | Fabaceae         | Climber     |
| 3.     | <i>Abutilon indicum</i>            | Pedipedica        | Malvaceae        | Shrub       |
| 4.     | <i>Acalypha indica</i>             | <i>Nakachana</i>  | Euphorbiaceae    | Herb        |
| 5.     | <i>Achyranthes aspera</i>          | <i>Apamaranga</i> | Amaranthaceae    | Herb        |
| 6.     | <i>Acorus calamus</i>              | Bacha             | Araceae          | Herb        |
| 7.     | <i>Ageratum conyzoides</i>         | Pokasungha        | Compositae       | Herb        |
| 8.     | <i>Aegle marmelos</i>              | Bela              | Rutaceae         | Tree        |
| 9.     | <i>Aervasanguinolenta</i>          | Chauladhua        | Amaranthaceae    | Shrub       |
| 10.    | <i>Agave americana</i>             |                   | <i>Agavaceae</i> | <i>Herb</i> |
| 11.    | <i>Alstoniascholaris</i>           | Chatiana          | Apocyanaceae     | Tree        |
| 12.    | <i>Alternanthera sessilis</i>      | <i>Madaranga</i>  | Amaranthaceae    | Herb        |
| 13.    | <i>Amorophophalus campanulatus</i> | Olua              | Araceae          | Herb        |
| 14.    | <i>Anacyclus pyrethrum</i>         | <i>Akarakara</i>  | Asteraceae       | Herb        |
| 15.    | <i>Ananas comosus</i>              | Sapuri            | Bromeliaceae     | Herb        |
| 16.    | <i>Andrographis paniculata</i>     | Bhuinnimba        | Acanthaceae      | Herb        |
| 17.    | <i>Annona squamosa</i>             | Ata               | Apocyanaceae     | Tree        |
| 18.    | <i>Anogeissus latifolia</i>        | Dhau              | Combretaceae     | Tree        |
| 19.    | <i>Argyreia nervosa</i>            | Brudhadaraka      | Convolvulaceae   | Climber     |
| 20.    | <i>Aristolochia bracteata</i>      | Panairii          | Aristolochiaceae | Climber     |
| 21.    | <i>Artocarpus heterophyllus</i>    | Panas             | Moraceae         | Tree        |
| 22.    | <i>Asparagus racemosus</i>         | Satabari          | Liliaceae        | Climber     |
| 23.    | <i>Atylosia scarabaeoides</i>      | Banakolatha       | Fabaceae         | Climber     |
| 24.    | <i>Averrhoa carambola</i>          | Karamanga         | Geraniaceae      | Tree        |
| 25.    | <i>Azadirachta indica</i>          | Nimba             | Meliaceae        | Tree        |
| 26.    | <i>Bacopa monnieri</i>             | Brhmi             | Scrophulariaceae | Herb        |
| 27.    | <i>Barleria cristata</i>           | Daskerenda        | Acantheceae      | Herb        |
| 28.    | <i>Bauhinia variegata</i>          | Kanchana          | Caesalpiniaceae  | Tree        |
| 29.    | <i>Beideliareta</i>                | <i>Kasi</i>       | Euphorbiaceae    | Tree        |
| 30.    | <i>Boerhavia diffusa</i>           | Puruni            | Nyctaginaceae    | Herb        |
| 31.    | <i>Bombax ceiba</i>                | Simuli            | Bombacaceae      | Tree        |
| 32.    | <i>Bryophyllum pinnatum</i>        | Amarapoi          | Crassulaceae     | Herb        |
| 33.    | <i>Buchanania lanzan</i>           | Chara             | Anacardiaceae    | Tree        |

|     |                               |              |                |         |
|-----|-------------------------------|--------------|----------------|---------|
| 34. | <i>Butea monosperma</i>       | Palasa       | Fabaceae       | Tree    |
| 35. | <i>Caesalpinia bonduca</i>    | Gila         | Caesalpinaceae | Shrub   |
| 36. | <i>Callistemon linariis</i>   | kundana      | Myrtaceae      | Shrub   |
| 37. | <i>Calotropis gigantea</i>    | Arakha       | Asclepiadaceae | Shrub   |
| 38. | <i>Caricapapeya</i>           | Amrutabhand  | Caricaceae     | Tree    |
| 39. | <i>Cassia angustifolia</i>    | Sunamukhi    | Caesalpinaceae | Herb    |
| 40. | <i>Cassia fistula</i>         | Sunari       | Caesalpinaceae | Tree    |
| 41. | <i>Cassia siamia</i>          | Chakunda     | Caesalpinaceae | Tree    |
| 42. | <i>Catharanthus roseus</i>    | Sadabihari   | Apocyanaceae   | Herb    |
| 43. | <i>Centella asiatica</i>      | Thalkudi     | Apiaceae       | Herb    |
| 44. | <i>Cissampelos pareira</i>    | Akanabindhi  | Menispermaceae | Climber |
| 45. | <i>Cissus quadrangularis</i>  | Hadabhanga   | Vitaceae       | Climber |
| 46. | <i>Cleistanthus collinus</i>  | Karada       | Euphorbiaceae  | Tree    |
| 47. | <i>Cleome gynandra</i>        | Anaorisa     | Capparidaceae  | Herb    |
| 48. | <i>Clitoria ternate</i>       | Aparajita    | Fabaceae       | Climber |
| 49. | <i>Commelinabenghalensis</i>  | Kansiri      | Commelinaceae  | Herb    |
| 50. | <i>Couropitaguianensis</i>    | Nageswar     | Lecythidaceae  | Tree    |
| 51. | <i>Curculigo orchoides</i>    | Talamuli     | Amaryllidaceae | Herb    |
| 52. | <i>Cuscuta reflexa</i>        | Nirmuli      | Convolvulaceae | Climber |
| 53. | <i>Cyanodondactylon</i>       | Duba         | Poaceae        | Herb    |
| 54. | <i>Cycas circinalis</i>       | Cycas        | Cycadaceae     | Shrub   |
| 55. | <i>Cyperus rotundus</i>       | Mutha        | Poaceae        | Herb    |
| 56. | <i>Albizia lebbek</i>         | Sirsa        | Mimaceae       | Tree    |
| 57. | <i>Dalbergiasisso</i>         | Sisoo        | Fabaceae       | Tree    |
| 58. | <i>Datura metel</i>           | Dudura       | Solanaceae     | Shrub   |
| 59. | <i>Dioscoria bulbifera</i>    | Pitalau      | Dioscoriaceae  | Climber |
| 60. | <i>Diospyros montana</i>      | Halda        | Ebenaceae      | Tree    |
| 61. | <i>Diospyros tomentosa</i>    | Kedu         | Ebenaceae      | Tree    |
| 62. | <i>Elephantopus scaber</i>    | Mayurachulia | Asteraceae     | Herb    |
| 63. | <i>Emblica officinalis</i>    | Amla         | Euphorbiaceae  | Tree    |
| 64. | <i>Erythrina variegata</i>    | Paladhua     | Fabaceae       | Shrub   |
| 65. | <i>Eucalyptus citriodora</i>  | Eucalyptus   | Myrtaceae      | Tree    |
| 66. | <i>Euphorbia hirta</i>        | Chitakuti    | Euphorbiaceae  | Herb    |
| 67. | <i>Euphorbia tirucalli</i>    | Khadisiju    | Euphorbiaceae  | Herb    |
| 68. | <i>Ficus benghalensis</i>     | Bara         | Moraceae       | Tree    |
| 69. | <i>Ficus carica</i>           | Dimiri       | Moraceae       | Tree    |
| 70. | <i>Flacourtia jangomas</i>    | Baichikoli   | Flacourtiaceae | Shrub   |
| 71. | <i>Gloriosa superba</i>       | Agnisikha    | Liliaceae      | Climber |
| 72. | <i>Gmelia arborea</i>         | Gambhari     | Verbenaceae    | Tree    |
| 73. | <i>Heliotropium indicum</i>   | Hatisundha   | Boraginaceae   | Herb    |
| 74. | <i>Hemidesmus indicus</i>     | Anantamul    | Asclepiadaceae | Climber |
| 75. | <i>Hibiscus aculeatus</i>     | Piripirika   | Malvaceae      | Herb    |
| 76. | <i>Hibiscus rosa-sinensis</i> | Mandar       | Malvaceae      | Shrub   |

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

|      |                             |               |                  |         |
|------|-----------------------------|---------------|------------------|---------|
| 120. | <i>Shorearobusta</i>        | Sala          | Dipterocarpaceae | Tree    |
| 121. | <i>Sidacordifolia</i>       | Bajramuli     | Malvaceae        | Herb    |
| 122. | <i>Smilax zeylanica</i>     | Muturi        | Liliaceae        | Climber |
| 123. | <i>Solanum nigrum</i>       | Nunnunia      | Solanaceae       | Herb    |
| 124. | <i>Solanum xanthocarpum</i> | Ankaranti     | Solanaceae       | Herb    |
| 125. | <i>Solenaamplexicaulis</i>  | Banakunduri   | Cucurbitaceae    | Climber |
| 126. | <i>Sphaeranthus indicus</i> | BhuinKadamba  | Asteraceae       | Herb    |
| 127. | <i>Strebulus asper</i>      | Sahada        | Moraceae         | Tree    |
| 128. | <i>Strychnosnux-vomica</i>  | Kochila       | Loganiaceae      | Tree    |
| 129. | <i>Syzygiumcumini</i>       | Jamu          | Myrtaceae        | Tree    |
| 130. | <i>Tamarindusindica</i>     | Tentuli       | Caesalpiniaceae  | Tree    |
| 131. | <i>Tectonagrandis</i>       | Teak          | Verbenaceae      | Tree    |
| 132. | <i>Terminalia arjuna</i>    | Arjuna        | Combretaceae     | Tree    |
| 133. | <i>Terminalia bellerica</i> | Bahada        | Combretaceae     | Tree    |
| 134. | <i>Terminalia chebula</i>   | Harida        | Combretaceae     | Tree    |
| 135. | <i>Terminalia tomentosa</i> | Asana         | Combretaceae     | Tree    |
| 136. | <i>Tinosporacordifolia</i>  | Guluchi       | Menispermaceae   | Climber |
| 137. | <i>Tridaxprocubens</i>      | Bisalyakarani | Asteraceae       | Herb    |
| 138. | <i>Tylophoraindica</i>      | Anantamul     | Asclepiadaceae   | Climber |
| 139. | <i>Urariahamosa</i>         | Salaparni     | Fabaceae         | Herb    |
| 140. | <i>Vetiveriazizanioides</i> | Bena          | Poaceae          | Herb    |
| 141. | <i>Vitex nigundo</i>        | Begunia       | Verbenaceae      | Shrub   |
| 142. | <i>Wedeliachinensis</i>     | Bhrungaraj    | Asteraceae       | Herb    |
| 143. | <i>Wooddordiafruiticosa</i> | Dhatuki       | Lythraceae       | Shrub   |
| 144. | <i>Ziziphus oenoplia</i>    | Kanakoli      | Myrtaceae        | Shrub   |
| 145. | <i>Zizyphusjujuba</i>       | 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.     | <i>Adiantum incisum</i> Forssk.   | Adiantaceae      | --         |
| 2.     | <i>Adiantum philippense</i> L.    | Adiantaceae      | --         |
| 3.     | <i>Dryopteris</i> sp.             | Dryopteridaceae  | --         |
| 4.     | <i>Lygodiumflexuosum</i> (L.) Sw. | Lygodiaceae      | Indrajal   |
| 5.     | <i>Marsilea minuta</i> L.         | Marsileaceae     | Sunsunia   |
| 6.     | <i>Sellaginellasps</i>            | 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.     | <i>Aegle marmelos</i>           | Rutaceae         | Bela          | Fruits, Leaves     |
| 2.     | <i>Alstoniascholaris</i>        | Apocynaceae      | Chatiana      | Bark               |
| 3.     | <i>Azadirachta indica</i>       | Meliaceae        | Nima          | Leaves, Bark, Seed |
| 4.     | <i>Bombax ceiba</i>             | Bombacaceae      | Simili        | Thorn              |
| 5.     | <i>Butea monosperma</i>         | Fabaceae         | Palasa        | Seeds              |
| 6.     | <i>Cassia fistula</i>           | Caesalpiniaceae  | Sunari        | Bark               |
| 7.     | <i>Cleistanthus collinus</i>    | Euphorbiaceae    | Karada        | Fruits, Leaves     |
| 8.     | <i>Eucalyptus citridora</i>     | Myrtaceae        | Eucalyptus    | Leaves             |
| 9.     | <i>Holarrhenapubescens</i>      | Apocynaceae      | Kutaja        | Bark               |
| 10.    | <i>Lagerstroemia parviflora</i> | Lythraceae       | Sidha         | Bark               |
| 11.    | <i>Mimusopselengii</i>          | Sapotaceae       | Baula         | Bark               |
| 12.    | <i>Nyctanthes arbor-tristis</i> | Nyctanthaceae    | Gangasiuli    | Leaves             |
| 13.    | <i>Phyllanthus emblica</i>      | Euphorbiaceae    | Amla          | Fruit              |
| 14.    | <i>Pongamiapinnata</i>          | Fabaceae         | Karanja       | Bark, Seed oil     |
| 15.    | <i>Schleicheraoleosa</i>        | Sapindaceae      | Kusuma        | Seed oil           |
| 16.    | <i>Semecarpus anacardium</i>    | Anacardiaceae    | Bhalia        | Seed               |
| 17.    | <i>Syzygiumcumini</i>           | Myrtaceae        | Jamun         | Fruit, Bark        |
| 18.    | <i>Terminalia arjuna</i>        | Combretaceae     | Arjuna        | Bark               |
| 19.    | <i>Terminalia bellirica</i>     | Combretaceae     | Bahada        | Fruit              |
| 20.    | <i>Terminalia chebula</i>       | Combretaceae     | Harida        | Fruit              |
| 21.    | <i>Abrusprecatorius</i>         | Faceae           | Kaincha       | Seed               |
| 22.    | <i>Aristolochia indica</i>      | Aristolochiaceae | Panairi       | Root               |
| 23.    | <i>Asparagus racemosus</i>      | Liliaceae        | Satabari      | Tuber              |
| 24.    | <i>Atylosiascrabaeoides</i>     | Fabaceae         | Banakolatha   | Root/ Whole plant  |
| 25.    | <i>Caesalpinia bonduc</i>       | Caesalpiniaceae  | Gila          | Seed               |
| 26.    | <i>Cissampelospareira</i>       | Menispermaceae   | Akanabindhi   | Leaves, Root       |
| 27.    | <i>Cissusquadrangularis</i>     | Vitiaceae        | Hadajoda      | Stem               |
| 28.    | <i>Hemidesmusinducus</i>        | Periplocaceae    | Anantamool    | Root               |
| 29.    | <i>Mucunapuriens</i>            | Fabaceae         | Baidonka      | Seeds              |
| 30.    | <i>Smilax zeylanica</i>         | Smilacaceae      | Muturi        | Root               |
| 31.    | <i>Tinosporacordifolia</i>      | Menispermaceae   | Guluchi       | Stem               |
| 32.    | <i>Tylophora indica</i>         | Asclepiadaceae   | Anantamool    | Leaves             |
| 33.    | <i>Calotropis gigantea</i>      | Asclepiadaceae   | Arakha        | Root               |
| 34.    | <i>Datura metel</i>             | Solanaceae       | Dudura        | Seed               |
| 35.    | <i>Jatropha gossypifolia</i>    | Euphorbiaceae    | Nalibaigaba   | Stem               |
| 36.    | <i>Justicia adhatoda</i>        | Acanthaceae      | Basanga       | Leaves             |
| 37.    | <i>Lawsonia inermis</i>         | Lythraceae       | Manjuati      | Leaves/ Root       |
| 38.    | <i>Ricinus communis</i>         | Euphorbiaceae    | Gaba          | Seeds/ Root        |
| 39.    | <i>Vitex nigundo</i>            | Verbenaceae      | Begunia       | Leaves             |
| 40.    | <i>Woodfordia fruticosa</i>     | Lythraceae       | Dhataki       | Flower             |
| 41.    | <i>Alternanthera sessilis</i>   | Amaranthaceae    | Madarnga saga | Whole plant        |
| 42.    | <i>Achyranthes aspera</i>       | Amaranthaceae    | Apamaranga    | Root               |
| 43.    | <i>Andrographis paniculata</i>  | Acanthaceae      | Bhuin neem    | Whole Plant        |

|     |                             |                  |                |             |
|-----|-----------------------------|------------------|----------------|-------------|
| 44. | <i>Barleriacristata</i>     | Acanthaceae      | Daskerenda     | Leaves      |
| 45. | <i>Centellaasiatica</i>     | Apiaceae         | Thalakudi      | Leaves      |
| 46. | <i>Costusspeciosus</i>      | Zingiberaceae    | Keu            | Tuber       |
| 47. | <i>Curculigoorchioides</i>  | Hypoxidaceae     | Talamuli       | Root        |
| 48. | <i>Cyperusrotundus</i>      | Cyperaceae       | Mutha          | Tuber       |
| 49. | <i>Elephantopusscaber</i>   | Asteraceae       | Mayurchulia    | Root        |
| 50. | <i>Mimosa pudica</i>        | Mimoceae         | Lajakuli       | Root        |
| 51. | <i>Phyllanthus amarus</i>   | Euphorbiaceae    | Badi anala     | Whole Plant |
| 52. | <i>Scopariadulcis</i>       | Scrophulariaceae | Badijustimadhu | Whole Plant |
| 53. | <i>Sidaacuta</i>            | Malvaceae        | Bajramuli      | Stem        |
| 54. | <i>Sida cordata</i>         | Malvaceae        | Brhmanajhatia  | Stem        |
| 55. | <i>Solanum virginianum</i>  | Solanaceae       | Ankaranti      | Fruit/ Root |
| 56. | <i>Sphaerathus indicus</i>  | Rubiaceae        | BhuinKadamba   | Whole Plant |
| 57. | <i>Tridaxprocumbens</i>     | Asteraceae       | Bisayakarani   | Whole Plant |
| 58. | <i>Vetiveriazizanioides</i> | 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        |
| <b>Total Fruits Area</b>  | -                | -            | -             | -              | -            | -             | -               | -             | -             | <b>2.22</b>                                 | <b>5.67</b> | <b>7.89</b> |
| <b>Total Cropped Area</b> | <b>71.53</b>     | <b>77.30</b> | <b>148.83</b> | <b>63.84</b>   | <b>58.91</b> | <b>122.75</b> | <b>135.37</b>   | <b>136.21</b> | <b>271.58</b> | <b>2.22</b>                                 | <b>5.67</b> | <b>7.89</b> |

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          |
| <b>Total</b>          | <b>148.83</b>  | <b>-</b>      | <b>333.89</b>   | <b>122.75</b>  | <b>-</b>      | <b>449.36</b>   |

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                     | -                     | -                    |
| <b>Total</b> | <b>7.92</b>    | <b>100.0</b>             | <b>-</b>              | <b>-</b>             |

Source: Orissa Agriculture Statistics: 2013-14, Directorate of Agriculture and Food Production, Bhubaneswar, 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 have been 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 |
|----------|--|---------------|---------------------|---------------|--------------|
|          | <b>Surface water</b>                                 |               |                     |               |              |
| <b>1</b> | <b>Surface Irrigation</b>                            |               |                     |               |              |
| (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                           | -             | -                   | -             |              |
|          | <b>Sub Total</b>                                     | <b>104839</b> | <b>55127</b>        | <b>159966</b> | <b>1.600</b> |
| <b>2</b> | <b>Ground Water</b>                                  |               |                     |               |              |
| (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 Janaidhi I & II                        | 1925          | 84                  | 2009          | 0.020        |
|          | <b>Sub Total</b>                                     | <b>29784</b>  | <b>23150</b>        | <b>52934</b>  | <b>0.529</b> |
|          | <b>Total</b>   | <b>134623</b> | <b>78277</b>        | <b>212900</b> | <b>2.129</b> |

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                           |
|----------|--|--------------|--------------------|---------------|--|
|          | <b>Surface water</b>                                 |              |                    |               |  |
| <b>1</b> | <b>Surface Irrigation</b>                            |              |                    |               |  |
| (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                                  |
|          | <b>Sub Total</b>                                     | <b>51724</b> |                    | <b>51724</b>  | <b>0.517</b>                           |
| <b>2</b> | <b>Ground Water</b>                                  |              |                    |               |  |
| (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                                  |
|          | <b>Sub Total</b>                                     | <b>19806</b> |                    | <b>19806</b>  | <b>0.198</b>                           |
|          | <b>Sub-sub Total</b>                                 |              |                    |               | <b>0.715</b>                           |
|          | <b>Total</b>   | <b>71530</b> | <b>63840</b>       | <b>135370</b> | <b>1.354</b><br><b>(0.638 + 0.715)</b> |

#### 3.12.4 Avenue Plantation:

There are several road side plantation found in the area, which includes *Mangifera indica*, *Azadiracta indica*, *Bombax ceiba*, *Delonix regia*, *Cassia siamea*, *Albizia lebbek*, *Terminalia chebula*, *Terminalia bellirica*, *Embllica officinalis*, *Mangifera indica*, *Terminalia arjuna*, *Terminalia alata*, *Gmelia arborea*, *Syzygium cumini*, *Cassia fistula*, *Anthocephalus kadamba*, *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.

| Habitat                         | Species  |
|---------------------------------|--|
| <b>Rooted submerged species</b> | <i>Hydrilla verticillata, Potamogetonsp, Valisnariaspirallis, Urticularia</i>  |
| <b>Floating species</b>         | <i>Nymphaea, Nelumbo, Azolla, Lemna, Ichornea, Pistea, Salvinia, Sagitaria, Fragmitis, Juncus</i>  |
| <b>Marshy species</b>           | <i>Marsillea, Cyperus, Adiantum, Alternathera, Centella, Ecliptasps</i>  |
| <b>Decomposers</b>              | <i>Aspergillus, Cephalosporium, Cladosporium, Pythium, Rhizopus, Pennicillium, Phieladia, Alternaria, Trichoderma, Cercinella, Fusarium, Curvularia, Saprolegnia</i> |

### 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.

### 3.12.10 Fauna Composition in the Core Zone

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

### 3.12.11 Fauna 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 |
|-----------------|---------------------------|-------------------------------|--|
| <b>Mammal</b>   |                           |                               |  |
| 1.              | Common Mongoose           | <i>Herpestresedwardsii</i>    | IV   |
| 2.              | Jackal                    | <i>Canis aureus</i>           | II, V  |
| 3.              | Common house rat          | <i>Rattus rattus</i>          | V  |
| 4.              | Indian hare               | <i>Lepus nigricollis</i>      | IV   |
| 5.              | Indian Field Mouse        | <i>Mus booduga</i>            | V  |
| 6.              | Rhesus Monkey             | <i>Macacamulata</i>           | II   |
| 7.              | Squirrel                  | <i>Funambulus pennant</i>     | IV   |
| <b>Reptiles</b> |                           |                               |  |
| 8.              | Monitor Lizard            | <i>Varanus spp.</i>           | II   |
| 9.              | Common krait              | <i>Bangaruscaerulidus</i>     | II   |
| 10.             | Common Indian House Geiko | <i>Homodactylusflevirudis</i> | IV   |
| 11.             | Yellow Rat Snake          | <i>Ptyasmucosus</i>           | IV   |
| 12.             | Garden Lizard             | <i>Calotes versicolor</i>     |  |
| 13.             | Common of Brahminy Skink  | <i>Mabuyacarinata</i>         |  |
| <b>Birds</b>    |                           |                               |  |
| 14.             | Pariah Kite               | <i>Milvus migrans</i>         | V  |
| 15.             | Common Crow               | <i>Corvussplendens</i>        | V  |
| 16.             | Jungle Crow               | <i>C. marorhynchos</i>        | IV   |
| 17.             | House Sparrow             | <i>Passer domesticus</i>      |  |
| 18.             | Common Mynah              | <i>Acridotherestrictis</i>    | IV   |
| 19.             | Pied Mynah                | <i>Sturnus contra</i>         | IV   |
| 20.             | Cattle Egret              | <i>Bubulcus ibis</i>          | IV   |
| 21.             | Pond Heron                | <i>Ardeolagrayii</i>          | IV   |
| 22.             | Drongo                    | <i>Dicrurusadsimilis</i>      | IV   |
| 23.             | Doves                     | <i>Streptopeliaspp</i>        | IV   |
| 24.             | Common Kingfisher         | <i>Alcedoatthis</i>           | IV   |
| 25.             | Common Babbler            | <i>Turboidescaudatus</i>      | IV   |
| 26.             | Crow-Pheasant             | <i>Psittaculakrameri</i>      | IV   |
| 27.             | Koel                      | <i>Eudynamysscolopacea</i>    | IV   |

|                   |                    |                           |    |
|-------------------|--------------------|---------------------------|----|
| 28.               | Tailor Bird        | <i>Orthotomussutorius</i> | IV |
| 29.               | House Sparrow      | <i>Passer domesticus</i>  | IV |
| <b>Amphibians</b> |                    |                           |    |
| 30.               | Common Indian Toad | <i>Bufo melanosticus</i>  |    |
| 31.               | Paddy-field Frog   | <i>Rana limnocharis</i>   | 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 Binjharपुरi 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.*, *Ceriodaphnia*, *Alonella*, belongs to *Cladocera*, *Brachionus*, *Keratella*, *Mytilina* etc. belongs to Rotifera *Nauplius sp.*, *Oithona nana*, *Acartiaspinata*, *Miraciaefferata*, *Harpacticoid sp.*, *Diaptomus*, *Cyclopus* etc. belongs to Copepoda.

#### 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 | Scientific Name              |
|--------|------------|------------------------------|
| 1.     | Mohurali   | <i>Amblyupharngodon mola</i> |
| 2.     | Bhakura    | <i>Catla catla</i>           |
| 3.     | Kerondi    | <i>Labio calbasi</i>         |

|                        |             |                          |
|------------------------|-------------|--------------------------|
| 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 3.15 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.

#### 3.15.1 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.

### **3.15.2 Study Area**

There are 39 villages present within the buffer zone of the project area located within 10 km radius of the project site.

### **3.15.3 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.

### **3.5 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**

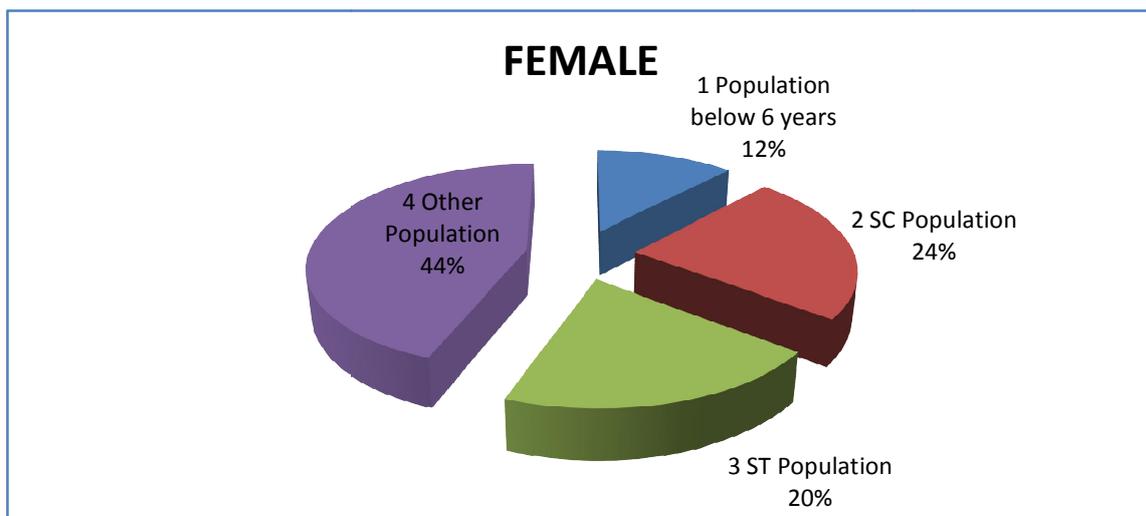
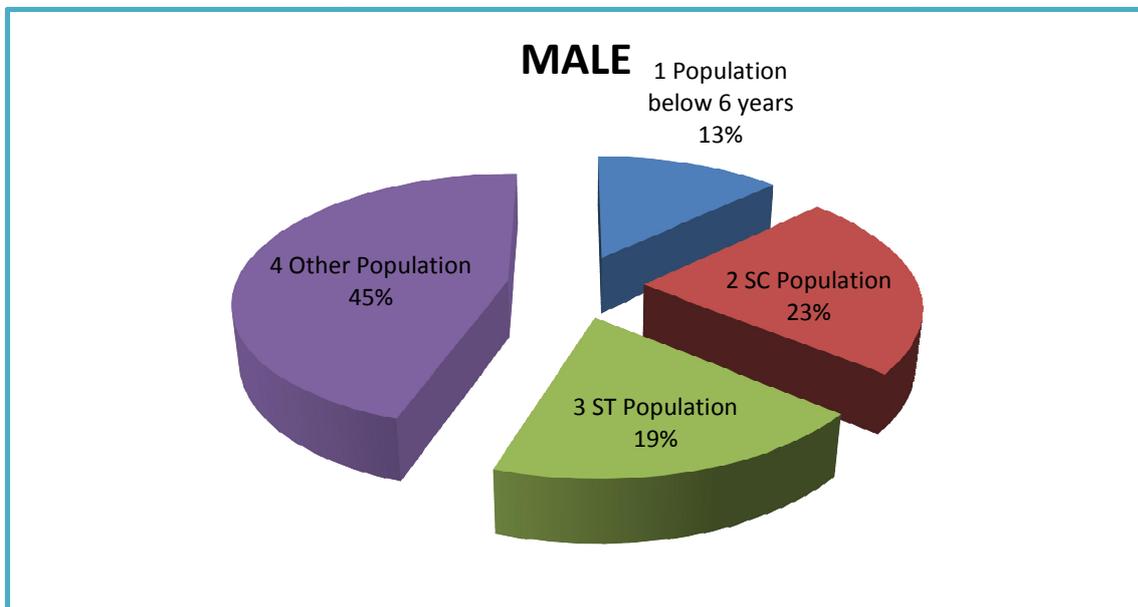
The demography of the project area is summarized from census data 2011 for Jajpur District. The position of demographic profile of the project area has been given in **Figure 3.16**. The village wise demographic profile of the project area has been given in **Annexure 4**.

**Table 3.37: Demographic profile of the buffer zone**

| <b>Sl. No.</b> | <b>Attributes</b> | <b>Radius of 10 km</b> |
|----------------|-------------------|------------------------|
| 1              | No. of Villages   | 38                     |
| 2              | Total Household   | 7723                   |

|   |                          |          |
|---|--------------------------|----------|
| 3 | Total Population         | 34910    |
| 4 | Male Population          | 17893    |
| 5 | Female Population        | 17017    |
| 6 | Total ST population      | 6849     |
| 7 | Total SC Population      | 8126     |
| 8 | Sex Ratio ( F / M )      | 95 : 100 |
| 9 | Population below 6 Years | 4359     |

**Figure 3.16: Demographic Profile of Study area**



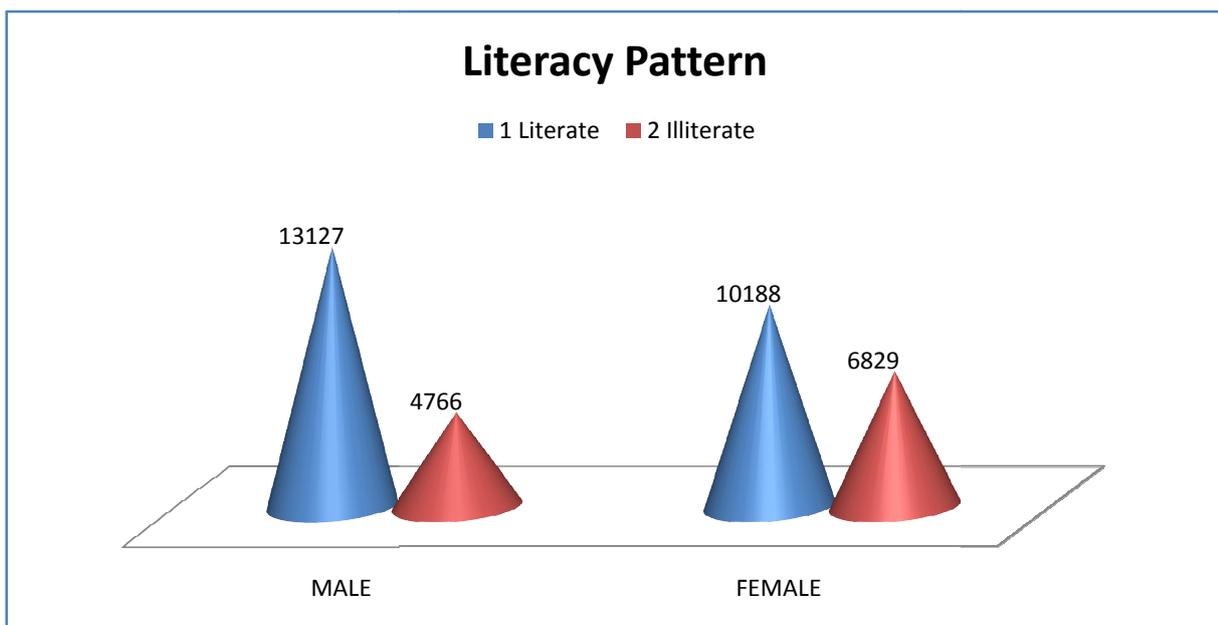
## B.Literacy

Out of the total population, 23315 persons are literate which contribute about 67% within the buffer zone. Out of the total literate, male literacy is contributed as 13127 i.e. 56% and female literacy is contributed as 10188 by 44%. It is observed that the literacy percentage is more among the male as compare to the female population. About 33% 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 3.38: Literacy pattern of the area**

| Sl. No. | Attributes        | Radius of 10 kms |
|---------|-------------------|------------------|
| 1       | Total Literate    | 23315            |
| 2       | Literate Male     | 13127            |
| 3       | Literate Female   | 10188            |
| 4       | Total Illiterates | 11595            |
| 5       | Illiterate Male   | 4766             |
| 6       | Illiterate Female | 6829             |

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



### 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 :

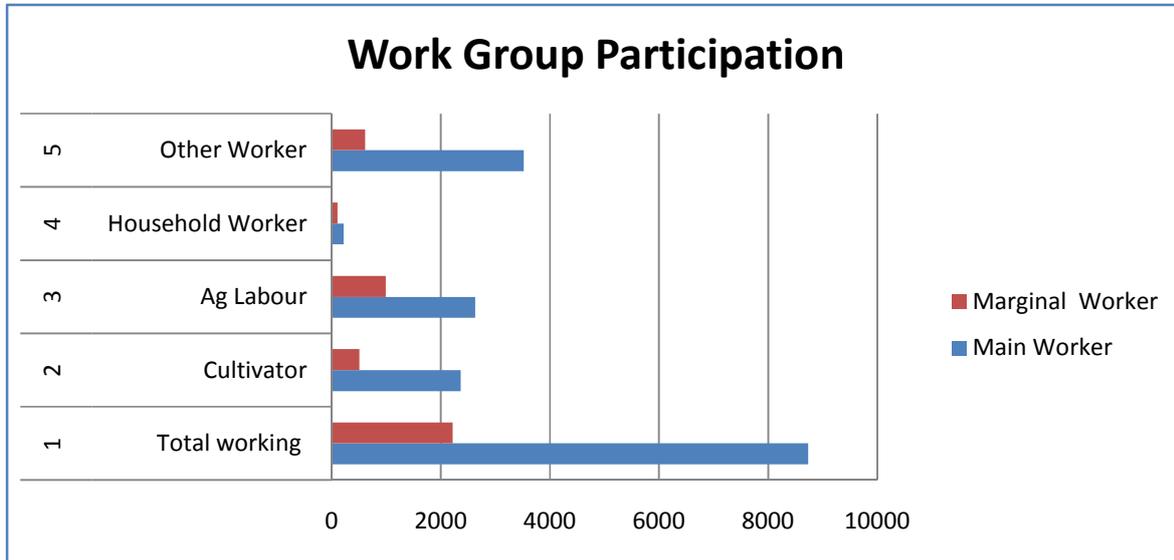
- Out of the total population, 10949 persons (about 31%) are workers and 23961 (about 69%) persons are non workers. This can be inferred that more than half of the population is depending on others for their livelihood.
- Regarding workforce participation rate of both the sex, the data reveals that female workforce participation rate is comparatively low with respect to male. Out of the total working population 9541 (87%) are male and 1408 (13%) are female.
- Out of the total workers 8733 are main workers and 2216 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 3.39: Work group participation in main and marginal section**

| Sl. No. | Attributes          | Main | Marginal |
|---------|---------------------|------|----------|
| 1       | Total Working       | 8733 | 2216     |
| 2       | Cultivator          | 2365 | 506      |
| 3       | Agricultural labour | 2632 | 994      |
| 4       | Household workers   | 219  | 102      |
| 5       | Other Workers       | 3517 | 614      |

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

**Figure 3.18: Work Group Participation in the 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**

| SI No.          | Location                         | Distance from the Project site |
|-----------------|----------------------------------|--------------------------------|
| Traffic Point 1 | On NH 200<br>(Chadheidhra Chhak) | 1.0 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**

| <b>Types of vehicles</b> | <b>Number of Vehicles / hr</b> |
|--------------------------|--------------------------------|
|                          | <b>TP1</b>                     |
| HMV                      | 450                            |
| LMV                      | 520                            |
| 4/3-Wheeler              | 680                            |
| 2-Wheeler                | 830                            |
| Cycles                   | 35                             |
| <b>Total</b>             | <b>2515</b>                    |

*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.<br>Reduction in biodiversity of the locality.<br>Altered landforms due to construction.<br>Altered drainage and runoff flows<br>Increased erosion of site area<br>Increased situation of surface water |

|   |   |   |
|---|---|---|
| Removal and storage of stones and waste materials | Stripping /sorting of soil overburden.<br>Waste rock stock piling, extracted stone piling.  | Land alienation from waste rock stock piles.<br>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.<br>Disturbance due to noise and vibrations.<br>Dust and fumes from explosion, mine vehicles and transport systems<br>Contamination from explosive residues. |
| Transport of final product to markets             | Packaging /loading of final product for transportation<br>Transportation of final product   | Disturbance due to noise, vibrations and site illumination.<br>Dust & fumes from exposed product & stockpiles.  |
| Mine closure and post operational waste           | Decommissioning of roads<br>Dismantling of buildings<br>Plantation in disturbed areas<br>Recounting waste dumps<br>Water Quality treatment<br>Fencing dangerous areas | Noise & dust during dismantling.<br>Subsidence, slumping and flooding of previously mined areas.<br>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**

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

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

## 4.2 IMPACT OF MINING ON LAND ENVIRONMENT

### 4.2.1 Impact on Topography

Cluster-6 (Lunibar Hillock) is located within the revenue jurisdiction of Lunibar village under Dharmasala Tahasil of Jajpur district. The targeted area represents a hilly terrain with highest altitude of 80 mRL in the middle part where as the NE part shows the lowest altitude of 25 mRL. There is hardly any vegetation. There is no human settlement within the auction area. 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 19.345 hectares in Cluster-6. 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 hillock will be mined out during conceptual period. The ultimate quarry bottom will be at 10mRL.

#### 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 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.

Ultimate extent of the quarry will be confined to the area of 19.345 hectares in Cluster-6. 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 hillock will be mined out during conceptual period. The ultimate quarry bottom will be at 10mRL. 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-6. 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.

#### 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 be 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 deforestation 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 19.345 hectares in Cluster-6.

#### **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 hillock/patch of the Cluster-6 area surrounding the hillock. About 3497 nos. saplings will be planted over an area of 2.914 hectare in 7.5m wide safety zone along peripheral hillock boundary of Cluster-6. 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 hillock/patch of Cluster-6 (Ref. Plate-VII). As the life of the mine is almost same as the lease period effort will be made by individual lessees 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-6, the future life of the mine can not be ascertained. It will be confirmed after further exploration and observation from the quarry floor at the end of the lplan period. Hence, at present no reclamation is envisaged over the Cluster-6 area. However, as discussed the quarry floor of 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, 23237 nos of saplings will be planted over 19.346 Ha in Cluster-6. 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**

As the Cluster-6 area is for building stone, suitability of the rock is not dependant on chemical parameters. The Cluster-6 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-6. 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 2/3<sup>rd</sup> 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 1/3<sup>rd</sup> 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. However, the process as above will be followed as per the respective approved mining plan of the quarry lease of Cluster-6 and as such no waste dump will be there in the cluster-6 area at the end of plan period of ten (10) years.

A total of **116376m<sup>3</sup>** 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-6 and as such no soil stack will be there in the cluster-6 area at the end of plan period of ten (10) years.

#### **4.2.8 Mitigation Measures**

- It is proposed to store 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 NO<sub>x</sub>,

SO<sub>2</sub> 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**

| <b>Activities</b>         | <b>Air Pollutants</b>                                |
|---------------------------|--|
| Drilling                  | PM <sub>10</sub> , PM 2.5                            |
| Loading & Unloading       | PM <sub>10</sub> , PM 2.5                            |
| Blasting                  | PM <sub>10</sub> , PM 2.5, SO <sub>2</sub> , Nox     |
| Haul Road                 | PM <sub>10</sub> , PM 2.5                            |
| Transportation            | PM <sub>10</sub> , PM 2.5, SO <sub>2</sub> , NOx, CO |
| Waste / Top soil handling | PM <sub>10</sub> , 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 (1<sup>st</sup>March to 31<sup>st</sup>May2020) 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:**

| <b>Parameters</b>           | <b>Details</b>                                   |
|-----------------------------|--|
| 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.

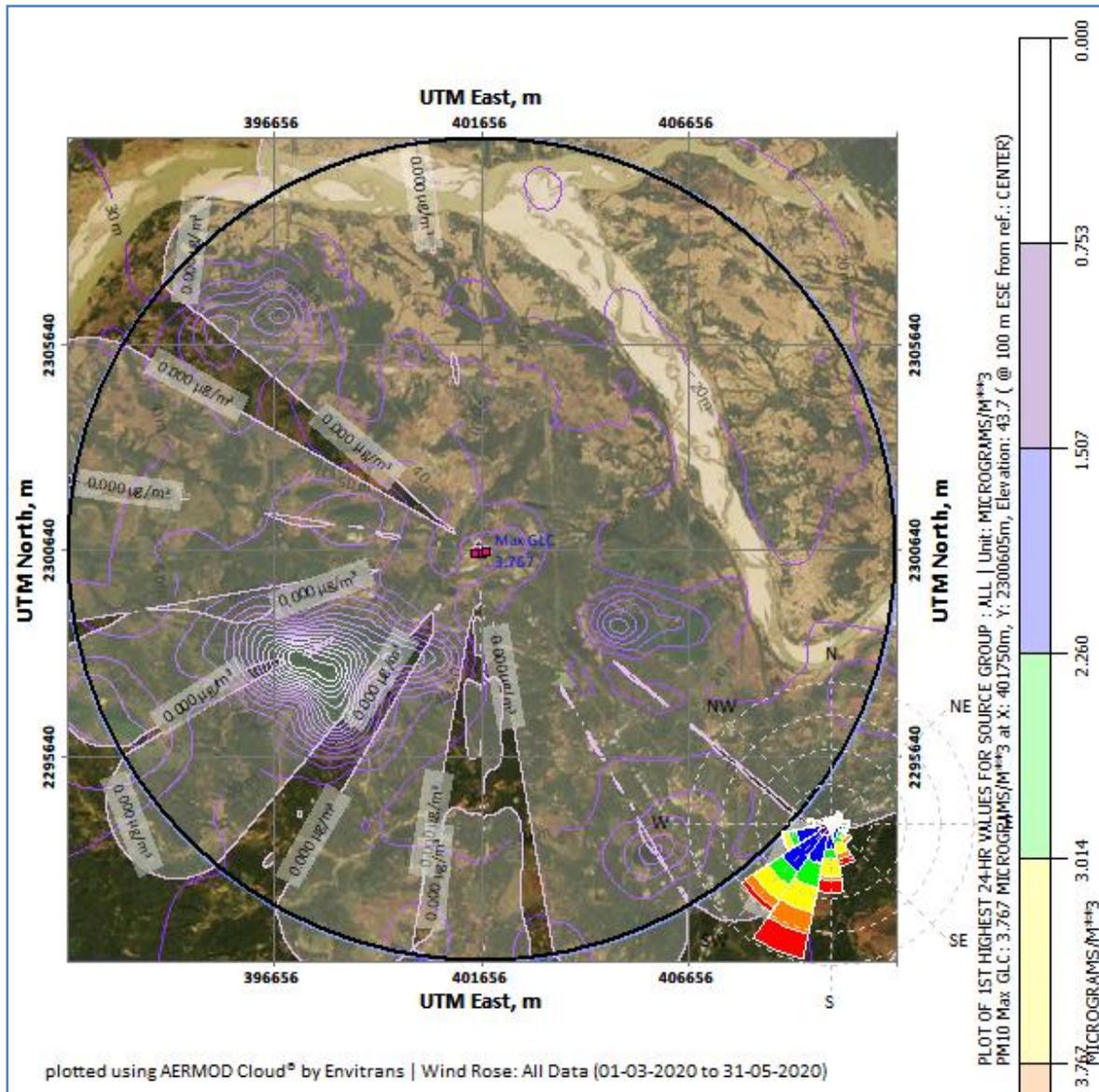
**Table 4.5: First Highest, 24 Hr Average Predicted Concentration | Group: All**

| Report Cl. 6   |                 |  |       |                       |                            |                                    |
|--|-----------------|--|-------|-----------------------|----------------------------|------------------------------------|
| AERMOD RUN REPORT: 24 HR AVERAGE CONCENTRATION OF PM10   |                 |  |       |                       |                            |                                    |
| Title:   |                 | Dharmasala Stone Mines Cluster 6 (Lunibar Hillock)       |       |                       |                            |                                    |
| Subtitle:  |                 | Vill: Lunibar, Tahasil: Dharmasala, Dist: Jajpur, Odisha |       |                       |                            |                                    |
| Pollutant ID:  |                 | PM10   |       |                       |                            |                                    |
| Conc. Unit:  |                 | MICROGRAMS/M**3  |       |                       |                            |                                    |
| Source Group:  |                 | ALL  |       |                       |                            |                                    |
| -----  |                 |  |       |                       |                            |                                    |
| Y-Coordinate   | Average<br>Time | Elevation  | RANK  | Flagpole <sup>^</sup> | Conc.<br>ug/m3<br>dd/mm/yy | X-Coordinate<br>Date/Time<br>meter |
| meter  | meter           | meter  | meter | meter                 | dd/mm/yy HH                | meter                              |
| -----  |                 |  |       |                       |                            |                                    |
| 2300605.362  | 24-HR           | 43.700   | 1     | 0.000                 | 3.76706<br>07-05-20        | 401749.631<br>00:00                |
| 2300622.199  | 24-HR           | 43.900   | 2     | 0.000                 | 3.61962<br>07-05-20        | 401754.142<br>00:00                |
| 2300589.564  | 24-HR           | 43.600   | 3     | 0.000                 | 3.56886<br>07-05-20        | 401742.264<br>00:00                |
| 2300575.285  | 24-HR           | 43.500   | 4     | 0.000                 | 3.28945<br>07-05-20        | 401732.266<br>00:00                |
| 2300673.766  | 24-HR           | 43.600   | 5     | 0.000                 | 3.19865<br>07-05-20        | 401561.692<br>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 Stone Mines Cluster 6 (Lunibar Hillock).ac5 |                 |  |       |                       |                            |                                    |
| Envitran AERMOD Cloud v18.1.87   |                 |  |       |                       |                            |                                    |
| 17-06-2020 17:45:23  |                 |  |       |                       |                            |                                    |

#### 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 3.76 µg/cu.m at a distance of 500 m 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 ( $\mu\text{g}/\text{cu.m}$ )



#### 4.3.5. Transportation

There will be transportation 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 exist near the cluster area which are presently non working. However, the district administration decided to allocate another area for installation of crushers which is at a distance of about 10 Km from the project site. Considering average annual production of 4,34,000 cu.m per annum i.e. 1447 cu.m per day of stone there will be movement of around 150 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<br>Workers provided with PPEs  |
| Drilling and Blasting              | Emission of Particulate Matter and gaseous emission | Wet drilling and blasting will be carried out.<br>Water sprinkling<br>Safety shelter will be constructed within lease area.<br>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.<br>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.<br>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 100 sprinklers along both side of road, 50 sprinklers along the quarry faces and working area and 50 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, SO<sub>2</sub>, NO<sub>x</sub>, 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*, *Azadirchta indica*, *Nyctanthesarbor-tristis*, *Psidium guajava*, *Tectonagrandis* etc 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 conform 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 4,34,000m<sup>3</sup> (max) productions per annum of Cluster-6, the monthly production target will be around 36167m<sup>3</sup>. To produce 36167m<sup>3</sup> of rock mass, tentatively 72334kg/month of explosive will be required assuming powder factor 2m<sup>3</sup> /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 monitored in trial blasts to generate 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.

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

Where,

$V_{max}$  = Peak particle velocity

K &  $\alpha$  = 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 &  $\alpha$  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 5 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 8 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 hill/patch of the Cluster-6 area. Therefore, at the end of the plan (lease) period depth of the respective quarry over the Cluster-6 area is not possible to predict. However, after 10 years (lease period) of mining the tentative bottom RLs of Cluster 6 would be 10mRL. 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.

There is chance that during monsoon the run-off water may find access to some of the quarries in the cluster-6. 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.

**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 3.0 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 forest.
- The cluster area and its buffer zone are devoid of any ecologically sensitive 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 leaves 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-6 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 the hillock/patch of Cluster-6 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-6 area is at the rate of 1200/ha. About 3500 nos. saplings will be planted over an area of 2.914 hectare in 7.5m wide safety zone along peripheral hillock boundary of Cluster-6. 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 hillock/patch of Cluster-6. Plantation will be undertaken by individual lessees of the cluster in the supervision of the District Administration. 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-5 area is as follows:

**Table 4.8 A: Green Belt Development Plan**

| Period                  | Location               | Area in Ha   | No of saplings |
|-------------------------|------------------------|--------------|----------------|
| 1st year                | Peripheral Safety Zone | 0.5828       | 700            |
| 2nd Year                | Peripheral Safety Zone | 0.5828       | 700            |
| 3rd year                | Peripheral Safety Zone | 0.5828       | 700            |
| 4th year of Plan Period | Peripheral Safety Zone | 0.5828       | 700            |
| 5th year of Plan Period | Peripheral Safety Zone | 0.5828       | 700            |
| <b>Total</b>            |                        | <b>2.914</b> | <b>3500</b>    |

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 plantation 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. Commencement 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 dependency 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 opportunity 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 drinking 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 1624 persons and indirect employment for about 5000 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 1624 people include Skilled workers 200, Semi-skilled workers 600 and Unskilled workers 800 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 case, 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.

| 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  |

| 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 NO<sub>x</sub> and SO<sub>2</sub> 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.

| 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 |
| <b>Total</b> |                  |         |   |   |   |   |   | <b>37</b> |           |       |

#### 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<br>=<br>-0.36   | --                         | 0.3 ×<br>-0.3 =<br>-0.09   | --                       | --                      | 0.1 ×<br>0.0 =<br>0.0 | -36.48         |
| 54.05              | Health                         | 0.3 × -0.5<br>=<br>-0.15   | --                         | 0.3 × -<br>0.2 = -<br>0.06 | --                       | 0.2 × -0.3<br>= -0.06   | 0.2 ×<br>0.0 =<br>0.0 | -14.59         |
| 108.1              | Public utilities               | 0.7 × +0.5<br>=<br>+0.35   | --                         | 0.2 ×<br>+0.2 =<br>+0.04   | --                       | 0.1 × 0.2<br>= +0.02    | --                    | +44.32         |
| 108.1              | Economic aspect                | 0.6 × 0.4<br>=<br>+0.24    | --                         | 0.3 ×<br>0.3 =<br>+0.09    | --                       | 0.1 × 0.1<br>= +0.01    | --                    | +34.59         |
| 135.1              | Land use & soil Characteristic | 0.45 × -<br>0.4 =<br>-0.18 | 0.3 × -<br>0.1 = -<br>0.03 | 0.1 ×<br>-0.2 =<br>-0.02   | 0.1 ×<br>-0.1 =<br>-0.01 | 0.05 × -0.3<br>= -0.015 | 0.1 ×<br>0.0 =<br>0.0 | -52.68         |
| 27.02              | Wild Life                      | 0.5 × -0.4<br>=<br>-0.2    | --                         | 0.3 × -<br>0.2 = -<br>0.06 | --                       | --                      | 0.2 ×<br>0.0 =<br>0.0 | -2.16          |
| 108.1              | Flora                          | 0.4 × -0.2<br>=<br>-0.08   | --                         | 0.4 × -<br>0.2 = -<br>0.08 | 0.1 ×<br>-0.1 =<br>-0.01 | --                      | 0.1 × 0<br>= 0        | -14.05         |
| 81.08              | Human settlement               | 0.4 × -<br>0.5 =<br>-0.20  | --                         | 0.3 ×<br>+0.2 =<br>+0.06   | 0.3 ×<br>-0.2 =<br>-0.06 | --                      | --                    | -25.94         |
| <b>TOTAL SCORE</b> |                                |                            |                            |                            |                          |                         |                       | <b>-136.06</b> |

**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 0.9. | -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 these operations.   | Adverse              | 0.5        | There are four activities causing impact on air quality of work environment 0.5 RPII values have been  | -0.6  | It is observed that the amount of SPM generated is high. Minor increase in SPM is observed       |

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|     |               |                         |   |   |            |     |  |       |   |
|-----|---------------|-------------------------|---|---|------------|-----|--|-------|---|
|     |               |                         |   |   |            |     | assigned to interactions 1 & 2 due to following reason : Dust & gases produced after blasting are instantaneous. |       | 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 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.   | 0.01  | 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. |

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|    |              |                       |   |   |            |     |  |      |  |
|----|--------------|-----------------------|---|---|------------|-----|--|------|--|
| 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 environment <sup>5</sup> , 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.<br>b) The people are exposed to increased noise levels.<br>c) The injury rate is |

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|     |                  |                              |   |   |            |     |  |      |  |
|-----|------------------|------------------------------|---|---|------------|-----|--|------|--|
|     |                  |                              |   |   |            |     |  |      | 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.<br>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<br>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.<br>b) Improvement in power supply is significant<br>c) Improvement in transportation facility by 100 percent. |
| 17  | Public utilities | Transportation               | 2 | Provides better transportation systems to mining area. Improves road network  | Beneficial | 0.2 | This has next significant impact RPII=0.2  | +0.2 | This benefits approx.25% EII =0.2  |

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|     |                  |                              |   |  |            |     |  |      |   |
|-----|------------------|------------------------------|---|--|------------|-----|--|------|---|
|     |                  |                              |   | and 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 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.<br>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 economic status of people. | Beneficial | 0.1 | Employment opportunities are therefore limited. Persons involved in other transportation activities. Hence a RPII of 0.1                 | +0.1 | Marginal job opportunities are observed hence marginal impact   |

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|     |                                 |                              |   |   |            |      |   |      |  |
|-----|---------------------------------|------------------------------|---|---|------------|------|---|------|--|
| 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 habit destruction                    | Adverse    | 0.5  | All operations are open cast, hence strong impact is observed. RPII of 0.5                                      | -0.4 | Impact due to air, noise and land pollution which is significant           |
| 29  | Wild Life                       | Transportation               | 2 | Adverse effect due to air and noise pollution by vehicular traffic                        | Adverse    | 0.3  | This is comparatively less important than other interaction.  | -0.2 | Significant traffic movement is observed due to                            |

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|    |                  |                       |   |  |            |     |  |      |  |
|----|------------------|-----------------------|---|--|------------|-----|--|------|--|
|    |                  |                       |   | and roadside accidents   |            |     | Hence RPII = 0.3   |      | 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 environmental degradation since more natural resources like fuel wood, water, electricity etc are | 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. |

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|     |                  |                              |   |  |            |     |  |      |                                   |
|-----|------------------|------------------------------|---|--|------------|-----|--|------|-----------------------------------|
|     |                  |                              |   | required   |            |     |  |      |                                   |
| 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<sub>x</sub> and SO<sub>2</sub> 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 dividing 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 0.5. | -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 throughout 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. |

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|     |               |                         |   |   |            |     |  |       |   |
|-----|---------------|-------------------------|---|---|------------|-----|--|-------|---|
|     |               |                         |   |   |            |     | 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.  |

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|     |              |                       |   |   |            |     |  |      |  |
|-----|--------------|-----------------------|---|---|------------|-----|--|------|--|
|     |              |                       |   |   |            |     | 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.<br>b) The people are exposed to increased noise levels.<br>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.<br>d) Air and noise pollution  |

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|     |                  |                              |   |   |            |     |  |      |  |
|-----|------------------|------------------------------|---|---|------------|-----|--|------|--|
| 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<br>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.<br>e) Improvement in power supply is significant<br>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  |

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|     |                  |                              |   |  |            |     |  |      |   |
|-----|------------------|------------------------------|---|--|------------|-----|--|------|---|
|     |                  |                              |   | 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 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.<br>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   |

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|     |                                 |                              |   |   |            |      |   |      |  |
|-----|---------------------------------|------------------------------|---|---|------------|------|---|------|--|
|     |                                 |                              |   | 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                          |

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|    |           |                       |   |   |            |     |  |      |  |
|----|-----------|-----------------------|---|---|------------|-----|--|------|--|
|    |           |                       |   | noise pollution and habitat 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.   |

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|     |                  |                              |   |   |            |     |  |      |  |
|-----|------------------|------------------------------|---|---|------------|-----|--|------|--|
| 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  |

| 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      |
| <b>Total</b> |                  |         |   |   |   |   |   | <b>27</b> | <b>1.0</b> | <b>1000</b> |

| 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                    | $0.6 \times -0.06 = -0.036$          | --                        | --                          | --                        | --                           | --                        | -1.008       |
| 55.6                             | Ground water resource                     | $0.5 \times -0.4 = -0.20$            | --                        | --                          | --                        | $0.3 \times -0.1 = -0.03$    | --                        | -12.78       |
| 111.1                            | Air Quality                               | $0.3 \times -0.4 = -0.12$            | $0.2 \times -0.1 = -0.02$ | $0.3 \times -0.02 = -0.006$ | --                        | --                           | $0.1 \times 0.01 = 0.001$ | -16.33       |
| 83.3                             | Water Quality                             | --                                   | --                        | --                          | --                        | $0.2 \times -0.1 = -0.02$    | --                        | -1.66        |
| 83.3                             | Noise Levels                              | $0.3 \times -0.4 = -0.42$            | --                        | $0.3 \times -0.3 = -0.09$   | --                        | --                           | $0.1 \times 0.0 = 0.0$    | -17.49       |
| 55.6                             | Health                                    | $0.3 \times -0.5 = -0.15$            | --                        | $0.3 \times -0.2 = -0.06$   | --                        | $0.2 \times -0.3 = -0.06$    | $0.2 \times 0.0 = 0.0$    | -15.01       |
| 111.1                            | Public utilities                          | $0.7 \times +0.5 = +0.35$            | --                        | $0.2 \times +0.2 = +0.04$   | --                        | $0.1 \times 0.2 = 0.02$      | --                        | +45.5        |
| 111.1                            | Economic aspect                           | $0.6 \times 0.4 = +0.24$             | --                        | $0.3 \times 0.3 = +0.09$    | --                        | $0.1 \times 0.1 = +0.01$     | --                        | +37.74       |
| 138.9                            | Land use & soil Characteristic            | $0.45 \times -0.4 = -0.18$           | $0.3 \times -0.3 = -0.09$ | $0.1 \times -0.2 = -0.02$   | $0.1 \times -0.2 = -0.02$ | $0.05 \times -0.3 = -0.015$  | $0.1 \times 0.0 = 0.0$    | -45.14       |
| 27.8                             | Wild Life                                 | $0.5 \times -0.4 = -0.2$             | --                        | $0.3 \times -0.2 = -0.06$   | --                        | --                           | $0.2 \times 0.0 = 0.0$    | -7.23        |
| 111.1                            | Flora                                     | $0.4 \times -0.2 = -0.08$            | --                        | $0.4 \times -0.2 = -0.08$   | $0.1 \times -0.1 = -0.01$ | --                           | $0.1 \times -0.1 = -0.01$ | -19.98       |

|                    |                  |                      |    |                       |                 |                       |              |       |
|--------------------|------------------|----------------------|----|-----------------------|-----------------|-----------------------|--------------|-------|
|                    |                  | -0.08                |    | = -0.08               | 0.1 = -<br>0.01 |                       | = -0.01      |       |
| 83.3               | Human settlement | 0.4 × -0.5=<br>-0.20 | -- | 0.3 × +0.2<br>= +0.06 | --              | 0.3 × -0.2<br>= -0.06 | --           | -26.7 |
| <b>TOTAL SCORE</b> |                  |                      |    |                       |                 |                       | <b>80.08</b> |       |

### 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   |
|------------------------------|---|--|--|
| <b>1.</b>                    | <b>Air quality</b>  |  |  |
|                              | 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<br>Twice in a Year | PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> |
| <b>2.</b>                    | <b>Water and waste water quality</b>  |  |  |
| 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  |
| <b>3.</b>                    | <b>Noise level monitoring</b>   |  |  |
| 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)   |
| <b>Green belt monitoring</b> |   |  |  |
| 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 6 area (Lunibar 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 35°-37°. The waste dump will be stabilized by planting grasses and other arrangements as detailed below:-

- Individual dump slope angle will be 35° 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 standar equipments 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 IMPACT 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 289 people in the proposed mining period. Apart from this the lease will create employment opportunity for about 500 people of the nearby area, who will be involved in crushing, 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.) |
|-----------------------------------|--|--|--------------------|--------------------|--------------------|--------------------|--------------------|------------------------|
|                                   |  |  | 1 <sup>st</sup> Yr | 2 <sup>nd</sup> Yr | 3 <sup>rd</sup> Yr | 4 <sup>th</sup> Yr | 5 <sup>th</sup> Yr |                        |
| <b>Pollution Control measures</b> |  |  |                    |                    |                    |                    |                    |                        |
| 1.                                | Installation of water sprinklers (30 Nos)  | Individual leases of the cluster         | **                 | **                 |                    |                    |                    | 2,00,000.00            |
| 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)                        | Road Connecting Madhupur garh RoadNH 200 | **                 | **                 | **                 | **                 | **                 | 1,00,000.00            |
| 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                        |                    |                    | **                 | **                 | **                 | 1,00,000.00            |
| 6.                                | Rain water harvesting structure  | Individual leases of the cluster         |                    | **                 | **                 |                    |                    | 1,00,000.00            |
| <b>Peripheral Development</b>     |  |  |                    |                    |                    |                    |                    |                        |
| 1.                                | Development and maintenance of village road connecting individual lease of cluster         | Nearby villages                          | **                 | **                 | **                 |                    |                    | 1,00,000.00            |
| 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   | Lunibar Village                          |                    |                    |                    | **                 | **                 | 2,00,000.00            |
| 4.                                | Distribution of education material to the primary school                                   | Lunibar 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 measures (financial estimates and organizational set-up). The potential identified impacts of the proposed Lunibar mining Cluster -6 of Dharmasala Tahasil of Jajpur district 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:

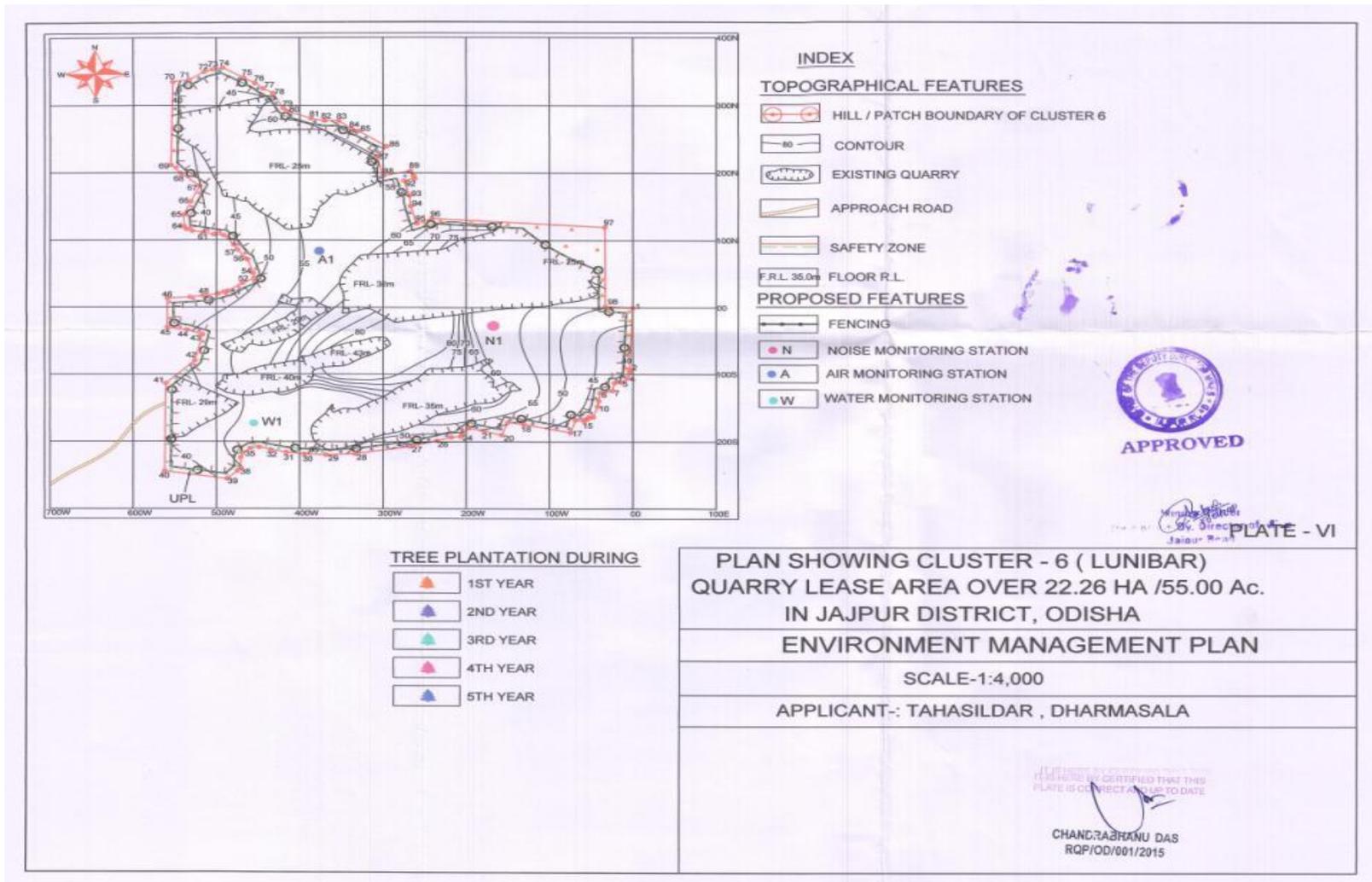
- Haul road within the cluster area well compacted that will reduce dust emission.
- Periodical water sprinkling on the haul road through water tanker of 10 KL capacity
- Over loading of transport equipments to be avoided to prevent spillage.

- 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 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 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 prevailing 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 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.

Ultimate extent of the quarry will be confined to the area of 19.345 hectares in Cluster-6. 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 hillock will be mined out during conceptual period. The ultimate quarry bottom will be at 10mRL. This is above the ground water table as the RL of ground water table is around 10 m. Therefore such depth of working would not affect the ground water table.

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 Lunibar mining cluster (Cluster 6) 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**

| <b>Activities</b>                        | <b>Inspection methods by EMMD</b>  |
|--|--|
| 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 monitored 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 Lunibar Stone Cluster (Cluster 6) 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 Rahadpur stone Cluste stone quarry.

- The Lessee is committed towards efficient use of natural resources based on reduce, recycle and reuse method.
- The Project is committed 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 regarding prevention of accident, accident response and emergency 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**

| Sl. No.      | Description                  | Nos.     |
|--------------|------------------------------|----------|
| 1.           | Manager, (Pollution Control) | 1        |
| 2.           | Environmental Engineer       | 1        |
| 3.           | Horticultural Supervisor     | 1        |
| 4.           | Field assistant              | 1        |
| 5.           | Labourers                    | 1        |
| <b>Total</b> |                              | <b>5</b> |

## 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.

| <b>Table 10.3: Cost of Environmental Pollution Control Measures</b>                                     |                                 |   |
|---|---------------------------------|---|
| <b>Environmental Management Activity</b>  | <b>Capital Cost (Lakhs Rs.)</b> | <b>Recurring Cost (Lakhs Rs. / Yr.)</b> |
| 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                                    |
| <b>Total</b>  | <b>20.00</b>                    | <b>10.00</b>                            |

## 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 Lunibar Hillocks (Cluster 6) over an area of 22.26Ha, at Village-Lunibar under Dharmasala tahasil District Jajpur, Odisha. Cluster-6 (Lunibar hillock) is featured in the Survey of India Toposheet No. 73 L/1 and bounded between the latitudes 20°47'55.16"N to 20°48'15.06"N and longitudes 86°02'59.48" E to 86°03'18.90" E.

#### 11.2 HIGHLIGHTS

##### A. The Project

|                           |  |
|---------------------------|--|
| Name of the Project       | : Lunibar Hillocks (Cluster 6)                         |
| Product                   | : Building Stone                                       |
| Type of mine              | : Semi mechanized open cast mining                     |
| Rated production capacity | : 4340000m <sup>3</sup> during Plan Period (Ten Years) |

**Table 11.1: Brief profile of the project:**

| Sl. No. | Salient Features   | Descriptions                               |
|---------|--------------------|--|
| 1       | Cluster area       | 22.26 Ha (5nos of mining lease.)           |
| 2       | Village            | Lunibar                                    |
| 3       | Tahasil            | Jajpur                                     |
| 4       | District and State | Jajpur, Odisha                             |
| 5       | Land category      | Non forest Govt. Land                      |
| 6       | Toposheet No.      | 73 L/1                                     |
| 7       | Nearest town       | Madhupur                                   |
| 8       | Nearest road       | NH:200- 100m,E & NH:5- 9Km,E               |
| 9       | River distance     | Brahmani River – 5Km, E                    |
| 12      | Railway station    | New Gad Madhupur Railway Station 1.7 Km, E |
| 13      | Madhupur           | 2.5 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**

Lunibar Hillocks (Cluster 6) over an area of 22.26 Ha is an opencast semi- mechanized mine situated in the village Lunibar, Tahasil Dharmasala, District Jajpur, Odisha. This cluster comes under ownership of Dharmasala, Tahasil, Jajpur, Odisha quarry leases for Building stone/ Road metal comprising 5nos. of lease areas covering a total mineralised area of 55Acres or 22.26 Hectares located in village/Mouza Lunibar of Dharmasala Tahasil & District Jajpur, Odisha have been proposed to be leased out to different intenders through auction. Cluster-6 constituted of Lunibar building stone quarry has been approved by approved by the Deputy Directorate Mines, Jajpur Road Circle, Jajpur Road, vide memo no.318 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 6 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-6 has comprised mineralised area of Lunibar hillock over 22.26 Ha. The geological reserve (Probable & Possible) for building stone/road metal has been estimated as 5584824 cum. It is evident that demonstrated the mineable reserve has been estimated in similar manner as geological reserve leaving 7.5m safety zone barrier all along the hillock area boundary and maintaining the safety distance of 200 meters from existing revenue habitations, if any and the mineral blocked under benches to maintain safe quarry slope. Thus, the mineable reserve (Probable) for building stone/road metal is worked out to be 4349654cum over the cluster-6.

**Table 11.2 (A): Geological Reserve of Cluster**

| Section Considered | Length of Influence (M) | X-Area of Rock Mass (M <sup>2</sup> ) | Vol. of Rock Mass (M <sup>3</sup> ) | Saleable Rock In (M <sup>3</sup> ) | Waste Rock In (M <sup>3</sup> ) | X-Area of Soil (M <sup>2</sup> ) | Vol. of Soil (M <sup>3</sup> ) | Category |
|--------------------|-------------------------|---------------------------------------|-------------------------------------|------------------------------------|---------------------------------|----------------------------------|--------------------------------|----------|
| A                  | B                       | C                                     | D=BXC                               | E=D X .70                          | F=D X .30                       | E                                | F=E XB                         | G        |
| G1-G1'             | 336                     | 21835                                 | 7336560                             | 5135592                            | 2200968                         | 398                              | 133728                         | Probable |
|                    | 336                     | 1910                                  | 641760                              | 449232                             | 192528                          | 0                                | 0                              | Possible |
| <b>Total</b>       |                         | <b>23745</b>                          | <b>7978320</b>                      | <b>5584824</b>                     | <b>2393496</b>                  | <b>398</b>                       | <b>133728</b>                  |          |

**Table 11.2 (B): Mineable Reserve of Cluster**

| Section Considered | Length of Influence (M) | X-Area of Rock Mass (M <sup>2</sup> ) | Vol. of Rock Mass (M <sup>3</sup> ) | Saleable       | Waste          | X-Area of Soil (M <sup>2</sup> ) | Vol. of Soil (M <sup>3</sup> ) | Category   |
|--------------------|-------------------------|---------------------------------------|-------------------------------------|----------------|----------------|----------------------------------|--------------------------------|------------|
| A                  | B                       | C                                     | D=BXC                               | E=D X .70      | F=D X .30      | G                                | H=GXB                          | I          |
| G1-G1'             | 312                     | 19916                                 | 6213792                             | 4349654        | 1864138        | 373                              | 116376                         | Probable   |
| <b>Total</b>       |                         | <b>---</b>                            | <b>6213792</b>                      | <b>4349654</b> | <b>1864138</b> | <b>---</b>                       | <b>116376</b>                  | <b>---</b> |

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 4340000m<sup>3</sup> of building stone/road metal will be extracted per annum from the Cluster-6 area. During next 10 years of the plan period the level of production expected is given in Table below.

**Table 11.3: Proposed Tentative Maximum Production of Building Stone/Road Metal during Plan Period (Ten Years)**

| Sl. No.           | Year    | Cluster-6 in cum |
|-------------------|---------|------------------|
| 1.                | First   | 434000           |
| 2.                | Second  | 434000           |
| 3.                | Third   | 434000           |
| 4.                | Fourth  | 434000           |
| 5.                | Fifth   | 434000           |
| 6.                | Sixth   | 434000           |
| 7.                | Seventh | 434000           |
| 8.                | Eighth  | 434000           |
| 9.                | Ninth   | 434000           |
| 10.               | Tenth   | 434000           |
| <b>Sub -Total</b> |         | <b>4340000</b>   |

A total of 282 workers (Skilled-27nos., Semi-skilled-70nos. and Un-skilled-180nos & Mines Manager/Mine Permit Manager-5nos) will be employed during mining operation. The Cluster-6 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-6. 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 baseline monitoring and analysis of different environmental parameters was conducted by M/s Kalyani Laboratories Pvt. Ltd

#### **11.5.1 Land use and Topography**

The lease area in favor of applicant Tahasildar of Dharmasala, District Jajpur, Odisha, for excavation of building stone quarry over an area of 55.00 Acres or 22.26 Hectares is 73L/1 and is bounded by the latitudes from latitudes 20°47'55.16" N to 20°48'15.06" N and Longitudes 86°02'59.48" E to 86°03'18.90" E as per survey. The nearest highway is NH 200 located at a distance of 100m from the lease area. The nearest airport is Bhubaneswar Airport located at a distance of about 62km from the lease area. The area is at a distance of 2.5km from Madhupur town. The nearest railway siding is at New Gad Madhupur railway station located at a distance of about 1.7 km, E from the cluster 6 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 5 m to 8 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. There is chance that during monsoon the run-off water may find access to some of the quarries in the Cluster-6. 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 land use pattern of the buffer zone of the proposed project area it has been observed that about 46.5% of the land is used for agricultural purpose, fallow land 22% 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 9.0% of the buffer zone and 9% of the area comes under forest land. Forest in the buffer zone mainly scrub and open forest. The mining area covers 1.5% of the total land use.

### **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 35.2-70.0µg/m<sup>3</sup>. The concentration of SO<sub>2</sub> varies from 4.7-12.2µg /m<sup>3</sup> and NOx concentrations vary from 9.1-21.5µg /m<sup>3</sup>. 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<sub>10</sub>, 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  $\mu\text{s}/\text{cm}$
- Dissolved oxygen in the surface water sample ranges from 5.6-7.2 mg/l.
- Biochemical oxygen demand of the surface water body is 3-10 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 6.7-7.7. 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 55.8 dB (A) in day time and 44.3dB (A) in the night time. In the buffer zone the noise level ranges from 49.3 to 56.4 dBA during day time and 31.2 to 41.6 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  $\mu\text{s}/\text{Cm}$ . Nitrogen content of soil varies from 1210 to 1814 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 1.88%. 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 38 villages present within the buffer zone of the project area located within 10 km radius of the project site.

**Table no.11.4 Demographic profile of the buffer zone**

| Sl. No. | Attributes               | Radius of 10 km |
|---------|--------------------------|-----------------|
| 1       | No. of Villages          | 38              |
| 2       | Total Household          | 7723            |
| 3       | Total Population         | 34910           |
| 4       | Male Population          | 17893           |
| 5       | Female Population        | 17017           |
| 6       | Total ST population      | 6849            |
| 7       | Total SC Population      | 8126            |
| 8       | Sex Ratio ( F /M )       | 95 : 100        |
| 9       | Population below 6 Years | 4359            |

Out of the total population, 23315 persons are literate which contribute about 67% within the buffer zone. Out of the total literate, male literacy is contributed as 13127 i.e. 56% and female literacy is contributed as 10188 by 44%. It is observed that the literacy percentage is more among the male as compare to the female population. About 33% 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, 10949 persons (about 31%) are workers and 23961 (about 69%) persons are non workers. This can be inferred that more than 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 9541 (87%) are male and 1408 (13%) are female.
- Out of the total workers 8733 are main workers and 2216 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.11.5 Work group participation in main and marginal section**

| Sl. No. | Attributes         | Main | Marginal |
|---------|--------------------|------|----------|
| 1       | Total Working      | 8733 | 2216     |
| 2       | Cultivator         | 2365 | 506      |
| 3       | Agricultural labor | 2632 | 994      |
| 4       | Household workers  | 219  | 102      |
| 5       | Other Workers      | 3517 | 614      |

## **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-6 (Lunibar Hillock) is located within the revenue jurisdiction of Lunibar village under Dharmasala Tahasil of Jajpur district. The targeted area represents a hilly terrain with highest altitude of 80mRL in the middle part where as the NE part shows the lowest altitude of 25mRL. There is hardly any vegetation. There is no human settlement within the auction area.

#### **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 19.345hectares in Cluster-6. 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 hillock will be mined out during conceptual period. The ultimate quarry bottom will be at 10mRL as shown in the Conceptual Plan & Sections.

#### **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.

#### **11.6.2 Impact on Air Quality and Mitigation Measures:**

Mining operation and its associated activities are potentially air 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*, *Azadirchta indica*, *Nyctanthes arbor-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 3m to 6m. Assuming 4,34,000m<sup>3</sup> (max) productions per annum of Cluster-6, the monthly production target will be around 36167m<sup>3</sup>. To produce 36167m<sup>3</sup> of rock mass, tentatively 72334kg/month of explosive will be required assuming powder factor 2m<sup>3</sup> /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. 10KLD of potable water will be required from which 7.5 KLD of water will be required for drinking & domestic purpose. 1.5 KLD of water is suggested to be utilized for dust suppression and 1 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 hill/patch of the Cluster-6 area. Therefore, at the end of the plan (lease) period depth of the respective quarry over the Cluster-6 area is not possible to predict. However, after 10 years (lease period) of mining the tentative bottom RLs of Cluster 6 would be 10mRL. This is above the ground water table as the RL of ground water table is around 8m. 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-6. 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.

#### **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 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.

#### **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 19.346Ha of dump area will be covered with plantation of 23237 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.

A total of 282 workers (Skilled-27nos., Semi-skilled-70nos. and Un-skilled-180nos & Mines Manager/Mine Permit Manager-5nos) will be employed during mining operation.

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.

### **11.6 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 be 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 be 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 6) 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 8.1 Proposed CER Plan**

| Sl. No.                           | Activities   | Location                                 | Time Frame         |                    |                    |                    |                    | Allocated Budget (Rs.) |
|-----------------------------------|--|--|--------------------|--------------------|--------------------|--------------------|--------------------|------------------------|
|                                   |  |  | 1 <sup>st</sup> Yr | 2 <sup>nd</sup> Yr | 3 <sup>rd</sup> Yr | 4 <sup>th</sup> Yr | 5 <sup>th</sup> Yr |                        |
| <b>Pollution Control measures</b> |  |  |                    |                    |                    |                    |                    |                        |
| 1.                                | Installation of water sprinklers (30 Nos)  | Individual leases of the cluster         | **                 | **                 |                    |                    |                    | 2,00,000.00            |
| 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)                        | Road Connecting Madhupur garh RoadNH 200 | **                 | **                 | **                 | **                 | **                 | 1,00,000.00            |
| 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                        |                    |                    | **                 | **                 | **                 | 1,00,000.00            |
| 6.                                | Rain water harvesting structure  | Individual leases of the cluster         |                    | **                 | **                 |                    |                    | 1,00,000.00            |
| <b>Peripheral Development</b>     |  |  |                    |                    |                    |                    |                    |                        |
| 1.                                | Development and maintenance of village road connecting individual lease of cluster         | Nearby villages                          | **                 | **                 | **                 |                    |                    | 1,00,000.00            |
| 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   | Lunibar Village                          |                    |                    |                    | **                 | **                 | 2,00,000.00            |
| 4.                                | Distribution of education material to the primary school                                   | Lunibar Village                          | **                 | **                 | **                 | **                 | **                 | 1,00,000.00            |

## 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 28<sup>th</sup> April 2022
2. **NABL:** Certificate No.TC -7043 dated 16.03.2018
3. **MoEF:** Gadget Notification No. S.O 2003 (E) dated 6<sup>th</sup> August 2014
4. **Odisha State Pollution Control Board:** Letter no. 266/ VISC (Iem) i& PR-41/15-16 dated 12.02.2016

**Kalyani Laboratories Private Limited** also provided laboratory 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   |
|--------------------------------|---------------------|---|
| <b>EIA Coordinators</b>        |                     |   |
| 01                             | Dr. D. Biswal       | Mining of minerals(Open cast & underground)<br>Coke oven plants<br>Mineral Beneficiation<br>Metallurgical Industries<br>Thermal power Plant |
| 02                             | Dr. R. Nayak        | Mining of mineral(Open cast & underground), Coal washeries<br>Building and large construction projects                                      |
| 03                             | Mr. Rajesh Kanungo  | Metallurgical Industries<br>Thermal power Plant   |
| 04                             | Dr. Madhusmita Jena | Building and large construction projects  |
| <b>Functional Area Experts</b> |                     |   |
| 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   |
| <b>Team Member</b> |                       |  |
| 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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**କୃଷ୍ଣ-୨ ଲୁଣିବର ପାହାଡ଼ ଅନ୍ତର୍ଗତ ପଥରଖଣି ପରିମିତ ଅଂଚଳ ୨୨.୨୬ ହେକ୍ଟର  
ବା ୫୫ ଏକର ଖଣି ଖନନ ନିମନ୍ତେ ପ୍ରସ୍ତୁତ କରାଯାଇଥିବା ଦୁଇ ପରିବେଶ ସଂଘାତ  
ଆକଳନ ଓ ପରିବେଶ ପରିଚାଳନା ଯୋଜନାର ନିର୍ବାହୀ ସାରାଂଶ**

ଗ୍ରାମ- ଲୁଣିବର,  
ତହସିଲ - ଧର୍ମଶାଳା,  
ଜିଲ୍ଲା- ଯାଜପୁର,  
ରାଜ୍ୟ - ଓଡ଼ିଶା

**ପ୍ରକଳ୍ପର ଶ୍ରେଣୀ- ଖ**

କଲ୍ୟାଣୀ ଲାବୋରେଟୋରିଜ୍ ପ୍ରାଇଭେଟ୍ ଲିମିଟେଡ୍ ଦ୍ଵାରା ମାର୍ଚ୍ଚ ୨୦୨୦ରୁ ମେ  
୨୦୨୦ ସମୟ ମଧ୍ୟରେ ସଂଗଠିତ ସମସ୍ତ ମୂଳତଥ୍ୟକୁ ଏକତ୍ର କରାଯାଇ ପ୍ରସ୍ତୁତ  
କରାଯାଇଥିବା ସନ୍ଦର୍ଭ ।

**ପ୍ରକଳ୍ପର ପ୍ରସ୍ତାବକ  
ତହସିଲଦାର, ଧର୍ମଶାଳା ତହସିଲ  
ଜିଲ୍ଲା- ଯାଜପୁର, ରାଜ୍ୟ - ଓଡ଼ିଶା**

ପରିବେଶୀୟ ପରାମର୍ଶଦାତା :

**କଲ୍ୟାଣୀ ଲାବୋରେଟୋରିଜ୍ ପ୍ରାଇଭେଟ୍ ଲିମିଟେଡ୍**

ପ୍ଲଟ ନଂ- ୭୮/ ୯୪୪, ମିଲେନିୟମ ସିଟି, ପାହାଳ, ଭୁବନେଶ୍ଵର

ଓଡ଼ିଶା-୭୫୨୧୦୧, ଦୂରଭାଷ-୦୬୭୪-୨୯୭୪୦୫୯

ନାବେଟ ପ୍ରମାଣପତ୍ର ନଂ. : ନାବେଟ/ଇ ଆଇ ଏ/୧୯୨୨/ଆର୍ ଏ ୦୧୫୪, ତା.୧୮.୦୨.୨୦୨୦

**ଉପକ୍ରମ:**

ଏହି ନିର୍ବାହ ସାରାଂଶଟି ଓଡ଼ିଶାର ଯାଜପୁର ଜିଲ୍ଲା ଅନ୍ତର୍ଗତ କୁଷ୍ଠର-୬ ପଥର ଖଣିରୁ ଲୁଣିବର ଗ୍ରାମର ସର୍ବମୋଟ ୨୨.୨୬ ହେକ୍ଟର ପରିମିତ ଅଞ୍ଚଳରେ ପଥର ଉତ୍ପାଦନ ନିମନ୍ତେ ଲିଖିତ ପରିବେଶ ସଂଘାତ ଆକଳନ ଓ ପରିବେଶ ପରିଚାଳନା ଯୋଜନାର ସଂକ୍ଷିପ୍ତ ବିବରଣୀ ଅଟେ ।

**କ) ପ୍ରସ୍ତାବିତ ପ୍ରକଳ୍ପର ବିଷୟ ବିବରଣୀ**

| କ୍ର.ନଂ. | ବିବରଣୀ                                      | ସବିଶେଷ ସୂଚନା  |
|---------|---|---|
| ୧.      | ନାମ   | କୁଷ୍ଠର-୬ (ଲୁଣିବର) ପଥର ଖଣି   |
| ୨.      | ସ୍ଥାନ                                       | ଗ୍ରାମ- ଲୁଣିବର, 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 ୪୩,୪୦,୦୦୦ ପଥର ଉତ୍ପାଦନ  |
| ୬.      | ଅକ୍ଷାଂଶ/ଦ୍ରାଘିମା                            | ୨୦° ୪୭” ୫୫.୧୬’ ଉତ୍ତର ଅକ୍ଷାଂଶରୁ ୨୦° ୪୮” ୧୫.୦୬’<br>୮୬° ୦୨” ୫୯.୪୮’ ପୂର୍ବ ଦ୍ରାଘିମାରୁ ୮୬° ୦୩” ୧୮.୯୦’<br>ଚପୋସିଟ୍ ନଂ ୭୩ ଏଲ୍ /୧ |
|         | ପରିମିତ ଅଞ୍ଚଳ                                | ୨୨.୨୬ ହେକ୍ଟର  |
|         | ଜାଗାର କିସମ                                  | ଅଣଜଙ୍ଗଲ ସରକାରୀ ଜମି  |
|         | ସର୍ବନିମ୍ନ ଦୂରତାରେ ଥିବା<br>କ) ରାଷ୍ଟ୍ରୀୟ ସଡ଼କ | N.H. ୨୦୦ ( ୫୦୦ ମିଟର ଦୂରରେ ଅବସ୍ଥିତ ) ଓ N.H. ୫ - ୯ km   |
|         | ଖ) ରେଳମାର୍ଗ                                 | ନୂଆ ଗଡ଼ ମଧୁପୁର ରେଳଷ୍ଟେସନ ୧.୭ km   |
|         | ଗ) ନଦୀ                                      | ବ୍ରାହ୍ମଣୀ ନଦୀ ୫ km  |
|         | ଘ) ନିକଟତମ ସହର                               | ମଧୁପୁର ୨.୫ 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 ଗୁରିପଟେ ବାୟୁ ଓ ଭୂମି ପରିବେଶ ଉପରେ ସାମାନ୍ୟ କୁପ୍ରଭାବ ପଡ଼ିବ ଯାହାକି ପରେ ମାନବୀୟ, ସାମାଜିକ ତଥା ଅର୍ଥନୈତିକ ଲାଭଜନକ ଯୋଜନା ଦ୍ୱାରା କ୍ଷତି ଭରଣା ହୋଇପାରିବ ।

**ବିସ୍ତୃତ ବିବରଣୀ :**

କୁଷ୍ଠର-୬ ପଥର ଖଣି ଲୁଣିବର ଗ୍ରାମ ୨୨.୨୬ ହେକ୍ଟର ପରିମିତ ଅଞ୍ଚଳରେ ଧର୍ମଶାଳା ତହସିଲ, ଜିଲ୍ଲା-ଯାଜପୁର, ରାଜ୍ୟ - ଓଡ଼ିଶା ଅଧିନରେ ଆସୁଅଛି । ଏହି କ୍ଷେତ୍ରଟି ଏକ ପାହାଡ଼ିଆ ଅଞ୍ଚଳର ପ୍ରତିନିଧିତ୍ୱ କରୁଛି ଯେଉଁଥିରେ ୫ଟି ପଟା ଅଞ୍ଚଳ ରହିଛି । ଓଡ଼ିଶା ସରକାରଙ୍କ ଭୂବିଜ୍ଞାନ ନିର୍ଦ୍ଦେଶକଙ୍କ ଦ୍ୱାରା ପତ୍ର ସଂଖ୍ୟା ୩୧୮ ତା ୧୯.୦୨.୨୦୨୦ ମାଧ୍ୟମରେ ଖଣି ଖନନ ଯୋଜନା ପାଇଁ ମଞ୍ଜୁରି ଦିଆଯାଇଥିଲା ।

କୁଷ୍ଠର-୬ ଲୁଣିବର ପଥର ଖଣି ପାଇଁ ପଟା ଆକାରରେ ଦିଆଯାଇଥିବା ଖନନ କାର୍ଯ୍ୟ ନିମନ୍ତେ ଭାରତ ସରକାରଙ୍କ ପରିବେଶ ସଂଘାତ ଆକଳନ ଓ ପରିବେଶ ପରିଚାଳନା ନିର୍ଦ୍ଦେଶନାମା, ୨୦୦୬ ଅନୁଯାୟୀ ଜଙ୍ଗଲ ଓ ପରିବେଶ ମନ୍ତ୍ରାଳୟର ଅନୁମତି ଆବଶ୍ୟକ । ଏହି ପରିବେଶୀୟ ଅନୁମୋଦନ ପ୍ରାପ୍ତ କରିବା ନିମନ୍ତେ ତହସିଲଦାର, ଧର୍ମଶାଳା ତହସିଲ କଲ୍ୟାଣୀ ଲାବୋରେଟୋରିଜ୍ ପ୍ରାଇଭେଟ୍ ଲିମିଟେଡ୍ ପାହାଳ, ଭୁବନେଶ୍ୱରକୁ 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 ।

କୁଷ୍ଠର-୬ ଲୁଣିବର 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)    |                  |
|--|------------------|
| କୁଷ୍ଠର-୬ ଲୁଣିବର                        | ୫୫,୮୪,୮୨୪ ଘନମିଟର |
| ଖନନ ଯୋଗ୍ୟ ଭଣ୍ଡାର (ସମ୍ଭାବିତ / ପ୍ରମାଣିତ) |                  |
| କୁଷ୍ଠର-୬ ଲୁଣିବର                        | ୪୩,୪୯,୬୫୪ ଘନମିଟର |

**ଭୂବିଜ୍ଞାନ ଭଣ୍ଡାର ପରିସଂଖ୍ୟାନ :**

| ବିଭାଗ  | ଲମ୍ବ (ଘନମିଟର) | ପଥରର ଘନତ୍ୱ (ଘନମିଟର) | ଖନନଯୋଗ୍ୟ ପଥର ଉତ୍ପାଦନ (ଘନମିଟର) | ଅସୁଲଯୋଗ୍ୟ ପଥର (ଘନମିଟର) | ବର୍ଜ୍ୟବସ୍ତୁ ମାତ୍ରା (ଘନମିଟର) | ମୃତ୍ତିକା କ୍ଷେତ୍ର ଅଞ୍ଚଳ (ଘନମିଟର) | ମୃତ୍ତିକାର ମାତ୍ରା (ଘନମିଟର) | ବର୍ଗ     |
|--------|---------------|---------------------|-------------------------------|------------------------|-----------------------------|---------------------------------|---------------------------|----------|
| କ      | ଖ             | ଗ                   | ଘ=ଖXଗ                         | ଙ=ଘX୦.୭୦               | ଚ=ଘX୦.୩୦                    | ଟ                               | ଛ=ଚXଖ                     | ଜ        |
| G1-G1' | ୩୩୬           | ୨୧୮୩୫               | ୭୩୩୬୫୬୦                       | ୫୧୩୫୫୯୨                | ୨୨୦୦୯୬୮                     | ୩୯୮                             | ୧୩୩୭୨୮                    | ସମ୍ଭାବିତ |
|        | ୩୩୬           | ୧୯୧୦                | ୬୪୧୭୬୦                        | ୪୪୯୨୩୨                 | ୧୯୨୫୨୮                      | ୦                               | ୦                         | ସମ୍ଭବ    |
|        |               | ୨୩୭୪୫               | ୭୯୭୮୩୨୦                       | ୫୫୮୪୮୨୪                | ୨୩୯୩୪୯୬                     | ୩୯୮                             | ୧୩୩୭୨୮                    |          |

**ଖନନ ଯୋଗ୍ୟ ଭଣ୍ଡାର ପରିସଂଖ୍ୟାନ :**

| ବିଭାଗ  | ଲମ୍ବ (ଘନମିଟର) | ପଥରର ଘନତ୍ୱ (ଘନମିଟର) | ଖନନଯୋଗ୍ୟ ପଥର ଉତ୍ପାଦନ (ଘନମିଟର) | ଅସୁଲଯୋଗ୍ୟ ପଥର (ଘନମିଟର) | ବର୍ଜ୍ୟବସ୍ତୁ ମାତ୍ରା (ଘନମିଟର) | ମୃତ୍ତିକା କ୍ଷେତ୍ର ଅଞ୍ଚଳ (ଘନମିଟର) | ମୃତ୍ତିକାର ମାତ୍ରା (ଘନମିଟର) | ବର୍ଗ     |
|--------|---------------|---------------------|-------------------------------|------------------------|-----------------------------|---------------------------------|---------------------------|----------|
| କ      | ଖ             | ଗ                   | ଘ=ଖXଗ                         | ଙ=ଘX୦.୭୦               | ଚ=ଘX୦.୩୦                    | ଟ                               | ଛ=ଚXଖ                     | ଜ        |
| G1-G1' | ୩୧୨           | ୧୯୯୧୬               | ୬୨୧୩୭୯୨                       | ୪୩୪୯୬୫୪                | ୧୮୬୪୧୩୮                     | ୩୭୩                             | ୧୧୬୩୭୬                    | ସମ୍ଭାବିତ |

ଅର୍ଦ୍ଧଯନ୍ତ୍ରାକୃତ ଖନନ କାର୍ଯ୍ୟ ପଦ୍ଧତିରେ ଖଣି ଖନନ କାର୍ଯ୍ୟ କରାଯିବ । ପଥରଗୁଡ଼ିକୁ ଧରିବା ପାଇଁ ମନୁଷ୍ୟକୃତ ତଥା ଯାନ୍ତ୍ରିକ ପଦ୍ଧତି ଅବଲମ୍ବନ କରାଯିବ । ପଥର ଖୋଳାଯାଇ ଓ ବିସ୍ଫୋରଣ କରାଯାଇ ପଥରଗୁଡ଼ିକୁ ଢିଲା କରାଯିବ । ଅଧିକରୁ ଅଧିକ ୪୩,୪୦,୦୦୦ ଘନମିଟର ଘର ନିର୍ମାଣ ପାଇଁ ଆବଶ୍ୟକ ପଡୁଥିବା ପଥର ଖୋଳି ବାହାର କରାଯିବ । ଯୋଜନା ଅବଧି ସମୟ ୧୦ବର୍ଷ ପରେ ଉତ୍ପାଦନ ସ୍ତର ନିର୍ଦ୍ଧାରଣ କରାଯିବ । ଉତ୍ପାଦନର ଲକ୍ଷ୍ୟ ନିମ୍ନୋକ୍ତ ସାରଣୀ ମାଧ୍ୟମରେ ଦର୍ଶାଯାଇଛି :

| ବର୍ଷ | କୁଣ୍ଡର-୬ ଲୁଣିବର<br>(ଘନମିଟର) | ସର୍ବମୋଟ<br>(ଘନମିଟର) |
|------|-----------------------------|---------------------|
| ୧ମ   | ୪୩୪୦୦୦                      | ୪୩୪୦୦୦              |
| ୨ୟ   | ୪୩୪୦୦୦                      | ୪୩୪୦୦୦              |
| ୩ୟ   | ୪୩୪୦୦୦                      | ୪୩୪୦୦୦              |
| ୪ର୍ଥ | ୪୩୪୦୦୦                      | ୪୩୪୦୦୦              |
| ୫ମ   | ୪୩୪୦୦୦                      | ୪୩୪୦୦୦              |
| ୬ଷ୍ଠ | ୪୩୪୦୦୦                      | ୪୩୪୦୦୦              |
| ୭ମ   | ୪୩୪୦୦୦                      | ୪୩୪୦୦୦              |
| ୮ମ   | ୪୩୪୦୦୦                      | ୪୩୪୦୦୦              |
| ୯ମ   | ୪୩୪୦୦୦                      | ୪୩୪୦୦୦              |
| ୧୦ମ  | ୪୩୪୦୦୦                      | ୪୩୪୦୦୦              |
| ମୋଟ  | ୪୩୪୦୦୦୦                     | ୪୩୪୦୦୦୦             |

ପ୍ରସ୍ତାବିତ ପଥର ଖଣିରେ ୨୮୨ ଜଣ ଲୋକଙ୍କ ପାଇଁ ନିଯୁକ୍ତିର ସୁଯୋଗ ରହିବ । ସେଥିମଧ୍ୟରୁ ୨୭ ଜଣ କୁଶଳୀ ଶ୍ରମିକ, ୭୦ ଜଣ ଅର୍ଦ୍ଧକୁଶଳୀ ଶ୍ରମିକ, ୧୮୦ ଜଣ ଅଣକୁଶଳୀ ଶ୍ରମିକ ତଥା ୫ ଜଣ ପରିଚାଳକ ଓ ତତ୍ପାରିତ ଭାବରେ କାର୍ଯ୍ୟ କରିବେ । ଏହି ଖଣିର ପଥର ମାଟି ମିଶ୍ରିତ ତଥା ଗ୍ରାନାଇଟ ଯୋଗ୍ୟ ଅଟେ । ଏହି ମୃତ୍ତିକାକୁ ଚିହ୍ନିତ କରାଯାଇଥିବା ଘାଟରେ ରଖାଯିବ ଓ ବୃକ୍ଷରୋପଣ ନିମନ୍ତେ ଉପଯୋଗ କରାଯିବ । ଖନନ ସମୟରେ ୩୦ ପ୍ରତିଶତରୁ ଅଧିକ କଚରା ସଢ଼କ ନିର୍ମାଣ ପାଇଁ ଉପଯୋଗ କରାଯିବ । ସାଧାରଣତଃ ଦୁଇ ଡିଗ୍ରୀରୁ କଚରା କ୍ରସର ଥିବା ସ୍ଥାନକୁ ପଠାଯିବ ।

**ପରିବେଶର ବର୍ତ୍ତମାନ ସ୍ଥିତି :**

ଖଣି ଖନନ କାର୍ଯ୍ୟ ପାଇଁ ପରିବେଶ ସଂଘାତ ଆକଳନ କରିବା ଲକ୍ଷ୍ୟରେ ପ୍ରସ୍ତାବିତ ପ୍ରକଳ୍ପର କେନ୍ଦ୍ରୀକ ଓ ୧୦ କି.ମି. ବ୍ୟାସାର୍ଦ୍ଧରେ ଥିବା ପାର୍ଶ୍ଵବର୍ତ୍ତୀ ଅଂଚଳ ମଧ୍ୟରେ ପରିବେଶ ସମ୍ବନ୍ଧୀୟ ପ୍ରାଥମିକ ତଥ୍ୟ ହାସଲ କରିବା ପାଇଁ ଏକ ସଜ୍ଜ ସାମୟିକ ସ୍ଥାନୀୟ କ୍ଷେତ୍ର ଅଧ୍ୟୟନ ମାର୍ଚ୍ଚ ୨୦୨୦ ରୁ ମେ ୨୦୨୦ ମାସ ମଧ୍ୟରେ କଲ୍ୟାଣୀ ଲାବୋରେଟୋରିଜ୍ ପ୍ରାଇଭେଟ୍ ଲିମିଟେଡ୍, ଭୁବନେଶ୍ଵର (NABL ଏବଂ MoEF ସୀକୃତିପ୍ରାପ୍ତ ପରୀକ୍ଷାଗାର) ଦ୍ଵାରା କରାଯାଇଥିଲା ।

ଏହି ଖଣି ଅଞ୍ଚଳ ଯାଜପୁର ଜିଲ୍ଲାର ଲୁଣିବର ଗ୍ରାମରେ ଅବସ୍ଥିତ । ଏହା ଟପୋସିଟ ନଂ 73 L/1 ରେ ଦର୍ଶାଯାଇଛି । ଏହି ଅଞ୍ଚଳ ୨୦° ୪୭” ୫୫.୧୬’ ଉତ୍ତର ଅକ୍ଷାଂଶରୁ ୨୦° ୪୮” ୧୫.୦୬’ ଏବଂ ୮୬° ୦୨” ୫୯.୪୮’ ପୂର୍ବ ଦ୍ରାଘିମାରୁ ୮୬° ୦୩” ୧୮.୯୦’ ରେ ଅବସ୍ଥିତ । ଏହି ଅଞ୍ଚଳ ମଧୁପୁର ଠାରୁ ୨.୫ କି.ମି. ଦୂରରେ ଅବସ୍ଥିତ ।

ବର୍ଷାଦିନେ ଭୂତଳ ଜଳସ୍ତର ଭୂପୃଷ୍ଠଠାରୁ ୫ ମିଟର ଓ ଗ୍ରୀଷ୍ମଦିନରେ ୧୦ ମିଟର ନିମ୍ନରେ ରହିବ । ବର୍ଷାଦିନେ ବର୍ଷାଜଳ ଖଣି ଅଞ୍ଚଳ ମଧ୍ୟକୁ ପ୍ରବେଶ କରିବାର ସମ୍ଭାବନା ଅଛି । ଏହି ଜଳକୁ ନିଷ୍କାସନ କରିବା ପାଇଁ ୫ଏଚ୍.ପି. ଡିଜେଲ ପମ୍ପର ବ୍ୟବସ୍ଥା କରିବା ପାଇଁ ପ୍ରସ୍ତାବ ଦିଆଯାଇଛି । ଏହି ଅଞ୍ଚଳର ମୁଖ୍ୟ ବ୍ରାହ୍ମଣୀ ନଦୀ ଦ୍ଵାରା ପରିଚାଳିତ । ଏହି ଖଣି ଅଞ୍ଚଳଟି ୨୨.୨୬ ହେକ୍ଟର ପରିବ୍ୟାପ୍ତ ଓ ମୁଖ୍ୟତଃ ପାହାଡ଼ିଆ ଜମିକୁ ନେଇ ସୃଷ୍ଟ । ଏହା କୌଣସି ଐତିହାସିକ ଓ ସଂସ୍କୃତିକ ଦୃଷ୍ଟିକୋଣରୁ ଗୁରୁତ୍ଵପୂର୍ଣ୍ଣ ନୁହେଁ । ଅଧ୍ୟକ୍ଷ ଅଞ୍ଚଳର ଜମି ପ୍ରକାର ଭେଦରୁ ଜଣାଯାଏ ଯେ ଏଠାକାର ଜମିର ମୁଖ୍ୟ ବ୍ୟବହାର ଗୁଣ୍ଡପଯୋଗୀ ଜମି ୪୬.୫ ପ୍ରତିଶତ, ନଦୀ ତଥା ଜଳାଶୟ ୧୮ ପ୍ରତିଶତ ଓ ଅନାବାଦି ଜମି ୨୨ ପ୍ରତିଶତ ଅଟେ । ସମୁଦାୟ କ୍ଷେତ୍ର ଅଞ୍ଚଳର ୧.୫ ପ୍ରତିଶତ ଖଣି ଖନନ କାର୍ଯ୍ୟରେ ବ୍ୟବହୃତ ହେବ ।

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 ହାରାହାରି ତାପମାତ୍ରା ୪୦°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 ଗୁଣବତ୍ତା ପରୀକ୍ଷଣ ପାଇଁ ୮ଟି ଗ୍ରାମକୁ ମାର୍ଚ୍ଚରୁ ମେ ମାସ ପର୍ଯ୍ୟନ୍ତ ବାୟୁର ନମୁନା ସଂଗ୍ରହ କରାଯାଇଥିଲା । ଏହି ବାୟୁରେ ଭାସମାନ ପଦାର୍ଥର ମାତ୍ରା (ପି.ଏମ୍. ୧୦) ୩୫.୨ – ୭୦ ମାଇକ୍ରୋଗ୍ରାମ/ଘନ ମି., ସଲଫର ଡାଇଅକ୍ସାଇଡ୍ ୪.୭ ରୁ ୧୨.୨ ମାଇକ୍ରୋଗ୍ରାମ/ଘନ ମି. ଏବଂ NOx ର ମାତ୍ରା ୯.୧ ରୁ ୨୧.୫ ମାଇକ୍ରୋଗ୍ରାମ/ଘନ ମି. ରହିଛି । ଏହି ମାତ୍ରା କେନ୍ଦ୍ରୀୟ ପ୍ରଦୂଷଣ ନିୟନ୍ତ୍ରଣ ପରିଷଦ ଦ୍ଵାରା ସ୍ଥିରୀକୃତ ଜାତୀୟ ଭୂପୃଷ୍ଠ ବାୟୁର ନିର୍ଦ୍ଧାରିତ ମାନାଙ୍କଠାରୁ ଯଥେଷ୍ଟ କମ୍ ରହିଛି । ଭାସମାନ ପଦାର୍ଥ, ଶ୍ଵାସନୀୟ ଭାସମାନ ପଦାର୍ଥ ଓ ସଲଫର ଡାଇଅକ୍ସାଇଡ୍‌ର ମାନାଙ୍କ ଗ୍ରାମାଞ୍ଚଳ 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 ନିଶ୍ଚିତ ଅଟେ । ଏହି ଜଳର ବୈଦ୍ୟୁତିକ ପରିବାହିତା ୧୪୪-୪୮୦  $\mu\text{s/cm}$  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.ଡି. ର ମାତ୍ରା ୩ ରୁ ୧୦ ମି.ଗ୍ରା./ଲି ରହୁଛି । ଏଥିରେ କପର, ଲେଡ଼, ନିକେଲ, ଭାନାଡ଼ିୟମ୍, କ୍ରୋମିୟମ୍, ସିୟାନାଇଡ଼, ଫ୍ଲୋରାଇଡ଼, ଡେଲିକ ଓ ଗ୍ରୀସ୍ ଇତ୍ୟାଦି ନାହିଁ । ଭୂପୃଷ୍ଠ ଜଳର ପରୀକ୍ଷଣରୁ ଜଣାଯାଏ ଯେ, ଏହି ଜଳର ସମସ୍ତ ଉପାଦାନ ନିର୍ଦ୍ଦାୟକ 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.ଏଚ୍. ୬.୬ ରୁ ୭.୬ ଓ ଏହା ନିଶ୍ଚିତ 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 ପରିଚାଳନା ଯୋଜନାର ତୃତୀୟ ଅଧ୍ୟାୟରେ ଦିଆଯାଇଛି । ଭୂତଳ ଜଳର ପରୀକ୍ଷଣର ଫଳାଫଳରୁ ଜଣାଯାଏ ଯେ, ଏହି ଜଳ ପାନୀୟ ଉପଯୋଗୀ ଅଟେ ।

ଏହି ଅଞ୍ଚଳର ପରିବେଷଣୀ ଧୂନୀର ମାତ୍ରା ନିର୍ଦ୍ଧାରିତ ମାନାଙ୍କ ମଧ୍ୟରେ ରହିଛି । ୮ଟି ନମୁନା ସଂଗ୍ରହ କେନ୍ଦ୍ରରେ ଧୂନୀର ମାତ୍ରା ଆକଳନ କରାଯାଇଥିଲା । ପ୍ରକଳ୍ପ ଅଞ୍ଚଳରେ ଧୂନୀର ମାତ୍ରା ଦିନ ସମୟରେ ୫୫.୮ ଡେସିବଲ ଓ ରାତ୍ର ସମୟରେ ୪୪.୩ ଡେସିବଲ ରେକର୍ଡ଼ କରାଯାଇଛି ଯାହା କି ଅନୁମୋଦିତ ମାତ୍ରା ମଧ୍ୟରେ ରହିଛି । ବଫର ଅଞ୍ଚଳରେ ଦିନ ସମୟରେ ଶବ୍ଦର ମାତ୍ରା ୪୯.୩ ରୁ ୫୬.୪ ଡେସିବଲ ଓ ରାତ୍ର ସମୟରେ ୩୧.୨ ରୁ ୪୧.୬ ଡେସିବଲ ରେକର୍ଡ଼ କରାଯାଇଛି ।

ଅଧ୍ୟୟନର ୧୦ କି.ମି. ବ୍ୟାସାର୍ଦ୍ଧ ମଧ୍ୟରେ ମୃତ୍ତିକାର ନମୁନା ଗ୍ରାମରୁ ସଂଗ୍ରହ କରାଯାଇଥିଲା । ଏହାର ଉପଲକ୍ଷ ନାଇଟ୍ରୋଜେନର ମାତ୍ରା ୧୨୧୦ ରୁ ୧୮୧୪ କେ.ଜି./ ହେକ୍ଟର, ପଟାସିଅମର ପରିମାଣ ୧୩୪ ରୁ ୪୮୨ କେ.ଜି./ହେକ୍ଟର, ଫସଫରସର ପରିମାଣ ୧୩.୯୧ ରୁ ୪୯.୯୯ କେ.ଜି./ହେକ୍ଟର । ଅର୍ଗାନିକ କାର୍ବନର ମାତ୍ରା ୦.୩୬ ରୁ ୧.୮୮ 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, ଓଷ୍ଠଗଛ, 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 ଅଞ୍ଚଳରେ ୩୮ଟି ଗ୍ରାମ ରହିଛି ଓ ଏଠାକାର ସମୁଦାୟ ଜନସଂଖ୍ୟା ୩୪୯୧୦ (୨୦୧୧ ଜନଗଣନା, ଓଡ଼ିଶା) ଓ ଘର ସଂଖ୍ୟା ୭୭୨୩ ଅଛି । ସମୁଦାୟ ଜନସଂଖ୍ୟାରୁ ୧୭୮୯୩ ଜଣ ପୁରୁଷ ଓ ୧୭୦୧୭ ଜଣ ମହିଳା ଅଟନ୍ତି । ଏହି ଅଞ୍ଚଳର ଜନସଂଖ୍ୟା ମଧ୍ୟରୁ ୮୧୨୬ ତତ୍ପସିଲ ଭୁକ୍ତ ଜାତି ଓ ୬୮୪୯ ତତ୍ପସିଲ ଭୁକ୍ତ ଜନ ଜାତିର ଅନ୍ତର୍ଗତ । ସମୁଦାୟ ଜନସଂଖ୍ୟାରୁ ୨୩୩୧୫ ଜଣ ଶିକ୍ଷିତ ଅଟନ୍ତି ଓ ଏହା ସମୁଦାୟ ଜନସଂଖ୍ୟାର ୬୭ ଶତକଡ଼ା ଅଟେ । ସମୁଦାୟ ଶିକ୍ଷିତ ମଧ୍ୟରୁ ୧୩୧୨୭ ଜଣ ପୁରୁଷ ଓ ୧୦୧୮୮ ଜଣ ମହିଳା ଅଟନ୍ତି ।

ଅଧ୍ୟୟନ ଅଞ୍ଚଳରେ ୧୦୯୪୯ ଜଣ ରୋଜଗାରକ୍ଷମ ଅଟନ୍ତି । ପୁରୁଷ ଶ୍ରମଜୀବିକ ସଂଖ୍ୟା ୯୫୪୧ ଥିବା ବେଳେ ମହିଳା ଶ୍ରମଜୀବିକ ସଂଖ୍ୟା ୧୪୦୮ ଅଟେ । ସେଥିମଧ୍ୟରୁ ୮୭୩୩ ଜଣ ମୁଖ୍ୟ ଶ୍ରମଜୀବି ଓ ୨୨୧୬ ଜଣ ସାଧାରଣ ଶ୍ରମଜୀବି ଅଟନ୍ତି ।

**ପରିବେଶ ସଂଘାତ ଆକଳନ :**

ବର୍ତ୍ତମାନର ପରିବେଶ ସଂଘାତ ଆକଳନ ଏକ ଦ୍ରୁତ ପ୍ରକ୍ରିୟା ଯାହା କି ଯାଜପୁର ଜିଲ୍ଲାର ଲୁଣିବର ଗ୍ରାମରେ ପ୍ରସ୍ତାବିତ ଖଣି ଖନନ କାର୍ଯ୍ୟ ଦ୍ୱାରା ସୃଷ୍ଟି ହେବାକୁ ଥିବା ପରିବେଶ ପ୍ରଦୂଷଣର କାରଣ ଓ ପ୍ରଭାବର ଗଭୀରତାକୁ ଆକଳନ କରୁଅଛି ।

**ଭୂମି ଓ ଭୂମିରୂପ ଉପରେ ପ୍ରଭାବ :**

- ଏହି ପଟା ଅଞ୍ଚଳରେ ଖଣି ଖନନ, ବର୍ଜ୍ୟବସ୍ତୁ ଗଦାଜବା ଓ ଆନୁସଙ୍ଗିକ ଭିତ୍ତିଭୂମି ନିର୍ମାଣ ଯୋଗୁଁ ଭୂମିରୂପର ପରିବର୍ତ୍ତନ ହେବାର ଆଶା କରାଯାଏ । ଖନନ ସମୟରେ ଉପର ମୃତ୍ତିକାକୁ ଅଲଗା ରଖାଯାଇ ବୃକ୍ଷରୋପଣ କାର୍ଯ୍ୟରେ ଲଗାଯିବ ।
- 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 କାର୍ଯ୍ୟକାଳ ମଧ୍ୟରେ ଉପର ମୃତ୍ତିକା ସୃଷ୍ଟି ହୋଇ ବର୍ଜ୍ୟବସ୍ତୁ ଗଦା ଅସ୍ଥାୟୀ ରୂପେ କାର୍ଯ୍ୟ କରିବ ।

**ପରିବେଷଣ ବାୟୁ ଉପରେ ପ୍ରଭାବ ଓ ପରିଚାଳନା ଯୋଜନା :**

ଖଣି ଖନନ ଓ ତରଫ 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 ଉତ୍ପାଦନ ନିକଟରେ ସର୍ବାଧିକ ଓ ଏହାର ମାତ୍ରା ଉତ୍ତରାଠାରୁ ଦୂରତା ଅନୁସାରେ କମ୍ ହୋଇଥାଏ ।
- ଧୂଳିକଣାଜନିତ ପ୍ରଦୂଷଣର ମାତ୍ରା ଖଣି ଉତ୍ପାଦନ 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 । ଉର୍ତ୍ତ୍ତି 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 ।

**ପରିବେଷଣୀୟ ଧ୍ୱନି ଉପରେ ପ୍ରଭାବ ଓ ପରିଚାଳନା ଯୋଜନା :**

ପଥର ଖୋଳିବା କାର୍ଯ୍ୟ ମାନବୀକୃତ ଭୂଉପରିସ୍ଥ ଖଣି ଖନନ ପଦ୍ଧତି ଦ୍ୱାରା ହେବ । ଏହି ପ୍ରକ୍ରିୟାରେ ବିଶ୍ଳେଷଣ ସାମଗ୍ରୀର ବ୍ୟବହାର ଦ୍ୱାରା ଶବ୍ଦ ପ୍ରଦୂଷଣ ଜାତ ହେବ । ମୋଟାମୋଟି ଭାବରେ ପ୍ରତିବର୍ଷ ୪୩୪୦୦୦ ଘନମିଟର ପଥର ଉତ୍ପାଦନ ପାଇଁ ହାରାହାରି ୭୨୩୩୪ କେ.ଜି. ପ୍ରତିମାସ ହିସାବରେ ବିଶ୍ଳେଷଣ ବ୍ୟବହୃତ ହେବ ଯେଉଁଥିରେ ପାଉଡ଼ର ମାତ୍ରା ୨ ଘନମିଟର/କେ.ଜି. ରହିବ । ଗ୍ରାମବାସୀମାନଙ୍କୁ ଆଗରୁ ଖବର ଦିଆଯାଇ ଦିନ ୧୨ଟାରୁ ୧୨.୩୦ ମଧ୍ୟରେ ବିଶ୍ଳେଷଣ କରାଯିବ ।

ଏହି ପ୍ରକ୍ରିୟା ଦ୍ୱାରା ଶବ୍ଦ ପ୍ରଦୂଷଣର ମୁଖ୍ୟତଃ ତିନୋଟି 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 ତିନୋଟି ଚାଳିତ ଯନ୍ତ୍ରପାତିର ଉପଯୁକ୍ତ ରକ୍ଷଣାବେକ୍ଷଣ ଓ ସ୍ଥାୟୀ ଯନ୍ତ୍ରପାତିଗୁଡ଼ିକୁ ଯେତେଦୂର ସମ୍ଭବ ଆବଶ୍ୟକ ସ୍ଥାନରେ ରଖାଯିବାର ବ୍ୟବସ୍ଥା କରାଯିବ । ଶ୍ରମିକମାନଙ୍କୁ ବ୍ୟକ୍ତିଗତ

ରକ୍ଷାକାରୀ ଉପକରଣ ଯୋଗାଇ ଦିଆଯିବ । ଖଣି ଅଂଚଳର ଚତୁଃପାର୍ଶ୍ଵରେ ବୃକ୍ଷରୋପଣ କରାଯିବ ଯାହାଦ୍ଵାରା କି ଶବ୍ଦ ପ୍ରଦୂଷଣକୁ ରୋକାଯାଇପାରିବ ।

ଜଳ ଉପରେ ପ୍ରଭାବ :

ଏହି ଅଂଚଳର ମୁଖ୍ୟ ନଦୀ ଲିଜ ଅଂଚଳଠାରୁ ୫ କି.ମି. ଦୂରରେ ଅବସ୍ଥିତ । ଲିଜ ଅଂଚଳ ମଧ୍ୟରେ କୌଣସି ନାଳ ପ୍ରବାହିତ ହେଉନାହିଁ । ଏହି ଅଂଚଳରେ ଭୂତଳ ଜଳ ବର୍ଷାରତୁରେ ଭୂପୃଷ୍ଠରୁ ୫ମି. ଗଭୀରତାରେ ଓ ଗ୍ରୀଷ୍ମରତୁରେ ୧୦ମି. ଗଭୀରତାରେ ରହିଥାଏ । ସ୍ଥାନୀୟ ଅଂଚଳର ଭୂତଳ ଜଳସ୍ତର ଉପରେ ଖଣି ଖନନର ପ୍ରଭାବ ଜାଣିବା ପାଇଁ ଏକ ଅନୁଧ୍ୟାନ କରାଯାଇଛି ଓ ତଦନୁଯାୟୀ ପରିଚାଳନା ଯୋଜନା ପ୍ରସ୍ତୁତ କରାଯାଇଛି ।

ପ୍ରତିଦିନ ୧୦ କିଲୋଲିଟର ଜଳର ଆବଶ୍ୟକତା ଥିବାବେଳେ ପାନୀୟ ତଥା ଗୃହପଯୋଗୀ ଜଳ ୭.୫ କିଲୋଲିଟର, ଧୂଳିକଣା ହ୍ରାସ ପାଇଁ ୧.୫ କିଲୋଲିଟର ଏବଂ ବୃକ୍ଷରୋପଣ ଉଦ୍ଦେଶ୍ୟରେ ୧ 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 ଦ୍ଵାରା ଭୂପୃଷ୍ଠ ଜଳ ପ୍ରଦୂଷଣ ହୋଇପାରେ :-

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

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

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

- ବର୍ଜ୍ୟବସ୍ତୁ ଗଦାକବାର ସ୍ଥାନ ଠିକ୍ ଭାବରେ ନିରୂପଣ କରାଯିବ
- ବର୍ଜ୍ୟବସ୍ତୁ ଗଦା ଚାରିପଟରେ ଥିବା ଗାରଲ୍ୟାଣ୍ଡ ନାଳରେ ଛୋଟ ବନ୍ଧର ବ୍ୟବସ୍ଥା କରାଯିବ ଯାହା ଦ୍ଵାରା କି ଭାସିଯାଉଥିବା ବର୍ଜ୍ୟବସ୍ତୁ କୁ ରୋକା ଯାଇପାରିବ ।
- ବର୍ଷାଦିନେ ଗଦାରୁ ଗୋଡ଼ି, ମାଟି, ବର୍ଷାଜଳ ସହ ଧୋଇ ହୋଇ ଚାଲିଯିବାର ସମ୍ଭାବନା ଥିବାରୁ ଗଦା ଚାରିପଟେ ଥିବା ନାଳରେ କୁଣ୍ଡର ବ୍ୟବସ୍ଥା ରହିବ ଯାହାଦ୍ଵାରା 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 ଚୂଣ, ବୁଦା ଗଛ ରହିଅଛି । ଲିଜ ଅଂଚଳରେ କାଜୁ, ନିମ୍ବ, ଖଜୁରୀ, ଶାଳ, ଓଷ୍ଠଗଛ, ତାଳଗଛ, ବାଉଁଶ, କେନ୍ଦୁ, ଶାଗୁଆନ, ଶିମିଳି, ସୁନାରୀ, ଅଗସ୍ତି, ନିର୍ଗୁଣ୍ଡି ଇତ୍ୟାଦି ବୃକ୍ଷରୋପଣ କରାଯାଇଛି । ଖଣି କାର୍ଯ୍ୟକାଳ ସମାପ୍ତି ପରେ ୧୯.୩୪୬ ହେକ୍ଟର ଅଂଚଳରେ ସବୁଜ ବଳୟ ସୃଷ୍ଟି କରିବା ପାଇଁ ୨୩୨୩୭ ଚାରା ରୋପଣ କରାଯିବ ।

**ସାମାଜିକ ପ୍ରଭାବ ଓ ପରିଚାଳନା ଯୋଜନା :**

ପ୍ରକଳ୍ପ କାର୍ଯ୍ୟଦ୍ୱାରା ପ୍ରତ୍ୟେକ୍ଷ ଓ ପରୋକ୍ଷ ନିୟୁକ୍ତି ସୁଯୋଗ, ଯାତାୟାତର ସୁବିଧା ଦ୍ୱାରା ସ୍ଥାନୀୟ ଅଂଚଳର ଅର୍ଥନୈତିକ ବିକାଶ ଦ୍ୱାରା ମାନବୀୟ ପରିବେଶ ଉପରେ ଲାଭଜନକ ପ୍ରଭାବ ପଡ଼ିବ । ପ୍ରସ୍ତାବିତ ପଥର ଖଣିରେ ୨୮୨ ଜଣ ଲୋକଙ୍କ ପାଇଁ ନିୟୁକ୍ତିର ସୁଯୋଗ ରହିବ । ସେଥିମଧ୍ୟରୁ ୨୭ ଜଣ କୁଶଳୀ ଶ୍ରମିକ, ୭୦ ଜଣ ଅର୍ଦ୍ଧକୁଶଳୀ ଶ୍ରମିକ, ୧୮୦ ଜଣ ଅଣକୁଶଳୀ ଶ୍ରମିକ ତଥା ୫ ଜଣ ପରିଚାଳକ ଓ ତତ୍ତ୍ୱାବଧାରକ ଭାବରେ କାର୍ଯ୍ୟ କରିବେ ।

ନିୟମିତ ଭାବରେ କାର୍ଯ୍ୟରତ ଶ୍ରମିକ ମାନଙ୍କର ସାମ୍ମୁଖ୍ୟ 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 ୧୦୦ଟି 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 ବିସ୍କୋରଣ କରାଯିବ ।
- ଡିଜେଲଗୁଳିତ ସମସ୍ତ ଯନ୍ତ୍ରପାତିର ଉପଯୁକ୍ତ ରକ୍ଷଣାବେକ୍ଷଣ କରାଯିବ ।

ପଥର ଖୋଳିବା କାର୍ଯ୍ୟ ମାନବୀକୃତ ଭୂଉପରିସ୍ଥ ଖଣି ଖନନ ପଦ୍ଧତି ଦ୍ୱାରା ହେବ । ଏହି ପ୍ରକ୍ରିୟାରେ ବିସ୍କୋରକ ସାମଗ୍ରୀର ବ୍ୟବହାର ଦ୍ୱାରା ଶବ୍ଦ ପ୍ରଦୂଷଣ ଜାତ ହେବ । ମୋଟାମୋଟି ଭାବରେ ପ୍ରତିବର୍ଷ ୪୩୪୦୦୦ ଘନମିଟର ପଥର ଉତ୍ପାଦନ ପାଇଁ ହାରାହାରି ୭୨୩୩୪ କେ.ଜି. ପ୍ରତିମାସ ହିସାବରେ ବିସ୍କୋରକ ବ୍ୟବହୃତ ହେବ ଯେଉଁଥିରେ ପାଉଡ଼ର ମାତ୍ରା ୨ଘନମିଟର/କେ.ଜି. ରହିବ । ଗ୍ରାମବାସୀମାନଙ୍କୁ ଆଗରୁ ଖବର ଦିଆଯାଇ ଦିନ ୧୨ଟାରୁ ୧୨.୩୦ ମଧ୍ୟରେ ବିସ୍କୋରଣ କରାଯିବ ।

ଏହି ପ୍ରକ୍ରିୟା ଦ୍ୱାରା ଶବ୍ଦ ପ୍ରଦୂଷଣର ମୁଖ୍ୟତଃ ଡିଜେଲ ଚାଳିତ ଯନ୍ତ୍ରପାତିର ପରିଚାଳନା ଓ ଗାଡ଼ି ମଟର ଚାଳିବା 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 ଡିଜେଲଗୁଳିତ ସମସ୍ତ ଯନ୍ତ୍ରପାତିର ଉପଯୁକ୍ତ ରକ୍ଷଣାବେକ୍ଷଣ ଓ ସ୍ୱାୟୀ ଯନ୍ତ୍ରପାତିଗୁଡ଼ିକୁ ଯେତେଦୂର ସମ୍ଭବ ଆବଶ୍ୟକ ସ୍ଥାନରେ ରଖାଯିବାର ବ୍ୟବସ୍ଥା କରାଯିବ । ଶ୍ରମିକମାନଙ୍କୁ ବ୍ୟକ୍ତିଗତ ରକ୍ଷାକାରୀ ଉପକରଣ ଯୋଗାଇ ଦିଆଯିବ । ଖଣି ଅଞ୍ଚଳର ଚତୁଃପାର୍ଶ୍ୱରେ ବୃକ୍ଷରୋପଣ କରାଯିବ ଯାହାଦ୍ୱାରା କି ଶବ୍ଦ ପ୍ରଦୂଷଣକୁ ରୋକାଯାଇପାରିବ ।

### ଜଳ ପ୍ରଦୂଷଣ ଓ ନିରାକରଣ

ଏହି ଅଞ୍ଚଳର ମୁଖ୍ୟ ନଦୀ ଲିଜ ଅଞ୍ଚଳଠାରୁ ୫ କି.ମି. ଦୂରରେ ଅବସ୍ଥିତ । ଲିଜ ଅଞ୍ଚଳ ମଧ୍ୟରେ କୌଣସି ନାଳ ପ୍ରବାହିତ ହେଉନାହିଁ । ସ୍ଥାନୀୟ ଅଞ୍ଚଳର 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 ତିଜେଲରୁଲିତ ସମସ୍ତ ଯନ୍ତ୍ରପାତିର ଉପଯୁକ୍ତ ରକ୍ଷଣାବେକ୍ଷଣ ଓ ସ୍ଥାୟୀ ଯନ୍ତ୍ରପାତିଗୁଡ଼ିକୁ ଯେତେଦୂର ସମ୍ଭବ ଆବଶ୍ୟ ସ୍ଥାନରେ ରଖାଯିବାର ବ୍ୟବସ୍ଥା କରାଯିବ । ଶ୍ରମିକମାନଙ୍କୁ ବ୍ୟକ୍ତିଗତ ରକ୍ଷାକାରୀ ଉପକରଣ ଯୋଗାଇ ଦିଆଯିବ । ଖଣି ଅଂଚଳର ଚତୁଃପାର୍ଶ୍ୱରେ ବୃକ୍ଷରୋପଣ କରାଯିବ ଯାହାଦ୍ୱାରା କି ଶବ୍ଦ ପ୍ରଦୂଷଣକୁ ରୋକାଯାଇପାରିବ । ଗାଡ଼ି ଚଳକମାନଙ୍କୁ ତଥା କାର୍ଯ୍ୟରତ ଶ୍ରମିକମାନଙ୍କୁ କାନ ସୁରକ୍ଷାକାରୀ ପୁରୁ ଯୋଗାଇ ଦିଆଯିବ ।

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

**ସମାପ୍ତିପାତି ପର୍ଯ୍ୟାବରଣ ଦାୟିତ୍ଵ :**

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 ସମାପ୍ତିପାତି ପର୍ଯ୍ୟାବରଣ ଦାୟିତ୍ଵ ଖର୍ଚ୍ଚରେ ବିନିଯୋଗ କରାଯିବ ।

ପ୍ରସ୍ତାବିତ ସମାପ୍ତିପାତି ପର୍ଯ୍ୟାବରଣ ଦାୟିତ୍ଵର ସବିଶେଷ ବିବରଣୀ ନିମ୍ନରେ ଦିଆଯାଇଛି :

| କ୍ରମିକ ସଂଖ୍ୟା | ଗତିବିଧି   | ସ୍ଥାନ            | ସମୟସୀମା |    |    |      |    | ଖର୍ଚ୍ଚ (ଟଙ୍କାରେ) |
|---------------|---|------------------|---------|----|----|------|----|------------------|
|               |   |                  | ୧ମ      | ୨ୟ | ୩ୟ | ୪ର୍ଥ | ୫ମ |                  |
| (କ)           | ପ୍ରତ୍ୟକ୍ଷ ନିୟନ୍ତ୍ରଣ ଉପାୟ  |                  |         |    |    |      |    |                  |
| ୧.            | ପାଣି ଛିଠିବା ଯନ୍ତ୍ରର ସ୍ଥାପନା (୨୦)                                    | ପଟା ଅଞ୍ଚଳ        | **      | ** |    |      |    | ୧୦ ଲକ୍ଷ          |
| ୨.            | ଗାରଳ୍ୟାଣ୍ଡ ଡ୍ରେନ ଏବଂ ଇଟେନିଙ୍ଗ ଓଲ                                    | ପଟା ଅଞ୍ଚଳ        | **      | ** | ** |      |    | ୧୦ ଲକ୍ଷ          |
| ୩.            | ଗ୍ରାମ୍ୟ ସଡ଼କରେ ଟ୍ୟାଙ୍କର ଦ୍ଵାରା ଜଳ ସଂଚନ କରିବା (୧୦ କିଲୋଲିଟର ଟ୍ୟାଙ୍କର) | ଲୁଣିବର ଗ୍ରାମ     | **      |    |    |      |    | ୧୦ ଲକ୍ଷ          |
| ୪.            | ସୁରକ୍ଷିତ ଅଞ୍ଚଳରେ ବୃକ୍ଷରୋପଣ  | ପଟା ଅଞ୍ଚଳ        | **      | ** | ** |      |    | ୧୦ ଲକ୍ଷ          |
| ୫.            | ପଟା ଅଞ୍ଚଳକୁ ସଂଯୋଗ କରୁଥିବା ସଡ଼କରେ ବୃକ୍ଷରୋପଣ                          | ରାଜସ୍ଵ ବୃକ୍ଷରୋପଣ |         |    | ** | **   | ** | ୫ ଲକ୍ଷ           |
| ୬.            | ବର୍ଷାଜଳ ସଂରକ୍ଷଣ ସଂରଚନା  | ପଟା ଅଞ୍ଚଳ        |         | ** | ** |      |    | ୩ ଲକ୍ଷ           |
| (ଖ)           | ପାରିପାତ୍ରିକ ଅଞ୍ଚଳର ବିକାଶ  |                  |         |    |    |      |    |                  |
| ୧.            | ବ୍ୟକ୍ତିଗତ ପଟା ଅଞ୍ଚଳକୁ ସଂଯୋଗ କରୁଥିବା ସଡ଼କର ବିକାଶ                     | ନିକଟସ୍ଥ ଗ୍ରାମ    | **      | ** | ** |      |    | ୬ ଲକ୍ଷ           |
| ୨.            | ନିକଟସ୍ଥ ଗ୍ରାମର ଯୁବକମାନଙ୍କୁ ପ୍ରାଥମିକତା ଭିତ୍ତିରେ ନିଯୁକ୍ତିର ସୁଯୋଗ      | ନିକଟସ୍ଥ ଗ୍ରାମ    | **      | ** | ** | **   | ** | ନିୟମ ଅନୁସାରେ     |
| ୩.            | ସୌରଚାଳିତ ବିଦ୍ୟୁତର ସ୍ଥାପନ  | ଲୁଣିବର ଗ୍ରାମ     |         |    |    | **   | ** | ୧୦ ଲକ୍ଷ          |
| ୪.            | ପ୍ରାଥମିକ ଶିକ୍ଷାକେନ୍ଦ୍ର ମାନଙ୍କରେ ଶିକ୍ଷା ସମ୍ପନ୍ନ ସାମଗ୍ରୀ ବିତରଣ        | ଲୁଣିବର ଗ୍ରାମ     | **      | ** | ** | **   | ** | ୧ ଲକ୍ଷ           |

# EXECUTIVE SUMMARY

## CLUSTER-6 MINE CONSTITUTED OF LUNIBAR HILLOCKS OVER AN AREA OF 22.26 HECTARES

AT VILL: LUNIBAR  
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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**Document No.: KLPL-EIA(MM)B<sub>1</sub>/2020-14**

**Document Name: EIA/EMP Report For Lunibar hillocks (Cluster-6)  
over an area of 22.26 Hectares in Village Lunibar of Dharmasala  
Tahasil, District Jajpur Odisha.**

**Issue. No.: 01**

**Date: 17.06.2020**

**Copy No.: -**

**Copy Holders Name: -**

## 1.1 INTRODUCTION

This Summary is a brief outline of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) carried out for Lunibar Hillocks (Cluster 6) over an area of 22.26Ha, at Village-Lunibar under Dharmasala tahasil District Jajpur, Odisha. Cluster-6 (Lunibar hillock) is featured in the Survey of India Toposheet No. 73 L/1 and bounded between the latitudes 20°47'55.16"N to 20°48'15.06"N and longitudes 86°02'59.48" E to 86°03'18.90" E.

## 1.2 HIGHLIGHTS

### A. The Project

|                           |  |
|---------------------------|--|
| Name of the Project       | : Lunibar Hillocks (Cluster 6)                         |
| Product                   | : Building Stone                                       |
| Type of mine              | : Semi mechanized open cast mining                     |
| Rated production capacity | : 4340000m <sup>3</sup> during Plan Period (Ten Years) |

**Table 1.1: Brief profile of the project:**

| Sl. No. | Salient Features   | Descriptions                               |
|---------|--------------------|--|
| 1       | Cluster area       | 22.26 Ha (5nos of mining lease.)           |
| 2       | Village            | Lunibar                                    |
| 3       | Tahasil            | Jajpur                                     |
| 4       | District and State | Jajpur, Odisha                             |
| 5       | Land category      | Non forest Govt. Land                      |
| 6       | Toposheet No.      | 73 L/1                                     |
| 7       | Nearest town       | Madhupur                                   |
| 8       | Nearest road       | NH:200- 100m,E & NH:5- 9Km,E               |
| 9       | River distance     | Brahmani River – 5Km, E                    |
| 12      | Railway station    | New Gad Madhupur Railway Station 1.7 Km, E |
| 13      | Madhupur           | 2.5 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

Lunibar Hillocks (Cluster 6) over an area of 22.26 Ha is an opencast semi- mechanized mine situated in the village Lunibar, Tahasil Dhramasala, District Jajpur, Odisha. This cluster comes under ownership of Dharmasala, Tahasil, Jajpur, Odisha quarry leases for Building stone/ Road metal comprising 5nos. of lease areas covering a total mineralised area of 55Acres or 22.26 Hectares located in village/Mouza Lunibar of Dharmasala Tahasil & District Jajpur, Odisha have been proposed to be leased out to different intenders through auction. Cluster-6 constituted of Lunibar building stone quarry has been approved by approved by the Deputy Directorate Mines, Jajpur Road Circle, Jajpur Road, vide memo no.318 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 6 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-6 has comprised mineralised area of Lunibar hillock over 22.26 Ha. The geological reserve (Probable & Possible) for building stone/road metal has been estimated as 5584824 cum. It is evident that demonstrated the mineable reserve has been estimated in similar manner as geological reserve leaving 7.5m safety zone barrier all along the hillock area boundary and maintaining the safety distance of 200 meters from existing revenue habitations, if any and the mineral blocked under benches to maintain safe quarry slope. Thus, the mineable reserve (Probable) for building stone/road metal is worked out to be 4349654cum over the cluster-6.

**Table 1.2 (A): Geological Reserve of Cluster**

| Section Considered | Length of Influence (M) | X-Area of Rock Mass (M <sup>2</sup> ) | Vol. of Rock Mass (M <sup>3</sup> ) | Saleable Rock In (M <sup>3</sup> ) | Waste Rock In (M <sup>3</sup> ) | X-Area of Soil (M <sup>2</sup> ) | Vol. of Soil (M <sup>3</sup> ) | Category |
|--------------------|-------------------------|---------------------------------------|-------------------------------------|------------------------------------|---------------------------------|----------------------------------|--------------------------------|----------|
| A                  | B                       | C                                     | D=BXC                               | E=D X .70                          | F=D X .30                       | E                                | F=E XB                         | G        |
| G1-G1'             | 336                     | 21835                                 | 7336560                             | 5135592                            | 2200968                         | 398                              | 133728                         | Probable |
|                    | 336                     | 1910                                  | 641760                              | 449232                             | 192528                          | 0                                | 0                              | Possible |
| <b>Total</b>       |                         | <b>23745</b>                          | <b>7978320</b>                      | <b>5584824</b>                     | <b>2393496</b>                  | <b>398</b>                       | <b>133728</b>                  |          |

**Table 1.2 (B): Mineable Reserve of Cluster**

| Section Considered | Length of Influence (M) | X-Area of Rock Mass (M <sup>2</sup> ) | Vol. of Rock Mass (M <sup>3</sup> ) | Saleable       | Waste          | X-Area of Soil (M <sup>2</sup> ) | Vol. of Soil (M <sup>3</sup> ) | Category |
|--------------------|-------------------------|---------------------------------------|-------------------------------------|----------------|----------------|----------------------------------|--------------------------------|----------|
| A                  | B                       | C                                     | D=BXC                               | E=D X .70      | F=D X .30      | G                                | H=GXB                          | I        |
| G1-G1'             | 312                     | 19916                                 | 6213792                             | 4349654        | 1864138        | 373                              | 116376                         | Probable |
| <b>Total</b>       |                         | ---                                   | <b>6213792</b>                      | <b>4349654</b> | <b>1864138</b> | ---                              | <b>116376</b>                  | ---      |

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 4340000m<sup>3</sup> of building stone/road metal will be extracted per annum from the Cluster-6 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)**

| Sl. No.           | Year    | Cluster-6 in cum |
|-------------------|---------|------------------|
| 1.                | First   | 434000           |
| 2.                | Second  | 434000           |
| 3.                | Third   | 434000           |
| 4.                | Fourth  | 434000           |
| 5.                | Fifth   | 434000           |
| 6.                | Sixth   | 434000           |
| 7.                | Seventh | 434000           |
| 8.                | Eighth  | 434000           |
| 9.                | Ninth   | 434000           |
| 10.               | Tenth   | 434000           |
| <b>Sub -Total</b> |         | <b>4340000</b>   |

A total of 282 workers (Skilled-27nos., Semi-skilled-70nos. and Un-skilled-180nos & Mines Manager/Mine Permit Manager-5nos) will be employed during mining operation. The Cluster-6 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-6. 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 lease area in favor of applicant Tahasildar of Dharmasala, District Jajpur, Odisha, for excavation of building stone quarry over an area of 55.00 Acres or 22.26 Hectares is 73L/1 and is bounded by the latitudes from latitudes 20°47'55.16" N to 20°48'15.06" N and Longitudes 86°02'59.48" E to 86°03'18.90" E as per survey. The nearest highway is NH 200 located at a distance of 100m from the lease area. The nearest airport is Bhubaneswar Airport located at a distance of about 62km from the lease area. The area is at a distance of 2.5km from Madhupur town. The nearest railway siding is at New Gad Madhupur railway station located at a distance of about 1.7 km, E from the cluster 6 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 5 m to 8 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. There is chance that during monsoon the run-off water may find access to some of the quarries in the Cluster-6. 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 land use pattern of the buffer zone of the proposed project area it has been observed that about 46.5% of the land is used for agricultural purpose, fallow land 22% 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 9.0% of the buffer zone and 9% of the area comes under forest land. Forest in the buffer zone mainly scrub and open forest. The mining area covers 1.5% of the total land use.

### 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 35.2-70.0µg/m<sup>3</sup>. The concentration of SO<sub>2</sub> varies from 4.7-12.2µg /m<sup>3</sup> and NOx concentrations vary from 9.1-21.5µg /m<sup>3</sup>. 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<sub>10</sub>, 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 3-10 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 6.7-7.7. 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 55.8 dB (A) in day time and 44.3dB (A) in the night time. In the buffer zone the noise level ranges from 49.3 to 56.4 dBA during day time and 31.2 to 41.6 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  $\mu\text{s}/\text{Cm}$ . Nitrogen content of soil varies from 1210 to 1814 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 1.88%. 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 38 villages present within the buffer zone of the project area located within 10 km radius of the project site.

**Table no.1.4 Demographic profile of the buffer zone**

| Sl. No. | Attributes               | Radius of 10 km |
|---------|--------------------------|-----------------|
| 1       | No. of Villages          | 38              |
| 2       | Total Household          | 7723            |
| 3       | Total Population         | 34910           |
| 4       | Male Population          | 17893           |
| 5       | Female Population        | 17017           |
| 6       | Total ST population      | 6849            |
| 7       | Total SC Population      | 8126            |
| 8       | Sex Ratio ( F /M )       | 95 : 100        |
| 9       | Population below 6 Years | 4359            |

Out of the total population, 23315 persons are literate which contribute about 67% within the buffer zone. Out of the total literate, male literacy is contributed as 13127 i.e. 56% and female literacy is contributed as 10188 by 44%. It is observed that the literacy percentage is more among the male as compare to the female population. About 33% 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, 10949 persons (about 31%) are workers and 23961 (about 69%) persons are non workers. This can be inferred that more than 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 9541 (87%) are male and 1408 (13%) are female.
- Out of the total workers 8733 are main workers and 2216 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      | 8733 | 2216     |
| 2       | Cultivator         | 2365 | 506      |
| 3       | Agricultural labor | 2632 | 994      |
| 4       | Household workers  | 219  | 102      |
| 5       | Other Workers      | 3517 | 614      |

## 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-6 (Lunibar Hillock) is located within the revenue jurisdiction of Lunibar village under Dharmasala Tahasil of Jajpur district. The targeted area represents a hilly terrain with highest altitude of 80mRL in the middle part where as the NE part shows the lowest altitude of 25mRL. There is hardly any vegetation. There is no human settlement within the auction area.

#### 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 19.345hectares in Cluster-6. 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 hillock will be mined out during conceptual period. The ultimate quarry bottom will be at 10mRL as shown in the Conceptual Plan & Sections.

#### 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 air 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*, *Azadirchta indica*, *Nyctanthes arbor-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 3m to 6m. Assuming 4,34,000m<sup>3</sup> (max) productions per annum of Cluster-6, the monthly production target will be around 36167m<sup>3</sup>. To produce 36167m<sup>3</sup> of rock mass, tentatively 72334kg/month of explosive will be required assuming powder factor 2m<sup>3</sup> /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. 10KLD of potable water will be required from which 7.5 KLD of water will be required for drinking & domestic purpose. 1.5 KLD of water is suggested to be utilized for dust suppression and 1 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 hill/patch of the Cluster-6 area. Therefore, at the end of the plan (lease) period depth of the respective quarry over the Cluster-6 area is not possible to predict. However, after 10 years (lease period) of mining the tentative bottom RLs of Cluster 6 would be 10mRL. This is above the ground water table as the RL of ground water table is around 8m. 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-6. 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.

#### 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 19.346Ha of dump area will be covered with plantation of 23237 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.

A total of 282 workers (Skilled-27nos., Semi-skilled-70nos. and Un-skilled-180nos & Mines Manager/Mine Permit Manager-5nos) will be employed during mining operation.

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 6) 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 1.6 Proposed CER Plan**

| Sl. No.                           | Activities  | Location                                 | Time Frame         |                    |                    |                    |                    | Allocated Budget (Rs.) |
|-----------------------------------|---|--|--------------------|--------------------|--------------------|--------------------|--------------------|------------------------|
|                                   |   |  | 1 <sup>st</sup> Yr | 2 <sup>nd</sup> Yr | 3 <sup>rd</sup> Yr | 4 <sup>th</sup> Yr | 5 <sup>th</sup> Yr |                        |
| <b>Pollution Control measures</b> |   |  |                    |                    |                    |                    |                    |                        |
| 1.                                | Installation of water sprinklers (30 Nos)                           | Individual leases of the cluster         | **                 | **                 |                    |                    |                    | 2,00,000.00            |
| 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) | Road Connecting Madhupur garh RoadNH 200 | **                 | **                 | **                 | **                 | **                 | 1,00,000.00            |
| 4.                                | Plantation in the safety zone                                       | Individual leases of the                 | **                 | **                 | **                 |                    |                    | 1,00,000.00            |

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| 2020 | Executive Summary for Lunibar Hillocks (Cluster 6) Over An Area of 55 Acres /22.26 Ha., Village Lunibar of Dharmasala Tahasil , District Jajpur, Odisha. |
|------|--|

|                               |  | cluster                          |    |    |    |    |    |                 |
|-------------------------------|--|----------------------------------|----|----|----|----|----|-----------------|
| 5.                            | Plantation in the village road connecting ML area  | Avenue Plantation                |    |    | ** | ** | ** | 1,00,000.00     |
| 6.                            | Rain water harvesting structure  | Individual leases of the cluster |    | ** | ** |    |    | 1,00,000.00     |
| <b>Peripheral Development</b> |  |                                  |    |    |    |    |    |                 |
| 1.                            | Development and maintenance of village road connecting individual lease of cluster         | Nearby villages                  | ** | ** | ** |    |    | 1,00,000.00     |
| 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   | Lunibar Village                  |    |    |    | ** | ** | 2,00,000.00     |
| 4.                            | Distribution of education material to the primary school                                   | Lunibar Village                  | ** | ** | ** | ** | ** | 1,00,000.00     |

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